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FINAL
WORK PLAN/
SAMPLING AND ANALYSIS PLAN
FOR SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
COLD CREEK SWAMP OPERABLE UNIT
COLD CREEK/LEMOYNE SUPERFUND SITES
MOBILE COUNTY, ALABAMA

Prepared for:

Akzo Chemicals Inc.
Chicago, Illinois

and

ICI Americas Inc.
Wilmington, Delaware

Prepared by:

EA Mid-Atlantic Regional Operations
EA Engineering, Science, and Technology, Inc.
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Sparks, Maryland 21152

December 1990

EA Project 11653.02

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December 1990

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EXECUTIVE SUMMARY

In 1989 the U.S. Environmental Protection Agency (EPA) Region IV designated the Cold Creek Swamp as Operable Unit Number 3 (OU3) of the Cold Creek/LeMoyne Superfund sites. Cold Creek Swamp is a freshwater river-bottom hardwood swamp encompassing several hundred acres along the Mobile River. The site is located approximately 20 miles north of Mobile, Alabama. The upper portion of the swamp originates on property formerly owned by the Stauffer Chemical Company. The former Stauffer property includes two chemical processing facilities. The LeMoyne Plant produces industrial chemicals and is currently owned by Akzo Chemicals Inc. (Chicago, Illinois). The Cold Creek Plant manufactures agricultural chemicals and is owned by ICI Americas Inc. (Wilmington, Delaware). Akzo and ICI have been designated by EPA as potentially responsible parties (PRPs) with respect to environmental contamination at the Cold Creek/LeMoyne Superfund sites.

In July 1990, Akzo and ICI initiated supplemental Remedial Investigation/ Feasibility Study (RI/FS) activities to investigate specific environmental concerns in the Cold Creek Swamp that had been identified by EPA, the U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration (NOAA) pursuant to review of the original RI/FS for the Cold Creek/LeMoyne Superfund sites. Akzo and ICI retained EA Engineering, Science, and Technology (Sparks, Maryland) to develop work plans for supplemental RI/FS activities associated with the characterization of Cold Creek Swamp (OU3). On 16-17 August 1990, EA conducted a preliminary site reconnaissance. The main objective of the site visit was to assimilate sufficient background understanding of current site conditions at Cold Creek Swamp to be able to develop and scope the strategy for data collection for this supplemental RI/FS.

Project Plans

EA has prepared the four site specific RI/FS project plans as required by EPA guidance. These plans will govern all project activities, including data collection and analysis, health and safety, quality assurance/ quality control, contamination and risk assessments, report development, and examination of potential remedial actions. The following plans have been prepared. Note that the Work Plan and Field Sampling Plan have been combined as a Work Plan/Sampling and Analysis Plan.

- Work Plan/Sampling and Analysis Plan (WP/SAP)
- Site Health and Safety Plan (SHSP)
- Quality Assurance Project Plan (QAPP)

The Work Plan/Sampling and Analysis Plan describes objectives of the RI/FS; data quality objectives, data collection rationale; number and location of samples and analyses; field sampling procedures, contamination and risk assessment approach; and RI/FS report development. Potential hazards, levels of protection, and other considerations affecting the health and safety of field personnel are detailed in the Site Health and Safety Plan. Field and laboratory Quality Assurance/ Quality Control (QA/QC) requirements for chemical analyses, laboratory operations, required detection limits, field operations, sampling, sample preservation, sample holding times, equipment decontamination, and chain-of-custody are detailed in the Quality Assurance Project Plan.

Objectives of the RI/FS

The overall objective of this RI/FS is to supplement existing investigatory work to support quantitation of site-related risks and assessment of remedial alternatives for the Cold Creek Swamp Operable Unit of the Cold Creek/LeMoyne sites. Specific tasks to be performed to meet these response objectives include the following:

- Developing an inventory of environmental receptors present in the swamp, including key wetland plants and animals, and endangered or threatened species.

- Delineating wetland boundaries and the extent of upland in the Cold Creek Swamp.

- Characterizing the nature and extent of contamination present in swamp soil, sediment, surface water, and biota, including screening representative samples for Target Compound List analytes and thiocarbamates and examining the relationship between total and organic mercury both at depth and in biotically active zones.

- Characterizing contamination upstream, downstream, and within Cold Creek Swamp, and the interaction of the surface water system with the ground-water regime based on existing data available from other previous and ongoing investigations, information to be gathered under this Work Plan, and other available information.

- Estimating and verifying quantitative risks to human health and the environment due to site-related contaminants by modeling exposure and toxicity and measuring tissue concentration in key receptors.

- Evaluating potential remedial alternatives.

Approach

A three stage field investigation will be used for data collection at this site. Stage I will include soil, sediment, and surface water sampling to characterize the nature and extent of contamination in the swamp and to focus sampling efforts for subsequent stages. In addition, a wetland delineation/ecological assessment survey will be conducted.

During Stage II, more intensive sampling will be conducted to characterize the nature and extent of contamination specifically within the bioaccessible zone of the swamp. The Stage II sampling will be focused to concentrate on the parameters determined to be representative of bioaccessible chemical contamination within the swamp. Existing data indicate that mercury will be the primary contaminant of concern for this study. This Work Plan is developed based upon that premise. Should additional contaminants be identified as significant as a result of Stage I testing, additional characterization of these contaminants will be added to the Stage II field effort, as appropriate.

Data generated during Stages I and II will be used to develop a preliminary ecological risk assessment and to conduct ecological risk modeling. Results of ecological risk modeling will be used to select representative numbers and types of biological species to be sampled and analyzed during Stage III. This staged approach will enable the consultant to optimize biological tissue collection. Based upon the ecological risk modeling, key species, species at risk, and surrogates for threatened or endangered species will be selected for Stage III sampling.

At the conclusion of Stage III data collection, a contamination assessment will be made to examine the nature and extent of site contamination and to examine contaminant transport pathways and potential impacts beyond the site area. Risk assessments will also be conducted to identify exposure pathways and magnitude of risk from contaminant exposure from both ecological and human health perspectives. The contamination assessment and risk assessment data will be compiled and combined into a comprehensive Remedial Investigation (RI) report in accordance with EPA protocols.

The Feasibility Study (FS) will be initiated midway through development of the RI. The FS will identify remedial action objectives, based upon the findings of the RI contamination and risk assessments, and the applicable or relevant and appropriate requirements (ARARs) governing remediation at the site. Potential remedial action alternatives will be developed and examined with respect to evaluation criteria defined by EPA in the revised National Contingency Plan (NCP). Treatability studies will be conducted as needed during the FS. A particular consideration related to this site will be potential adverse impacts of remedial action alternatives to the Cold Creek wetland ecosystem. Alternatives that may result in greater destruction of the wetland than is necessary for the protection of natural resources will not be considered to be feasible.

The ultimate product of this investigation will be a final supplemental RI/FS report submitted to EPA Region IV. It will be a stand-alone document and will take into account all available OU3 data.

1. INTRODUCTION

Cold Creek Swamp is a freshwater cypress swamp that drains into the Mobile River near Axis, Alabama, approximately 20 miles north of Mobile, Alabama (Figure 1-1). Previous environmental investigations have indicated that the swamp has become contaminated as a result of wastewater discharges from chemical plants previously operated by Stauffer Chemical Company and Halby Chemical Company (Figure 1-2). The two Stauffer Chemical plants (Cold Creek Plant and LeMoyne Plant) are listed as sites on EPA's National Priority List (NPL).

A Remedial Investigation/Feasibility Study (RI/FS) was conducted between 1985 and 1989 to characterize the nature and extent of contamination related to Stauffer Chemical plant activities. A Final Remedial Investigation (RI) Report was submitted to the Environmental Protection Agency (EPA) Region IV in May 1988. Subsequent to EPA and other regulatory review comments, a follow-up Biota Study was conducted to characterize the effect of mercury contamination on the biological community in Cold Creek Swamp. This report was submitted to EPA in June 1989.

In May 1990, the EPA concluded that additional environmental studies were needed to further characterize the nature and extent of contamination in Cold Creek Swamp and to further examine potential impacts of swamp contamination on the biological community within and around the swamp. EPA requested that a supplemental RI/FS be initiated to address specific concerns raised by EPA, the U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration (NOAA) related to Cold Creek Swamp.

1.1 DESCRIPTION OF CURRENT STUDY

In 1989 the U.S. Environmental Protection Agency (EPA) Region IV designated the Cold Creek Swamp as Operable Unit Number 3 (OU3) of the Cold Creek/LeMoyne Superfund sites. Cold Creek Swamp is a freshwater river-bottom hardwood swamp encompassing several hundred acres along the Mobile

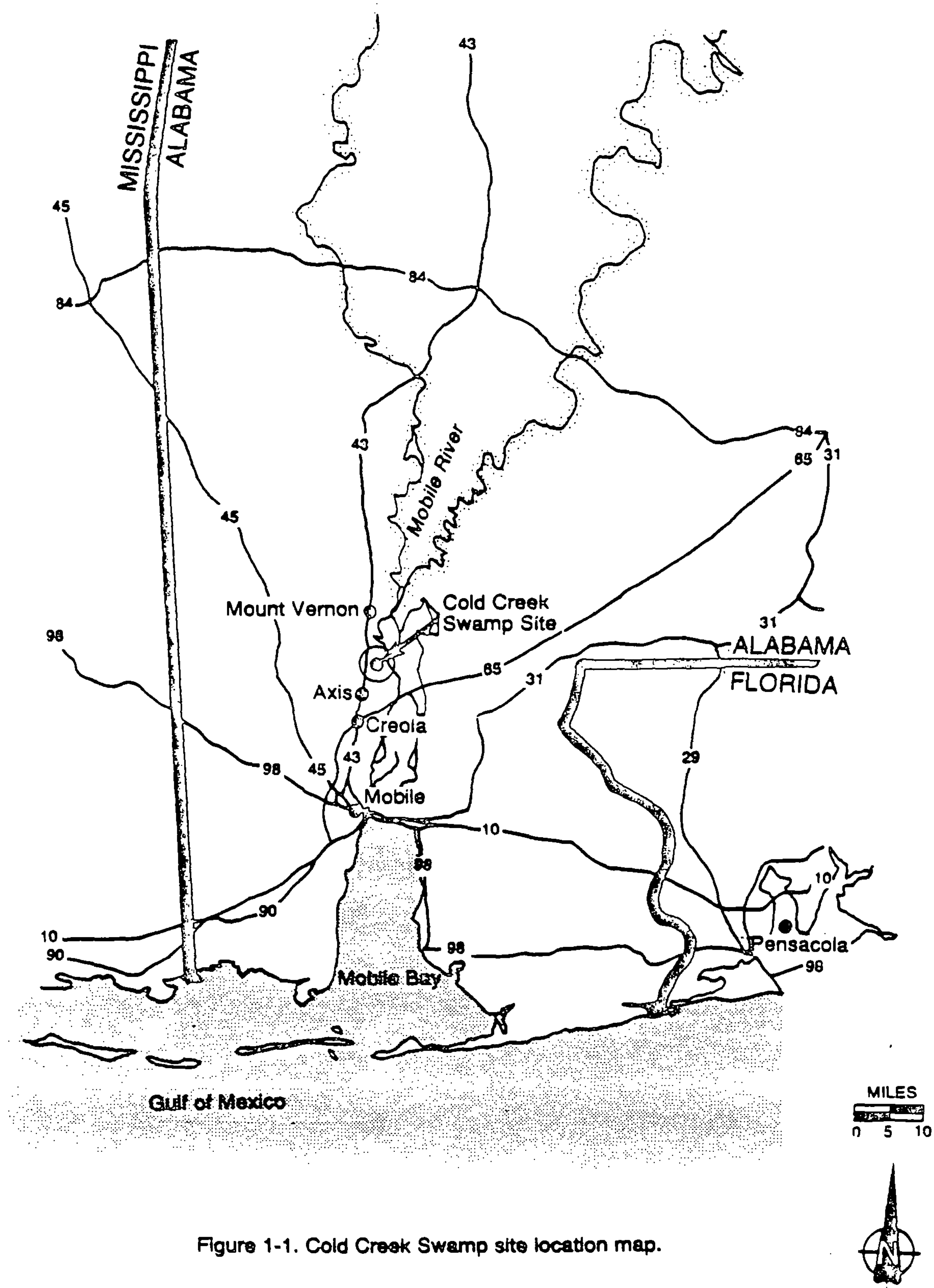

Figure 1-1. Cold Creek Swamp site location map.

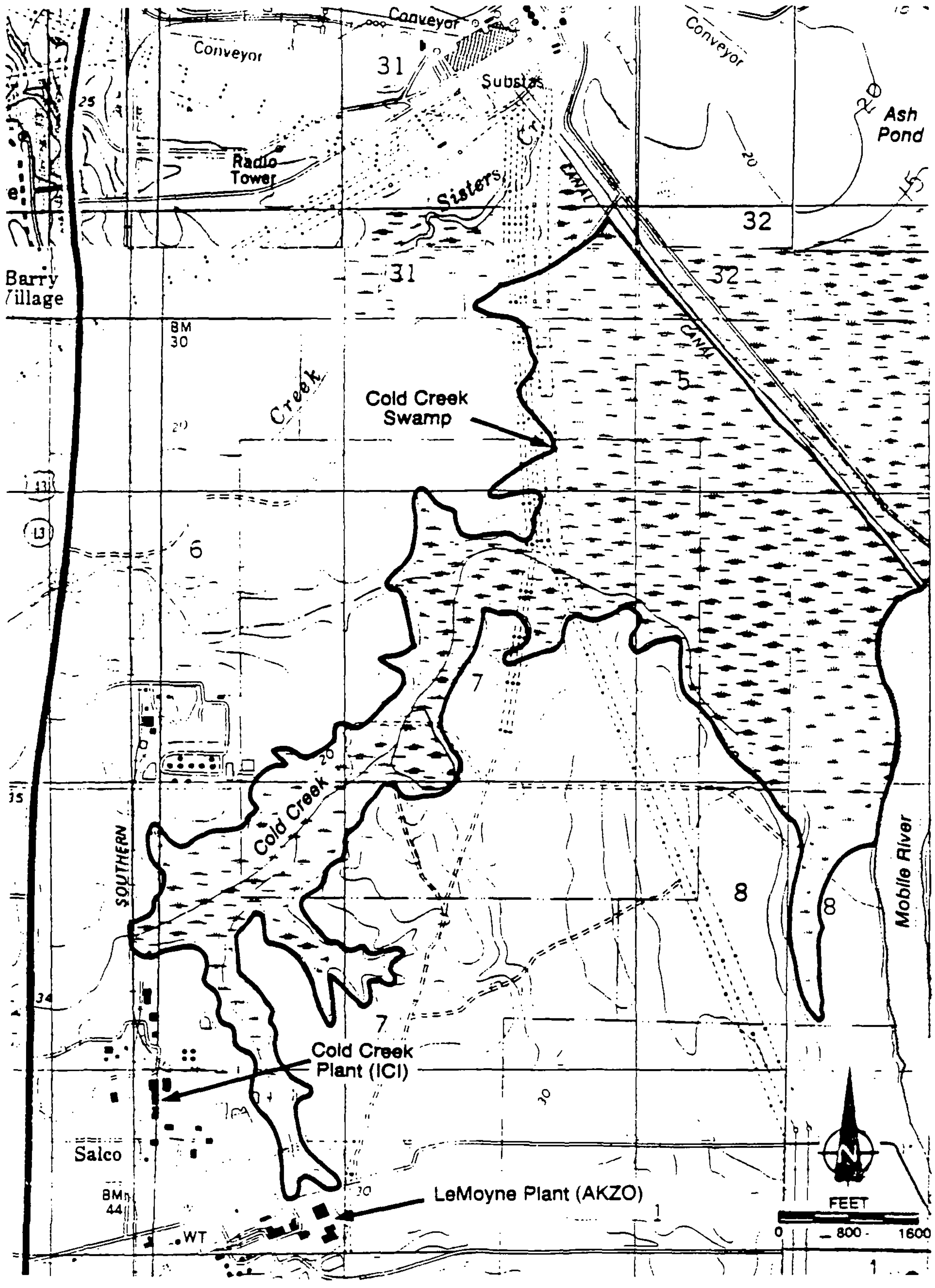

Figure 1-2. Site map showing locations of the Cold Creek Plant and the LeMoyne Plant.

River. The site is located approximately 20 miles north of Mobile, Alabama. The upper portion of the swamp originates on property formerly owned by the Stauffer Chemical Company. The former Stauffer property includes two chemical processing facilities. The LeMoyne Plant produces industrial chemicals and is currently owned by Akzo Chemicals Inc. (Chicago, Illinois). The Cold Creek Plant manufactures agricultural chemicals and is owned by ICI Americas Inc. (Wilmington, Delaware). Akzo and ICI have been designated by EPA as potentially responsible parties (PRPs) with respect to environmental contamination at the Cold Creek/LeMoyne Superfund sites.

In August 1990 Akzo and ICI selected EA Engineering, Science, and Technology to perform the supplemental RI/FS for Cold Creek Swamp. On 16-17 August 1990, EA conducted a preliminary reconnaissance to examine site conditions. The site visit included interviews with key plant personnel, review of plant historical records, a site walk-through, and a site overflight. Aerial and ground photographs taken during the preliminary reconnaissance are included in Appendix A.

Previous investigations at the site include the May 1988 RI report (ERT) and the June 1989 Cold Creek Biota Study (BCM). These investigations indicated that the primary contaminant of concern at Cold Creek Swamp is mercury. Potential impacts from mercury exposure are primarily to the biological community in and around the swamp. Previous studies have not characterized potential ecological impacts of swamp contamination to an extent that satisfactorily allays the concerns of various review agencies, including the EPA, USFWS, and NOAA.

The approach outlined in this Work Plan is responsive to the concerns raised by EPA, USFWS, and NOAA during evaluation of the original RI/FS for the Cold Creek/LeMoyne Superfund site as summarized in EPA's 29 June 1990 letter to Akzo and ICI. It provides a more comprehensive characterization of the nature and extent of chemical contamination in the swamp (both vertically and laterally); further investigates the bioavailability of contaminants and effects on biota; and further examines potential surface water/ground water interaction.

A three stage field investigation will be used to optimize data collection and assure that all Data Quality Objectives are satisfied. Field activities will include shallow soil/sediment sampling and analysis; surface water sampling and analysis; soil borings and analysis; biological tissue collection and analysis; wetland delineation; and ecological characterization.

These specific investigative tasks are intended to characterize the nature and extent of contamination and potential impacts to the biological community within the swamp, and to aid in the assessment of contaminant migration pathways and rates beyond the limits of the swamp.

1.2 OBJECTIVES

The objective of this RI/FS is to develop a database sufficient to

1. Characterize the nature and extent of pollutant-specific contamination within the swamp, both vertically and horizontally.

2. Characterize the nature and extent of pollutant-specific contamination within the biologically active zone of Cold Creek Swamp.

3. Characterize potential impacts of pollutant-specific contamination in Cold Creek Swamp on the biological community within and around the swamp.

4. Further assess the potential relationship between surface water in the swamp and the underlying ground-water system.

5. Identify the areal and ecological limits of Cold Creek Swamp.

6. Evaluate potential human health and environmental risks based upon data collection and ecological modeling.

7. Develop an RI report.

8. Support an informed risk management alternatives analysis for remedial actions to be evaluated in the Feasibility Study (FS).

Data collected for this study will be used to develop the final RI and FS reports.

This Work Plan was developed based upon a complete review of available background information and previous environmental investigations of Cold Creek Swamp; a preliminary site reconnaissance; and preliminary discussions with representatives of EPA, USFWS, and NOAA.

1.3 PLANNING DOCUMENTS

This Work Plan/Sampling and Analysis Plan (WP/SAP) presents the overall approach and details project activities that will be performed to meet RI/FS objectives for the Cold Creek Swamp Operable Unit. The WP/SAP describes known contamination characterization and potential pathways of contaminant migration; data quality objectives; the rationale underlying the number and location of sampling points; sample collection equipment and procedures; and sample handling protocols. The WP/SAP also presents the project schedule and management plan.

The expected hazards and levels of protective measures to be implemented in order to protect the health and safety of field personnel are detailed in the Site Health and Safety Plan (SHSP). Field and laboratory quality assurance/quality control (QA/QC), requirements for chemical analyses, laboratory operations, required detection limits, field operations, sampling, sample preservation, sample holding times, equipment decontamination, and chain-of-custody are detailed in the Quality Assurance Project Plan (QAPP).

2. SITE BACKGROUND AND SETTING

Cold Creek Swamp is located in the northeast section of Mobile County, Alabama, approximately 20 miles north of Mobile, 6 miles south of Mt. Vernon and 5 miles north of Creola (Figure 2-1). The site encompasses several hundred acres (precise area to be determined as a component of this study) situated between U.S. Highway 43 to the west and the Mobile River to the east. The surrounding area is sparsely populated and consists primarily of riverbottom swamp and other wetlands (Figure 2-2).

The Mobile River in Mobile County is an important water source for industrial, agricultural, and recreational uses. Other water supply sources in the site vicinity include wells, springs, and farm ponds.

Agricultural land in the area primarily supports soybeans, corn, and wheat. Specialty crops include watermelons, Irish potatoes, sweet corn, cabbage, snap beans, fruit, and pecans. Beef cattle, dairy cattle, and hogs are the major local livestock.

The main industries adjacent to the Cold Creek Swamp are chemical production plants to the west and south and a coal fired electrical power generating plant to the north (Alabama Power Company).

2.1 REGIONAL GEOLOGY, PHYSIOGRAPHY, AND SOILS

2.1.1 Regional Geologic Setting

Cold Creek Swamp is located within the Southern Pine Hills Section (Piney Meadows subsection) of the East Gulf Coastal Plain Physiographic Province. The generalized geology of the Coastal Plain region includes several types of Mesozoic- and Cenozoic-age sedimentary rocks that occur in narrow northwest-southeast trending bands which dip gently southward at approximately 20 to 40 ft/mi. Within the Southern Pine Hills Section of the Coastal Plain, the underlying sedimentary units are overlain by

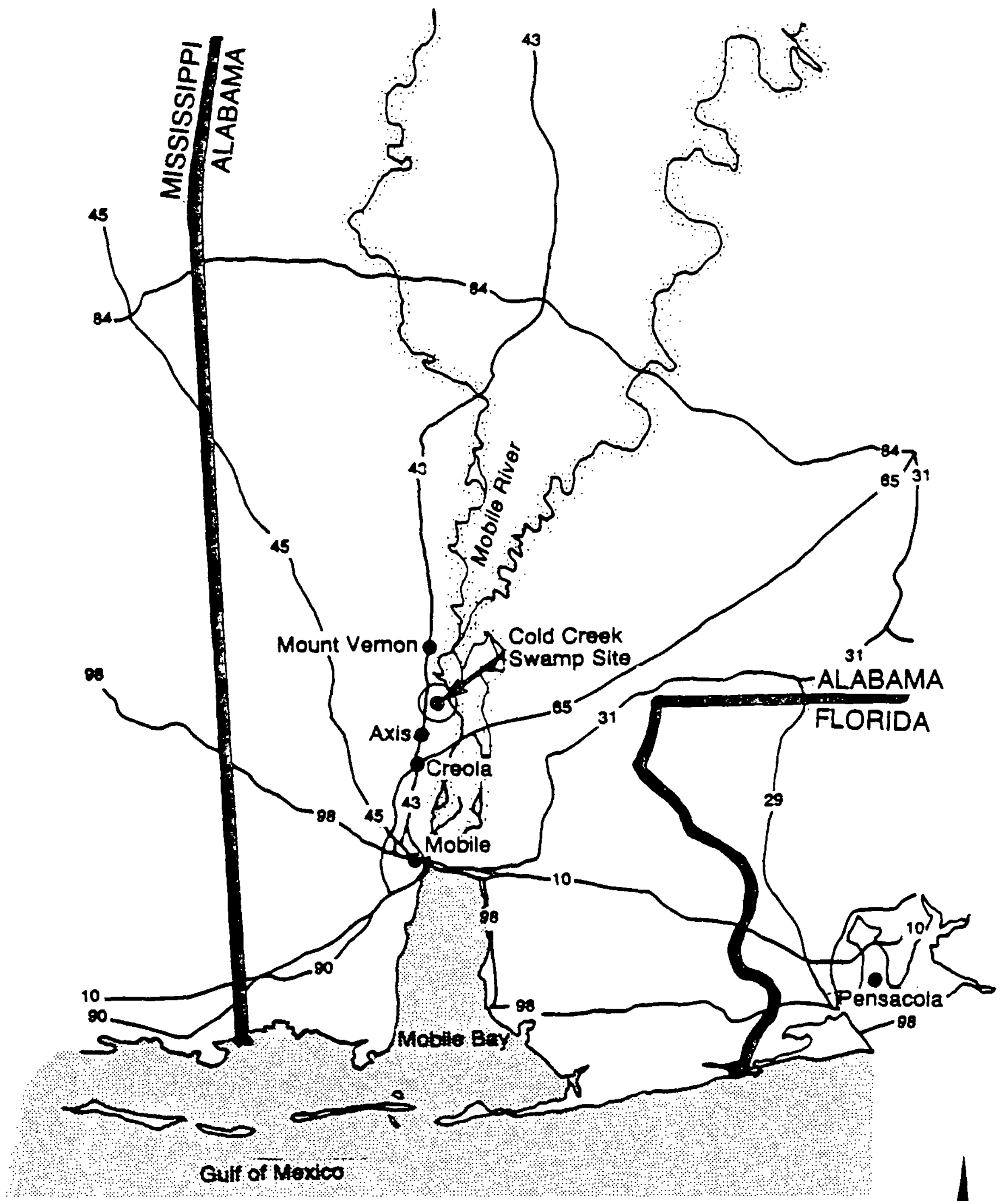

Figure 2-1. Cold Creek Swamp site location map.

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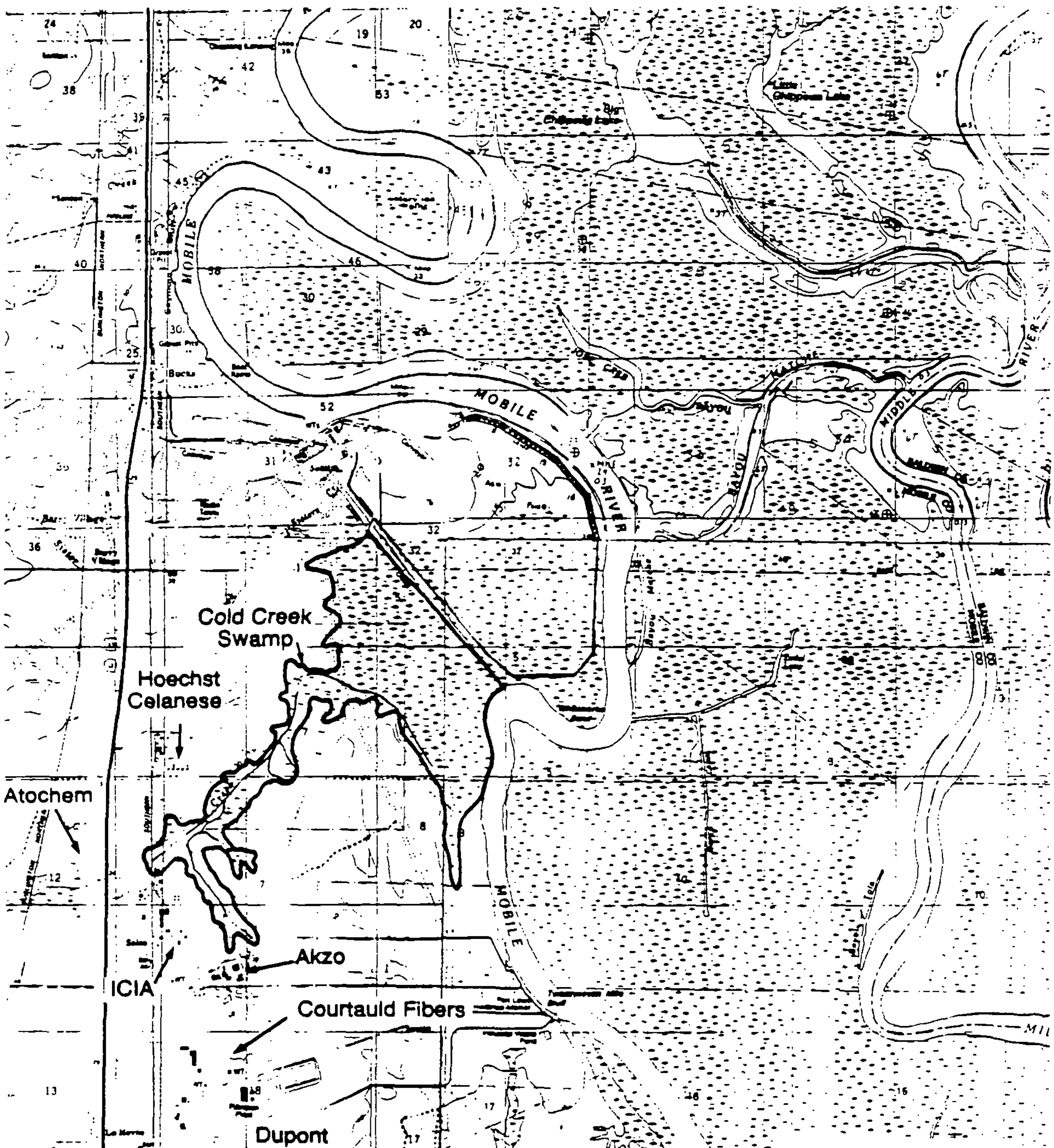
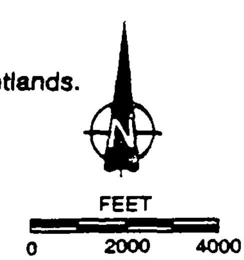


Figure 2-2. Cold Creek Swamp site vicinity showing large tracts of wetlands.



Miocene estuarine deposits consisting of interbedded sands and clays, and in some areas the younger Pliocene Citronelle Formation which generally consists of sand and gravel (Geological Survey of Alabama 1968, 1971). These deposits are in many areas overlain and incised by younger Pleistocene- and Holocene-age alluvial deposits, with deposition occurring from long-term sedimentation from several north-south trending streams and rivers.

2.1.2 Site Geology

The site is underlain by low river terrace and alluvial deposits that are approximately 110 to 130 ft thick. These deposits thin to approximately 60 ft adjacent to the Mobile River, which is located approximately 1½ mile east of the westernmost edge of the swamp study area. The deposits consist of generally clean, unconsolidated, fine to very coarse-grained sands that contain some interbedded, discontinuous clayey seams as well as some gravelly zones. Table 2-1 summarizes the stratigraphic column in the site area. The upper sands, varying in thickness from 0 to 50 ft, consist of fine to medium-grained sands, fine-grained sandy silts, silty clays, and clays. The upper sands have moderate to low permeability. The lowermost sands, situated generally 80 ft below ground surface, contain the most highly permeable material. A very stiff, dense, bluish-gray clay (permeability 4.4×10^{-8}), presumably of marine origin, underlies the alluvial deposits. Previous studies indicate that the clay unit dips very slightly to the southwest (Stilson 1974).

2.1.3 Physiography and Topography

Cold Creek Swamp is a flat, low-lying area situated west of the Mobile River. Cold Creek drains the swamp, flowing generally west to east through the swamp and ultimately discharging to the Mobile River (Figure 2-3). The uppermost portion of the swamp (Zone I) is located on the LeMoyne and Cold Creek plant property, and is characterized by nearly level to undulating topography. The swamp is relatively narrow in the upper and middle zones (Zone I and Zone II) until it reaches two power

TABLE 2-1 STRATIGRAPHIC COLUMN

Range of Thickness	Range of Depths		Description
	Top	Bottom	
10-17	0	8-22	Red, yellow to brown stiff clay with basal sandy clay section pinching out locally.
0-35	10-15	11-74	Sand and clay interbeds grading laterally into sand.
14-34	8-63	30-63	Clean coarse sand with some clay interbeds.
18-45	30-74	63-102	Sand and gravel with lenses of sand or sand with some clay interbeds. Clay occurs interbedded with sand and gravel locally.
3-20	63-82	75-110	Gray sand and clay grading laterally into either sandy clay or sand.
1-23	75-110	75-115	Gray sand with some clay with lenses of sandy clay.
0-23	80-115	111-131	Sand and gravel with some clay interbeds.
	111-131		Blue clay

Source: ERT Hydrogeologic Investigation (1985).

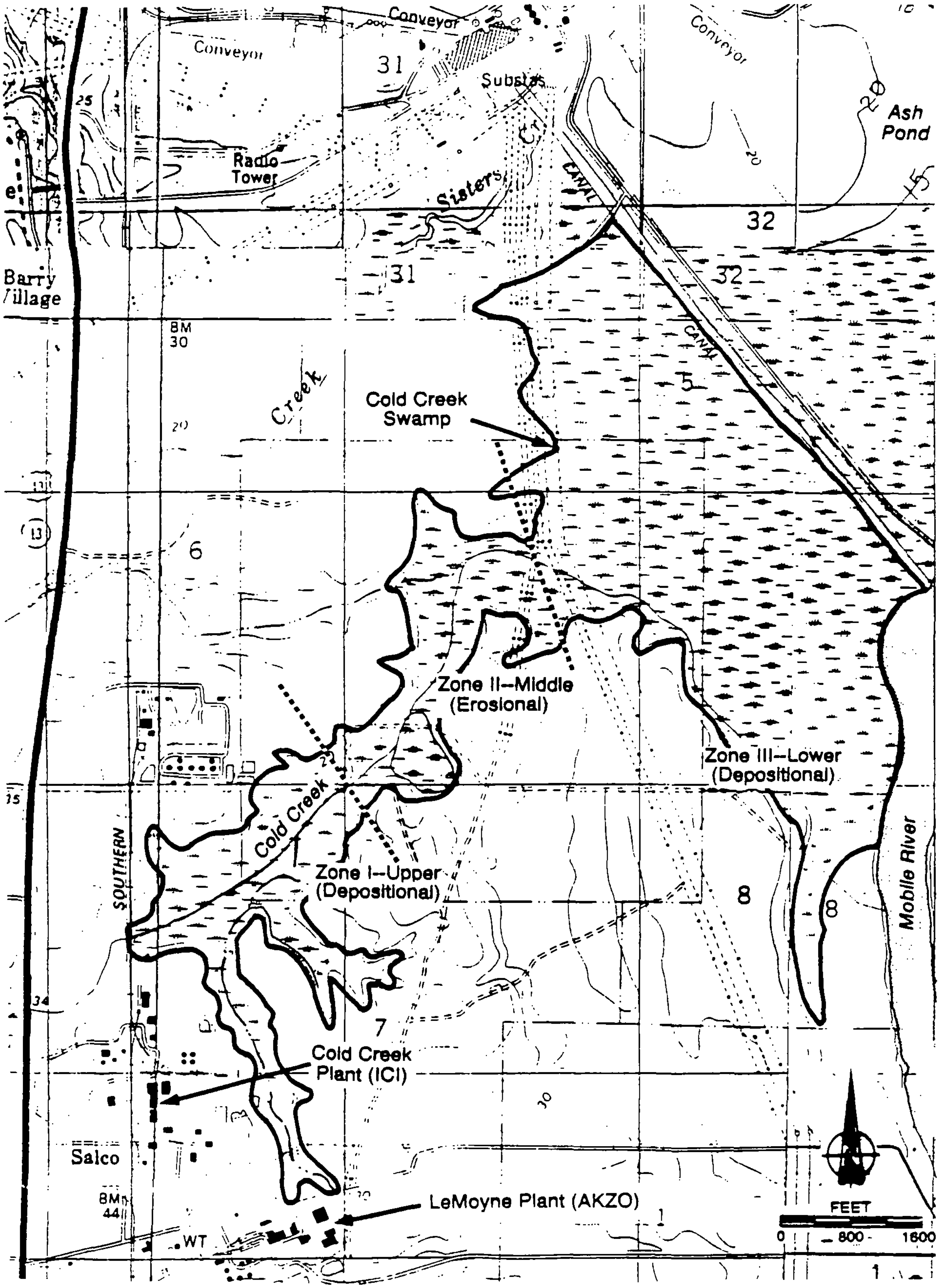


Figure 2-3. Site map showing aerial extent of Cold Creek Swamp and Hydrologic Zones.

line cuts. At the power line cuts, the swamp broadens and supports dense woody vegetation (Zone III). Cold Creek flows along the south and southeastern edge of the swamp and discharges into the Mobile River approximately ½ mile downstream of the Alabama Power Company cooling water discharge canal.

Surface elevations in the swamp range from highs of about 30 ft in the Upper Swamp Zone (Zone I) at the two plant sites, to lows of approximately 6 ft in the Lower Swamp Zone (Zone III) along the Mobile River. Most of the narrow Middle Swamp Zone (Zone II) and all of the broad lower swamp zone (east of the power line right-of-way) have an elevation less than 10 ft.

2.1.4 Soils

There are two main soil associations within Cold Creek Swamp: the Izagora-Bethera association and the Dorovan-Levy association (Figure 2-4) (USDA 1980).

2.1.4.1 Izagora-Bethera Association

The Izagora-Bethera association is most prominent in the narrow western portion of the site (Upper Swamp Zone and part of Middle Swamp Zone). This association consists of gently undulating soil types which supports woodland vegetation.

Izagora Soil

The predominant soil is the Izagora which encompasses 60 percent of the area. It is a moderately well-drained soil consisting of loamy marine sediments located on broad terraces of the Coastal Plain. The typical stratigraphy of this soil is as follows:

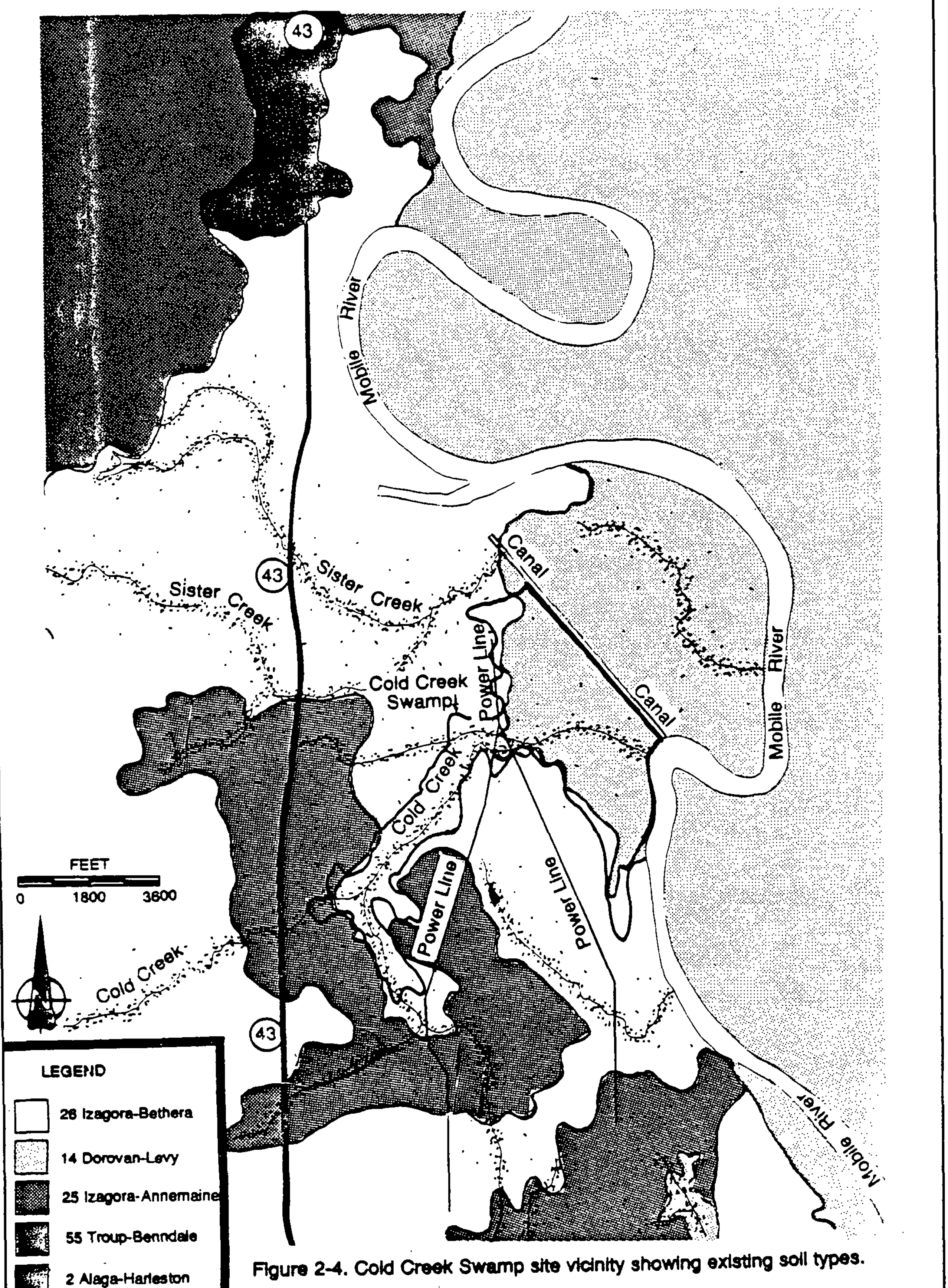


Figure 2-4. Cold Creek Swamp site vicinity showing existing soil types.

Dark grayish brown sandy loam	0-5 in.
Brown sandy loam	5-8 in.
Yellowish brown loam	8-14 in.
Yellowish brown and light yellowish brown clay loam with light gray, yellow, and red mottles	14-54 in.
Light gray and light brownish gray clay with red, yellow, and brown mottles	54-80 in.

The upper part of the Izagora subsoil is moderately permeable (approximately 10^{-3} cm/sec) and the lower part exhibits lower permeability (10^{-5} cm/sec). Slopes are typically less than 2 percent but range up to 5 percent. The water table is generally 2-3 ft below the surface of the ground during the winter months, with brief flooding occurring during periods of unusually high rainfall.

Izagora soil has a high available water capacity, is low in natural fertility and organic matter content, is acidic, has good tilth (soils can be worked over a wide range of moisture content), and has a deep root zone which is easily penetrated by plants. The capability subclass and woodland group for Izagora soil are IIw and 2w, respectively.

Bethera Soil

Bethera is the other major soil in this association, comprising 20 percent of the area. It is a poorly drained clayey soil located in narrow to broad depressions and narrow drainageways. The typical stratigraphy of this soil is as follows:

Dark gray loam	0-4 in.
Gray loam	4-6 in.
Light brownish gray clay loam	6-12 in.
Light gray clay loam with gray, brown, yellow, and red mottles	12-80 in.

This soil is moderately permeable (10^{-4} to 10^{-5} cm/sec), and the water table is near the surface during the winter and spring with periods of occasional brief flooding.

Bethera soil has a high available water capacity, is low in natural fertility and organic content, and is acidic. The capability subclass and woodland group for Bethera soils are IVw and 2w, respectively.

Other Soils

The remaining 20 percent of the Izagora-Bethera association consists of minor soils identified below:

- Alga - Excessively drained, loamy sand
- Annemaine - Moderately well-drained, sandy loam
- Harleston - Moderately well-drained, sandy loam
- Smithton - Poorly drained, sandy loam
- Johnston - Very poorly drained, mucky loam
- Dorovan - Very poorly drained, muck

2.1.4.2 Dorovan-Levy Association

The Dorovan-Levy association is the dominant soil association found in the broad eastern portion of Cold Creek Swamp. This association consists of very poorly drained soils located in depressional swamps and bottoms along the Mobile River, and it is dissected by meandering streams. This association supports woodland vegetation and wildlife habitats.

Dorovan Soil

The predominant soil type is Dorovan, which covers approximately 60 percent of the area and consists entirely of muck. The typical stratigraphy of this soil is as follows:

Dark grayish brown muck	0-8 in.
Black muck	8-80 in.

The soil is of low permeability and the water table is above or near the surface most of the year. The area is frequently flooded. It has a high available water capacity and is acidic. The capability subclass and woodland group for Dorovan soil are VIIw and 4w, respectively.

Levy Soil

Levy soil makes up about 20 percent of this association. The typical stratigraphy is as follows:

Gray silty clay loam	0-6 in.
Gray clay with yellow and brown mottles in upper part	6-75 in.

This soil is of low permeability and water is near or above the surface most of the year. The area is frequently flooded. Levy soil has a high available water capacity and is acidic.

The capability subclass and woodland group for Levy soil are VIIw and 3w, respectively.

Other Soils

Minor soils included in this association comprise the remaining 20 percent. They include:

Bibb - poorly drained, sandy loam
Pamlico - very poorly drained, muck

2.2 CLIMATOLOGY

In the general area of Cold Creek Swamp, climate is temperate, bordering on subtropical (U.S. National Weather Service, Bates Field, Alabama). Summers are hot and humid with an average temperature of 81°F and a daily high average of over 90°F. The hottest month is July and the highest recorded temperature was 104°F on 25 July 1952. Winters are generally warm, with only occasional freezing. Average winter temperature is 53°F with an average daily minimum of 43°F. The coldest month is January and the lowest recorded temperature was 3°F on 21 January 1985.

Average annual precipitation is 63.6 in. Most precipitation falls in summer. July, August, and September average 7.1 in. of precipitation. July has the highest monthly average with 7.8 in. October and November are generally the driest months. October has the lowest average precipitation, 2.5 in. Thunderstorms are common, occurring about 80 days per year, and snowfall is rare.

The average relative humidity is 60 percent in mid-afternoon and 90 percent at dawn. Sunshine probability is 60 percent during the summer and 50 percent during the winter. The prevailing winds are from the west and northwest, with hurricanes originating in the south.

Weather information presented herein is based on data from the closest U.S. National Weather Service (USNWS) station. Akzo plant personnel indicate that weather conditions in the plant vicinity differ somewhat. Specific weather data available from ICI and Akzo plant records will be used in conjunction with USNWS weather data as appropriate for assessments under this project.

2.3 LAND USE

Land use in the immediate vicinity of Cold Creek Swamp is primarily industrial, with chemical production plants located to the north, south, and west (Figure 2-2). In addition to the Cold Creek Plant and the LeMoyne Plant are Courtaulds Fibers, Inc., which manufactures viscose rayon fiber and nylon; DuPont, Inc., which manufactures insecticides; Hoechts-Celanese, Inc. (HCI), which produces sulfur dioxide, amines, sodium hydrosulfite, sodium bisulfite, and tetramethylfuran disulfide; and Atochem Chemicals, Inc., which manufactures organotin compounds. Directly north of the swamp area are a sand pit mining operation and a coal burning power plant. Near the northeast boundary of the swamp study area is a canal which carries cooling water discharge from the power plant southeast to the Mobile River. East of the canal is the continuation of the swamp to the Mobile River, and north of this swamp area is a large ash disposal area (>150 acres) for the power plant.

2.4 NATURAL RESOURCES

The primary natural resource in the site vicinity is the Mobile River, which receives discharge water from Cold Creek. In the vicinity of the site it is approximately 500 ft wide with an average depth of 28 ft. Minimum flow is 4,800 ft^3/sec (3.1 billion gallons per day), at a flow velocity of over 10 cm/sec. Minimum flow is exceeded 99 percent of the time. The river flows south, discharging into Mobile Bay and ultimately to the Gulf of Mexico. The river is heavily used for barge transportation.

In the Mobile River Basin, soil is a key natural resource. The region supports cultivated crop farms, livestock grazing on pasture, and natural timber production. In the immediate vicinity of the swamp, timber production is the only form of agriculture due to the lowland nature of the area.

Several oil and gas exploration and production wells are located in the general area (within 10 miles). No oil or gas wells are located on the plant sites.

2.5 SITE SURFACE-WATER HYDROLOGY

Natural drainage from several hundred acres, including the western part of the LeMoyne Plant property, a portion of the north-central part of the adjacent Courtaulds Fibers property, and a part of the adjacent Route 43 right-of-way, forms an unnamed stream that flows in an easterly direction south of the LeMoyne Plant area (Figure 2-5). This stream then turns northward and flows generally north-northwest through a 20-acre marsh area of Cold Creek Swamp. Flow from the marsh joins Cold Creek, which flows northeasterly and then easterly to the confluence with the Mobile River more than a mile upstream from the eastern extension of the LeMoyne Plant property.

Potential for flooding in the site area located on the LeMoyne Plant and the Cold Creek Plant property is minimal. Although high intensity rain storms (greater than 2 in./hr) are not uncommon, they generally do not last long. Based on current flood insurance rate maps, the 100 year flood zone within the site area is confined to the easternmost section of the LeMoyne Plant property adjacent to the Mobile River. The approximate area covered by the 100-year floodplain in this part of the site is 55 acres. The zone of influence of the 500-year floodplain is only slightly larger than that of the 100-year floodplain.

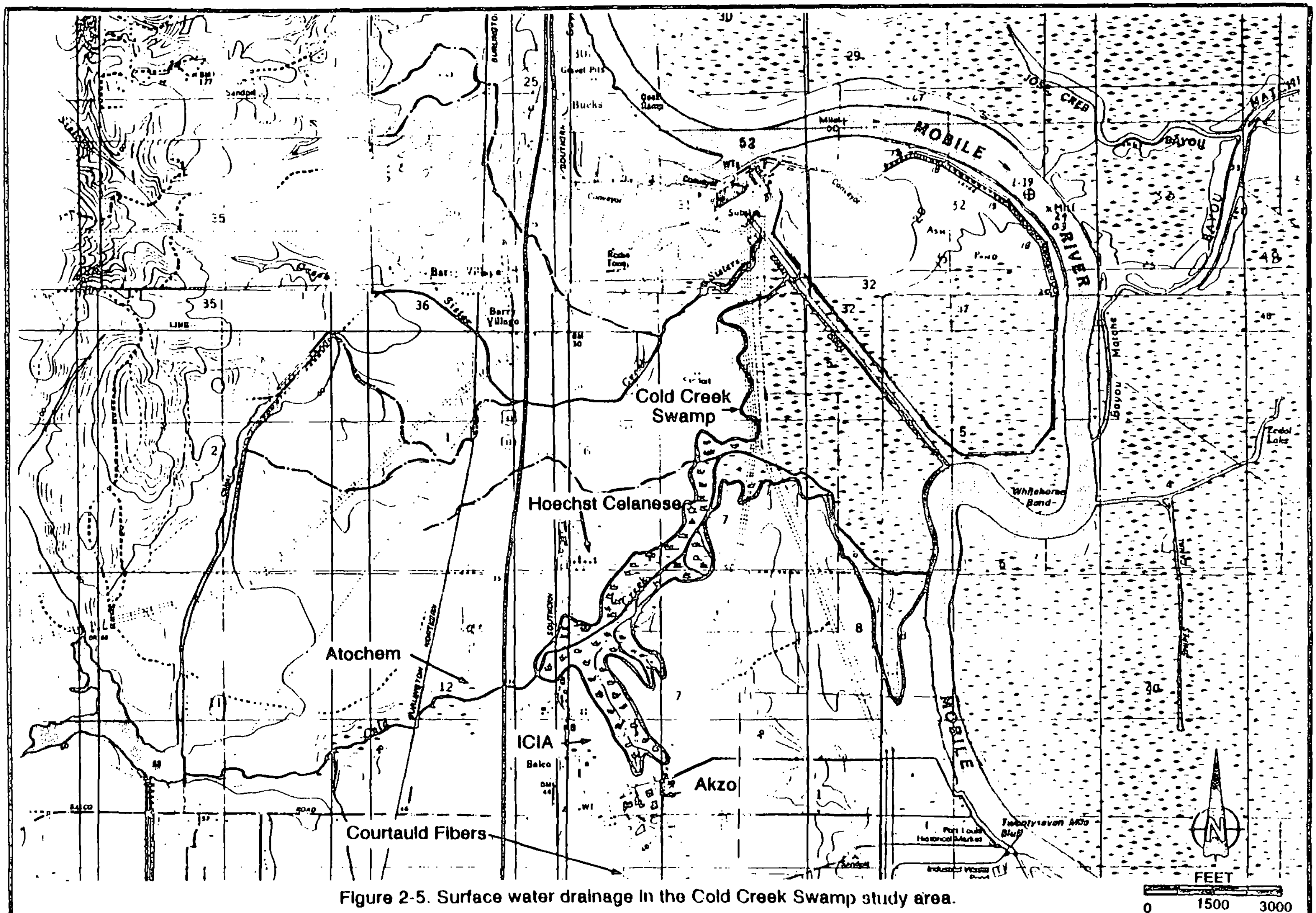


Figure 2-5. Surface water drainage in the Cold Creek Swamp study area.

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An extension of the present floodplain also occurs north of the plant sites along the lower portion of Cold Creek and portions of the Cold Creek Swamp. The combined 100- and 500-year floodplain areas are indicated as an approximate 800-ft-wide band along the section of Cold Creek, which flows in a northeasterly direction, with the floodplain broadening where Cold Creek begins its east-southeasterly direction of flow. The floodplain falls within, but does not completely encompass, the Cold Creek Swamp and does not extend southward toward the plant sites along the swamp area which is associated with the unnamed stream. Portions of the plant site and surrounding properties not within the 100- or 500-year flood areas, are classified as Zone C, or areas considered as having a minimal flooding potential. Figure 2-6 shows the 100-year floodplain boundary as indicated on current flood insurance maps.

2.6 SITE GROUND-WATER HYDROLOGY

2.6.1 Regional Hydrogeologic Setting

There are two principal water-table aquifers in Mobile County. A major aquifer is located several miles west of the site in the Miocene Uplands section of the county. The second aquifer is within the Mobile River Valley, where the site is located. This aquifer is the principal source of water for users within the valley. Existing municipal and industrial water supply wells in this aquifer typically yield 470 to 846 gpm, with specific capacities of 6 to 73 gpm per foot of drawdown (Riccio et al. 1973).

2.6.2 Site Hydrogeology

The Mobile River Valley water-table aquifer is recharged through infiltration from Cold Creek Swamp, the Mobile River, and rainfall. The background water quality is potable, with low total dissolved solids and iron. Prior to industrialization, ground-water flow was toward the Mobile River. The ground-water table varied from 0 to 20 ft below ground level depending on the topography. Presently, the direction of flow is

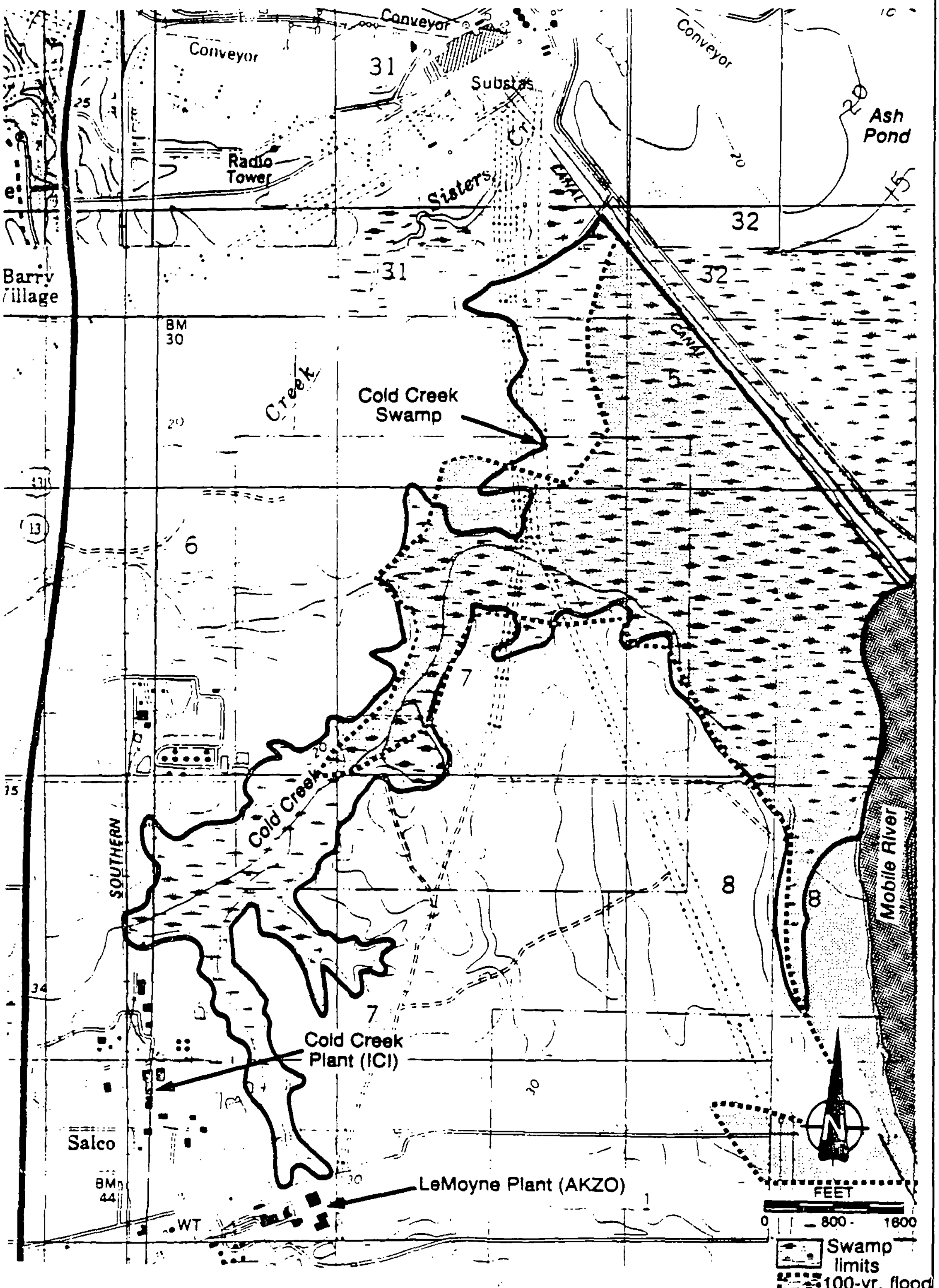

Figure 2-6. Site map showing areal extent of 100 year flood plain.

toward the south-southeast, because of the local influence of pumpage at Courtaulds Fibers and from interceptor wells at the southern limits of the LeMoyne Plant. The advent of industrialization and accompanying ground-water pumpage at the Courtaulds Fibers plant site and surrounding area has resulted in a lower water table and localized changes in the direction of ground-water flow, i.e., presently, ground water in the immediate plant vicinity flows away from the Mobile River (ERT 1988).

Relatively few deep borings or well installations that extend into stratigraphic units beneath the blue clay layer have been completed within the immediate site area. Well-construction information indicates a total of eight borings which extend to a significant depth beneath the clay layer. Three of these borings represent injection wells which were drilled to depths varying from 4,330 to 4,750 ft below ground surface, with screens set for injection at varying depths greater than 3,400 ft below ground surface. Five monitoring wells installed in association with the injection wells have been installed with screens at depths varying between 207 and 1,160 ft below ground surface. Lithologic logs available for two of the borings, IM-1 and IM-2, indicate numerous alternating layers of clay with silty fine sand extending several hundred feet beneath the blue clay layer. Both logs indicate that clay is the dominant lithologic formation encountered with relatively thin layers of fine sand or silt to depths approaching 500 ft below ground surface. Ground-water usage within the site area is believed to be limited to the upper aquifer above the clay layer.

Ground Water Associates (1978) conducted aquifer pumping tests with existing production wells LM-2 and CNA-1 to evaluate hydraulic responses and determine aquifer characteristics in the site area. Transmissivity from LM-2 testing was determined to be 93,123 gpd/ft, and the storage coefficient was calculated to be 0.31. Transmissivity from CNA-1 testing was 85,232 gpd/ft, and the storage coefficient was 0.15. Based on an average saturated thickness of 77 ft, the average hydraulic conductivity was calculated to be 1,100 gpd/ft^2.

2.7 SITE HISTORY

Stauffer Chemical Company previously owned and operated a multi-product chemical manufacturing plant at LeMoyne, Alabama, and an agricultural chemical facility at the adjacent Cold Creek site. The LeMoyne Plant, acquired by Akzo Chemie America (Now Akzo Chemicals Inc.) in 1987, began operations in 1953 with a retort carbon disulfide (CS_2) plant followed by a reactor CS_2 plant in 1956. Several other production facilities were subsequently added and include a sulfuric acid plant (on-line in 1957), a carbon tetrachloride (CTC) plant (1963), a caustic/chlorine plant (1964), and Crystex (a proprietary sulfur compound) plant (1974). The Cold Creek Plant has been in operation since 1966 and is currently owned by ICI Americas Inc. This facility has also expanded its operations over the past 20 years and has manufactured, and continues to manufacture, a variety of agricultural chemicals, including several thiocarbamates. Halby Chemical Company (later part of Witco, Inc.) also operated a small facility from approximately 1965 to 1979 on a leased section of the LeMoyne property (Figure 2-7).

Wastewaters from the Stauffer processes were held in clay-lined lagoons and discharged to the Cold Creek Swamp, which received effluent from the LeMoyne and Cold Creek plants as well as from a previous tenant, the Halby Chemical Company (HCC) until approximately 1975 (Figure 2-7). The effluent from the LeMoyne Plant included discharges of process waters from several production units. Process water discharges from one of the production units contained up to 10 ppm of mercury. Neutralized waste brine from the Cold Creek Plant was also discharged to the swamp during the late 1960s. Data from the June 1988 RI indicate that the contribution from HCC may have included thiocyanate and metal contaminated wastewater. Processed wastewater discharge to the Cold Creek Swamp ceased in 1975 when an effluent transport line was constructed to convey wastewater from treatment areas directly to the Mobile River. Treated effluent discharge to the Mobile River is conducted in accordance with ICI and Akzo individual NPDES permits, and no wastewater is currently discharged to the swamp.

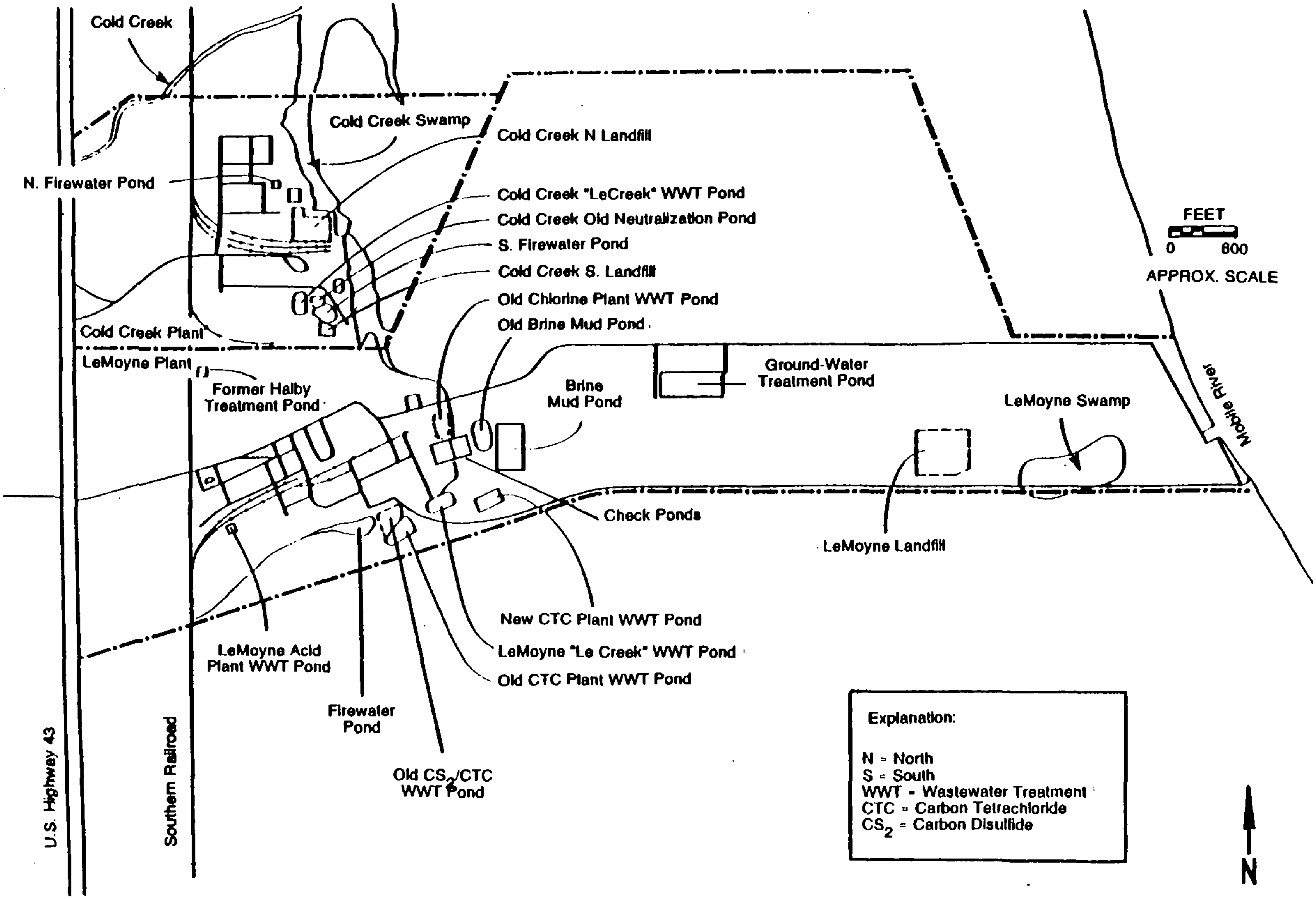

Figure 2-7. Cold Creek/LeMoyne site map.

(Modified After CDM, 1985)

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A small parcel of land on the western portion of the Cold Creek/LeMoyne site was leased from 1965 to 1979 to HCC, as noted above. Witco, Inc., purchased the HCC facility in 1974, and continued to operate the plant until approximately 1979, when the buildings were razed. Although little is known of this operation, waste products and effluents were reported to have been discharged to Cold Creek Swamp to the east and/or held in a pond on the property (Figure 2-7). The Halby Pond has since been closed and filled.

Presumably as a result of these practices, ground-water contamination developed. This was recognized in the early 1970s, and many improvements and waste-handling modifications were made. Lined ponds were installed, solid wastes were diverted for offsite treatment and/or disposal, and the existing disposal sites were cleaned, consolidated, and capped with impermeable covers. The ground-water contamination was addressed by installation of an interception and treatment system. The latter was conducted with review and approval by the Alabama Water Improvement Commission (AWIC), the predecessor agency to the present Alabama Department of Environmental Management (ADEM).

In 1982, an assessment of the plant sites was made by the Alabama Department of Public Health in response to submissions made by Stauffer to the House Committee on Interstate Commerce ("the Eckhardt Survey"). At the request of the Alabama Department of Public Health, additional monitoring wells were installed around the three closed landfills. In 1983, EPA concluded that data from these monitoring wells justified inclusion of the former Stauffer chemical facilities on the NPL, which ranks sites contaminated with hazardous substances under provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), commonly known as "Superfund."

There are currently six closed or inactive wastewater ponds and seven active ponds near the swamp (Figure 2-7). The seven active ponds, LeMoyne "LeCreek," Cold Creek "LeCreek," the new carbon tetrachloride plant wastewater treatment (WWT) pond, the ground-water treatment pond, the LeMoyne acid plant WWT (solids settling) pond, and the north and south chlorine plant wastewater check ponds, are all membrane lined and monitored regularly. Of the six inactive wastewater treatment ponds, four (the old carbon disulfide plant WWT pond, old chlorine plant WWT pond, Halby treatment pond, and Cold Creek old neutralization pond) are closed and covered. The old carbon tetrachloride plant WWT pond was lined and contains approximately 1,900 yd^3 of sulfur sludge; it is inactive but not closed. The old brine mud pond is a lined pond used for storage of brine muds from the chlorine plant. It was originally a RCRA facility, but contents have been delisted and the pond has been closed and is no longer a RCRA facility. One pond is presently a permitted RCRA facility (new brine mud pond) and meets current RCRA standards.

2.8 SUMMARY OF PREVIOUS INVESTIGATIONS

After ground-water contamination (carbon tetrachloride and other volatile organic compounds) was discovered in the early to mid-1970s, investigations of potential sources and clean-up activities were initiated. Two unlined waste burial sites at Cold Creek and the LeMoyne landfill were capped. The use of clay lined wastewater treatment ponds was discontinued, and several were closed. New lined ponds were installed, and treated wastewater was discharged to the Mobile River instead of to Cold Creek Swamp. Spill control and stormwater recycling and drainage controls were upgraded. Low lying plant areas adjacent to the unnamed stream feeding Cold Creek Swamp were selectively backfilled with clean fill material to control flooding. A number of monitoring wells were installed and ground-water analysis commenced. A limited swamp sediment sampling program was also conducted. In early 1986, field activities for a Remedial Investigation (RI) were initiated. Components of the RI sampling program related to this investigation included soil borings and tissue sampling within the swamp, as well as soil borings and ground-water sampling around existing ponds and landfills on the plant sites.

Cold Creek Swamp was sampled at 34 locations with 3-ft-deep soil borings (Figure 2-8). Three composite soil samples were analyzed for thiocarbamates, chlorides, and priority pollutants, including mercury. Remaining composite samples were analyzed for mercury only. Mercury was the only significant priority pollutant detected. No other priority pollutants were detected at concentrations exceeding trace element content ranges for natural soils (EPA 1983). Observed metal concentrations were found to compare favorably with regional soil analytical data provided by ADEM. Most thiocarbamates were found to be non-detectable, although some compounds were found at concentrations between 0.1 and 1.8 mg/kg. Mercury concentrations, as shown in Table 2-2, indicated low to elevated (BMDL to 690 mg/kg) levels. A key finding of the Cold Creek/LeMoyne Superfund sites RI/FS was that no mercury was found in any of the ground-water samples taken on the plant sites. It was concluded that residual mercury in swamp soils existed in a relatively insoluble form and that mercury contamination is not being transmitted from the swamp to underlying ground water. [See Final RI--1988 (ERT)--Appendix XXV]

Biological tissue samples were collected on two occasions at five locations within the swamp and at two background locations, and were analyzed for mercury (Figure 2-9). Levels ranged from below quantitation limits to 3.1 mg/kg based on whole body analysis. The species of finfish collected during the first sampling event are listed in Table 2-3. In addition, crayfish (Procambarus) and earthworms (Sparganophilus and Eisenia) were collected and analyzed as part of the second sampling event.

A total of twelve soil samples was taken around the three landfills. No priority pollutants were found other than low parts-per-million levels of a few heavy metals. A few samples showed above-average values for arsenic and mercury. The area around and under the Cold Creek landfills showed no detectable levels of site-specific (production-related) compounds with minor exceptions, the highest being 1.5 mg/kg molinate (a thiocarbamate pesticide) with an average value of 0.2 mg/kg. The presence of molinate in subsurface soils is considered to reflect residual contamination from prior facility operations. Vanadium levels were

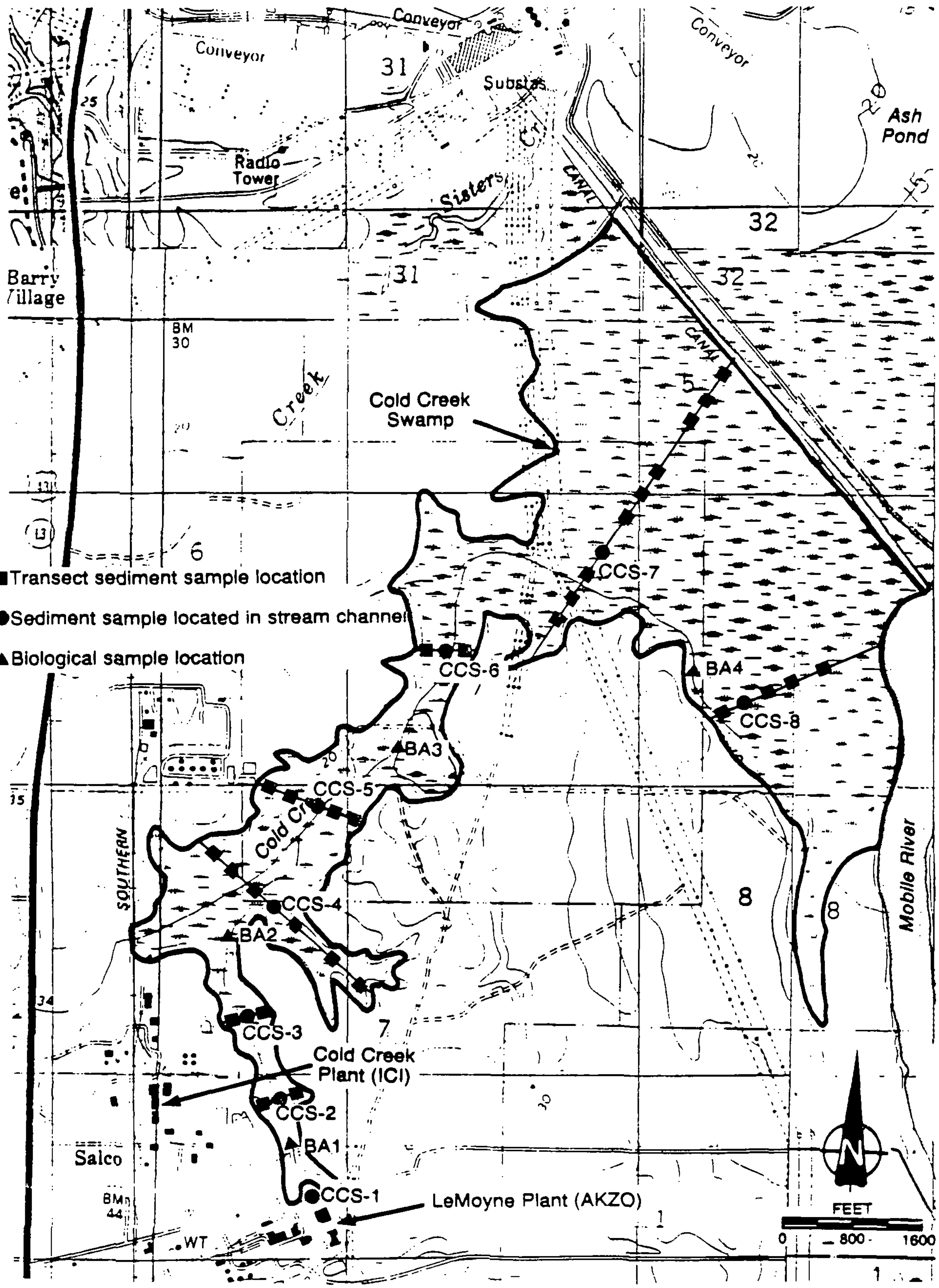

Figure 2-8. Cold Creek Swamp sample locations from original RI/FS.

BCM-CCS-7 Approximately 8 miles due north

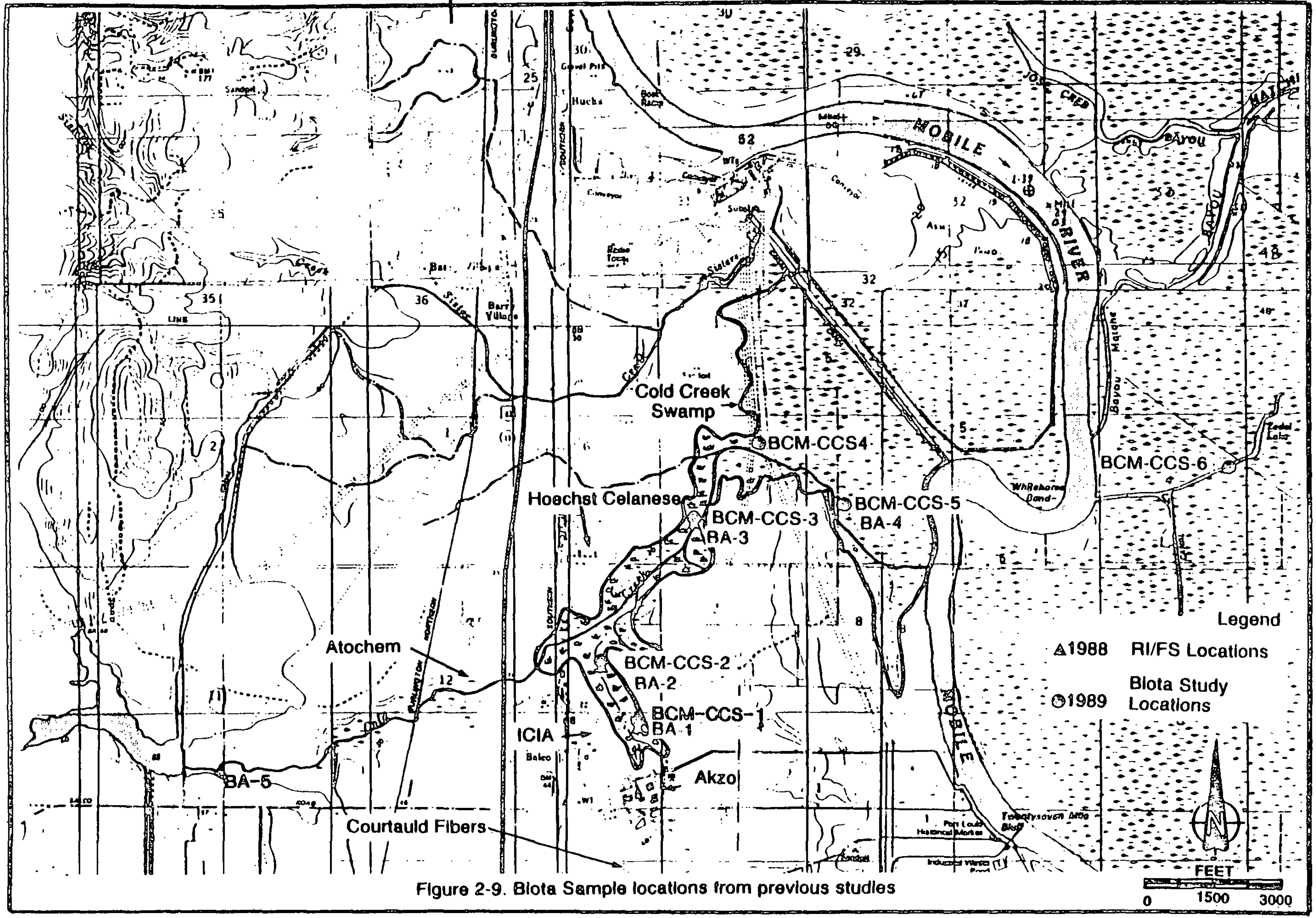

Figure 2-9. Biota Sample locations from previous studies

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TABLE 2-2 RESULTS OF MERCURY SAMPLING AND ANALYSIS OF SOIL SAMPLES IN COLD CREEK SWAMP FROM 1988 COLD CREEK/LEMOYNE SUPERFUND SITES RI/FS

Sample Location (See Figure 2-8)	Mercury Concentration[a] (mg/kg)
CCS-1S	300
CCS-2S	190
CCS-2-1E	1.8
CCS-2-1W	7.3
CCS-3S	230
CCS-3-1E	29
CCS-3-1W	690
CCS-4-1E	58
CCS-4-2E	1.2
CCS-4-3E	2.0
CCS-4-3W	BMDL
CCS-4-2W	0.14
CCS-4-1W	15
CCS-5-1E	1.8
CCS-5-2E	5.3
CCS-5-1W	9.3
CCS-5-2W	12.7
CCS-6-1E	4.9
CCS-6-1W	6.0
CCS-6-2W	5.6
CCS-7-1E	103
CCS-7-2E	35
CCS-7-3E	49
CCS-7-4E	25
CCS-7-5E	10.5
CCS-7-6E	17
CCS-7-3W	0.9
CCS-7-2W	22
CCS-7-1W	7.7
CCS-8-1E	8.3
CCS-8-2E	2.2
CCS-8-3E	1.7
CCS-8-4E	7.0
CCS-8-1W	2.1

(a) Mercury data shown based on chemical analyses from samples collected in May 1986.

TABLE 2-3 FINFISH SPECIES OBTAINED FOR TISSUE SAMPLING DURING 1988 COLD CREEK/LEMOYNE SUPERFUND SITES RI/FS AND 1989 BIOTA STUDY

Scientific Name	Common Name	Station(s)[a]
Anquilla rostrata	American eel	BCM-CCS2, 7
Aphredoderus savanus	Pirate perch	BCM-CCS3, 4, 5, 7
Dorosoma cepedianum	Gizzard shad	BCM-CCS6
Elassoma zonatum	Banded pygmy sunfish	BCM-CCS1, 5, 7
Erimyzon sucetta	Lake chubsucker	BCM-CCS1, 3, 7
Erimyzon tenius	Sharpfin chubsucker	BCM-CCS4, 7
Esox americanus	Redfin pickerel	BCM-CCS4, 7
Etheostoma fusiforme	Swamp darter	BCM-CCS7
Fundulus chrysotus	Gold-spotted topminnow	BCM-CCS1, 2, 3, 4, 5, 7
Fundulus notti	Starhead topminnow	BCM-CCS1, 2, 4, 5, 6, 7
Fundulus olivaceus	Blackspotted topminnow	BCM-CCS6, 7
Gambusia affinis	Mosquitofish	BCM-CCS1, 2, 3, 4, 5, 6, 7
Ictalurus natalis	Yellow bullhead	BCM-CCS3
Labidesthes sicculus	Brook silverside	BCM-CCS6, 7
Lepomis qulosus	Warmouth	BCM-CCS1, 2, 3, 4, 5, 7
Lepomis macrochirus	Bluegill	BCM-CCS1, 2, 3, 6, 7
Lepomis marginatus	Dollar sunfish	BCM-CCS1, 2, 3, 4, 5, 7
Lepomis megalotis	Longear sunfish	BCM-CCS6
Lepomis microlophus	Redear sunfish	BCM-CCS6
Lepomis punctatus	Spotted sunfish	BCM-CCS1, 2, 3, 4, 7
Micropterus salmoides	Largemouth bass	BCM-CCS2, 3, 4, 6, 7
Minytrema melanops	Spotted sucker	BCM-CCS7
Moxostoma poecilurum	Blacktail redhorse	BCM-CCS6
Notemiqonus crysoleucas	Golden shiner	BCM-CCS2, 3, 5
Notropis candidus	Silverside shiner	BCM-CCS6
Notropis emiliae	Pugnose shiner	BCM-CCS6, 7
Notropis roseipinnis	Cherryfin shiner	BCM-CCS7
Notropis texanus	Weed shiner	BCM-CCS6, 7
Percina nigrofasciata	Blackbanded darter	BCM-CCS7

(a) Station locations refer to station locations from the June 1989 Biota Study by BCM Engineers. Note that stations BCM-CCS1 through BCM-CCS3 and BCM-CCS5 correspond to stations BA-1 through BA-3 and BA-4 from the 1988 RI/FS. Station BA-5 was a background location approximately 1 mile west of the site. Station BCM-CCS5 was a new station at the power line junction. Stations BCM-CCS6 and BCM-CCS7 were new background locations.

(b) See Figure 2-9 for biota sampling locations.

typically 1.1 to 30 mg/kg, which is low compared to levels found in natural soil (20 to 500 mg/kg). The synthetic membrane covering of each of the landfills was exposed, sampled, and tested. These were found to be sound with no apparent deterioration.

Eighteen soil borings were made around nine ponds. Analysis of composite samples did not detect priority pollutants except for background levels of some heavy metals. A sample taken inside the closed Halby Pond showed high levels of copper (442 mg/kg), zinc (1,170 mg/kg), and cyanide (240 mg/kg), but samples taken adjacent to the pond were at or below background levels for these compounds. Heavy metals were not found in the ground water. Thiocyanate was detected in several soil samples collected from the Halby Pond borings. Low levels of thiocarbamates were detected in soil samples collected from under Cold Creek's closed neutralization pond. The presence of thiocarbamates in subsurface soils is considered to reflect residual contamination from prior facility operations. Priority pollutants were not detected in surface water samples from two small unnamed tributaries to Cold Creek or in samples taken from three active ponds.

3. INITIAL EVALUATION

3.1 CONTAMINANT CHARACTERIZATION

While a substantial effort has been made to characterize contaminants associated with the Cold Creek/LeMoyne site, much of the sampling effort to date has focused on contamination at the plant sites rather than at Cold Creek Swamp. Existing information on the nature and extent of swamp contamination includes a series of tissue analyses and depth-composite cores taken in 1986 for the original RI/FS (ERT/ENSR 1988) and tissue samples taken during a supplemental biota study (BCM 1989). While composite samples do not provide sufficient information to document the vertical extent of contamination, existing sample results can provide a basis for determining the lateral extent of contamination. Furthermore, three of the samples were screened for the range of EPA Priority Pollutant List compounds. These results provide useful information concerning the nature of soil contamination in Cold Creek Swamp.

Indicator compounds selected according to EPA guidance on the basis of detection frequency, concentration, and toxicity for the original RI/FS were carbon tetrachloride, carbon disulfide, cyanide, mercury, thiocarbamates, organophosphates, chloride, and thiocyanate. Of these, only mercury was detected at significant levels in Cold Creek Swamp. Thiocarbamates were present at low levels. Inorganics (chromium, copper, lead, and zinc) were observed in some soil samples from the swamp; however, most of these concentrations were within expected ranges for normal soils (EPA 1983). A data summary is provided in Table 4-1.

Primary concern for impacts to Cold Creek Swamp environmental receptors has focused on mercury contamination (USDOI 1987, 1989, 1990; NOAA 1989; EPA 1990) since mercury is the most ubiquitous and toxic contaminant that has been found in swamp sediment and biota. While there is reason to believe that sulfide in swamp sediment reduces mercury bioavailability, samples collected in 1986 indicate that mercury has been sequestered in finfish tissue. Total mercury was recovered consistently in composite samples of swamp sediment, with a detection frequency >95 percent at quantified concentration levels ranging from below the method detection level to 690.0 mg/kg.

3.2 POTENTIAL EXPOSURE PATHWAYS

Primary concerns for the environment and human health associated with contamination in Cold Creek Swamp are for potential toxicity to ecological receptors and for potential food-web-based exposure to humans. Because of these concerns and based on existing data, the following exposure pathways are of potential ecological or human health concern:

Ecological Pathways

- exposure to dissolved and sediment-bound contaminants in the surface water column
- exposure to contaminated upland soils
- exposure to contaminated aquatic sediments
- food-web exposure

Human Health Pathways

- food-web exposure
- exposure to dissolved and sediment-bound contaminants in the surface water column
- exposure to contaminated aquatic sediments

Figure 3-1 illustrates a conceptual model of potential exposure pathways in Cold Creek Swamp. The following paragraphs discuss the relative importance of each identified pathway with respect to existing data and understanding of the ecological dynamics of the swamp ecosystem.

3.2.1 Surface Water as a Potential Exposure Route

Surface water hydrodynamics in Cold Creek Swamp are complex. The upper and lower hydrologic zones of the swamp exhibit consistent, unidirectional base flow, while surface flow through the middle zone is intermittent (Figure 2-3). Observations made during a recent dry period (August 1990) suggest that base flow stretches (upper and lower hydrologic zones) are depositional while the intermittent stretch (middle hydrologic zone) is highly erosional. At the discharge delta where Cold Creek meets the Mobile River, it appears that surface water may flow either into or out of the Mobile River, depending on water levels. During the August 1990 site visit, it was noted that surface water from the Mobile River was flowing back into Cold Creek across an active, intact beaver dam. It is likely, however, that flow across the delta is out into the Mobile River at other times, although the river floodplain is broad in this stretch, and high water may result in flow into Cold Creek across the river levees.

Previous investigations of the Cold Creek Swamp have not examined surface water quality in the swamp; however, two surface water samples taken in the general vicinity of Cold Creek Swamp as a component of the 1988 RI revealed mercury and zinc to be the only quantifiable contaminants. Additional characterization of surface water quality in the swamp should be conducted to identify contaminants of concern. Based on sediment-source concentrations, metals (primarily mercury) would be expected to be the only compounds of concern in the water column in the swamp. Concentrations of organic indicator compounds in swamp sediments (1988 RI Report) were sufficiently low that dilution of dissolved or particulate-phase substances by water-column volume would render water-column concentrations exceedingly low.

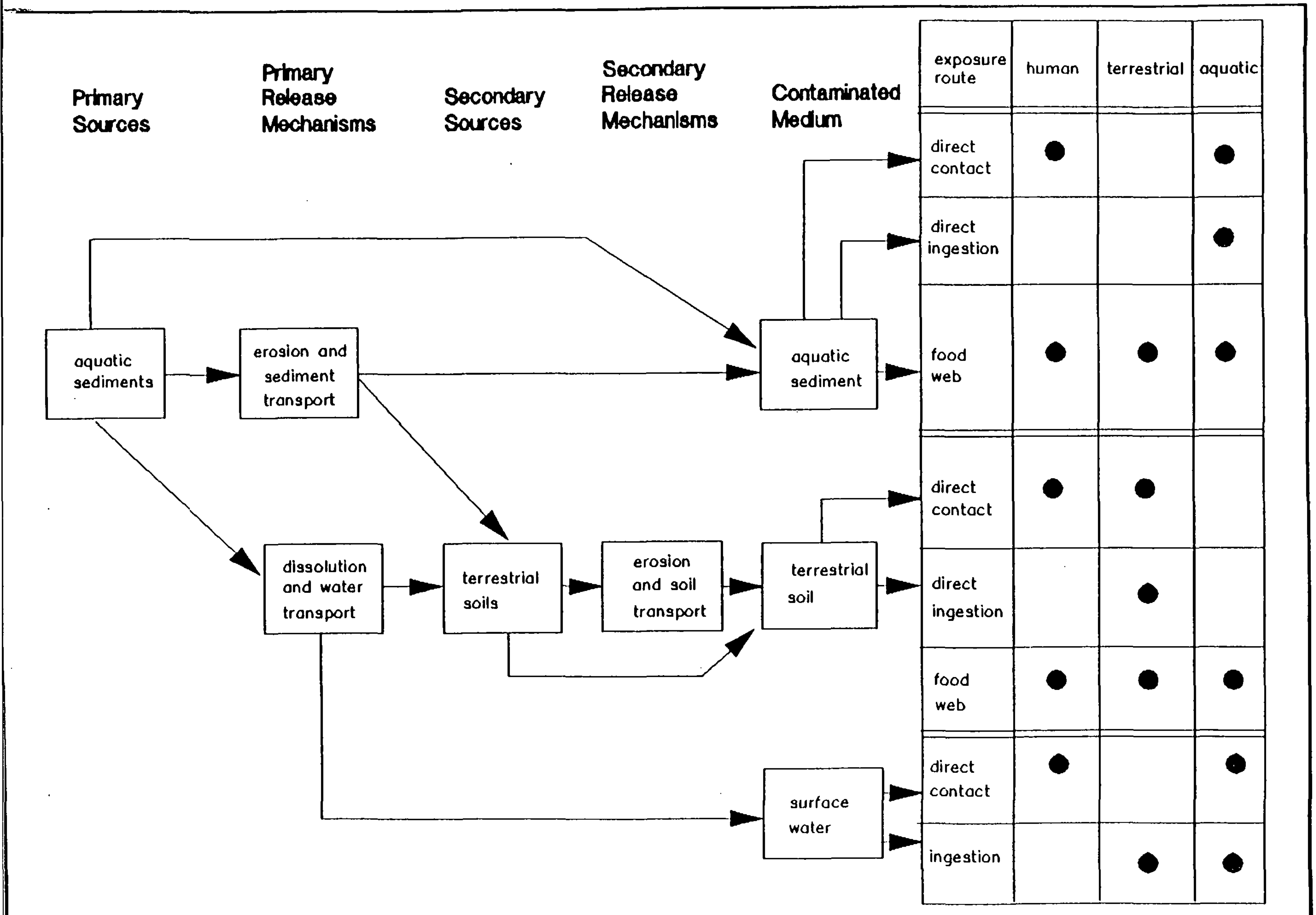

Figure 3-1. Cold Creek Swamp conceptual site model.

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Dissolved and particulate-phase mercury may both be of concern in the surface water column. Mercury may be present in both inorganic (e.g., H_2S) and organic (primarily as methyl) forms. In general, organic forms associated with dissolved or particulate carbon dominate biotic uptake. Consequently, the major concern for exposure to water-column contaminants is via feeding uptake by filtering organisms. Typically, mercury (if present) is expected to be found at low concentrations in tissues of filter-feeding detritivores. However, once sequestered as organomercury, depuration is slow, and bioaccumulation can occur. Under these conditions, it is possible that ecological populations in the swamp may be exposed to mercury through the food web. For terrestrial animals, direct consumption through drinking is a potential exposure route. Existing data are insufficient to address this issue.

In addition to direct exposure to waterborne contamination, erosion and transport may represent contaminant exposure pathways. Cold Creek Swamp is hydrodynamically active, and sediment suspension through flooding periodically occurs. Contaminated sediment suspended in the water column may deposit down- or up-stream (depending on water levels and flow directions and velocities) either in aquatic or periodically flooded upland areas. These depositional areas are considered to be secondary sources for potential exposure of receptor organisms.

3.2.2 Upland Soils as a Potential Exposure Route

As discussed above, terrestrial upland soils may have become contaminated via transport of dissolved or suspended materials. Under these circumstances, upland soils would be considered secondary exposure sources. While it is likely that dilution and dispersion reduce the concentration of contaminants following transport and deposition, there is insufficient data to address this question. This Work Plan provides for samples to screen terrestrial soils for site-related contaminants and assess potential threats of such contamination to human health and the environment.

As with surface water, mercury is considered to be the primary contaminant of concern for upland soils. Direct contact and subsequent uptake by plants or burrowing animals and food-web uptake are the potential exposure routes for upland soil contamination. In general, mercury is not taken up or bioconcentrated by plants unless the substrate is contaminated to very high levels. Thus, the primary exposure route is through food-web uptake by higher species. Soil invertebrates ingest contaminants with their particulate food sources, sequester mercury in organic forms, and pass it up the food web. In this way, terrestrial organisms at higher trophic levels can accumulate substantial body burdens even at relatively low water and soil concentrations.

3.2.3 Aquatic Sediments as a Potential Exposure Route

Exposure to contaminated sediments is expected to be the primary ecological exposure pathway in Cold Creek Swamp. Many of the most critical resource species are aquatic or depend on aquatic systems, and Cold Creek Swamp sediments have been found to be contaminated. Previous sediment sample results indicated detectable concentrations of thiocarbamates and certain metals. Mercury was detected with the greatest frequency and at the highest relative concentration. The other contaminants were found at relatively low concentrations, which represent lower relative exposure risks. Composite samples taken to date suggest a contamination gradient away from former discharge areas down the long axis of the swamp.

Organic forms of mercury are critical to biological uptake in aquatic ecosystems. Biotically mediated methylation can drive mercury concentration far from chemical equilibrium for metallic mercury (Gill and Bruland 1990), and even very low rates of methylation can result in substantial food-web uptake because of low depuration rates of methyl mercury from organisms (Faust and Aly 1981). Present data are insufficient to distinguish among possible future conditions in Cold Creek Swamp. If mercury is being sequestered in depositional areas beneath biotically active sediment zones, existing fish tissue data may represent peak body burdens.

Consequently, risks may be reduced by naturally occurring wetland processes. Alternatively, it is possible that ongoing processes continue to yield microbially methylated mercury available for food-web uptake. Because sediment contamination drives environmental risks in Cold Creek Swamp, the present Work Plan is specifically designed to quantitatively assess potential threats to receptors.

3.2.4 Ecological and Human Health Exposure via the Food Web

As discussed above, most of the potential impacts of mercury are driven by food-web interactions. The major concerns for soil, sediment, and water column contamination focus on the potential for mercury to enter food webs in various forms and to subsequently accumulate in tissue of receptors of concern. This Work Plan is designed to yield data sufficient to define the nature and extent of contamination, quantify contaminant risks to potentially affected native species in Cold Creek Swamp and to human health through the food chain, and project future behavior of contaminants in various environmental media. A substantial effort will be devoted to characterizing and modeling swamp food webs, as this is the primary route of potential exposure to both ecological and human receptors.

3.3 RESPONSE OBJECTIVES

The general objectives of the RI/FS process are to characterize the nature and extent of risks associated with site contamination and to evaluate potential remedial options. The overall objective of this RI/FS is to supplement existing investigatory work to support quantitation of site-related risks and assessment of remedial alternatives for the Cold Creek Swamp Operable Unit of the Cold Creek/LeMoyne Superfund sites. A staged investigation approach is proposed to assure the greatest flexibility to focus the investigation on the contaminants of greatest concern. Specific tasks to be performed to meet these response objectives include the following:

- Developing an inventory of environmental receptors present in the swamp, including key wetland plants and animals, and endangered or threatened species.

- Delineating wetland boundaries and the extent of upland in Cold Creek Swamp.

- Characterizing the nature and extent of contamination present in swamp soil, sediment, surface water, and biota, including screening samples for Target Compound List analytes and thiocarbamates and quantifying mercury both at depth and in biotically active zones.

- Characterizing contamination upstream, downstream, and within Cold Creek Swamp, and the interaction of the surface water system with the ground-water regime based on data from previous and ongoing investigations, information to be gathered under this Work Plan, and other available information.

- Estimating and verifying quantitative risks to human health and the environment due to site-related contaminants by modeling exposure and toxicity and measuring tissue concentrations in key receptors.

- Evaluating potential remedial alternatives.

Based on available information and on regulatory guidance and comments regarding this operable unit, it is anticipated that potential environmental and human health risks will be driven by food-web interactions involving mercury as the primary contaminant. If other contaminants are identified as contaminants of concern as a result of the Stage I characterization, the staged approach developed for this study will allow subsequent characterization stages to be modified to address other contaminants, as appropriate. Because the ecosystem of concern is a hardwood wetland of some intrinsic resource quality, a careful assessment of relative risks of various remedial options will be made in addition to evaluation of potential present and future contaminant-associated impacts.

4. WORK PLAN RATIONALE

This section addresses the Data Quality Objectives (DQOs) necessary for the risk assessment and the evaluation of remedial alternatives. The Work Plan rationale is presented in order to illustrate how field investigation activities will satisfy data needs.

A three stage data collection approach will be used. The staged approach is used to optimize sampling, locations, and data needs for each of the three stages and to assure the greatest flexibility to focus the investigation on contaminants of greatest concern. Stage I and II data collection efforts will concentrate on soil/sediment characterization and characterization of surface water within and around the swamp. The frequency and types of sampling proposed for Stages I and II have been developed based upon results of previous site characterization of Cold Creek Swamp done during the original RI/FS for the Cold Creek/LeMoyne Superfund sites, and pursuant to data needs indicated in regulatory review comments on the original RI/FS. Existing data indicate that mercury represents the primary contaminant of concern. The Stage II sampling program has been developed based upon this premise. The scope of Stage II sampling may be modified if additional contaminants of concern are identified based on assessment of Stage I data.

Data collection in Stage III will concentrate on biological tissue characterization. The exact scope of Stage III sampling will be determined subsequent to results of Stage I and II data collection and ecological modeling, so that the most meaningful biological characterization with the minimum amount of species sacrifice can occur.

Data collection must be sufficient to allow the following tasks to be carried out:

- Site Contamination Characterization - Assess the nature and extent of contamination within and around Cold Creek Swamp.

- Bioaccessible Contaminant Characterization - Assess the nature and extent of contamination within the biologically active zone of Cold Creek Swamp sediments.

- Biological Tissue Characterization - Assess the nature and extent of contamination within potentially affected biota.

- Risk Assessment - Develop a database for future evaluation of the threat posed by the site to ecological and human receptors.

- Evaluation of Alternatives - Develop a database for evaluation of remedial technologies during the feasibility study phase.

- Engineering Design - Support engineering design.

4.1 DATA QUALITY/QUANTITY NEEDS

The following sections discuss determination of the specific data quality/quantity needs for each environmental medium to be sampled during field activities for the supplemental RI/FS at the Cold Creek Swamp Operable Unit. It should be noted that the number and type of analyses to be performed in Stages II and III may be modified pursuant to assessment of data from previous stages.

4.1.1 Soil/Sediment Sampling Data Requirements

Existing data collected during the original RI/FS revealed concentrations of mercury ranging from below quantitation limits to 690 mg/kg in samples collected from shallow soil cores throughout Cold Creek Swamp. Other observed compounds included arsenic (5 mg/kg), chromium (130-180 mg/kg), lead (below detection level to 31 mg/kg), nickel (32-56 mg/kg), zinc (171-561 mg/kg), and several thiocarbamate pesticides (not detected to 1.8 mg/kg). Concentrations of all observed compounds were within order of magnitude levels typical of natural soils (Table 4-1) with the exception of mercury and the thiocarbamates. Previous data collection did

TABLE 4-1 PREVIOUS SOIL/SEDIMENT ANALYTICAL RESULTS FOR COLD CREEK SWAMP (1988 RI DATA)

Compound	No. of Locations sampled	Concentration Range (mg/kg)	Average Concentration (mg/kg)	Average Concentration in Natural Soils[a] (mg/kg)	
VOC's	3	ND[b]	ND	NA[c]	
Semivolatiles	3	ND	ND	NA	
PCB's/Pesticides	3	ND	ND	NA	
Metals				Range	Average
Mercury	34	ND-690	54.7	0.01-0.3	(.03)
Arsenic	3	5-5	5	1-50	(5)
Beryllium	3	.31-.8.1	0.53	0.1-40	(6)
Chromium	3	120-180	150	1-1,000	(100)
Copper	3	14-35	27.7	2-100	(30)
Lead	3	ND-31	19	2-200	(10)
Nickel	3	32-56	46.9	5-500	(40)
Zinc	3	171-561	348	10-300	(50)
Thiocarbamates					
EPTC (Eptam)	3	.1-1.0	.4	NA	
Butylate (Sutan)	3	ND-1.8	.7	NA	
Vernolate (Vernam)	3	ND-1.1	.4	NA	
Pebulate (Tillam)	3	ND-.3	.1	NA	
Molinate (Ordram)	3	.1-.9	.5	NA	
Cycloate (Ro neet)	3	ND-1.8	.8	NA	
Chloride	3	ND-50	33.3	NA	

(a) = Reference: *U.S. EPA Office of Solid Waste and Emergency Response, Hazardous Waste Land Treatment, SW-874 (April 1983) p.275, Table 6.46.*

(b) = ND - Not Detected

(c) = NA Not Available

not characterize contaminant concentrations at discrete vertical depths and did not differentiate between total and organic (methyl) mercury. The vertical distribution of contaminants is needed to identify whether contamination is concentrated in the biologically active zone of swamp sediments or is distributed throughout the soil matrix. Differentiation of total and organic (methyl) mercury is needed to indicate how much mercury is inorganic and how much is organic. Table 4-2 identifies sampling requirements for investigation activities for this supplemental RI/FS. Available data indicate that mercury will be the primary contaminant of concern in swamp soil/sediment. As such, Stage II sampling is designed to focus on refining mercury characterization. If additional contaminants of concern are identified during Stage I, Stage II will be modified, as appropriate.

Data collected from soil/sediment sampling will be used for several purposes. All of the Stage I soil/sediment sampling data and approximately half of the Stage II soil/sediment sampling data will be used for determination of the nature and vertical and horizontal extent of contamination; potential migration pathways (erosional and depositional) and rate of migration; and preliminary indication of source areas and "hot spots." Background concentrations of metals will be determined by calculating the geometric mean of soil/sediment samples taken at selected background locations. Cold Creek Swamp soil/sediment samples will be compared to background data to determine whether or not to analyze Stage II samples for specific metals contamination. The remainder of Stage II sampling data will be used to assess the nature and extent of contamination located specifically within the biologically active zone (upper 4 in.) of Cold Creek Swamp sediments. In addition to site characterization, soil/sediment data will be used for ecological modeling and risk assessment purposes. Soil/sediment sampling locations have been selected based upon examination of previous Cold Creek Swamp characterization and preliminary site reconnaissance by EA in August 1990.

TABLE 4-2 CHEMICAL COMPOUNDS TO BE ANALYZED IN SOIL/SEDIMENT SAMPLES

Compound	Number of Sample Locations	Number of Analyses
Stage I		
TCL Volatile Organics	12	17
TCL Semivolatile Organics	12	17
TCL Pesticides/PCBs	12	17
Cyanide	12	17
Thiocarbamates	12	17
Mercury (Total)	19	51
Other TAL Metals	16	21
Methyl Mercury	19	51
Sulfide	15	47
Stage II[a]		
Mercury (Total)	105	153
Methyl Mercury	72	96
Sulfide	105	153
Total Organic Carbon	60	60
Stage III[a]		
Not addressed at this time		

(a) The final number of samples and parameters to be analyzed for during Stages II and III may be modified pursuant to assessment of data results from previous stages.

Since this site is an Operable Unit for two NPL sites, analytical detection levels for chemical analysis will meet EPA Level III requirements. This level employs approved EPA procedures with specified detection limits. The appropriate analytical methods and detection limits are provided in the Quality Assurance Project Plan.

4.1.1.1 Applicable or Relevant and Appropriate Requirements (ARARs) for Soil/Sediment Sampling

Section 121 (d) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), requires that remedial actions at Superfund sites comply with requirements or standards under Federal or State environmental laws that are "applicable" or "relevant and appropriate" to the hazardous substances, pollutants, or contaminants at a site or the circumstances of the release. A requirement may be either applicable or relevant and appropriate to a remedial action, but not both. An applicable requirement is one that specifically addresses a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a hazardous waste site. Relevant and appropriate requirements, while not applicable, address problems or situations sufficiently similar to those encountered at a hazardous waste site so that their use is well suited to the particular site (55 FR 8666, 8 March 1990).

No federal or Alabama state standards, criteria, or guidelines are relevant to chemical contamination in soil or sediment; however, certain technical documents may be reviewed to assess potential exposure (including a March 1990 publication by NOAA entitled "The Potential for Biological Effects of Sediment-Sorbed Contaminants Tests in the National Status and Trends Program," and documents related to EP, and sediment toxicity testing).

4.1.1.2 Critical Samples for Soil/Sediment Analysis

Critical samples are those samples for which scaled data must be obtained to satisfy the objectives of the sampling and analysis task. They are as follows:

- Field Duplicate--to be collected one per 20 samples per matrix, for purposes of comparing repeatability of laboratory chemical analysis results and sampling procedures.

- Rinsate Blank--to be collected one per site per sampling event to demonstrate field sampling decontamination procedure effectiveness. Rinsate blanks will not be collected on dedicated sampling devices.

- Field Blank--to be collected one per site per sampling event to demonstrate preservation reagent quality and aliquot container cleanliness.

- Trip Blank--[volatile organics analysis (VOA) only] to accompany each shipment of samples (if VOA analysis is part of shipment) for purposes of demonstrating the effect of transport on the sample matrix.

In addition, soil samples will be collected from upland locations beyond the limits of the swamp and will be used as background soil samples. Those samples, along with background soil samples collected during the original RI/FS, will be used as a background baseline for soil.

4.1.2 Surface Water Sampling Data Requirements

No sampling has been conducted in the Cold Creek Swamp, although limited surface water sampling was conducted in the vicinity of Cold Creek Swamp as a component of the original RI/FS. Two surface water samples were collected from unnamed tributaries to Cold Creek. One tributary is located north of the Hoechst-Celanese Plant (north of Cold Creek), and the other is located approximately 100 ft north of the LeMoyne-Courtaulds Fibers property line near the railroad tracks. Previous surface water samples did not exhibit concentrations of priority pollutants above detection levels, with the exception of mercury (0.0002 mg/L) and zinc (0.31 mg/L) in one of the two samples.

Surface water data collection for this project is proposed to characterize surface water quality within the Cold Creek Swamp, within waters discharging to Cold Creek Swamp, at the mouth of Cold Creek and within the Mobile River, upstream and downstream of the swamp discharge location. The objectives of surface water data collection are to characterize contamination upstream, downstream, and within the Cold Creek Swamp; and to characterize contaminant transport via surface water and the potential for ground-water contamination through surface water aquifer recharge. Table 4-3 shows the proposed sampling program for investigation activities for this supplemental RI/FS.

Since surface water quality data will be used in ecological modeling and risk assessment, and since the site is an operable unit for two NPL sites, EPA Level III analytical data levels will be utilized.

4.1.2.1 ARARs for Surface Water Sampling

The Cold Creek/LeMoyne Superfund sites RI/FS concluded that surface water exposure at the Cold Creek and LeMoyne plants does not constitute a human health exposure pathway, based upon site use and limited site access. Cold Creek Swamp, however, represents an excellent habitat for wildlife, and potential receptors are the native plant and animal species. Water Quality Criteria (WQC) values established under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977, and the Water Quality Act of 1987, will be probable ARARs governing surface water quality. Table 4-3 shows the surface water parameters to be analyzed during the field investigation for this project.

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TABLE 4-3 CHEMICALS TO BE ANALYZED IN STAGE I SURFACE WATER SAMPLING

Compound	Number of Samples
TCL Volatile Organics	6
TCL Semivolatile Organics	6
TCL PCBs/Pesticides	6
Thiocarbamates	6
Cyanide	6
Methyl Mercury	6
Other TAL Metals	6

4.1.2.2 Critical Samples for Surface Water Analyses

The samples that will be classified as critical for purposes of this investigation are the same type of samples as described for soil/sediment sampling. Three of the ten proposed surface water sampling locations are intended for use as background water quality assessment. Background samples will be taken upstream of the project site along Cold Creek south and west of the site, and along the Mobile River north of the site.

4.1.3 Biological Tissue Sampling Data Requirements

Biological tissue sampling was conducted in Cold Creek Swamp in 1986 (1988 RI Report by ERT) and in 1988 (1989 Biota Study by BCM). Five species-composite samples of finfish were analyzed for whole-body mercury concentrations in 1986, and species-specific analyses including invertebrates were conducted in 1988. Some samples, including one taken above Cold Creek Swamp at a reservoir outfall in the headwaters of Cold Creek, carried mercury body burdens above those that would be expected in uncontaminated areas.

Samples to support quantitative risk estimates will be based on mercury food web and bioaccumulation model calculations. These models will incorporate information on resources present in the swamp, trophodynamics of the swamp ecosystem, and key receptor species chosen on the basis of scientific and regulatory requirements. Criteria to support selection of key receptors will include (1) potential risk of contaminant uptake and associated population effects, (2) unique value or regulatory status, and (3) potential for community or ecosystem-level effects. Samples will be taken of appropriate species to determine potential bioaccumulation, toxicity, and impacts as indicated by models. This approach minimizes the number of destructive samples that must be taken from swamp populations, and maximizes the value of each sample by providing a mechanistic basis for understanding mercury dynamics in the ecosystem.

Tissue data are required for specific comparative and risk assessment purposes, and detection limits, quantitation limits, precision, and accuracy will be defined by the analysis and study purpose. DQOs will provide accuracy and precision sufficient to meet the modeling objectives and characterize site-related risks. Within the limits of available methods, analytical methods will provide quantitation limits compatible with those employed for samples from other environmental media.

The existing database provides an opportunity to assess temporal trends in tissue contamination, allowing projection of future conditions given ongoing ecological processes. Biological tissue sampling for mercury will be conducted to characterize possible changes since 1986 and to support quantitative estimation of risks to human health and ecological resources. Samples to characterize temporal trends will reproduce as closely as possible the sampling that was conducted in 1986. Reports, notes, and interviews with and direction by personnel present at the past sampling will be employed to locate new samples in the vicinity of the old. Collection, analysis, and reporting methods will be similar, maximizing the comparative value of these samples.

4.1.3.1 ARARs for Tissue Samples

Consistent with EPA guidance (EPA 1989b), criteria will be identified which serve as potential ARARs. In general, tissue ARARs are limited and vary among states and regions. For Cold Creek Swamp, it is anticipated that federal or state tissue consumption limits, criteria possibly derived from CERCLA/NEPA equivalence, and/or additional state criteria may apply as ARARs or criteria to be considered (TBCs). Applicability will be assessed for each potential ARAR, based on study findings relating to human and environmental exposure, nature and extent of contamination, and contaminants potentially present.

4.1.3.2 Critical Samples for Tissue

Critical samples for quality assurance will be determined by analytical methods and will include blanks and duplicates as appropriate. The study as designed on the basis of environmental risk modeling does not rely on comparison with a "reference" area for tissue, because contaminant-associated risks in Cold Creek Swamp may be quantified and are of primary interest. However, at least one reference station with multiple samples will be included for samples taken in the Mobile River to determine upstream background concentrations of mercury.

4.2 SITE SAMPLING WORK PLAN DESIGN AND RATIONALE

In order to meet the stated objectives of this supplemental RI and to satisfy the specific data requirements previously established in this section, a Work Plan rationale must be defined. A synopsis of the data requirements for the Cold Creek Swamp supplemental RI follows:

- To further define the nature and extent of soil/sediment contamination within and around Cold Creek Swamp. A primary objective will be to characterize contamination both vertically and horizontally. Previous investigations did not sufficiently characterize vertical extent of characterization. The nature of contamination will also be more thoroughly characterized.

- To examine the bioavailability of identified contamination at the site. This program will include a series of soil and biological tissue sampling events that will differentiate between bioavailable (organic) and sediment-bound (inorganic) mercury contamination. Soil sampling will be designed to examine contaminant concentrations within discrete zones of the soil/sediment column.

- A program to identify the areal and ecological limits of the swamp will be conducted. The program will include wetlands delineation, qualitative modeling of the wetland, and an ecological assessment based upon the flora and fauna identified within and around the swamp.

- To further characterize surface water quality both within, and upstream of, Cold Creek Swamp.

- To assess surface-water/ground-water interactions based on data collected in this Work Plan, data from previous and ongoing investigations at the site, and other available information.

- To assess the potential impact to the Mobile River from the swamp through review of sediment and surface water sample data, surface water physical measurements, and data from other previous and ongoing investigations.

As noted previously, based upon the project data requirements, a three stage field investigation program has been developed. The program will be implemented on a staged basis to allow results of previous stages to be reviewed prior to initiation of subsequent stages, and to focus subsequent stages on identified contaminants of concern. The following sections describe field activities to be performed in the three stage field investigation at Cold Creek Swamp.

4.2.1 Stage I Field Activities

The primary objectives of Stage I Field Activities will be to (1) characterize the nature of contamination within and around the swamp, (2) characterize the depth of contamination of selected locations within the swamp, (3) characterize surface water quality both within and upstream of Cold Creek Swamp, (4) delineate and map the wetlands at the site and establish biophysical limits of the swamp, and (5) characterize the Cold Creek Swamp ecological community via species monitoring. Based upon data results obtained during Stage I, the Stage II data collection program will be focused to concentrate on characterization of contaminants of concern.

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The nature of swamp sediments makes it impossible to obtain rigidly defined depth characterization because of slumping, flushing, and mixing within the soil sampling devices. Therefore, in the following discussions the reader should keep in mind that all depths are approximate, that sample collection equipment actually employed will be subject to ability to successfully collect samples as indicated, and that interpretation will be subject to possible cross-contamination among depths.

4.2.1.1 Contaminant Nature Characterization

During previous investigations soil samples were collected from designated locations within Cold Creek Swamp for chemical analyses. Three soil samples were analyzed for priority pollutants, thiocarbamates, chlorides, and eight metals (including mercury). An additional 30 samples were analyzed for mercury only.

To address concerns that all potential contamination has been investigated, a focused sampling program to characterize contaminant nature will be conducted as part of Stage I field work. For this program, samples will be collected from each of the three hydrologic zones of the swamp (upper, middle, lower), including sample location CCS-3 of the original RI. This sample exhibited the highest mercury and thiocarbamate concentrations during original RI site characterization.

Twelve locations have been selected for the contaminant nature characterization. Two samples each will be collected from five of the sample locations. Samples will be collected at the surface (0-1 ft) and at 1-2 ft below the surface at these locations. One (0-1 ft) sample will be collected from the other seven locations. All samples will be analyzed for the organic parameters on EPA's Target Compound List (TCL) and the inorganic parameters on EPA's Target Analyte List (TAL). In addition, in order to characterize the bioavailable component of mercury, samples will be analyzed for organic (methyl) mercury. Samples will also be tested for thiocarbamates (Table 4-2).

Also, four samples will be taken from additional background locations for TAL metals scan only. The purpose of these samples is to confirm the actual local background conditions for these naturally occurring analytes. Inorganics in nature have a large variance and these samples will lessen the risk of an anomalously low background hit occurring.

Specific sample locations are identified in Chapter 5. Sampling equipment, sampling procedures, and sample handling procedures are described in Chapter 6.

4.2.1.2 Contaminant Depth Characterization

A vertical profile of site contamination characteristics cannot be prepared based on previous investigations. Previous sampling efforts collected 3-ft soil cores and all samples were composited prior to analysis. The objective of the Stage I contaminant depth characterization in this study is to assess the vertical distribution of contamination at selected locations within the swamp.

Three sample locations are proposed--one in each of the three hydrologic zones of the swamp (upper, middle, lower). Samples will be collected using split-barrel samplers driven by a drill rig mounted on an all-terrain vehicle (ATV). Discussions with drillers familiar with the site indicate that this approach will be feasible. Samples will be analyzed for total and organic mercury, sulfide, and pH. A detailed description of contaminant depth characterization sampling protocol and the sampling point locations is presented in Chapter 5. Sampling equipment, sampling procedures, and sample handling procedures are described in Chapter 6.

4.2.1.3 Surface Water Characterization

Surface water samples will be collected from selected locations within and upstream of Cold Creek Swamp. The purpose of this task is to evaluate the effect of site drainage as a potential contaminant migration and exposure pathway; to assess the nature of contamination within the Cold

Creek Swamp surface water column; and to characterize the physical interaction of surface water and sediment within the swamp and surrounding waterbodies. Samples collected during a dry period (i.e., no precipitation for 3 days prior to sampling) will be considered representative of base flow. Consequently, this condition will be considered an effluent (i.e., gaining stream) situation. Samples will be analyzed for the full EPA Target Compound List, including TAL metals and thiocarbamates. A total of six locations will be sampled. In order to examine the surface water/sediment interaction within and around the swamp, streamflow, water level, and dissolved oxygen measurements will be taken at each sample collection station. Streamflow and water level measurements will also be taken during Stage II and III sampling events to assess the impact of weather conditions on surface water conditions.

Specific sample locations and sampling protocol are identified in Chapter 5. Sampling equipment, sampling procedures, and sample handling procedures are described in Chapter 6.

4.2.1.4 Wetland Delineation and Characterization

The limits of the Cold Creek Swamp system will be delineated in accordance with the approach described in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation 1989). This approach permits a standardized evaluation of the soils, hydrology, and vegetative community of an area and provides a framework for determining whether the evaluated area is wetland or non-wetland.

There are several methods that can be used for evaluating whether or not a soil is hydric (wetland). Of these, color variations are perhaps most commonly used in non-sandy soils. Color is influenced by frequency and duration of saturation, while the distribution of color (mottling) is affected when periods of saturation are short and fluctuation of the water table is more frequent.

Soil color cannot be used as an indicator in sandy soils, although colors may be helpful in loamy sandy soils with appreciable quantities of silt or clay. An accumulation of organic matter at the surface, vertical streaking with darker colors, or a thin, hardened layer 12-30 in. below the surface (spodic) are features used to determine hydric status in the case of sandy or alluvial soils.

Wetland delineation guidelines require evidence that an area designated as wetland is inundated or saturated at some time during the growing season (wetland hydrology). Indicators of periodic saturation or inundation include drainage patterns, drift lines, sediment deposition, watermarks and staining, streams and seeps, and flood data. The water source for wetlands has a major influence on the length of time an area is wet. Topographic position and soil permeability are also important. Streams are often bounded by wet areas, as are springs and seeps. These areas are usually wet all the time. Areas of poorly permeable soils (clays) may, however, be wet only during times of heavy precipitation when ponding occurs. In these areas, water drains more slowly, allowing the seasonal presence of hydrophytes (wetland plants).

Mapping for this project may consist of review of aerial photographs, topography, and soils information. These data will be combined with field reconnaissance ground-truthing efforts.

In addition to the delineation of the wetland system, an approach to further discriminate among the different wetland communities will be implemented through the application of the U.S. Fish and Wildlife Service Classification System (Cowardin et al. 1979). Similarly, attempts to identify subcommunities of the Cold Creek Swamp system based on wetland hydrology, other wetland processes (e.g., depositional areas), and wetland functional values will be made. This approach should permit corroboration of observed and measured patterns of sediment and biota contamination through evaluation of site-specific wetland characteristics and modeling the relationship between these characteristics and wetland functional processes.

The Wetland Evaluation Technique (WET) will be used to model the relationship between observable and measurable physical, chemical, and biological characteristics and wetland functions and values. This approach (Adams et al. 1987) is a standardized technique by which 14 well-defined wetland functions are evaluated. The Wetland Evaluation Technique yields a qualitative evaluation of wetland functions in terms of social significance, effectiveness, and opportunity to perform.

The functions evaluated by WET are ground-water recharge, ground-water discharge, floodflow alteration, sediment stabilization, sediment/toxicant retention, nutrient removal/transformation, production export, wildlife diversity/abundance, aquatic diversity/abundance, recreation, and uniqueness/heritage. Generally, a single wetland area cannot have high value for all functions since some of these functions are antagonistic (e.g., ground-water recharge and ground-water discharge.)

WET assesses functions and values by characterizing a wetland in terms of its physical, chemical, and biological processes and attributes. This characterization is accomplished by identifying threshold values for predictors. Predictors are simple or integrated variables that directly or indirectly measure the physical, chemical, and biological processes or attributes of a wetland and its surroundings. Threshold values for predictors are established by addressing a series of questions concerning each predictor. Responses to the questions are analyzed in a series of interpretation keys within a computer model that define the relationship between predictors and wetland functions and values as defined in the technical literature. The interpretation results in the assignment of a qualitative probability rating of HIGH, MODERATE, or LOW to functions and values in terms of social significance, effectiveness, and opportunity.

The objective of wetland modeling using WET is to facilitate evaluation of the wetland system's functions as they relate to the storage and transport of contaminants within and among hydrologic components of the wetland (e.g., sediment, ground water, and surface water). WET model output will help explain observed pattern and importance of sediment, water, and biological tissue data.

4.2.1.5 Biota Inventory

An inventory of biota present or potentially present is necessary to develop site-specific food web models. An observation-based inventory will be coupled with published data and experience in the ecosystem of concern to compile an inventory of Cold Creek Swamp biota.

4.2.2 Stage II Field Activities

At the completion of Stage I data analysis, a series of risk screenings was conducted. The objective of the risk screenings was to identify chemicals of concern (COC) for further characterization during subsequent stages of the field sampling effort. The human health risk screen examined exposure pathways and assumptions that had been established with concurrence from EPA prior to Stage I sampling. No compounds, including mercury, were found to present increased human health risk. The ecological risk screen examined compounds with respect to toxicity potential, bioaccumulation factors (BCfs), and detection frequency using a weighted modeling methodology. Mercury was found to represent the greatest potential risk to ecological receptors. In addition, four other metals (cadmium, copper, zinc, and aluminum) were identified as possible COCs with respect to biotic uptake. A report summarizing Stage I data and the human health and ecological risk screenings was compiled and submitted to EPA (EA 1991).

Based upon the Stage I data evaluation and the human health and ecological risk screens, modifications to the Stage II sampling effort will be made. The primary objective of Stage II sampling will be to further refine characterization of the lateral and vertical extent of mercury contamination. In addition, the sampling program will be modified to include a characterization of the other possible COCs, including lateral extent and bioaccessibility and to determine if they represent an ecological concern. Stage II sampling will therefore consist of:

1. Mercury Contamination Characterization:

   Sediment sampling to further characterize the lateral and vertical extent of mercury contamination within the swamp.

2. Bioaccessible Contaminant Characterization:

   Sediment sampling in the surficial zone (upper 4 in.) of swamp sediment to characterize bioaccessibility of mercury and other COCs.

3. Surface Water Characterization:

   Physical/biological characterization of swamp surface water to examine impact of differing environmental conditions.

4.2.2.1 Mercury Contamination Characterization

The soil/sediment contaminant characterization sampling proposed for Stage II will be used to expand upon the previous RI characterization (May 1988, ERT) data and the Stage I contaminant depth characterization data just obtained (April 1991). Data collected during the original RI provide useful information on the horizontal extent of mercury contamination, but does not provide an understanding of the vertical extent of contamination. The data obtained during Stage I of this investigation provide a good understanding of vertical extent of contamination at selected locations within the swamp. The Stage II soil/sediment contaminant characterization will provide a much more comprehensive assessment of the vertical extent of contamination by analyzing soil at discrete 1-ft intervals to a depth of 3 ft at 23 locations. Samples will be collected from approximately the top 12 in. from an additional 22 locations. The sample locations have been selected to provide extensive characterization in the upper swamp zone (where highest contaminant concentrations were identified during the original RI/FS and during Stage I sampling); characterization along the stream in the middle and lower swamp zones; and characterization both upstream and downstream of the swamp. Samples will be analyzed for total mercury only.

Specific sample locations are identified in Chapter 5. Sampling equipment, sampling procedures, and sample handling procedures are described in Chapter 6.

4.2.2.2 Bioaccessible Contaminant Characterization

Ecological risk screening based on Stage I sampling data identified six possible contaminants of concern (COC): mercury, copper, methyl mercury, cadmium, aluminum, and zinc. These compounds were not found to present increased human health risks. Therefore, the primary risk associated with the Stage I COCs is impact to ecological receptors through biotic uptake. As such, a sampling program has been designed to further characterize contaminant distribution and potential bioaccessibility of Stage I COCs. A series of 60 additional soil sample points is proposed for this purpose. These samples will be distributed throughout and around the swamp. The majority of samples will be collected from within the swamp. Six samples will be collected along the Mobile River (three above and three below the site). Three samples will be collected from the upland soils west of the swamp, and three will be collected along Cold Creek at least 500 ft upstream of U.S. Highway 43 at locations away from industrial sources, in order to obtain representative background soil conditions. These samples will be collected from approximately the upper 4 in. of soil since this is the most biologically active portion of the soil strata. All of the samples will be analyzed for total and organic mercury and total copper, aluminum, cadmium, zinc, and sulfide. Approximately one-third of the samples will be tested for pH, Eh, total organic carbon (TOC), and acid volatile sulfide with simultaneously extracted metals (AVS/SEM) in addition to the aforementioned parameters. The results of the AVS/SEM will be particularly relevant since this methodology will provide a good understanding of the potential bioaccessibility of the COCs. It has been shown that the toxicity of divalent metals such as cadmium, copper, and zinc associated with sediments are directly correlated with the amount of acid volatile sulfide (AVS) present in the sediment (Ditoro et al. 1990). Acid volatile sulfides are the solid phase sulfides (e.g., MnS; amorphous FeS and FeS) which are soluble in cold acid. Comparison of the AVS associated with a sediment sample to the simultaneously extracted metals (SEM - those metals in solution after extraction of AVS) allows an analysis of potential toxicity of those metals.

For these reasons analysis of AVS and SEM is proposed for Stage II of the Cold Creek RI/FS. These samples will be associated with the biological effects analysis. Eh, pH, and TOC are important parameters since they are indicators of metals mobility and speciation.

In order to further characterize the possible contaminants of concern, observed mineralogical characterization will be performed on samples from 10 locations in the swamp. The objective of the mineralogical analysis is to identify and quantify compounds of concern which were analytically detected but are present as naturally occurring minerals. For example, aluminum was identified as a contaminant of concern but may actually be present as naturally occurring alumino-silicates or oxides which are a component of the sediment matrix itself. If this is the case, the aluminum cannot be traced to an anthropogenic source, is not available to organisms, and will therefore present no risk. The analysis will be performed by X-ray diffractometry and a brief synopsis of the geological sources will be made. Essentially, the purpose of these analyses is to further characterize bioavailability of COCs by identifying if the COCs are, in fact, naturally occurring minerals.

Specific sample locations are identified in Chapter 5. Sampling equipment, sampling procedures, and sample handling procedures are described in Chapter 6.

4.2.2.3 Surface Water Characterization

A series of physical measurements (channel depth, streamflow, dissolved oxygen content) will be made at each of six surface water sample locations (Section 4.2.1.3). The two Mobile River locations originally proposed in December 1990 (EA) will be replaced by two additional locations within the swamp to provide further characterization of the region of concern. The purpose of this sampling event is to collected physical streamflow data to be used in conjunction with similar data collected during Stages I and III to characterize the interaction of surface water and sediment within Cold Creek Swamp and surrounding waterbodies.

4.2.3 Stage III Field Activities

The primary objectives of Stage III field activities will be to (1) examine uptake of site contaminants by representative species through tissue sampling, and (2) further characterize bioaccessible contamination with the upper portion of the soil/sediment column (top 4-6 in.). Additional physical measurements at selected surface water sample locations will also be taken (Section 4.2.2.3).

4.2.3.1 Biological Tissue Characterization

Based upon the results of an ecological model that will be run using Stage I and Stage II field data to evaluate potential biotic uptake, representative ecological species will be selected for tissue characterization. The number and type of samples cannot be defined at this time. This Work Plan will be updated pursuant to the results of Stage I and Stage II data collection and the ecological modeling.

Once the number and type of species and the number of samples is defined, representative samples will be collected. The samples will be analyzed for concentrations of total mercury. Samples will also be examined as appropriate, for other compounds that have been identified as contaminants of concern during previous sampling stages.

Details on sample collection methods, sampling protocols, and number and location of samples will be developed subsequent to ecological modeling results. This Work Plan will be updated to incorporate this information at that time.

4.2.3.2 Bioaccessible Contaminant Characterization

Stage III bioaccessible contaminant characterization will be very similar to Stage II bioaccessible contaminant characterization. Only a limited number of sample locations will be used for this Stage. The objective of this sampling is to further delineate the vertical distribution of contaminants. Selected Stage II sampling locations will be chosen for the Stage III characterization. The sampling sites will be selected on the basis of observed organic (methyl) mercury concentration as determined during Stage II. At least one sampling location will be selected from each of the three ecological zones of the swamp (upper, lower, middle).

Since the objective of Stage III bioaccessible contaminant characterization will be to refine vertical contaminant distribution patterns in the biologically active zone, samples collected during this Stage will be collected from smaller discrete depth intervals. Discrete samples will be collected from approximately each of the first 5 cm, and another discrete sample will be collected from the 5-10 cm depth interval. The most effective available method--sequential scraping, freezing and cutting, etc.--will be employed.

Details concerning sample collection procedures and sampling protocols are described in Chapter 6. The specific number and location of samples will be developed subsequent to ecological modeling results. This Work Plan will be updated to incorporate that information at that time.

4.2.3.3 Surface Water Characterization

Additional physical measurements will be made at each of the six surface water sample locations (Sections 4.2.1.3 and 4.2.2.3) for surface water/ sediment interaction characterization.

5. RI/FS TASKS

This section describes the various field sampling methods, number and location of samples, sample numbering system, sample matrices, and the level of sampling quality control for field activities at the Cold Creek Swamp Operable Unit. Field sampling will be conducted in a three-stage process and will include soil borings, shallow soil samples, surficial soil/sediment samples, surface water samples, and biological tissue sampling. Breathing zone air monitoring will be conducted during initial sampling activities to assess the presence of airborne organic contaminants. An ecological assessment and wetlands delineation will also be conducted.

In addition to field data collection, this project will include ecological risk modeling; contaminant assessment; human health and ecological risk assessments; development and assessment of potential remedial action alternatives; and preparation of supplemental RI and FS reports. The primary objective is to develop documentation sufficient to fully evaluate the need for further remedial measures at the Cold Creek Swamp, so that an EPA decision document (ROD) can be prepared and supported. Specific data needs and data quality objectives (DQOs) have been addressed previously in Chapter 4.

The following sections describe the major components of field, modeling, and report development activities for this supplemental RI/FS. The field sampling procedures described herein will be conducted in accordance with the health and safety provisions described in the Site Health and Safety Plan (submitted under separate cover). Chemical quality assurance and quality control will be in accordance with provisions of the Quality Assurance Project Plan (submitted under separate cover).

5.1 STAGE I FIELD INVESTIGATION

Stage I field investigation activities have been developed to address specific concerns related to previous characterization of the nature and extent of chemical contamination within the swamp, and to identify the areal and ecological limits of the swamp ecosystem.

Previous studies have identified mercury to be the primary contaminant of concern impacting the biota of Cold Creek Swamp. Sampling activities in Stage I are designed to provide a comprehensive scan of potential contaminants at selected locations within the swamp and to characterize the vertical contamination profile at selected locations at the site. Available information indicates that other contaminants are not expected to be found in concentrations that may potentially impact biological communities of the swamp, and that contamination should be limited to the upper 2-3 ft of soil. Stage I sampling has been designed to verify these conditions. In the event that Stage I sample results indicate conditions to be considerably different than expected, Stage II sampling will need to be reassessed, and this Work Plan will be revised accordingly prior to Stage II sampling. A surface water quality characterization is the other major component of the Stage I field activity.

Ecological assessment/wetland characterization and compilation of a site specific biota inventory are the other primary objectives of Stage I sampling. This activity should be conducted as one of the first site characterization actions, because it is important to understand the limits of areas and ecological communities that are potentially impacted.

5.1.1 Contaminant Nature Characterization

An assessment of the nature of chemical contamination in the Cold Creek Swamp is one of two characterization activities proposed for Stage I. This assessment will be used to screen samples for a wide variety of contaminants typically found at waste sites, and to verify that mercury is the primary contaminant of concern at the site.

5.1.1.1 Number and Location of Samples

A total of 12 locations has been selected for Stage I contaminant nature characterization (Figure 5-1). The locations have been chosen to provide a screening of samples from each of the three hydrologic zones of the swamp; an assessment of background conditions; and to examine the site of highest observed contamination during previous investigation activities. Sample locations are distributed to maximize the likelihood of detecting previously undetected and/or suspected contaminants. The Cold Creek Swamp is conceptualized as having three hydrologic zones. Sampling for Stage I contaminant nature characterization is as follows:

- One location above the discharge source areas for the determination of background levels (N-1).
- Two locations in the upper depositional zone (N-2, N-3).
- One location between the upper and middle hydrologic zones (N-4).
- Two locations in the middle erosional zone (N-5, N-6).
- Six locations in the lower depositional zone (N-7, N-8, N-9, N-10, N-11, N-12).

All locations will be sampled from 0 to 12 in. and analyzed for the full range of TCL parameters as well as TAL metals and thiocarbamate pesticides. Five sampling locations (N-1, N-2, N-3, N-6, and N-10) will also have samples taken from the 12-24 in. increment and analyzed for TAL metals and thiocarbamate pesticides.

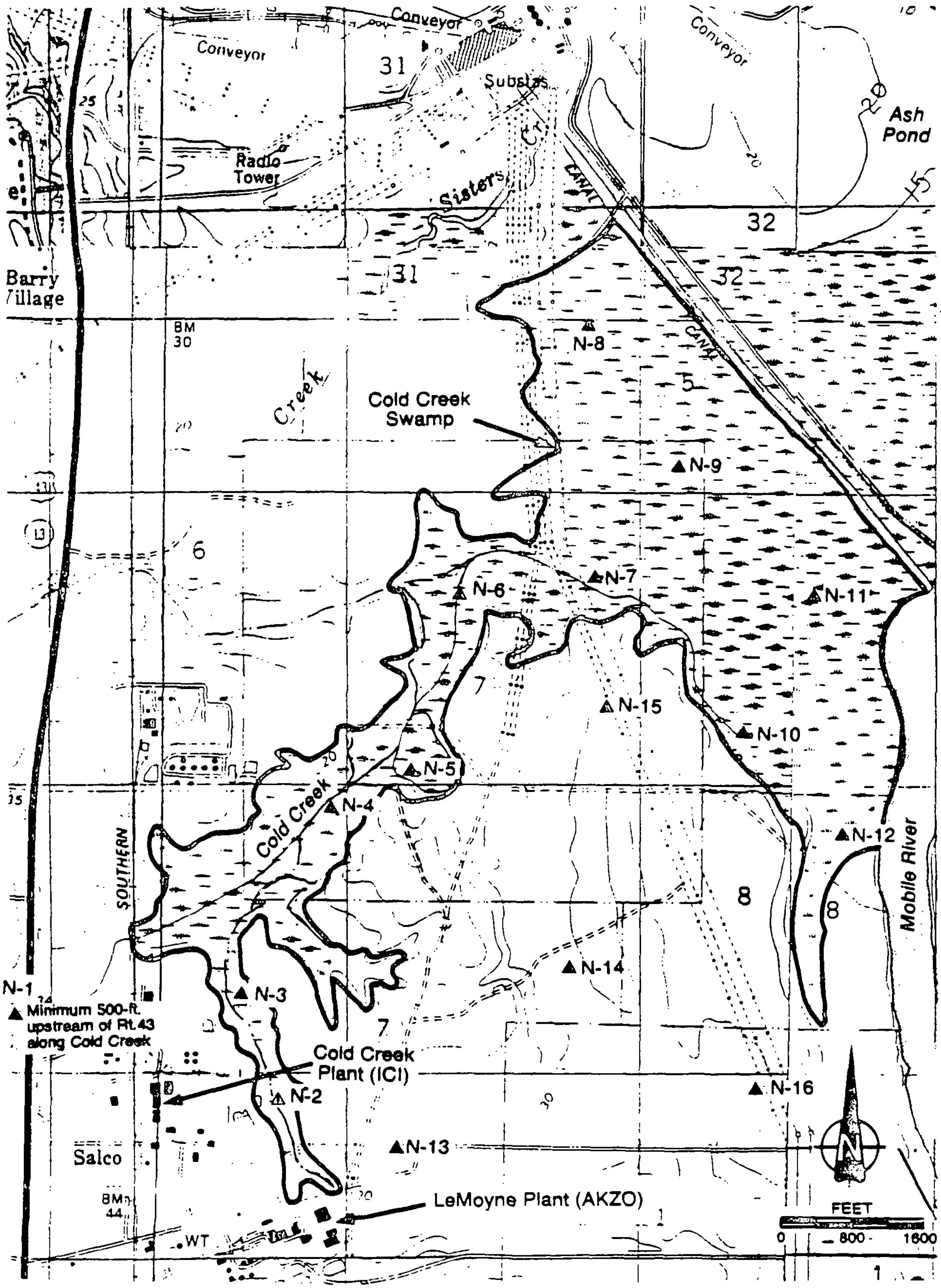

Figure 5-1. Stage I, Contaminant nature sample locations. ▲Sample locations

The basis for this approach is as follows:

1. Previous samples have covered the upper depositional zone; therefore, sampling in this zone is purely for confirmation and is limited to two samples.

2. In the middle erosional zone there is relatively little sediment deposits. Therefore, only two additional sites are proposed. One sample will be located at interface of zone 1 and zone 2.

3. The lower depositional zone is the most expansive zone and has the potential to have contaminants deposited in the sediments. Therefore, a total of six sites has been selected for sampling in this zone.

Additionally, four samples will be taken from background locations (N-13, N-14, N-15, N-16) for TAL metals scan only. The purpose of these samples is to confirm the actual local background conditions for these naturally occurring analytes. Inorganics in nature have a large variance and these samples will lessen the risk of an anomalously low background hit occurring.

This sampling approach is designed to address the nature of contamination in both erosional and depositional areas of the swamp. It will identify whether other contaminants are present in swamp soil/sediment and will be used as a basis for justification of Stage II sampling parameters.

The sample numbering system will designate Stage I contaminant nature samples as "N" (contaminant nature) samples. Sample numbers will be "N" followed by a numeric qualifier (1, 2, 3...) for the sample location, and another numeric qualifier for the depth interval (1 = surficial sample, 2 = deeper sample). Therefore, a Stage I contaminant nature sample taken from the second sampling location at the deeper depth interval will be N-2-2, while a sample taken from the surficial depth interval at the first sample location will be N-1-1, and so forth. Duplicates will be designated by the same sample number as the original. For field sampling quality control purposes, one duplicate will be taken per 20 samples and one field blank will be taken per sampling event. Trip blanks will be taken for volatile organic analysis samples only. Surficial soil sampling will be conducted in accordance with the Site Health and Safety Plan (under separate cover). The number of samples, including duplicates, rinsate blanks, field blanks, sample I.D., and analytical parameters for Stage I contaminant nature sampling is summarized in Table 5-1.

5.1.1.2 Sampling Equipment and Procedures

Two samples will be collected from five of the sampling locations. A surficial sample will be collected approximately from the upper 0-1 ft of soil. The deeper sample will be collected approximately between 1 and 2 ft below ground. One sample will be collected as a composite of the upper 12 in. from the remaining seven locations.

Surficial soil samples will be collected in the following manner. The sampling technician will collect a soil sample from the upper 6 in. of soil after leaves, grass, and/or any other debris have been removed. Surficial soil samples will be collected using discrete, laboratory-cleaned, stainless steel sampling devices (trowels and/or scoops). Samples for volatile organics analysis will be collected in 4-oz laboratory-cleaned, wide-mouth glass jars with Teflon-lined lids. The sample jars will be sufficiently filled and examined for evidence of air space prior to capping. Soil samples for other analytes will be mixed in accordance with EPA Region IV SOP and placed directly into 8-oz laboratory-cleaned glass soil jars with Teflon-lined lids (i.e., one jar per sample location).

Deeper soil samples will be collected immediately after surficial soil samples have been collected. The deeper soil samples will be collected approximately from the interval between 1 and 2 ft below ground surface.

TABLE 5-1 SUMMARY OF SAMPLES, ANALYTICAL PROCEDURES, HOLDING TIME, AND CONTAINERS FOR STAGE I CONTAMINANT NATURE CHARACTERIZATION

Parameter	Number of Sample Locations	Number of Samples	Field Duplicates	Field Blanks	Trip Blanks[a]	Total Samples	Analytical Procedures[b]	Preservation[c]	Holding Time [d]	Total Number of Containers	Containers
Volatile Organics	13	18	1	1	1	21	CLP (2/88)	Hold @ 4 C	14 days	4 oz wide mouth glass jar with Teflon liner	42[g]
Semivolatile Organics	13	18	1	1	0	20	CLP (2/88)	Hold @ 4 C	7 days extraction 40 days extract	8 oz wide-mouth glass jar with Teflon liner	20
Pesticides/ PCBs	13	18	1	1	0	20	CLP (2/88)	Hold @ 4 C	5 days extraction 40 days extract	8 oz wide-mouth glass jar with Teflon liner	20
Metals (TAL)	16	21	1	1	0	24	CLP (7/88)	Hold @ 4 C	(f)	8 oz wide-mouth glass jar with Teflon liner	24
Methyl Mercury	13	18	1	1	0	20	(e)	Hold @ 4 C	7 days extraction 40 days extract	8 oz wide-mouth glass jar with Teflon liner	20
Thio-Carbamate Pesticides	13	18	1	1	0	20	EPA 634[h]	Hold @ 4 C	7 days extraction 40 days extract	8 oz wide-mouth glass jar with Teflon liner	20
Sulfide	13	18	1	1	0	20	9030	Hold @ 4 C	7 days	8 oz wide-mouth glass jar with Teflon liner	20

(a) Trip blanks taken for volatile organics analysis only.
(b) All methods are EPA SW-846 unless otherwise noted.
(c) No chemical preservatives added to soils.
(d) From time of sample collection.
(e) Method for methyl mercury analysis is described in the QAPP.
(f) Holding time for all metals is 6 months, with the exception of mercury whose holding time is 28 days.
(g) Two containers per sample.
(h) See Table 7-1 in the QAPP.

Samples will be collected using 24-in.-long, 2-in. outside diameter (OD), 1-3/8-in. inside diameter (ID) split-barrel samplers or other effective sampling devices (i.e., Shelby tube samplers). All sampling equipment will be pre-cleaned in the laboratory prior to sampling, and split-spoon or Shelby tube samplers will be decontaminated between each use (Section 5.5). The split-barrel or Shelby tube sampler will be driven by hand to the desired depth at each of the surficial soil sample locations.

Samples shall be extracted from the sampler in as near an intact, undisturbed condition as practical. Once at the surface, the sampler shall be opened and the sample extracted, peeled, and bottled in as short a time as possible. "Peeling" is a process whereby that portion of the sample which was in direct contact with the sampler, as well as the ends of the sample, are removed and discarded.

Samples for volatile organics analysis will be collected in 4-oz laboratory-cleaned, wide-mouth glass jars with Teflon-lined lids. The sample jars will be sufficiently filled and examined for evidence of air space prior to capping. After the portion of sample for volatile organic analysis has been collected, the remaining soil will be thoroughly mixed in accordance with the EPA Region IV Standard Operating Procedure (SOP) prior to collection of sample for other analyses. Soil samples for other analyses will be collected in 8-oz laboratory-cleaned glass soil jars with Teflon-lined lids (i.e., one jar per sample location).

Locations of sampling points will be marked in the field by wooden stakes flagged with fluorescent pink ribbon. The sample location designation (i.e., N-1, N-2...) will be clearly written on the wooden stake in permanent black marker. The sample locations will be located in the field by the field survey team during Stage II.

5.1.1.3 Sample Containers, Preservation, Holding Time, and Analytical Methods

Table 5-1 shows the sample containers, preservation and holding time considerations, analytical procedures, and total number of samples for Stage I contaminant nature characterization. Additional analytical QA/QC considerations are addressed in the QAPP.

5.1.2 Soil/Sediment Contaminant Characterization

A preliminary assessment of the depth profile of contamination will be conducted during Stage I. This assessment is designed to examine the impact of mercury contamination at various depths below ground surface, and to identify if any contamination is found below the 2-3 ft depth at which contamination is expected.

5.1.2.1 Number and Location of Samples

A total of three locations have been selected for Stage I soil/sediment contaminant characterization (Figure 5-2). The sample locations have been chosen to be representative of each of the three ecologic zones of the swamp (SB-1 through SB-3). Specific sample locations were selected based upon data available from the original RI/FS. Locations with the highest observed mercury concentrations were chosen as the sample points for the current study.

Ten samples will be collected from each sampling location. Samples will be taken from the following approximate depth intervals:

0-0.5 ft	5-7.5 ft
0.5-1.0 ft	7.5-10 ft
1-2 ft	
2-3 ft	12.5-15 ft
3-4 ft	
4-5 ft	17.5-20 ft

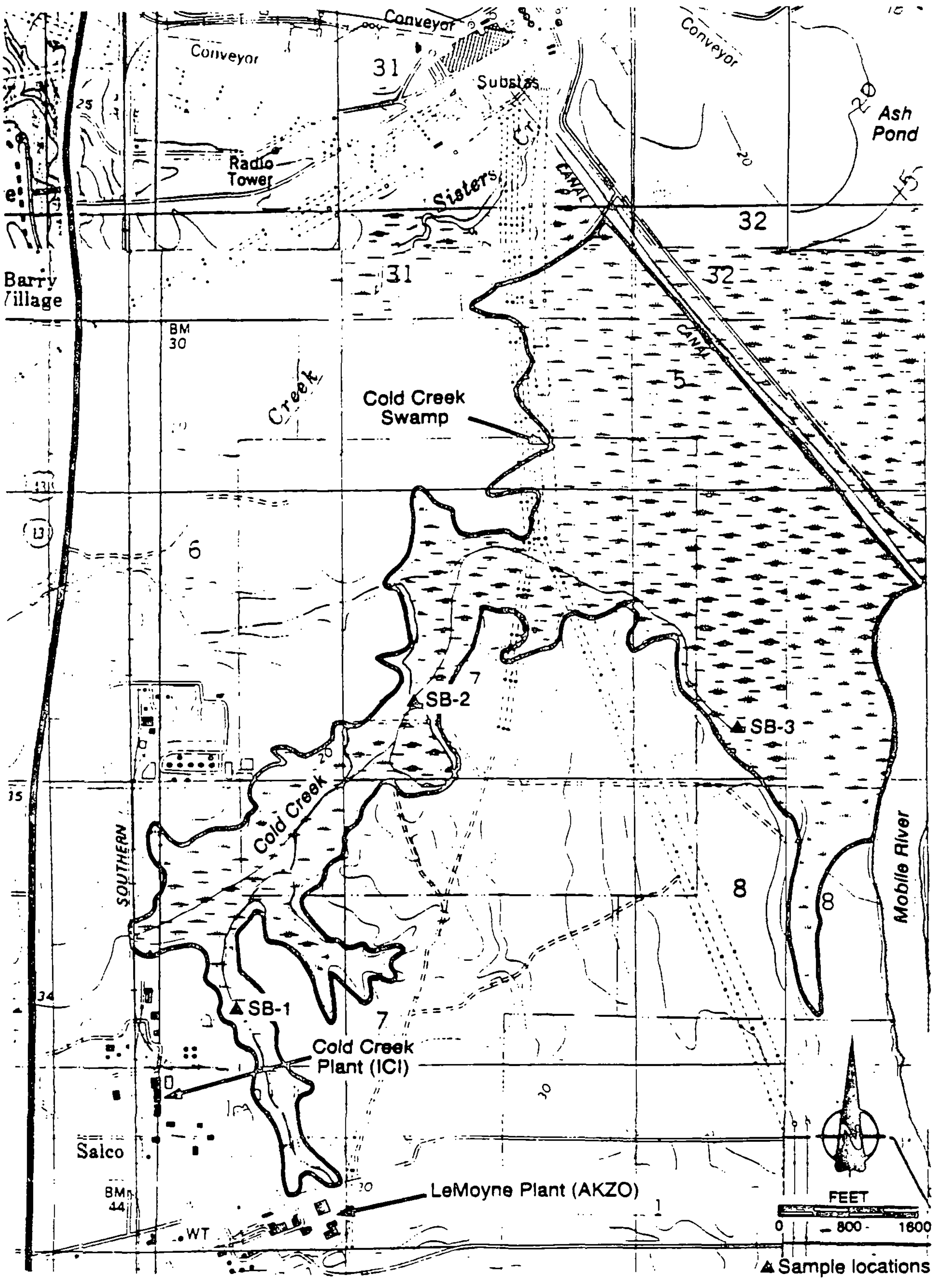

Figure 5-2. Stage I, soil/sediment contaminant characterization sample locations.

3 4 0 5 4 8

Samples will be analyzed for total and organic mercury, sulfide, and pH.

The soil sample numbering system will designate samples for the Stage I soil/sediment contaminant characterization sampling event as "SB" samples since samples will be collected from shallow soil borings. Sample numbers will be "SB" followed by a numeric designation (1,2,3...) for the sample location, and a second numeric designation for the depth interval (1,2,3...). Therefore, a soil sample from the upper swamp sample location in the 0-0.5 ft depth interval will be designated as sample number SB-1-1. A sample from the same location but collected from the 1-2 ft depth interval will be SB-1-3, and so forth. Duplicates will be designated by the same name as the original sample. For field sampling quality control purposes, one duplicate will be taken per 20 samples and one field blank and trip blank will be taken per sampling event.

5.1.2.2 Sampling Equipment and Procedures

Samples at each of the three locations will be collected from shallow soil borings. Equipment capable of operating in marshland and swamp conditions will be used. Boreholes will be drilled to a depth of approximately 20 ft (thickness of upper geologic strata in the vicinity of the swamp). Soil samples will be collected using 36-in.-long, 2-in. OD, 1-3/8-in. ID, split-barrel samplers with stainless steel inserts or other appropriate equipment, such as Shelby tube samplers. Stainless steel inserts and other sampling devices will be pre-cleaned in the laboratory prior to mobilization onsite. Stainless steel inserts or other sampling devices as required will be properly decontaminated according to EPA Region IV SOP between each use (Section 5.5). A minimum of 10 inserts will be provided so that it will not be necessary to decontaminate until all samples are collected for each sample location. In this scenario, decontamination of the entire drill rig will only be required prior to drilling at a new location.

Samples will be extruded from the sampler and contained immediately following collection of the sample. Samples will be placed directly into 8-oz laboratory-cleaned glass soil jars with Teflon-lined lids. One jar will be used for each discrete depth interval sample.

Boreholes will be sealed with bentonite or bentonite grout immediately after samples have been collected. Borehole cuttings will remain onsite in the vicinity of the soil boring. Borehole locations will be marked with wooden stakes and flagged with fluorescent pink ribbon. Wooden stakes will be marked in black permanent marker with the sample location designation. Borehole locations will be located by the field survey team during Stage II.

5.1.2.3 Sample Containers, Preservation, Holding Time, and Analytical Methods

Table 5-2 shows the sample containers, preservation and holding time considerations, analytical procedures, and total number of samples for Stage I soil/sediment contaminant characterization. Additional analytical QA/QC considerations are addressed in the QAPP.

5.1.3 Surface Water Characterization

This section describes the various field sampling methods, sample numbers and locations, and sampling quality control for Stage I water sampling field activities at the Cold Creek Swamp.

5.1.3.1 Number and Location of Samples

A total of six locations has been selected for the Stage I surface water characterization (Figure 5-3). The locations are (1) Cold Creek at least 500 ft upstream of U.S. Highway 43, (2) the unnamed tributary on the Cold Creek Plant property which represents the top third of the swamp, (3) Cold Creek downstream of the discharge point of the unnamed

TABLE 5-3 SUMMARY OF SAMPLES, ANALYTICAL PROCEDURES, HOLDING TIME AND CONTAINERS FOR STAGE I IN SITU SURFACE WATER CHARACTERIZATION

Parameter	Number of Samples and Locations	Field Duplicates	Field Blanks	Total Samples	Analytical Procedure[a]	Preservation	Holding Time [b]	Containers
Total dissolved solids	6	1	1	8	EPA 160.1	Hold @ 4 C	7 days	P, G
Hardness	6	1	1	8	APHA 314A	Hold @ 4 C HNO_3 to pH<2	6 months	P, G
pH	6	1	1	8	9040	None	Analyze immediately	P, G
Chlorides	6	1	1	8	9250	None	28 days	P, G
Sulfides	6	1	1	8	9030	Hold @ 4 C Zinc acetate NaOH to pH>9	7 days	P, G
Total dissolved mercury	6	1	1	8	245.1 CLP-M	HNO_3 to pH<2	28 days	P, G
Total mercury	6	1	1	8	245.1 CLP-M	HNO_3 to pH<2	28 days	P, G
Methyl mercury	6	1	1	8	(c)	Hold @ 4 C	7 days extraction 40 days extract	G, Teflon cap
Volatile Organics	6	1	1	8	CLP (2/88)	pH<2 Hold @ 4 C	14 days	G, Teflon cap
Semivolatile Organics	6	1	1	8	CLP (2/88)	Hold @ 4 C	7 days extraction 40 days extract	G, Teflon cap
Pesticides/PCBs	6	1	1	8	CLP (2/88)	Hold @ 4 C	5 days extract 40 days extract	G, Teflon Cap
Metals (TAL)	6	1	1	8	CLP (7/88)	Hold @ 4 C	(d)	P, G

(a) All anlaytical procedures are from EPA SW-846 unless otherwise noted, see Table 7-1 in QAPP.
(b) From time of sample collection.
(c) Described in QAPP.
(d) Holding time for all metals is 6 months, with the exception of mercury whose holding time is 28 days.
P = plastic
G = glass

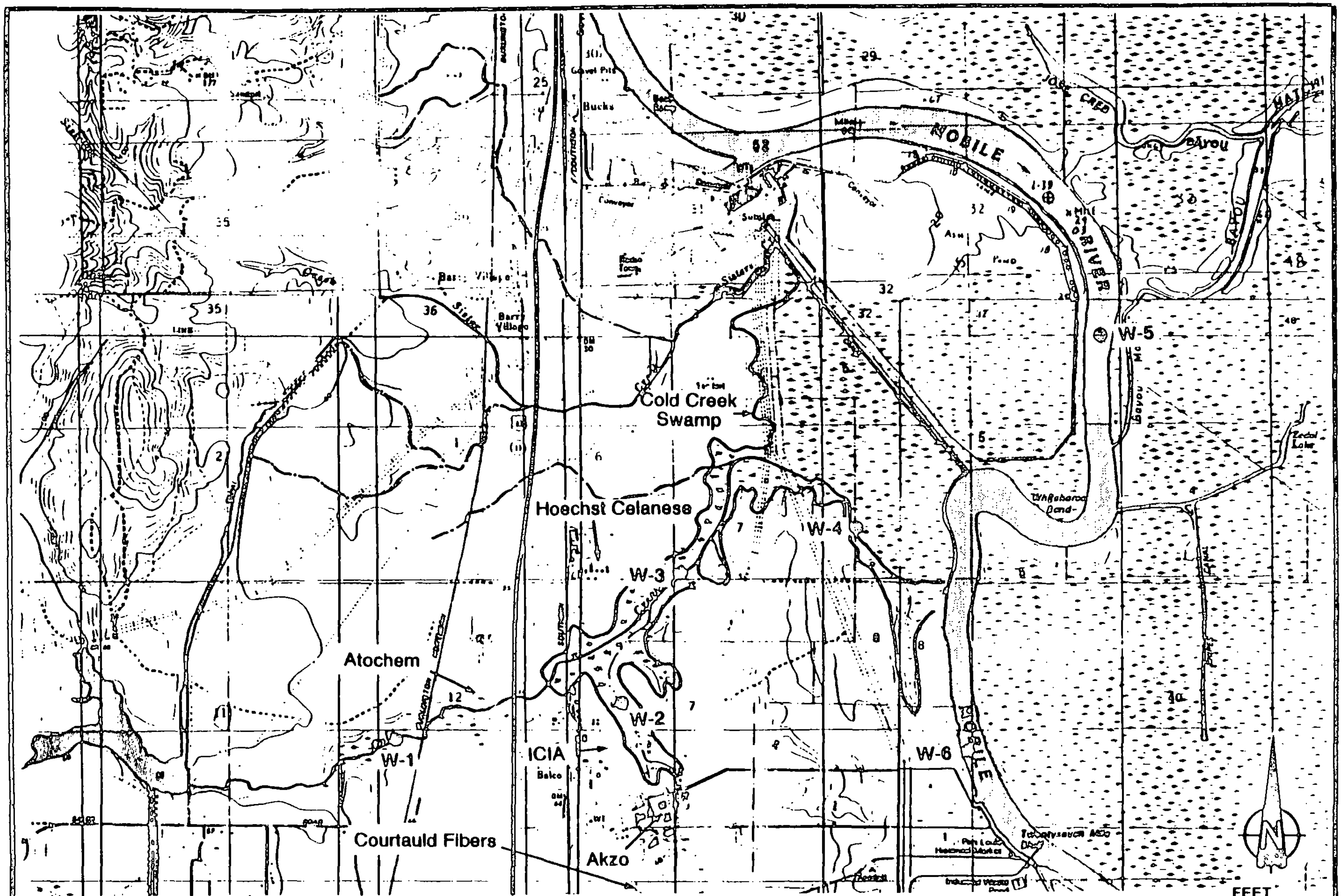

Figure 5-3. Sample locations for surface water characterization.

tributary, upstream of the backwater area and due east of the Hoechst-Celanese Plant, which represents the middle third of Cold Creek Swamp, (4) Cold Creek downstream from where it crosses the power lines, (5) the Mobile River upstream of the discharge point of Cold Creek, and (6) the Mobile River downstream of the discharge point of Cold Creek. In addition to these six samples it will be necessary to collect a field duplicate from any one of the six locations and one field blank. All samples will be analyzed for the full TCL list, including TAL metals, as well as thiocarbamates, chlorides, sulfides, pH, hardness, total dissolved solids, total and dissolved mercury, and methyl mercury.

The water sample numbering system will designate samples for the Stage I dry season *in situ* surface water characterization sampling event as "W" samples. Sample numbers will be "W" followed by a numeric designation (1, 2, 3...) for the sample location, e.g., W-1 for the sample downstream of the dam. Duplicates will be designated by the same number as the original sample.

5.1.3.2 Sampling Equipment and Procedures

Surface water samples will be collected as single subsurface grabs using discrete, laboratory-cleaned sample containers. Care must be taken to ensure that the air/water interface is not sampled by opening and closing the lid of the jar underwater. This will prevent excess oils, particulates, and other floating substances from being collected and affecting the sample. In addition, estimates of streamflow rates will be made and recorded at each sampling location using an in-stream flow meter. Field measurements of dissolved oxygen, conductivity, pH, and temperature will be obtained and recorded. The sampling crew will collect the surface water sample from the bank if possible; however, if it is necessary to collect the sample from within the water course, the sampling agent will approach the sample point from the downstream direction and stand downstream of the collection point. The Mobile River sampling will require the use of a boat, as the locations would be difficult to reach by land.

In addition, the sample would need to be taken away from the shore to eliminate boundary/shoreline effects, and the average depth of the river at this location is 28 ft. Prior to sample collection, the sampling device will be rinsed downstream of the sampling location. Surface water samples will be placed in the appropriate aliquot container and preserved in the field in accordance with the preservation and sample handling criteria outlined in Section 5.2.3.3. Samples for dissolved solids and dissolved mercury will require filtering the appropriate volume of water through a 0.45 μ filter prior to placing the sample into the container. Care should be taken to properly label filtered samples.

A staff gauge will be installed at each surface water sampling location prior to the sampling event. The staff gauge will be horizontally tied into the surveyed traverse and will be vertically located in reference to existing onsite benchmarks. Water level, flow measurements, and dissolved oxygen content measurements will be taken during this stage and both subsequent stages. Field physical testing will be done in accordance with provisions outlined in EPA Region IV SOP.

5.1.3.3 Sample Containers, Preservation, Holding Time, and Analytical Methods

Table 5-3 shows the sample containers, preservation and holding time considerations, analytical procedures, and total number of samples for the surface water characterization. Additional analytical QA/QC considerations are addressed in the QAPP.

5.1.4 Wetland Delineation and Characterization

The Cold Creek Swamp system will be delineated through a combination of data obtained from a survey of existing information (aerial photographs, topographic maps, soil survey, and existing wetland maps, i.e., N.W.1.) and from detailed field reconnaissance efforts (hydric soil characteristics, wetland hydrology, and hydrophytic community composition). Aerial photographs will be used to identify signature differences among the various plant communities. The soil survey will be evaluated for

TABLE 5-3 SUMMARY OF SAMPLES, ANALYTICAL PROCEDURES, HOLDING TIME AND CONTAINERS FOR STAGE I IN SITU SURFACE WATER CHARACTERIZATION

Parameter	Number of Samples and Locations	Field Duplicates	Field Blanks	Total Samples	Analytical Procedure(a)	Preservation	Holding Time (b)	Containers
Total dissolved solids	6	1	1	12	160.1	Hold @ 4 C	7 days	P, G
Hardness	6	1	1	12	314A, 314B	Hold @ 4 C HNO_3 to pH<2	6 months	P, G
pH	6	1	1	12	9040	None	Analyze immediately	P, G
Chlorides	6	1	1	12	9025, 9250	None	28 days	P, G
Sulfides	6	1	1	12	9030	Hold @ 4 C Zinc acetate NaOH to pH>9	7 days	P, G
Total dissolved mercury	6	1	1	12	245.1 CLP-M	HNO_3 to pH<2	28 days	P, G
Total mercury	6	1	1	12	245.1 CLP-M	HNO_3 to pH<2	28 days	P, G
Methyl mercury	6	1	1	12	(c)	Hold @ 4 C	7 days extraction 40 days extract	G, Teflon cap
Volatile Organics	6	1	1	8	CLP (2/88)	Hold @ 4 C HCL to pH<2	14 days	G, Teflon cap
Semivolatile Organics	6	1	1	8	CLP (2/88)	Hold @ 4 C	7 days extraction 40 days extract	G, Teflon cap
Pesticides/PCBs	6	1	1	8	CLP (2/88)	Hold @ 4 C	5 days extract 40 days extract	G, Teflon cap
Metals (TAL)	6	1	1	8	CLP (7/88)	Hold @ 4 C	(d)	P, G

(a) All anlaytical procedures are from EPA SW-846 unless otherwise noted.
(b) From time of sample collection.
(c) Described in QAPP.
(d) Holding time for all metals is 6 months, with the exception of mercury whose holding time is 28 days.
P = plastic
G = glass

Please identify source for some different #'s (not SW-846)

H_2O samples to be analyzed for VOA's must be preserved w/ conc. HCL to pH<2.

There are no 314A & 9025 in SW-846.

the distribution of soils listed in the publication "Hydric Soils of the United States" (USDA 1985). In addition, soils with a capability listing of IIw or greater in the Mobile County, Alabama, soil survey will be considered and evaluated for their potential hydric condition. Topography will be used to identify low-gradient areas, drainage areas, and to assess the degree of stream channel incision.

Field reconnaissance efforts will include an evaluation of soil color, moisture, and texture, with the soil color generally determining whether the soil could be characterized as hydric soil. Soil samples will be collected using an Oakland soil probe with a core tube length of 16 in. and a diameter of 1 in. Several hundred soil samples will be evaluated along the upland/wetland boundary as necessary to identify the transition area. Evidence of wetland hydrology will be evaluated with the purpose of documenting the presence of this parameter as necessary for wetland delineation and to assist in establishing the duration and frequency of wetland saturation/inundation. In addition, plant community composition and dominance will be evaluated using standard prism counting techniques and other procedures outlined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (USEPA, USFWS, SCS, and USACE 1989).

Where 50 percent or more of the plant species in a community is characterized as facultative, facultative wetland, or obligate wetland species, where wetland hydrology is present, and where the underlying soils are mottled, gleyed (chroma <2), or exhibit other hydric characteristics, the area will be identified as a wetland. Such an area will be identified on a map base with an estimate of its areal distribution.

Observed patterns of aerial photo textures, plant community composition, hydric soils distribution, and topography will be used to develop the map of wetland distribution on the site. This information will also be used to differentiate the various wetland communities which comprise the Cold Creek Swamp wetland system.

During the field effort, data sheets for the Federal Manual's delineation approach will be completed. In addition, input information required by the Wetland Evaluation Technique (WET) model (USACE 1987) will also be obtained, using the standard data sheets provided in the WET manual. The WET model will be run in EA's office after the field reconnaissance effort is completed.

5.1.5 Biota Inventory

Beginning in Stage I and continuing through Stage II, an inventory of biota present in the Cold Creek Swamp area will be compiled from direct observation by a botanist, wetlands specialist, and field zoologist. These observations will concentrate on macrophytic vegetation and resource and food web fauna, as these define the basic community types. Observations will be combined with published habitat data and community structural information to assure that species observed and potentially present are included in inventories.

Particular attention will be paid to potential presence of endangered or threatened species. Any such species observed will be noted. Emydid turtles will be identified to determine potential presence of Alabama Red-Bellied Turtle.

5.2 STAGE II FIELD INVESTIGATION

As a result of Stage I data analysis and the human health and ecological risk screenings, mercury was found to present the greatest potential risk to ecological receptors. Four other metals (aluminum, copper, cadmium, and zinc) were also identified as possible contaminants of concern (COCs) with respect to ecological risk. None of the observed compounds was found to present an increased risk to human health at the concentrations present in the swamp.

The Stage II field investigation has been modified to address results of Stage I data assessment and risk screenings. The first component of

Stage II sampling will be to further characterize the lateral and vertical extent of mercury contamination. This information will primarily be used for identification of areas of concern during the feasibility study (Section 5.10). In addition to refining the characterization of mercury contamination, Stage II is designed to examine the ecological impacts associated with other possible COCs, as defined from Stage I data.

Sample Management Trailer

Stage II field activities will include a mercury contamination characterization, a bioaccessible contaminant characterization, and a surface water characterization. A total of two three-person sampling teams will be used for the sediment sampling events. Two members of each team will be engaged in sample collection at all times. The third team member will be engaged in sample handling (extrusion, characterizing, marking, packaging, shipping, and tracking) and equipment decontamination (see Section 5.5 for detailed discussion of decontamination procedures). All samples will be extruded, containerized, and labelled in the field immediately after collection. Sample containers will be inventoried and stored in an air conditioned, onsite sample management trailer. The trailer will be equipped with sufficient bench space for sample packaging, shipping, and tracking activities and a refrigerator for sample storage prior to shipment. The sample management trailer will be located on the property of the LeMoyne chemical plant (Akzo Chemicals), pursuant to approval from Akzo Chemical and in accordance with all provisions as required by Akzo.

Soil samples will be stored in the refrigerator prior to shipment. Every other day, or more frequently if required, samples will be shipped to the analytical chemistry laboratory via Federal Express overnight priority air delivery.

Field Surveying

Sampling points will be located in the field by the surveying team at the beginning of Stage II activities. The field surveying team will re-establish the survey traverse that had been developed for the original Cold Creek LeMoyne RI/FS and will locate Stage I sampling points that had been marked in the field after samples were collected.

The survey crew will also establish and mark in the field the locations for all Stage II sample locations. Sample locations will be marked with wooden stakes with fluorescent flagging. The wooden stakes will be clearly marked with the sample location designation in permanent marker. Stakes will be driven sufficiently into the ground so that they will not be easily destroyed or removed prior to sampling and will extend high enough so that they will not be easily inundated by a storm. The sample location surveying is scheduled so that the survey crew will be setting points for Stage II just ahead of the sampling crews to minimize the potential for missing location stakes. Confirmatory surveying will be made at the completion of Stage II for sample points that may have been moved from the original staked location during the Stage II sampling event.

After all sample locations have been marked in the field, the surveyor will develop a site map showing the location of all sample points and major site features. A table listing the horizontal coordinates of sample points will be provided.

5.2.1 Mercury Contamination Characterization

The Stage II mercury contamination characterization is a more comprehensive assessment of the lateral and vertical extent of mercury contamination within the sediments of the Cold Creek Swamp. This assessment is designed to focus sample collection to locations of elevated mercury concentrations in order to accurately map mercury isoconcentration contours across the swamp.

Of particular interest will be further characterization in the vicinity of Stage I sample location N-3 which showed mercury concentrations in excess of 800 mg/kg. Another focus of Stage II sampling will be to more thoroughly characterize the northeastern portion of the lower swamp. Samples in this area showed the highest mercury levels on the site (20-35 mg/kg) except for the sample N-3 vicinity.

Stage I sampling confirmed that mercury contamination appears to be limited to surficial sediment deposits. Therefore, the depth characterization planned for Stage II will be limited to the upper 3 ft of soil/ sediment.

5.2.1.1 Number and Location of Samples

A total of 45 discrete sample locations is proposed for this sampling event (Figure 5-4). Of these sample locations, 23 will be sampled at three discrete depth intervals to approximately 0-1 ft, 1-2 ft, and 2-3 ft. The remaining twenty-two sample locations will only be sampled in the upper 1 ft surficial interval. Sample locations have been chosen to provide a comprehensive characterization of mercury contamination within and immediately surrounding the swamp.

Based on sample results from the original RI/FS and on the Stage I sample results, the Upper Zone of the swamp exhibits the highest mercury concentration levels. Sixteen of the forty-five samples will be located in this zone with an emphasis on characterization in the vicinity of Stage I sample point N-3. The Middle Zone did not exhibit significant mercury contamination during either sampling event. Eight samples will be located in the Middle Zone to provide coverage in locations that were not previously sampled. The Lower Zone of the swamp (closest to the Mobile River) exhibited relatively high mercury concentrations (20-35 mg/kg) at several locations. Due to the areal extent of this zone, and the identified concentrations levels, 18 of the 45 samples will be located in the Lower Zone. The remaining 3 samples will be located upgradient of the swamp as background samples. Figure 5-4 shows the proposed sample locations. Sample locations by zone are summarized below.

Swamp Zone	Number of Surficial Sample Locations	Number of Discrete Depth Sample Locations	Total Number of Sample Locations
Upper	6	10	16
Middle	3	5	8
Lower	11	7	18
Background	2	1	3
	22	23	45

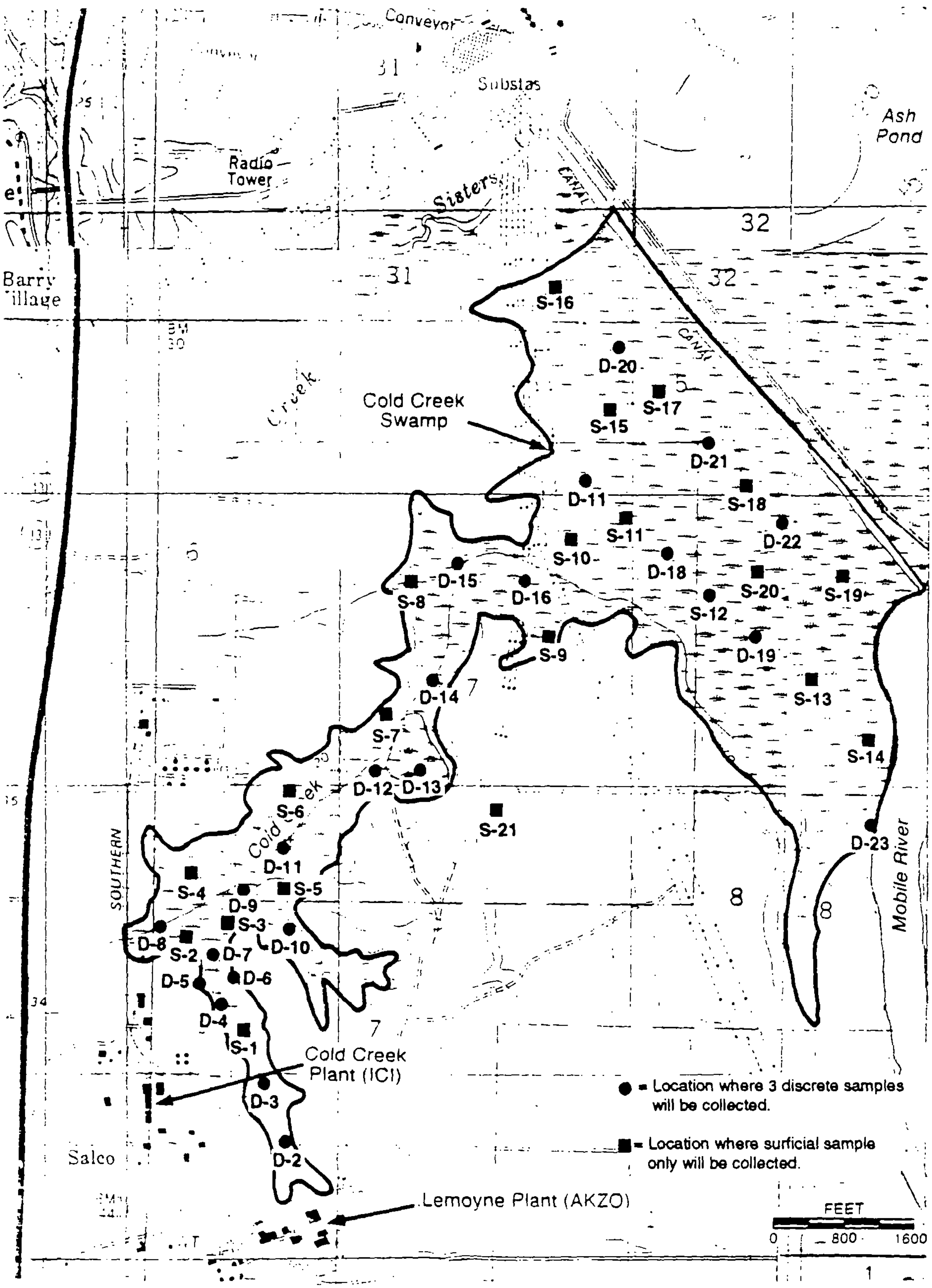

Figure 5-4. Stage II mercury contamination characterization sample locations.

The proposed Stage II sample distribution is designed to supplement existing data in providing comprehensive coverage of the swamp area. It addresses the "data gaps" that were identified by EPA, NOAA, and USFWS reviewers by collecting "discrete" samples at various depths instead of "composite" samples through the entire core. It also provides for more intensive characterization of identified areas of mercury contamination.

This approach, in conjunction with the 60 samples for bioaccessible zone contamination characterization (Section 5.2.2) should adequately supplement existing contamination data.

All of the soil/sediment samples will be analyzed for total mercury. Methyl mercury and other identified COCs will not be examined in these samples. Methyl mercury and other COCs will be addressed in the bioaccessible contaminant characterization component of Stage II sampling since these compounds have been identified as a possible risk to ecological receptors.

The soil sample numbering system will designate locations where samples will be collected from three discrete intervals as "D" samples, and locations where samples will be collected from only one depth interval as "S" samples. Sample numbers will be "D" or "S" followed by a numeric designation for sample location (1, 2, 3...). "D" samples will also have a second numeric designation reflecting the discrete depth interval at which the sample was collected. Therefore, D-1-2 refers to a soil sample from the 1-2 ft depth interval at the first sample location where three discrete zone samples will be taken; D-1-3 refers to the 2-3 ft depth interval sample at the same location; S-2 refers to the soil sample collected from the second location where only one discrete soil sample will be taken; and so forth.

Duplicates will be designated as D-DUP-1, D-DUP-2, or S-DUP-1, S-DUP-2, etc. The field notebook will indicate which sample the duplicate sample corresponds to. This approach will ensure that the identification of duplicate samples is not apparent to the analytical laboratory. For field sampling quality control purposes, one duplicate will be taken per 20 samples and one field blank will be taken per sampling event. Rinsate blanks will be collected and analyzed at the beginning and end of the sampling event. Soil sampling will be conducted in accordance with the Site Health and Safety Plan.

5.2.1.2 Sampling Equipment and Procedures

All soil samples for this sampling event will be collected using 2-in. OD, 1-3/8-in. ID split-barrel samplers with stainless steel inserts or other appropriate equipment (i.e., Shelby tube samplers). All sampling equipment will be pre-cleaned in the laboratory prior to sampling, and stainless steel inserts or other sampling equipment will be decontaminated between each use (Section 5.5).

Samplers will be pushed or driven to the desired sampling depth by hand, and will be extracted by hand with the assistance of pipe wrenches as required. If split-barrel samplers are used, stainless steel inserts will be removed from the split-barrel sampler and the inserts will be labeled with the sample designation, sealed, and stored in a cooler packed with ice to 4 C while other samples are collected. Soil samples will be extruded in the field from the stainless steel inserts or other sampling devices immediately after collection. Samples will be thoroughly mixed prior to placement in sample bottles in accordance with the EPA Region IV SOP. Samples will be placed directly into 8-oz laboratory-cleaned glass soil jars with Teflon-lined lids. One jar will be used for each discrete depth interval from each sample location.

Sample locations will be marked in the field with wooden stakes flagged with fluorescent ribbon. Wooden stakes will be marked in permanent marker with the sample location designation. Sample locations will be located by the field survey team prior to sample collection. Modifications of actual sample location will be recorded in the field notebook.

5.2.1.3 Sample Containers, Preservation, Holding Time, and Analytical Methods

Table 5-4 shows the sample containers, preservation and holding time considerations, analytical procedures, and total number of samples for Stage II mercury contamination characterization. Additional analytical QA/QC considerations are addressed in the QAPP.

TABLE 5-4 SUMMARY OF SAMPLES, ANALYTICAL PROCEDURES, HOLDING TIME, AND CONTAINERS FOR STAGE II MERCURY CONTAMINATION CHARACTERIZATION

arameter	Number of Sample Locations	Number of Samples	Filed Dupli-cates	Field Blanks	Rinsate Blanks	Trip Blanks[a]	Total Samples	Analytical Procedures	Preservation[b]	Holding Time[c]	Containers	Total Number of Containers
tal mercury	45	91	5	1	2	0	99	245.2-CLP	Hold @ 4 C	28 days	8 oz wide-mouth glass jar with Teflon liner	99

) Trip blanks taken for volatile organics analysis only.
) No chemical preservatives added to soils.
) From time of sample collection.

5.2.2 Bioaccessible Contaminant Characterization

In swamp sediments, typically only the uppermost increments of the soil column are biotically active, supporting a dynamic community of invertebrates, providing food-web support to natant arthropods and vertebrates, and linking the substrate to the water column through matter and energy exchange. Deeper increments are less biotically active, with processes dominated by microbes and access to the water column being constrained and controlled by the uppermost sediment layers. Because risks to human and environmental receptors will be governed by upper-increment processes, a distinct program to assess the nature and extent of bioaccessible contamination is provided in this Work Plan. Sediments vary across Cold Creek Swamp in both space and time. Field observations in all aquatic habitats of the swamp suggest that a sample depth of approximately 4 in. will adequately define the biotically active zone and, therefore, the bioaccessible contamination. This depth will be employed in all samples taken for assessing contaminant bioaccessibility.

5.2.2.1 Number and Location of Samples

Because biological and chemical conditions exhibit great spatial variability in Cold Creek Swamp, samples for bioaccessible contaminant assessment will be distributed throughout the drainage system. Within each homogeneous sampling area, sample replication will be adequate to meet Data Quality Objectives and perform meaningful statistical assessment.

A total of 60 sample locations has been identified for characterization of contamination in the biologically active zone. The samples will be distributed to address both depositional and erosional impacts within the swamp, as well as conditions immediately upstream and downstream of the swamp. Table 5-5 shows the proposed distribution of samples for Stage II bioaccessible contaminant characterization. Specific locations are not shown because the actual location chosen will be a function of observed physical conditions to achieve the best distribution of sampling points. These 60 locations are in addition to the 45 samples identified in Section 5.2.1.1.

All of the samples will be analyzed for total and methyl mercury, total aluminum, cadmium, copper, and zinc, and total sulfide. Of the 60 samples, 20 will also be analyzed for Eh, pH, total organic carbon (TOC), and AVS/SEM in addition to the above-listed parameters. Ten of the twenty samples will also be analyzed through X-ray diffractometry to further investigate metals bioavailability.

The sample numbering system will designate Stage II bioaccessible contaminant characterization soil/sediment samples as "B" samples. Sample numbers will be "B" followed by a numeric designation (1, 2, 3...). Table 5-5 shows sample designations for this sampling event.

Duplicates will be designated as B-DUP-1, B-DUP-2, etc. The field notebook will indicate which sample the duplicate samples corresponds to. For field sampling quality control purposes, one duplicate will be taken per 20 samples and one field blank will be taken per sampling event. Rinsate blanks will be collected and analyzed at the beginning and end of the sampling event. Soil sampling will be conducted in accordance with the Site Health and Safety Plan.

5.2.2.2 Sampling Equipment and Procedures

Samples will be collected from approximately the upper 4 in. of soil after leaves, grass, and/or any other debris have been removed. Samples will be collected using stainless steel sampling devices that have been pre-cleaned in the laboratory prior to sample collection. Sampling devices may include trowels, scoops, hand augers, or benthic grabs. Trowels or scoops will be used for most samples. Hand augers or benthic grabs will be used for samples that are inaccessible due to flooding. Sample depth will be controlled to approximately 4 in. by repeated measurement or by application of a measured jig from which sample

TABLE 5-5 PROPOSED DISTRIBUTION OF SAMPLES FOR STAGE II BIOACCESSIBLE CONTAMINANT CHARACTERIZATION

Sample Location	Number of Samples	Designation
Upper Swamp Zone	6	B-1 through B-6
Middle Swamp Zone	6	B-7 through B-12
Lower Swamp Zone	6	B-13 through B-18
Upper Zone Thalweg	3	B-19 through B-21
Middle Zone Thalweg	3	B-22 through B-24
Lower Zone Thalweg	3	B-25 through B-27
Backwater Area in Middle Zone	3	B-28 through B-30
East Powerline Crossing	3	B-31 through B-33
West Powerline Crossing	3	B-34 through B-36
Behind Beaver Dams in Swamp (3 Dams)	9	B-37 through B-45
Behind Beaver Dam @ Cold Creek Mouth	3	B-46 through B-48
Upstream along Mobile River shoreline	3	B-49 through B-51
Downstream along Mobile River shoreline	3	B-52 through B-54
Uplands west of Cold Creek Swamp	3	B-55 through B-57
Cold Creek wetland west of US 43	3	B-58 through B-60
Total	60	

material will be recovered. All sampling equipment will be decontaminated prior to use and between each use (Section 5.5).

Soil/sediment samples will be thoroughly mixed in accordance with the EPA Region IV SOP and will be placed into 8-oz laboratory-cleaned glass soil jars with Teflon-lined lids (one jar per sample location). Sample locations will be marked in the field with a wooden stake and flagged with fluorescent ribbon. Wooden stakes will be marked in permanent marker with the sample location designation. Sample locations will be located by the field survey team prior to sample collection. Modifications of active sample location will be recorded in the field notebook.

Soil pH Determination

Soil pH will be detected in accordance with EPA SW-846. Samples to be analyzed for soil pH will be bottled and capped immediately upon collection and will not be composited with other soil for analysis. Samples for soil pH will be brought back to the field trailer for analysis.

Soil Eh Determination

The oxidation-reduction of potential soil samples (Eh) will be determined in accordance with Proposed Method 2580 from Standard Methods (APHA, 17th Ed. Supplement 1990). An Orion platinum combination electrode (Orion 97-78) will be used to measure oxidation-reduction potential. Samples will be analyzed in situ at each proposed location at the time that samples are collected for other analyses.

5.2.2.3 Sample Containers, Preservation, Holding Time, and Analytical Methods

Table 5-6 shows the sample containers, preservation and holding time considerations, analytical procedures, and total number of samples for Stage II bioaccessible contaminant characterization. Additional analytical QA/QC considerations are addressed in the QAPP.

5.2.3 Surface Water Physical Measurements

In order to assess the physical interaction of sediment and surface water within and around Cold Creek Swamp, physical measurements (including depth of flow in the channel, flow rate, and dissolved oxygen content) will be taken at six surface water sampling locations described previously (Section 5.1.3). In an effort to focus data collection for greatest benefit, the two Mobile River samples (W-5 and W-6) will be deleted and replaced with two additional sample locations within the swamp. Measurement of physical parameters will be in accordance with provisions of the EPA Region IV SOP for field data collection. Attempts will be made to collect physical stream data shortly after a precipitation event of moderate intensity during this stage. This information will be used in conjunction with stream data taken during dry season conditions (Stage I) and stream data shortly after a precipitation event of greater intensity (Stage III).

5.3 ECOLOGICAL RISK MODELING

The ecological risk evaluation process is designed to satisfy two objectives of this investigation. The primary goal is development of an ecological risk assessment (see Section 5.8.1). After compilation

TABLE 5-6 SUMMARY OF SAMPLES, ANALYTICAL PROCEDURES, HOLDING TIME, AND CONTAINERS FOR STAGE II BIOACCESSIBLE CONTAMINANT CHARACTERIZATION

arameter	Number of Sample Locations	Number of Samples	Filed Dupli- cates	Field Blanks	Rinsate Blanks	Trip[a] Blanks	Total Samples	Ana- lytical Procedures[b]	Preservation[c]	Holding Time[d]	Containers	Total Number of Containers
thyl mercury	60	60	3	1	2	0	66	(e)	Hold @ 4 C	7 days extraction 40 days extract	8 oz wide-mouth glass jar with Teflon liner	66
tal metals g, Cd, Cu, n, Al)	60	60	3	1	2	0	66	245.2-CLP	Hold @ 4 C	28 days	8 oz wide-mouth glass jar with Teflon liner	66
lfide	60	60	3	1	2	0	66	9030	Hold @ 4 C	7 days	8 oz wide-mouth glass jar with Teflon liner	66
tal Organic Carbon	20	20	1	1	2	0	24	9060	Hold @ 4 C	28 days	8 oz wide-mouth glass jar with Teflon liner	24
	20	20	1	1	2	0	24	9045	None required	Analyze immediately	8 oz wide-mouth glass jar with Teflon liner	24
	20	20	1	1	2	0	24	----	None	Analyze immediately	8 oz wide-mouth glass jar with Teflon liner	24
id Volatile lfide with multaneously tracted tals (Hg, , Cu, Al)	20	20	1	1	2	0	24	(f)	Hold @ 4 C	7 days - AVS 28 days - SEM	8-oz wide-mouth glass jar with Teflon liner	24

a) Trip blanks taken for volatile organics analysis only.
b) Analytical procedures are in accordance with EPA SW-846, unless otherwise noted.
c) No chemical preservatives added to soils.
d) From time of sample collection.
e) Method for methyl mercury analysis is described in the QAPP.
f) Ditoro, D.M. et al. Toxicity of cadmium in sediments: The role of acid volatile sulfide. Environ. Toxicol. Chem. 9:1487-1502.

of Stage I and II data, a substantial body of site characterization data will be available. Information pertaining to the nature and extent of contamination, contamination within the bioaccessible zone, surface water quality, and wetland/ecological characterization will be examined and applied to predict the degree of contaminant exposure risk to potentially affected organisms. A preliminary ecological risk assessment will be developed at this time. It will then be refined through Stage III data collection.

Therefore, the second objective of ecological risk evaluation is to define the scope of activities for Stage III data collection. The risk evaluation process will identify the groups of organisms that should be sampled during Stage III. Key end receptors and important intermediate food web transfer species between lower trophic levels and human or ecological receptors will be targeted. The specific number and type of species to be sampled will be defined.

5.3.1 Preliminary Ecological Risk Assessment

EPA and Federal natural resources trustees have identified specific ecological concerns for Cold Creek Swamp. An ecological risk evaluation will be used directly for developing and interpreting study results. Ecological risk assessment will be conducted in accordance with applicable agency guidance (EPA 1988, 1989a, 1989b, 1989c) to meet requirements of CERCLA/SARA and the NCP. In addition, since ecological impacts are key concerns for Cold Creek Swamp, the ecological risk assessment will be innovatively and actively employed as an investigatory tool for this project. The utility of the assessment is illustrated in Figure 5-5. This figure shows how the ecological evaluation, refined on the basis of ongoing data acquisition, supports sampling and interpretation decisions. This erative approach focuses the investigation on key environmental receptors and those most likely to be at potential risk. This focus in turn permits scientifically sound decisions to be made regarding remedial options.

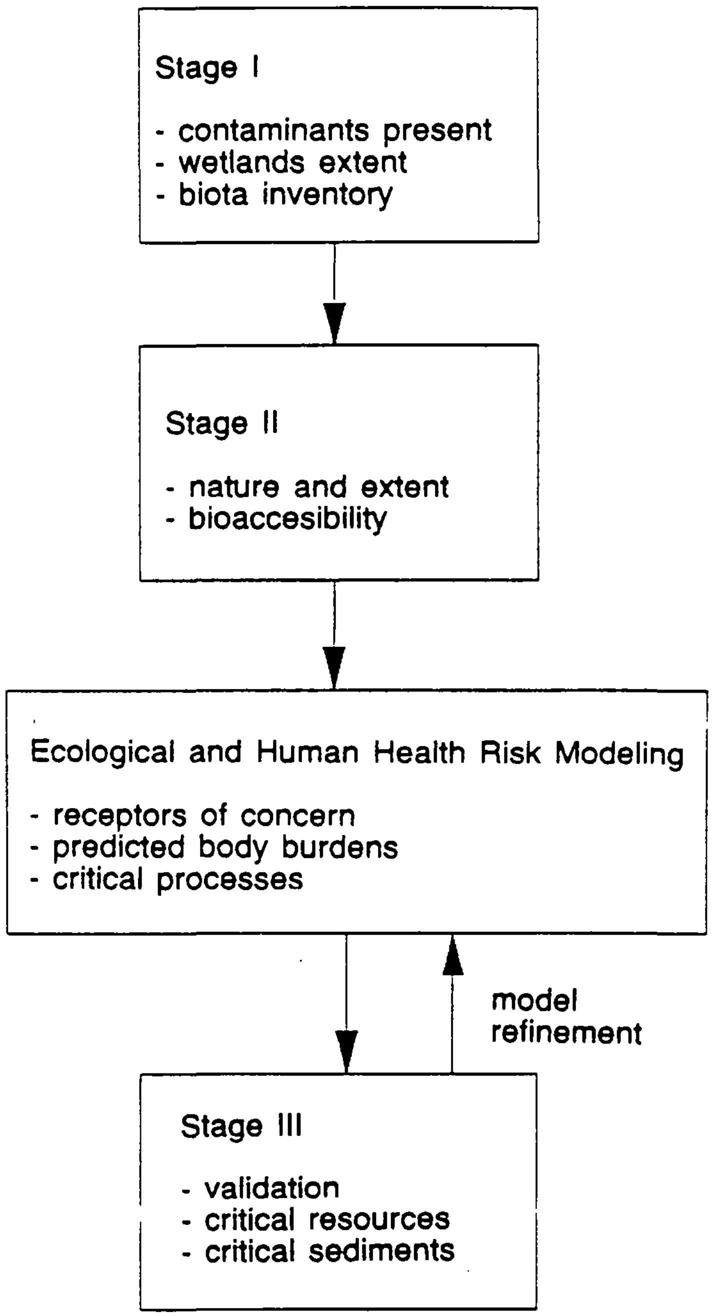

Figure 5-5 Interactive staged approach to Cold Creek Swamp Investigation.

Issues to be addressed in the ecological risk evaluation include the following:

- temporal trends in tissue concentration
- uptake mechanisms (what media are driving tissue acquisition?)
- key receptors present or potentially present in Cold Creek Swamp (in keeping with guidance, this will include evaluation of endangered or threatened species)
- food-web interactions (including potential food-web-based risks to both ecological receptors and human health)
- potential for site-related contaminants to affect resources in the Mobile River.

Modeling will employ a series of simple equations linking environmental contaminant concentrations to various components of the food web. As organic mercury will be the primary concern for tissue acquisition, bioaccumulation factors can be used to predict body burdens at various levels in the food web. Site-specific biota inventories will be generated to develop a trophic web. Criteria used to select individual key receptors will include (1) potential risk of contaminant uptake and population effects associated with such uptake, and (2) unique value or status. Resources at risk will be projected from the food webs and bioconcentration factors. Then body burden samples (Stage III) will include organisms at greatest potential risk of acquiring high tissue levels. Should rare, threatened, or endangered species be projected to acquire high tissue levels, surrogate species will be sampled. For example, Pseudemys alabamensis is a potential swamp inhabitant. Should this species prove to be present and potentially at risk, tissue from species closely related trophically [i.e., Pseudemys carcinna, rather than Chrysemys or Corapthemys (because diets are similar)] will be sampled. It is impossible to specify in advance what species would be the most likely targets for tissue analyses, because potential tissue levels are determined by site-specific food webs which must be developed. For example, aquatic snakes feed high in the food web and might be expected *a priori* to acquire high body burdens. However, such snakes (*Nerodia*, *Agkistrodon*) are highly piscivorous, and the intermittent nature of swamp stream may mean that much of the annual ration is acquired from relatively uncontaminated terrestrial or offsite resources. Thus, organisms feeding lower in the trophic web (e.g., amphibians or invertebrates) may provide more effective indication of overall tissue uptake.

Each of the issues noted above will be addressed through data gathered in the staged sampling program. Studies have been staged to allow maximum utility of previous results in fine-tuning sampling and analysis (Figure 5-5). Each of the listed issues is discussed below, with a brief statement of the problem and the technical approach that will be taken.

Temporal Trends in Tissue Concentration

Existing fish tissue data provide a solid basis for comparing present body burdens with those found in the past. Because most of the finfish inhabiting the intermittent or small permanent surface waters of Cold Creek Swamp are small species or small individuals of large species, tissue turnover will be rapid. It is estimated that a tissue sampling event during this study will be useful to examine temporal patterns. Sampling will reproduce the 1986 tissue sampling event as closely as possible, and DQOs will be established for consistency. Data will be analyzed to discern trends which might be present in whole-body samples.

Uptake Mechanisms

Substantial information exists in literature sources on both the ecological dynamics of Gulf Coast riverbottom forests and on the biodynamics of mercury. This information will be considered in conjunction with existing data and data to be acquired on water and sediment concentrations to develop a model of mercury accessibility, availability, uptake, and transformation. Modeled estimates will be supported and verified by samples of tissue and environmental media to be taken ex post facto and targeted to those receptors suggested most strongly by model results. Estimated and verified uptake mechanisms will provide technically defensible data for evaluating remedial options.

Key Receptors

Several key receptors have already been identified in agency correspondence: finfishes, waterfowl, wading birds, and threatened or endangered species. Of particular concern in the latter case is the Alabama Red-Bellied Turtle (*Pseudemys alabamensis*), proposed for listing. Habitat in lower stretches of Cold Creek swamp is potentially favorable for this species (Mount 1975).

Existing site-specific information (from previous site-related studies and USFWS 1986), general literature on swamp ecosystems and detailed field observations (biota inventory) will be used to develop a list of key receptors for the Cold Creek Swamp ecosystem. Contaminant model results will be applied to develop from this list a suite of receptors potentially at risk, of great potential indicator value, of regulatory interest, and/or of great value to the ecosystem. Species to be subjected to further detailed modeling assessment and/or tissue sampling as appropriate and necessary will be selected from the suite of receptors-of-concern.

Food-Web Interactions

As mercury is the primary contaminant of concern, food web interactions are the key to understanding biotic uptake and accumulation. Ecological risk models will incorporate particularly detailed evaluation of the role of trophic interactions in determining contaminant dynamics in the Cold Creek Swamp ecosystem. Field observations, existing data, and available literature provide sufficient information to document food-web interactions. Stage I and II contaminant sampling will provide data to parameterize trophic transfers. Stage III sampling will verify model predictions and further define any potential environmental effects of contamination.

Mobile River Potential Contamination

Ecological uptake models will address resources and conditions in the Mobile River. Direct assessment will be made of contaminants present in wetlands fringing the river and in biotic tissue in the vicinity of the Cold Creek confluence, both up- and down-stream. While it is not presently clear how discharge, reverse flow, and flooding affect creek and river hydrodynamics, a sufficiently general assessment will be developed that addresses potential effects of site-related contaminants to environmental resources of the Mobile River. This assessment will be based upon the surface water physical testing program, information from other previous and ongoing studies, and other available information.

5.3.2 Ecological Risk Modeling

A simple site specific ecological risk model will be developed which considers the following factors:

- soil and sediment as a source of mercury
- potential water column transport of mercury
- tissue uptake and accumulation of mercury by direct ingestion of mercury-contaminated sediments or exposure to mercury dissolved in water
- transfer of mercury between major food web compartments

- chemical transformation between organic and inorganic forms of mercury

- net export of mercury to the Mobile River

The model itself will consist of a series of linked equations taken from relevant scientific literature that is applicable to site conditions. These equations will be used to mathematically estimate the transfer of contaminants between and among key biotic and abiotic compartments of the ecosystem. Measured soil and water concentrations will provide the initial input parameters. The output of the model will be predicted tissue concentrations. Tissue concentrations will be estimated, both in key trophic intermediates (detritus-feeding vertebrates and invertebrates) and in higher-level consumers which represent critical receptors (rare, threatened, and endangered species, finfishes, wading birds, waterfowl). Because direct detection and attribution of community effects is very difficult in a system as heterogeneous as Cold Creek Swamp, a "bottom up" approach will be taken with respect to community assessment projecting impacts from specific findings. This approach provides for an interpretation of the site specific ecological mechanisms controlling mercury exposure, and establishes key input for evaluating remedial options.

One important application of the model will be to determine which abiotic and biotic compartments of the Cold Creek Swamp ecosystem should be targeted for additional sampling during Stage III. For example, finfish would be targeted in sampling if the ecological risk model predicted tissue concentration of mercury in finfish above the EPA action level for mercury. Alternatively, additional surface water samples might be collected for analysis if the model had predicted water-column concentrations above those necessary to cause acute or chronic toxicity to aquatic organisms.

This model will provide a powerful tool to selectively sample and analyze receptors most likely to be at risk from exposure to site contamination, and will optimize data collection during Stage III.

5.4 STAGE III FIELD INVESTIGATION

Stage III studies will be conducted after ecological risk modeling and Stage II field studies have been completed. The goal of this staged approach is to apply early stage results to focus and define Stage III. In this way, Stage III can concentrate on resources potentially at greatest risk, on those of greatest potential value as indicators of contamination or environmental effects, on those most appropriate from a regulatory standpoint, and/or on those most likely to drive food-web dynamics for human health and ecological risks.

In addition to targeting particular biota, sediment contamination will be assessed in greater detail in Stage III. As discussed below, distribution of mercury with depth in the sediment column is a key variable that can best be addressed after the nature and extent of contamination is understood from Stage I and Stage II sampling, and after areas of the swamp potentially critical for receptor impact have been identified.

Finally, additional assessment of physical surface water conditions (depth of flow, flow rate, dissolved oxygen content) will be made for comparison with similar data collected at other stages (Section 5.2.3).

5.4.1 Biological Tissue Characterization

After delineating the nature and extent of contamination in Cold Creek Swamp and after estimating biotic uptake and effects via ecological risk calculations, particular taxa or suites of taxa will be selected for further analysis. Depending on model results, these will likely include detritivores, which form the trophic base, some mixed-trophic level species, and possibly some species of particular concern or likelihood to exhibit high body burdens. These samples are intended to both validate risk calculations (correspondence with model predictions indicates that model mechanisms may in fact pertain; lack of correspondence suggests that other processes are occurring) and to monitor actual contaminant accumulation. Should calculations fail to validate as anticipated, these samples provide data to re-conceptualize calculations and re-estimate risks with more focused data.

5.4.1.1 Number and Location of Samples

The specific number and type of samples to be acquired in Stage III cannot be identified at this time because of the incremental nature of the study. Criteria for selecting samples will include the discovered and predicted nature and extent of contamination (Stage I and II data) and the particular risk concerns (ecological risk modeling). For example, if models indicate that finfish food webs have potential ecological impacts, whole-body samples would be taken. If models suggest a potential human health issue, fillets would be taken. This staged approach assures that ongoing regulatory concerns are addressed.

It is anticipated that it may be necessary to sample by species or taxa from several trophic levels including primary producers (i.e., green plants and algae), primary consumers (e.g., aquatic and terrestrial insects), detritivores (e.g., earthworms), secondary consumers and/or top carnivores (e.g., fish, amphibians, reptiles, and birds). Sampling will be targeted at key food web or end consumer species to confirm model predictions of body burdens of mercury. Details regarding the location and number of samples to be collected will therefore depend on the results of the Stage II modeling and sampling. It is anticipated that samples will be collected from each of four areas: upper Cold Creek Swamp (including the unnamed tributary), lower Cold Creek, the Mobile River, and possibly in terrestrial portions of the site. These areas encompass those which may support key resources (Mobile River, lower Cold Creek), those which may sequester mercury (upper and lower depositional areas), and those which may contribute to non-aquatic exposure (terrestrial habitats).

5.4.1.2 Sampling Equipment and Procedures

Standard sampling methods will be used to collect target organisms. Terrestrial plants will be sampled by a sample cut and harvest method. Benthic marcoinvertebrates will be sampled by taking grab samples or using an Eckman dredge. Samples will be watered in the field through a 0.25 mm sieve to remove sediment and debris. Finfish will be sampled using backpack or boat electroshocking techniques, seins, or gill nets, as appropriate. Terrestrial species will be sampled using taxa-specific gear.

5.4.1.3 Sample Containers, Preservation, and Holding Times

Benthic and invertebrate samples will be stored in clean bags or jars. Vertebrates will be stored in clean bags. All biological samples will be held frozen as appropriate until returned to the laboratory for sample preparation and chemical analysis. Holding times appropriate to tissue mercury analysis will be determined in conjunction with the laboratory performing the analyses, and will be set for all samples.

5.4.2 Bioaccessible Contaminant Characterization

After investigating the nature and extent of sediment-column and bioavailable contamination in Stages I and II and exploring the implications of these findings by ecological risk estimation, an additional round of detailed soil/sediment sampling will be conducted. This sampling will be designed to reveal the vertical distribution of contaminants in sediments that are most highly contaminated (as determined from Stage II sampling) or most critical for receptor exposure. Discrete samples will be collected as close as possible to 1-cm intervals through the bioaccessible zone, with a single larger increment beneath. The goal of this sampling is to provide information on potential sedimentation or erosion at critical locations in the swamp. These processes may ultimately drive any site-related ecological or human health risks, and so are crucial to success of the investigation.

5.4.2.1 Number and Location of Samples

The actual number of Stage III bioaccessible contaminant characterization samples is undetermined at this time. A minimum of three sample locations will be selected (one representing each hydrologic zone of the swamp). A maximum of 10 sample locations is anticipated. A total of 6 samples will be collected from each sample location. Samples will be taken as close as possible from each of the following depth intervals:

0-1 cm
1-2 cm
2-3 cm
3-4 cm
4-5 cm
5-10 cm

Samples will be analyzed for total and methyl mercury, sulfide, total organic carbon, pH, and Eh.

The sample numbering system will designate Stage III bioaccessible contaminant characterization samples as "BB" samples. Sample numbers will be "BB" followed by a numeric designation for the sample location (1, 2, 3...), and another numeric designation for the discrete depth interval (1, 2, 3...). Therefore, a sample from the second sample location and the 2-3 cm depth interval would be BB-2-3; a sample from the 3-4 cm depth interval at the third sample location would be BB-3-4; and so forth.

5.4.2.2 Sampling Equipment and Procedures

Sampling equipment and procedures will be as described previously for the Stage II bioaccessible contaminant characterization (Section 5.2.2.2).

5.4.2.3 Sample Containers, Preservation, Holding Time, and Analytical Methods

Sample containers, preservation and holding time considerations, and analytical methods will be as described previously for the Stage II bioaccessible contaminant characterization (Section 5.2.2.3 and Table 5-5). The total number of samples and sample containers is undetermined at this time, but will be defined subsequent to analysis of Stage I and Stage II data and ecological risk modeling, but prior to Stage III field activities.

5.4.3 Surface Water Physical Measurements

An additional round of surface water physical measurements will be conducted during Stage III. These measurements will be made shortly after a precipitation event of greater intensity. The sample locations, methodology, and objectives will be as described previously in Section 5.2.3.

5.5 DECONTAMINATION AND WASTE HANDLING PROCEDURE

All drilling and split-spoon sampling equipment will be decontaminated according to EPA Region IV SOP. The soil boring/drilling rig will be cleaned before being mobilized and brought onsite with a power washer, or steam generator, or it will be hand washed. Detergent will be used (laboratory detergent or other suitable degreaser) to remove oil, grease, and hydraulic fluid from the exterior of the unit. The unit will be rinsed thoroughly with tap water prior to being brought onsite and between boreholes. Auger flights, auger bits, drilling rods, drill bits, hollow-stem augers, split-spoon samplers, Shelby tubes, or other parts of the drilling equipment that will contact the soil or ground water will be cleaned as follows:

1. Washed with tap water and laboratory detergent using a brush if necessary to remove particulate matter and surface films.

2. Rinsed thoroughly with tap water.

3. Rinsed thoroughly with deionized water.

4. Rinsed twice with isopropanol solvent.

5. Rinsed thoroughly with organic-free water and allowed to air dry as long as possible.

6. If organic-free water is not available, equipment will be air dried as long as possible. Equipment will not be rinsed with deionized or distilled water.

7. Wrapped with aluminum foil, if appropriate, to prevent contamination if equipment is going to be stored or transported.

The hand corers will also be decontaminated as per the above seven-step procedure.

All discarded personal protective clothing will also be placed in drums. Different potentially contaminated materials (e.g., oil, tyvek-wear, cement bags) will be segregated into individual drums. Drums containing waste PPE and site debris will be labeled and dated. Nonhazardous materials derived from test borings will be spread out immediately adjacent to the boring.

5.5.1 Decontamination of Sediment Corer Samplers

In order to collect a sufficient volume of sample for chemical analysis and to satisfy EPA volume requirements for split samples, between two and five drops of the sediment sampler are required at each discrete sample location. During Stage I, individual stainless steel core liners were used for each of the multiple drops at each discrete sample depth. During Stage II, it is proposed that a single stainless steel core liner would be used for all of the multiple drops at each discrete sample depth. This methodology should not adversely impact sample quality since all of the collected material from each discrete depth will be composited prior to analysis. All sampling equipment will be decontaminated in accordance with the protocol outlined above in between each discrete sample depth.

5.6 DATA MANAGEMENT

An RI typically generates an extensive amount of information, the quality and validity of which must be consistently well documented because this information will be used to support remedy selection decisions and legal or cost recovery actions. Therefore, field sampling and analytical procedures for the acquisition and compilation of field and laboratory data are subject to data management procedures.

Data management procedures include Data Quality Objectives (Chapter 4); field sampling documentation and recordkeeping (Section 6.3); sample management and tracking (Section 6.4); and document control and inventory. These procedures, with the exception of document control and inventory, are described in more detail elsewhere in this document.

5.6.1 Document Control and Inventory

Since these sites are NPL-listed sites, maintenance of the Administrative Record is of primary importance. The Administrative Record is the legally binding record of investigation and response activities for the sites. As such, it is essential that all project activities be properly recorded as part of the Administrative Record.

For this supplemental RI/FS, the Work Plans, results of Stage I, II, and III sampling, the ecological risk modeling, the contamination assessment, the human health and ecological risk assessments, the RI and FS reports, and all relevant project correspondence will become part of the Administrative Record for this site. Sample results will be managed in a standardized form to promote easy reporting of data in the site characterization report. Precaution will be taken in the analysis and storage of the data collected during site characterization to prevent the introduction of errors or the loss or misinterpretation of data. A document inventory and filing system will be set up on the basis of serially numbered documents. Further discussion on the importance of the Administrative Record is addressed in EPA's "Interim Guidance on Administrative Records for Selection of CERCLA Response Actions" (EPA June 1988).

5.7 DATA ANALYSIS/CONTAMINATION ASSESSMENT

In accordance with the current interim final CERCLA/SARA guidance on RI/FS, a contamination assessment will be prepared which discusses the quantities and types of contaminants within and around the Cold Creek Swamp and the nature and extent of contamination, and evaluates potential transport mechanisms that are carrying or may carry contaminants from the originating site. The assessment will evaluate the severity of hazards by consideration of the above-mentioned characteristics.

The severity of hazards shall be determined by applying the applicable or relevant and appropriate requirements (ARARs). Enactment of SARA imposes comparison to and compliance with all ARARs from all levels of governmental bodies with jurisdiction. The contamination assessment will define the ARARs and provide the comparison.

Chemical analyses of surface water, sediment/soil samples, and biological tissue samples from the three stage field investigation will be used to investigate the presence of contamination within and around the swamp, and the presence of contamination specifically within the biologically active zone. A qualitative determination of the impact of the site as a source of soil, ground-water, or surface-water contamination will be made. An assessment of potential ground-water/surface-water interaction will be included. This interaction will be characterized based upon results of this study, results of other previous and ongoing studies at the site, and other pertinent available information. An assessment of the limits of the region impacted by site contamination and identification of the contaminant source will also be made.

The principle transport mechanisms for potential contaminant movement will be examined. They include (1) dissolved or liquid phase contaminant transport associated with surface waters, (2) erosion of contaminated soil/sediment directly into a surface waterway, and (3) transport via ground water through surface water infiltration in the swamp.

5.8 RISK ASSESSMENT

The purpose of performing a risk assessment for supplemental RI/FS activities at the Cold Creek Swamp Operable Unit is to characterize potential risks posed to the site environment and to human populations by site contaminants via various potential routes of exposure. A risk assessment consists of two components: a human health assessment and an environmental (ecological) assessment. EPA has recently issued revised guidance for conducting risk assessments at Superfund sites. The two-volume set entitled "Risk Assessment Guidance for Superfund" consists of the "Human Health Evaluation Manual" (dated December 1989) and the "Environmental Evaluation Manual" (dated March 1989). Both documents are presently issued by EPA in interim final status.

Previous site investigations indicate that human health risk considerations do not represent as significant a concern as ecological risk considerations because potential human health exposure scenarios are extremely limited, and the nature of contaminant transport does not indicate that site contaminants are impacting regional ground water or surface water. Both a human health and an ecological risk assessment will be conducted for this site. Ecological rather than human health risk considerations will most likely govern selection of final remedial action during the feasibility study.

5.8.1 Ecological Risk Assessment

As discussed in Section 5.3, ecological risk evaluation is being driven by specific technical and regulatory issues. To address these issues, quantitative ecological risk modeling will be conducted on particular receptors of interest and focused on particular ecological processes. As mercury is the primary contaminant of concern, bioavailability and trophic transfer will be key issues in quantifying potential risk to ecological receptors and to human health via possible food web interactions. To address these issues, the tasks outlined in Section 5.3 of this Work Plan will be conducted in compliance with agency guidance (EPA 1989b). This guidance describes eight subtasks which make up a complete ecological risk assessment under CERCLA/SARA:

1. specify objectives
2. define scope
3. describe site and study area

4. describe contaminants of concern
5. characterize exposure
6. characterize risk or threat
7. apply risk estimates to site assessment/remediation process
8. describe assessment conclusions and limitations.

Each of these components is discussed in greater detail below.

5.8.1.1 Specify Objectives

General objectives for the ecological risk assessment of contaminants in Cold Creek Swamp are to characterize potential receptors, characterize potential exposure, characterize potential risks, and evaluate risks associated with various remedial options. Specific objectives include determining temporal trends in biota body burdens, determining uptake and exposure mechanisms, determining the presence and distribution of key receptors in the swamp ecosystem, quantifying trophic transfer and bioavailability parameters, and determining the potential for site-related contaminants to affect resources in the Mobile River. As described in this work plan, these objectives will be met by combining existing information with additional field studies to characterize nature and extent of contamination and receptor distribution and with quantitative risk modeling to evaluate threats to key receptors.

5.8.1.2 Define Scope

The scope of the ecological risk assessment will largely depend on Stage I and Stage II findings during field investigations. The spatial scope of study is focused on Cold Creek Swamp and adjacent areas of the Mobile River. Temporal aspects will include data gathered in the past, present field studies, and projections of future conditions. Because certain receptors may travel beyond the bounds of the swamp (for example, migratory birds, raptors, fish and large reptiles), the scope will be further defined as studies proceed.

5.8.1.3 Describe Site and Study Area

Much descriptive information is available in existing documents, and further information on environmental conditions, ecological resources, and environmental processes will be gathered during this study. Presentation of this information in supporting risk assessment conclusions will include assessments of potential for off-site impacts associated with physical (for example, erosion or suspended sediment transport) and biological (for example, migration or local movements of biota) transport of contaminants.

In addition to describing physical, chemical and biological parameters associated with the site, a description of relevant ecological processes which play potential roles in exposure and toxicity will be provided. These processes may be discerned from both published literature and by site-specific information gathered in support of this study. An excellent primer on ecological processes in habitats found in and around Cold Creek Swamp is available in Costanza et al. 1983.

5.8.1.4 Describe Contaminants of Concern

Existing information and Target Compound List samples taken during Stage I and II of this study will be re-examined for contaminants of ecological concern. This evaluation will account for environmental behavior, concentration, occurrence, and toxicity, and will specifically address contaminants that have potential to impact biota. Preliminarily, on the basis of existing chemical data and site visit characterization of potential receptors, it is anticipated that various forms of mercury will be of primary concern and will likely drive environmental assessment and evaluation of remedial options. This preliminary conclusions will be explored further during Stage I and Stage II investigations.

5.8.1.5 Characterize Exposure

Generally, for sites at which ecological issues play key roles in developing and evaluating remedial options, exposure assessment is the most technically demanding investigation subtask. Receptor exposure is controlled by a complex of factors which include presence, distribution and speciation of carbon compounds; pH; Eh; hydrology; sediment structure; co-contaminants; food-web composition; seasonality; and habitat type, among many others. Where mercury is a contaminant of primary concern, as it is at Cold Creek Swamp, bioavailability and trophic transfer are critical processes controlling exposure because biotransformation vastly increases the mobility, availability, and toxicity of mercury in the environment.

For this environmental assessment, exposure analysis will serve as the basis for all quantitative risk modeling. Exposure will be modeled on the basis of both site specific (receptor surveys, contaminant assessment) and general (trophic structure, ecological processes) information. Exposure models will account for bioaccessibility, bioavailability, bioaccumulation, uptake, depuration, and transformation. From these models, predicted body burdens will be estimated. These data will support Stage III sampling efforts and risk evaluations (below), as well as providing parameters for exposure via trophic transfer.

5.8.1.6 Characterize Risk

Risk characterization will be conducted according to EPA guidance, and will address: probability, magnitude, and temporal nature of adverse effects and what components of the swamp and surrounding ecosystems might be impacted. Risk will be quantified for existing nature and extent of contamination. Semi-quantitative projections of future conditions will be developed as far as they may be technically feasible. In addition, a semi-quantitative framework will be developed for comparative evaluation of risks posed by various remedial options. This assessment will provide the basis for rational, defensible decision-making regarding threats to and potential remediation of Cold Creek Swamp and surrounding habitats.

5.8.1.7 Application

Under applicable guidance, risk estimates will be compared with existing ARARs and To Be Considered criteria (TBCs), and the basis for such comparison will be thoroughly documented and clearly presented. ARARs and TBCs are generally lacking for soil and sediment. Therefore, an approach to applying study results to response decision-making will be developed. This approach and resulting recommendations will again be fully documented and presented for discussion and use.

5.8.1.8 Conclusions and Recommendations

Conclusions from each subtask of the ecological risk assessment will be developed in such a fashion that the information from each supports and complements the other. In this way, a technically complete evaluation will result, combining evaluations of receptors potentially at risk, contaminant nature and distribution, exposure, toxicity, and projection of future conditions. Variance around quantitative estimates, uncertainty surrounding qualitative estimates and comprehensive conclusions, and the implications of each for application of study results will be thoroughly documented. Conclusions and recommendations resulting from this environmental assessment will support clear, technically strong, thoroughly documented evaluation of site related risks and rational evaluation of remedial options.

5.8.2 Human Health Assessment

There are five components of a human health risk assessment:

1. Data collection and evaluation
2. Exposure assessment

3. Estimation of human intakes
4. Toxicity assessment
5. Risk characterization

The following sections discuss each component in greater detail.

5.8.2.1 Data Collection and Evaluation

This activity begins with the identification of data needs and the establishment of Data Quality Objectives in the preliminary phases of the project. The risk assessor considers sources, pathways, and receptors as well as modeling needs to assist in developing the overall work plan, including the strategy for sample collection. Data evaluation addresses such issues as quantitation limits and detection limits, qualified data, concentrations detected in blanks, tentatively identified compounds, and comparison of samples with background.

5.8.2.2 Exposure Assessment

This step in the human health assessment process analyzes contaminant releases to identify possible exposure pathways, to determine the populations at risk, to estimate concentrations to which humans may be exposed, and to compare these concentrations to other requirements, standards, and criteria. It addresses the inherent properties of the contaminants and those related to the conditions of the site. Various models are available to quantify chemical releases to air, surface water, ground water, and soil in order to determine the potential for human exposure to the chemicals of concern, as well as to predict the environmental fate and transport of the chemicals through these media. The end result is a suite of estimates of pollutant concentrations at a point of exposure to humans.

5.8.2.3 Estimate of Human Intake

For those chemicals which are carried through the human health assessment, an estimation of human intake via various routes of exposure will be made. For example, intake via inhalation of a contaminant in the air will be estimated based on the air concentration of the chemical (mg/m^3), the amount of air breathed daily (m^3/day), and average body weight (kg) of the exposed person.

5.8.2.4 Toxicity Assessment

This step involves the identification and/or development of criteria toxicity values for each indicator chemical. EPA has developed such values for a significant number of compounds most often found at hazardous waste sites. EPA's values represent the latest consensus among various scientific review groups in the Agency. When possible, values have been developed for both oral and inhalation routes of exposure for both non-carcinogenic effects and carcinogenic effects. In the case where there are no toxicity values formally supplied by EPA, these values will be calculated using standard risk assessment procedures that are recommended by EPA (51 FR 33992, 51 FR 34406, 51 FR 34014, 51 FR 34028). The risk assessment will also consult with EPA for the Agency's latest information on the chemicals in question, using the Integrated Risk Information System (IRIS) database.

5.8.2.5 Risk Characterization

This is the final step in the human health evaluation process and results in the characterization of the human health risks for potential non-carcinogenic and carcinogenic effects based on combining the exposure and toxicity information developed in the previous steps.

Noncancer hazard indices will be developed based upon the assumption of additivity of effects. A noncancer hazard index is expressed as a function of the ratios of estimated exposure (or intake) levels (calculated in steps 2 and 3) to acceptable exposure (or intake) levels (calculated in step 4).

A noncancer hazard index is developed for both subchronic and chronic exposures. Should the hazard index result in a value greater than one, the compounds will be divided into subgroups based on the critical effect associated with each. Then hazard indices will be calculated for each type of effect. If the hazard index for a particular type of critical effect is greater than one, then there may be concern for a potential health risk.

In the case of carcinogenic effects, the additivity of risk is also assumed.

The total potential carcinogenic risk posed by a site is estimated by summing the carcinogenic risk associated with each chemical. Further refinements of the above calculations will be made by EA according to EPA's guidelines, as appropriate.

In characterizing the potential risks posed by contamination at Cold Creek Swamp, major areas of uncertainty associated with the human health assessments for each site will be discussed. When possible and appropriate, an indication of how and the degree to which these uncertainties affect the risk calculations will be made. Once the public health assessment is complete, it will then be used as the basis for developing performance goals for remedial alternatives.

5.9 SUPPLEMENTAL REMEDIAL INVESTIGATION (RI) REPORT

A supplemental RI report will be developed to compile the results of all investigation phase data collection, modeling, and analyses. Specifically, the supplemental RI report will address results of previous studies; Stage I, II, and III data collection; the ecological risk modeling; the contamination assessment; and the human health and ecological baseline risk assessments.

The procedures for development of the supplemental RI report are described in detail in Chapter 3 of EPA's Interim Final "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" dated October 1988. A suggested RI report format is shown in Table 3-13 of that document.

5.10 SUPPLEMENTAL FEASIBILITY STUDY (FS)

The FS process includes two major components: (1) development and screening of remedial alternatives, and (2) detailed analysis of alternatives. A third component, treatability studies, is sometimes required to provide sufficient data to fully develop and evaluate treatment processes and to reduce cost and performance uncertainties for treatment alternatives. It is important to note that the purpose of the FS process is to present relevant information needed to allow decision makers to select a site remedy, not the decision-making process itself.

5.10.1 Development and Screening of Remedial Alternatives

This phase of the FS begins within the data evaluation and baseline risk assessment (human health and ecological) phase of the RI. Development and screening of remedial alternatives consists of nine major subtasks. A thorough description of these subtasks is provided in EPA Interim Final "Guidance for Conducting Remedial Investigation/Feasibility Studies under CERCLA," October 1988.

The nine subtasks of this phase of the FS are identified below. To the right of each subcategory is a section reference in EPA's Interim Final RI/FS guidance.

1. Development of remedial action objectives (4.2.1)

2. Development of general response actions (4.2.2)

3. Identification of volumes or areas of media (4.2.3)

4. Identification and screening of remedial technologies and process options (4.2.4)

5. Evaluation of technologies/process options for effectiveness, implementability, and cost (4.2.5)

6. Assembling of remedial alternatives (4.2.6)

7. Alternatives definition (4.3.1)

8. Preliminary screening evaluation (for effectiveness, implementability, and cost consideration given for the use of innovative technologies) (4.3.2)

9. Screening of alternatives (selection of alternatives for detailed analysis) (4.3.3)

The first six subtasks comprise the alternative development process. The last three subtasks comprise the alternatives selection process.

For the Cold Creek Swamp Operable Unit, the remedial action objectives and general response actions developed in the initial phases of the supplemental FS will govern subsequent feasibility study evaluations. Identification of volumes or areas of media to which general response actions might be applied will be made based upon the existing RI data in addition to the supplemental RI field data and the supplemental RI contamination assessment. Once media to which response actions might be applied have been established, potentially acceptable technology types and process options will be pre-screened with respect to technical implementability.

The development of the potential remedial alternatives to achieve the criteria and objectives will involve close interaction with EPA, USFWS, and NOAA. The first step will be to identify all appropriate technologies and feasible alternatives including the no action alternative. Particular consideration will be given to innovative and alternative site remediation methods and remedies to mitigate ecological damage (i.e., wetland disturbance).

The initial screening will be completed to identify technically feasible alternatives for future development. Any alternatives deemed not feasible at this stage will not be carried through to the full analysis. A detailed justification for rejecting a particular alternative for further analyses will be given.

Since this site is a swamp, and since most, if not all, of the site area will be classified as wetlands, potential impacts to the wetlands area and quality must be addressed. Potential wetlands impacts will be a major consideration in the examination of all remediation technologies.

5.10.2 Detailed Analysis of Alternatives

The second major component of the FS process is the detailed analysis of alternatives. During the detailed analysis, each alternative is assessed against the evaluation criteria described in this section. The results of this assessment are arrayed to compare the alternatives and identify the key trade-offs among them. The specific subtasks that comprise the detailed analysis of alternatives are:

1.	Alternative Definition	(6.2.1)
2.	Overview of Evaluation Criteria	(6.2.2)
3.	Individual Analysis of Alternatives (Comparison of EPA's 9 evaluation criteria)	(6.2.3)
4.	Presentation of Individual Analysis	(6.2.4)
5.	Comparative Analysis of Alternatives	(6.2.5)
6.	Presentation of Comparative Analysis	(6.2.6)

The references to the right of the subtasks indicate section references in EPA's Interim Final "Guidance for Conducting Remedial Investigations and Feasibility Studies at CERCLA Sites," dated October 1988 (hereafter referred to as EPA's RI/FS guidance document) where these subtasks are described in detail. Steps 1-3 of the detailed analysis of alternatives pertain to definition and analysis of remedial alternatives. Selection and evaluation of alternatives will be based primarily on the nine evaluation criteria developed by EPA to address the requirements of CERCLA Section 121(b)(1)(A), and to address the additional technical and policy considerations that have proven to be important in selecting among remedial alternatives.

Specifically, the nine criteria are:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, and volume
5. Short-term effectiveness
6. Implementability
7. Cost (present worth value, including O&M, monitoring, salvage, and other costs)
8. State acceptance (pursuant to CERCLA Section 121(f))
9. Community acceptance (pursuant to CERCLA Sections 113 and 117)

Section 6.2.3 of EPA's RI/FS guidance document provides an excellent synopsis of EPA's nine evaluation criteria.

Results of individual detailed remedial alternative analyses will be presented in the supplemental FS report as a narrative discussion accompanied by summary tables (step 4 of the detailed analysis of alternatives). Applicability of each remedial alternative will be addressed in the individual analysis of that alternative. This section will present an assessment of each of the alternatives against the evaluation criteria.

The final section of the supplemental FS report will be the comparative analysis of alternatives (steps 5 and 6 of the detailed analysis of alternatives). The purpose of this comparative analysis is to identify the advantages and disadvantages of individual remedial alternatives at each site relative to one another so that the key trade-offs the decision maker must balance can be identified. The comparative analysis of remedial alternatives at each site will be conducted as specified in Section 6.2.5 of EPA's interim final RI/FS guidance document.

The comparative analysis will include a narrative discussion describing the strengths and weaknesses of the alternatives relative to one another with respect to each evaluation criterion, and how reasonable variations of key uncertainties could change the expectations of relative performance. If innovative technologies are being considered, their potential advantages in cost or performance and the degree of uncertainty in their expected performance (as compared with more demonstrated technologies) will be discussed.

A primary consideration of the comparative analysis will be the potential impacts of remedial actions on the wetland ecosystem in Cold Creek Swamp. Alternatives will be examined to determine if implementation of remedial action will result in greater destruction of the wetland than is necessary for the protection of natural resources, and will be compared accordingly.

5.10.3 Treatability Investigations

The third component of the FS process, treatability investigations, will be conducted as necessary to examine potential remedial actions for the supplemental FS at the Cold Creek Swamp Operable Unit. Treatability studies may include bench-scale or pilot-scale testing of potential remedial action processes. Treatability studies, if required, will be conducted in accordance with current EPA protocols and guidance for treatability studies under CERCLA.

6. SAMPLE HANDLING

6.1 ANALYTICAL PARAMETERS AND METHODS

The generic list of analytical parameters for the Cold Creek Swamp Operable Unit RI/FS is provided in the QAPP under the specific analytical categories of Target Compound List (TCL) volatiles, TCL semivolatiles, metals (Target Analyte List), thiocarbamates, methyl mercury, and other. The specific analytes per sampling task and site are listed in Tables 5-1 through 5-4 and 5-6.

The analytical methods are described under separate cover in the QAPP.

6.2 SAMPLING PRINCIPLES

Proper sample collection is one of the most important parts of an environmental studies project. Without proper sample collection techniques, the results that are obtained from the associated analyses will be neither useful nor valid, even though the analytical technique used may be very precise and accurate.

The variety of sampling locations and associated conditions which exist at the sampling site will require that some judgment be made regarding the implementation of the methodology noted in the subsequent paragraphs. These judgments will be made by qualified personnel and will be based on prior experience with representative samples previously analyzed and data from other sources concerning the sampling site.

Although each sampling location will require some special attention, depending upon its complexity, there are some basic requirements and precautions which will be generally applicable to the various sample types. Some of these are listed below.

6.2.1 Sampling Equipment

6.2.1.1 Water Samplers

a. Clean with a non-phosphate laboratory detergent such as Alquinox or Liquinox using a brush as necessary to remove particulate matter and surface films. Wash and rinse with tap water.

b. Rinse with 0.1 N nitric acid.

c. Rinse with distilled deionized water.

d. Rinse with pesticide-grade isopropanol.

e. Rinse with organic free water.

f. Air or oven (125 C) dry.

6.2.1.2 Excavation Equipment and Soil Samplers

a. Clean with tap water and laboratory detergent such as Alquinox or Liquinox using a brush if necessary to remove particulate matter and surface films.

b. Rinse thoroughly with tap water.

c. Rinse thoroughly with deionized water.

d. Rinse twice with isopropanol solvent.

e. Rinse thoroughly with organic-free water and allow to air dry as long as possible.

f. If organic-free water is not available, allow equipment to air dry as long as possible. Do not rise with deionized or distilled water.

g. Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is going to be stored or transported.

6.2.1.3 Biota Samplers

1. Clean equipment as appropriate (i.e., wash seiner and nets free of particles; scrub and rinse benthic grabs thoroughly; backwash and rinse seives).

2. Between sampling points, wash all equipment free of particles with tap or ambient water.

6.2.2 Sample Container Preparation

All sample containers will be prepared by the protocol noted below in order to minimize sample contamination.

1. Wash with nonphosphate laboratory detergent such as Alquinox or Liquinox and hot water.

2. Rinse three times with tap water.

3. Rinse with 1:1 nitric acid (use caution when performing this step).

4. Rinse well with deionized water. Sample containers should be totally filled and over-filled at least three times.

5. For bottles used for extractable organics:

   a. Rinse with methylene chloride.

   b. Rinse will with organic free water. Sample containers should be totally filled and over-filled four times.

6. Dry in a glassware oven (no organic contaminants) at 125 C. Allow to cool.

7. Teflon liners for the bottle caps should be carried through the same procedure. Polyseal liners and bottle caps should not be rinsed with nitric acid and should be air dried, not dried at 125 C.

Because of the stringent requirements for trace analysis, only bottles prepared as above are to be used. In addition, these sample containers should be handled, stored, and utilized to minimize the chances of contamination by outside sources.

The selection of the appropriate container is dependent upon the analytes of interest. A listing of required containers is included in Table II of 40 CFR 136.3.

6.2.3 Reagents

Only reagents and chemicals certified to be "reagent grade" or better, are to be used for environmental projects. For metal preservation and analysis, Ultrex nitric acid or equivalent is the reagent of choice. Reagents for organic contamination analysis, such as methylene chloride and ethyl ether, should be analyzed to determine trace organic content. Chemical reagents should be handled, stored, and utilized to minimize the chances of contamination by outside sources.

6.2.4 Sample Preservation

Since very few analyses will be performed on samples immediately after collection, it is important to prepare for and implement appropriate preservation techniques for the various sample matrices. Since the addition of chemicals as preservatives and changing the physical condition of the sample, such as cooling to 4 C, has some effect on the sample itself, it is important to implement analyses as soon as possible. For each of the various specific tests the appropriate preservation techniques are specified. When chemical preservatives are used, they should be added to the sample bottle initially so that all portions of the sample are preserved as soon as collected.

6.2.5 *Collection of the Sample*

When sampling, it is important to randomly collect enough material from the sampling source such that a representative sample is obtained. Liquids with no suspended solids generally require only small volumes of material to meet this requirement. On the other hand, solids or semisolids containing some liquid may require the collection of more material to fully represent the condition at the source. Some judgment must be made at individual collection sites to ensure that this objective is met.

Compromises on sample size may have to be exercised when practical limitations such as size of sample container and the need for storage and transportation are involved. In general, the collector of the sample has the responsibility for its validity. In those cases where a sample collector is unsure of the proper method for collection, he is required to consult with the site supervisor.

6.3 SAMPLE CUSTODY AND SHIPMENT

Accountability for a sample begins when the sample is taken from its natural environment. A bound field logbook will be maintained to record the acquisition of each sample. Entries must be made in waterproof ink.

Only samples for one project site are entered in a given logbook. The logbook will contain information to distinguish each sample from any other sample. This information will include:

- Project name for which sampling is being conducted
- Unique, sequential sample number
- Matrix being sampled (ground water, soil, etc.)
- Sample depth
- Sampling date and time
- Specific sampling location in sufficient detail to allow resampling at the same location
- Method of sampling
- Preservation techniques, including filtration, as appropriate for separate sample aliquots
- Analyte classes of interest
- Water volume removed during well development
- Significant observations made during the sampling process
- Results of any field measurements, such as depth to water, temperature, conductivity, and pH
- Printed name and signature of the person performing the sampling.

In addition to the sampling logbook, each sample will be unambiguously labeled in waterproof ink with the following information:

- Site name
- Unique, sequential sample number
- Sampling date
- Analysis type
- Preservative added and any filtration accomplished

When samples are shipped to the laboratory under chain-of-custody, a copy of the logbook pages describing samples are also sent in the same shipping container. Entries will be made in the logbook noting date of shipment, number of shipping containers, samples sent, and carrier.

If specified in the Site Health and Safety Plan or otherwise considered prudent, a separate safety label will be prepared for each sample. In some instances a seal which lists sample number, date and time of sample collection, and signature of the sampler must be placed on the lid of the sample bottle. This sample seal is to ensure that the sample is not tampered with during shipment. Figure 6-1 is a sample of a typical chain-of-custody form. One chain-of-custody form will be completed for each day of sampling at each sampling location. The chain-of-custody form is to accompany the sample throughout the shipping and analytical process. Each cooler will have a separate chain-of-custody.

Shipment of samples will be in accordance with DOT Regulations described in 49 CFR 171 and 49 CFR 172, and NEIC procedures (EPA-330). This is usually guaranteed air freight. If the nature of the samples precludes air shipment, the fastest motor freight is used. Samples are shipped, preserved, and cooled according to EPA protocols. Shipping schedules are arranged to ensure sample processing within holding times specified for analytical parameters. Shipping documents such as package registration are kept to record the shipping process and to serve as tracers.

Chain of Custody Record

EA Laboratories
15 Loveton Circle
Sparks, MD 21152
301-771-4950

Company Name | Project Manager or Contact

Project No. | Project Name

Special QA Protocols (Circle)

EPA CLP   TIER I (NJ)   OTHER (SPECIFY)

USATHAMA   TIER II (NJ)   ________

Date	Time	Grab	Comp	Sample Identification (I.D. and Matrix)	No. of Containers	Parameters for Analysis									EA Labs Accession Number	Remarks

Sampled by: (Signature) | Title: | Date/Time | Relinquished by: (Signature) | Date/Time | Received by: (Signature)

Relinquished by: (Signature) | Date/Time | Recieved by: (Signature) | Relinquished by: (Signature) | Date/Time | Rec'd. by Lab: (Signature)

Sample Custody Notes: ________

Sample Shipped by: (Circle)

Fed. Ex.   Puro.   UPS

Other (Specify) ________

Air Bill Number:

Figure 6-1. Sample custody form.

Sample packing and shipping procedures are as follows:

- Secure sample jar lids.
- Position jar in Ziploc bag so that labels can be read.
- Line coolers with large heavy plastic garbage bag.
- Place about 1 in. of absorbent packing material into bottom of garbage bag in cooler.
- Place jars in cooler and fill remaining volume of cooler with ice and packing material.
- Put paperwork in plastic bags and tape with masking tape to inside lid of cooler.
- Tape drain shut.
- After acceptance by shipper, tape cooler completely around with strapping tape at two locations. Secure lid by taping. Do not cover any labels.
- Place laboratory address on top of cooler.
- Put "This Side Up" labels and arrows on two sides.
- Affix numbered custody seals on front right and back left of cooler. Cover seals with wide, clear tape.
- Ship sample via overnight carrier.

6.4 SAMPLE TRACKING

Upon completion of sample collection, logging, and preservation, the chain-of-custody procedures will be initiated. Because of the large amount of samples to be collected (particularly during Stage II), sample tracking will start at the job site, where a spreadsheet will be updated daily after the samples are logged, chain of custody completed, and samples prepared for shipping. Following the arrival of samples at the laboratories, the conditions of those samples shipped will be confirmed (i.e., are any broken, improperly preserved?). Once the conditions of samples are established, the sample spreadsheet will be updated again, if needed.

Each field investigation Stage will have its own set of spreadsheets that summarize how many and what type of bottle and preservatives are needed. Each field crew will be issued this information prior to sampling.

7. PROJECT SCHEDULE

Table 7-1 shows the performance schedule and schedule of deliverables for project activities associated with the Cold Creek Swamp Operable Unit supplemental RI/FS.

A three stage field sampling effort is scheduled. Stages I and II are scheduled to be conducted during dry weather conditions, and will concentrate on soil/sediment and dry season, surface water data collection. Stage III field sampling is scheduled to be conducted during the spring wet-weather conditions. Stage III sampling will collect data for assessment of wet weather surface water quality and for biological tissue sampling. Stage III sampling is scheduled to allow adequate time to compile Stage I and II data and to perform ecological risk modeling activities. This information is necessary to design and optimize Stage III sampling.

The project is phased to begin feasibility study activities at the earliest reasonable time during the RI phase. This streamlined approach results in significant time savings and an anticipated project performance period of less than 24 months.

Two review conferences with all regulatory agencies have been scheduled. The first review conference will be held approximately 6 weeks after submission of the draft RI report. The second review conference will be held approximately 9 weeks after submission of the draft FS report. Both review conferences will be held at EPA Region IV offices in Atlanta.

It is recommended that an additional meeting be scheduled shortly after EPA has had an opportunity to review the Work Plans. This meeting should also be held at EPA Region IV offices in Atlanta.

TABLE 7-1 PROJECT SCHEDULE

1 Oct 90	Submit Work Plans to EPA
26 Oct 90	Receive EPA review comments
6 Nov 90	EPA review comment meeting
3 Dec 90	Submit final plans to EPA
4 Feb 91	Stage I field investigation begin
14 Feb 91	Stage I field investigation end
26 Mar 91	Stage I chemistry data available
9 May 91	Propose contaminants of concern
9 May 91	Submit revisions to work plan
23 May 91	Discuss contaminants of concern/Stage II Work Plan
3 Jun 91	Stage II field investigation begin
3 Jul 91	Stage II field investigation end
7 Aug 91	Stage II chemistry data available
21 Aug 91	Revised Stage III field plan submitted to USEPA
20 Sep 91	Receive EPA review comments
7 Oct 91	Stage III field investigation begin
26 Oct 91	Stage III field investigation end
6 Dec 91	Stage III chemistry data available
12 Dec 91	Nature/Extent Characterization complete (excluding ecological risk)
15 Jan 92	Establish ARARs/Remedial Objectives/General Response Actions
15 Jan 92	Ecological Risk Assessment complete
15 Jan 92	Human Health Risk Assessment complete
25 Mar 92	Draft RI to EPA
23 Apr 92	RI Review Comments from EPA
7 May 92	RI Review Conference at Region IV
28 May 92	Final RI to EPA
26 Aug 92	Draft FS to EPA
24 Sep 92	FS Review Comments from EPA
30 Sep 92	FS Review Conference at Region IV
21 Oct 92	Final FS to EPA

This schedule assumes 30 day regulatory agency review period for all project submittals and all projected dates are dependent on timely document review.

Stage III sampling must be initiated by early October to assure that representative biota samples can be collected. If Stage III field activities slip beyond the scheduled period, it is not certain that the necessary samples could be collected, and it would be necessary to reschedule Stage III field activities to mid to late March 1992. All reviewers (client and regulatory agency) must be aware of this situation during assessment of Stage II data and Stage III field recommendations.

8. MANAGEMENT PLAN

8.1 GENERAL

Management of this project will require flexibility in organizing a team of scientific and engineering personnel and technical resources to conduct an RI/FS to examine chemical contamination at the Cold Creek Swamp. The field investigation will be implemented in three stages and will employ pre-approved field procedures, sampling techniques, and analytical methods to accomplish data collection objectives. Effective program organization will accommodate these requirements for both flexibility and consistency while maintaining a manageable degree of control over all activities.

Figure 8-1 illustrates the proposed organization for accomplishment of this effort. The core of the technical organization is the Project Manager and the assigned Project Team. Additional individuals can be made available if warranted.

8.1.1 Project Director Responsibilities

The Project Director is responsible for oversight of all contractual activities and provides direction and guidance to the Project Manager in contractual matters. The Project Director is responsible for reviewing and approving any and all contractual submittals, including negotiation of contractual rates, submission of fee proposals, negotiation of fee proposals and project scopes, selection of specialty subcontractors (with concurrence of ICI and Akzo) and preparation of subcontractor agreements, monthly invoicing, and project status reports. The Project Director ensures that all activities under this project are carried out in accordance with contractual requirements and in accordance with the Corporate Hazardous Waste Program requirements.

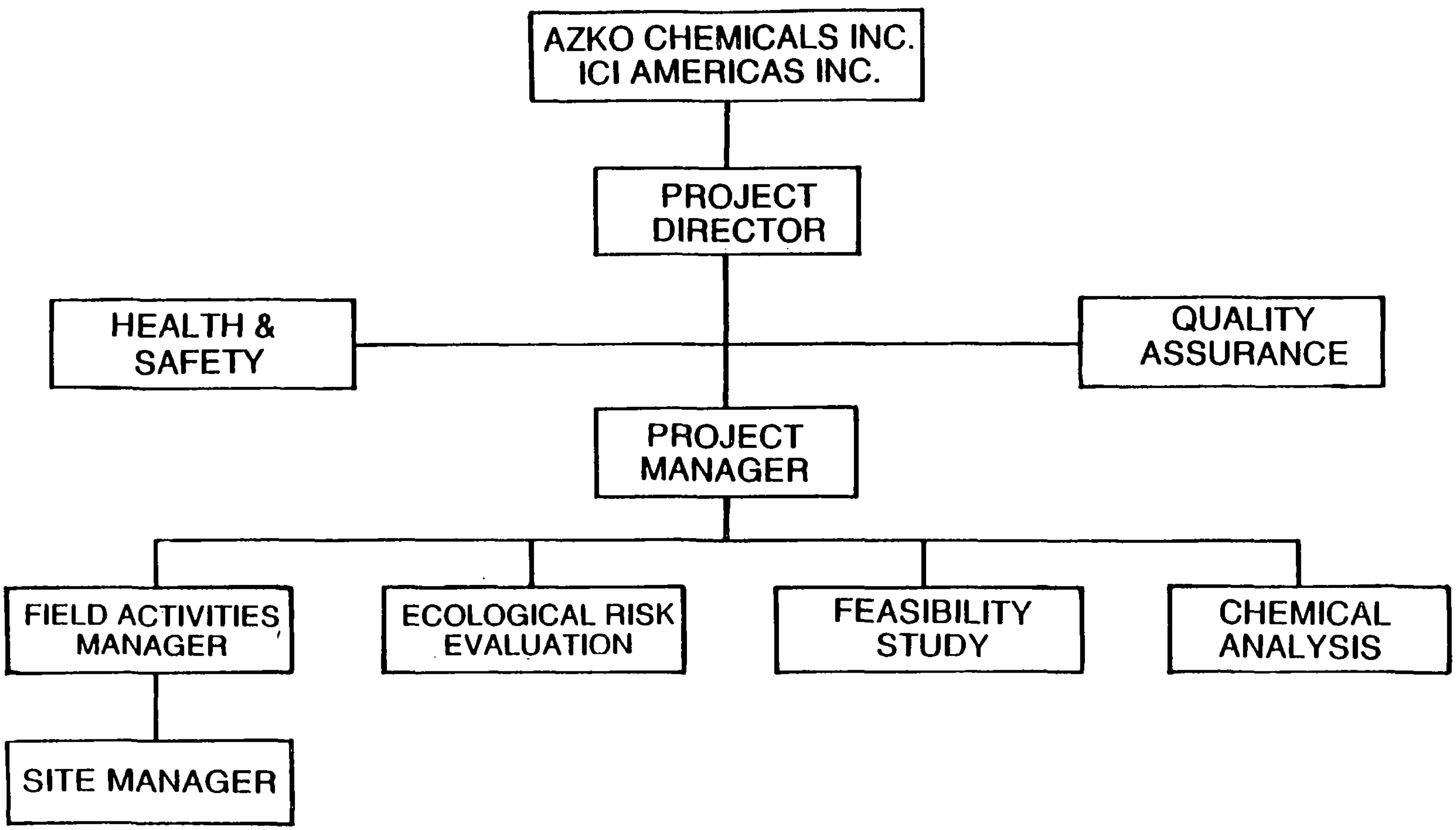

Figure 8-1. Project organization.

34 0675

8.1.2 Project Manager Responsibilities

The Project Manager is responsible for effective overall management of all project-related activities. The Project Manager serves as the primary technical point of contact with Akzo and ICI and coordinates management of project subtasks. Specific responsibilities of the Project Manager include (1) management of all technical activities; (2) preparation of work flow diagrams, schedules, labor allocations, and survey plans; (3) management of all funds for labor and materials procurement; (4) review and administration of all work-order changes; (5) successful accomplishment of all contractual obligations, including costs, schedules, and technical performance; (6) management of the Project Team toward unified, productive project accomplishment; (7) format and quality control of all documents and data reports; and (8) technical leadership.

8.1.3 Quality Assurance Officer Responsibilities

The Quality Assurance (QA) Officer will be responsible for overall quality assurance of all aspects of the project. The QA Officer reports directly to the Consultant's President and has the authority to audit all phases of all Corporate operations. The QA Officer oversees the Corporate Quality Assurance/Quality Control Program and is responsible for development of Standard Operating Procedures (SOPs) related to analytical chemistry laboratory methods; field investigation and sampling programs; engineering design; and construction quality control. The QA Officer is responsible for development and oversight of the Sampling and Analysis Plan and Quality Assurance Project Plan.

8.1.4 Health and Safety Officer Responsibilities

The Health and Safety Officer is responsible for development of project-related Health and Safety Plans. The Health and Safety Officer will assign site safety supervisors for various phases of construction activities in accordance with the project-specific Health and Safety

Plan. The Health and Safety Officer will have the authority to temporarily halt any and all construction activities based on identified health and safety concerns.

8.1.5 Field Activities Manager Responsibilities

The Field Activities Manager is responsible for direction and management of field sampling teams and assurance of quality data collection. The Field Activities Manager is responsible for implementation of the provisions of the Work Plan/Sampling and Analysis Plan, the Quality Assurance Project Plan, and the Site Health and Safety Plan during data collection activities, and for coordination with the analytical chemistry laboratory for sample handling and transport.

8.2 PROJECT MANAGEMENT/COST CONTROL

During technical accomplishment of the project, the Project Director tracks project cost by subtask order and maintains hands-on control of the technical activities of the project team and other discipline specialists.

The Consultant's financial accounting system supplies the Project Director with a record of labor and direct costs. The monthly and cumulative expenditures for each subtask are compared against the original budgets, percent expended determined, and the remaining budget calculated. A monthly analysis is conducted by the Project Director of the technical, schedule, and budget status of each subtask. A written report is prepared describing (1) planned accomplishments for the month, (2) actual accomplishments, (3) discussion of technical variance, (4) planned budget expenditures, (5) actual budget expenditures, (6) budget variance, and (7) estimates of completion. This monthly report is in turn submitted to the client Project Manager and constitutes the Monthly Performance and Cost Report. Corrective actions are taken when necessary by the Project Director to adjust performance or expenditures which are not tracking according to plan. The Project Director is a corporate officer and has full authority to draw upon the total resources of the corporation to ensure satisfactory technical and cost performance within the approved schedule.

Cost and schedule control is tracked on a day-to-day basis by the Project Manager with input from the designated Subtask Managers. SPC Software Publishing's Harvard Project Manager 3.0 will be used for internal project management of all subtasks under this contract. Use of the project management software provides project managers with quick access to key task order scheduling and budget projections to ensure that deadlines are met and resources are most appropriately allocated. Use of project management software also encourages a well-organized approach to individual task management to help the Project Director foresee and avoid potential project problems.

8.3 SUBCONTRACTORS

The Consultant will have full responsibility to Akzo and ICI for all work performed as the prime contractor, providing all the necessary professional, scientific, and engineering services needed to accomplish the work, including field sampling, laboratory analysis, interpretation of findings, ecological modeling, risk assessment, evaluation, and recommendations. Subcontractors will be employed for borehole drilling and land surveying. A subcontractor laboratory may be used for chemical analyses of biological tissue samples during Stage III of the field investigation.

A subcontractor drilling firm which has appropriate drill rigs located near the study site and which has experience and documented credentials in the proper installation of soil borings for environmental investigations of this type will be selected. Generally, a firm local to the study site has the practical knowledge and experience with local geologic and site access conditions. In addition, mobilization costs are generally lower for a qualified local firm, since equipment relocation costs are minor.

Competitive bids have been solicited from five qualified bidders for drilling services for this project. A drilling firm has not yet been selected at this time. Bids have been solicited from the following:

- TET Inc., Mobile, Alabama, (205) 666-1435
- Geotechnical Engineering-Testing Inc., Mobile, Alabama, (205) 666-7197
- Southern Earth Sciences, Inc., Mobile, Alabama, (205) 344-7711
- Griner Drilling Services, Mobile, Alabama, (205) 479-3510
- Pope Engineering and Testing Laboratories, Mobile, Alabama, (205) 471-3458

Bids were received from Geotechnical Engineering Testing, Inc.; TET, Inc.; and Pope Engineering. A selection will be made by 1 December 1990.

It will be necessary to field survey locations of sampling points to be able to map sample locations and contamination contours. Harper and Garrett Engineers, Inc., of Saraland, Alabama, has been identified as the land surveyor for this project. Harper and Garrett has worked at the site and established the original survey traverse within Cold Creek Swamp for sampling activities associated with the original RI/FS.

8.4 QA/QC PROGRAM

Effective Quality Assurance and Quality Control are essential to the development of all environmental investigation and design projects. The Consultant has an established system to monitor QA/QC for all aspects of investigations and designs. Quality Assurance is provided through the Corporate QA Director. The QA Director establishes and coordinates the QA/QC program. Key components of the program are the Work Plan/Sampling and Analysis Plan; the Quality Assurance Project Plan; analytical laboratory QA/QC protocols, field sampling protocols; and development of SOPs. The QA Director is a Corporate Officer and reports directly to the President of the corporation.

8.4.1 Field Investigation QA/QC

Field investigation projects are subject to the QC requirements of the Consultant's Standard Operating Procedures for Geotechnical Investigations, EPA guidelines, and specific Sampling and Analysis Plans (SAPs). The Consultant should have developed numerous SAPs for the EPA, the U.S. Army Corps of Engineers (USACE), other Department of Defense agencies, and understand what is required to satisfy the rigorous QA/QC requirements of the EPA. A key component of field QC is the Daily Quality Control reports and Quality Control Summary Report. These reports are prepared in conjunction with field activities for major hazardous waste investigation projects. Guidelines for developing these reports are based on USACE requirements.

8.4.2 Analytical Chemistry QA/QC

Laboratory analyses are conducted in accordance with established QA/QC protocols. All analytical chemistry will be in accordance with the Quality Assurance Project Plan for this project.

8.4.3 Subcontractor QA/QC

Effective subcontractor management also requires an established QA/QC System. The Consultant maintains responsibility for the quality and performance of all team members. As such, the Consultant requires that all subcontractor technical submittals be received by the prime contractor well before development of final contract deliverables. The project task managers are responsible for maintaining communication with team members on technical matters. The Project Director maintains contact with team member senior level personnel to ensure that all project activities are conducted in accordance with scopes and schedules of performance developed for the team members.

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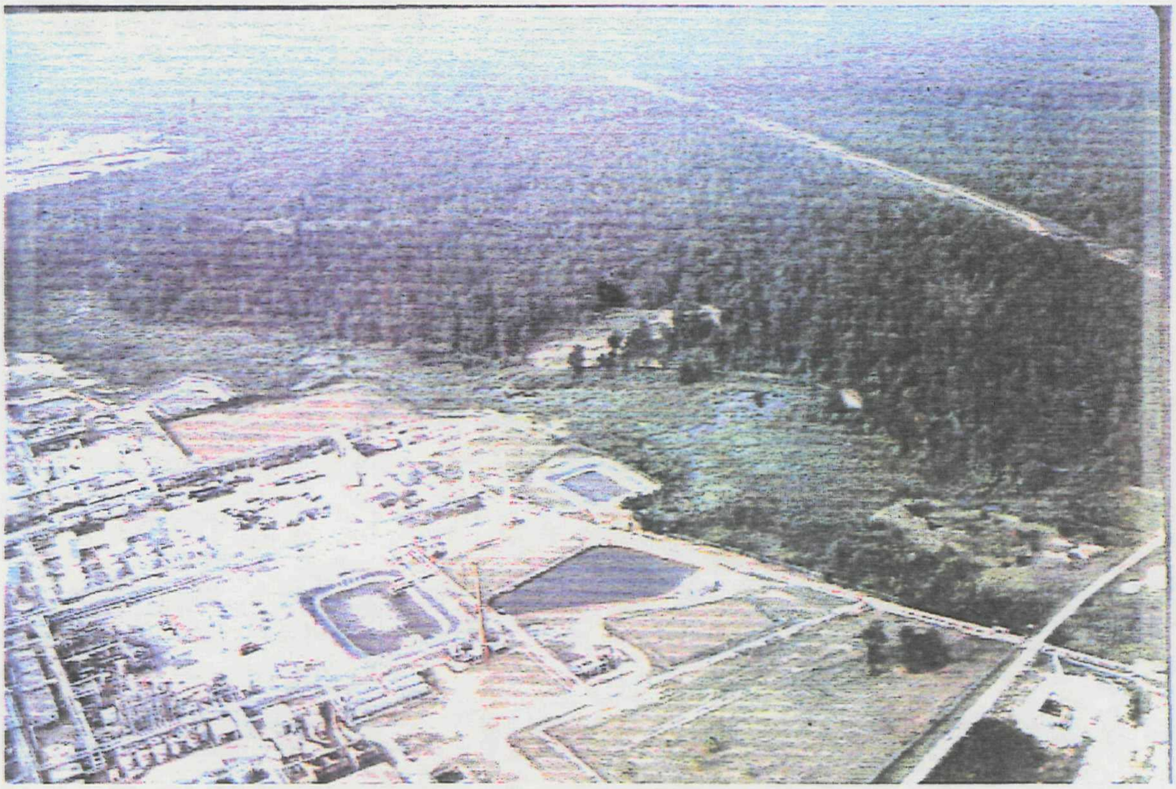
APPENDIX A

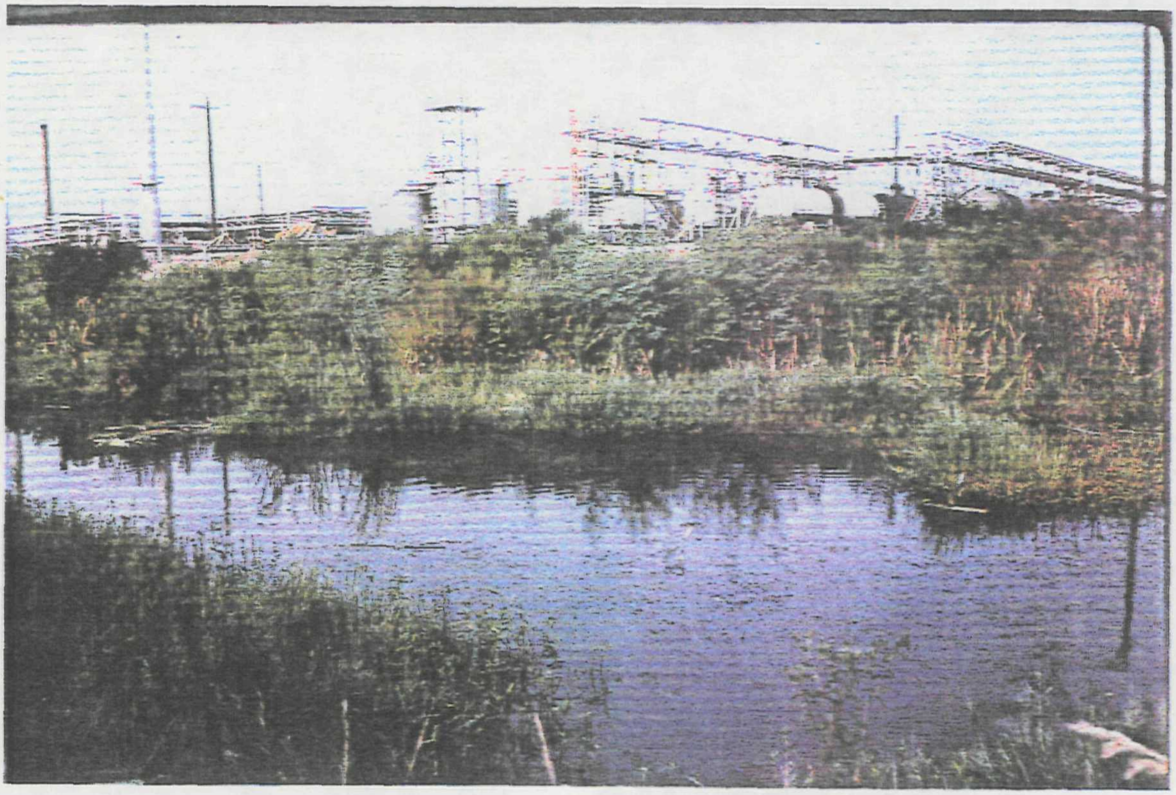
SITE PHOTOGRAPHS



Exposure No. 1, Aerial View Showing Akzo
Chemical Plant and Head of Cold Creek Swamp

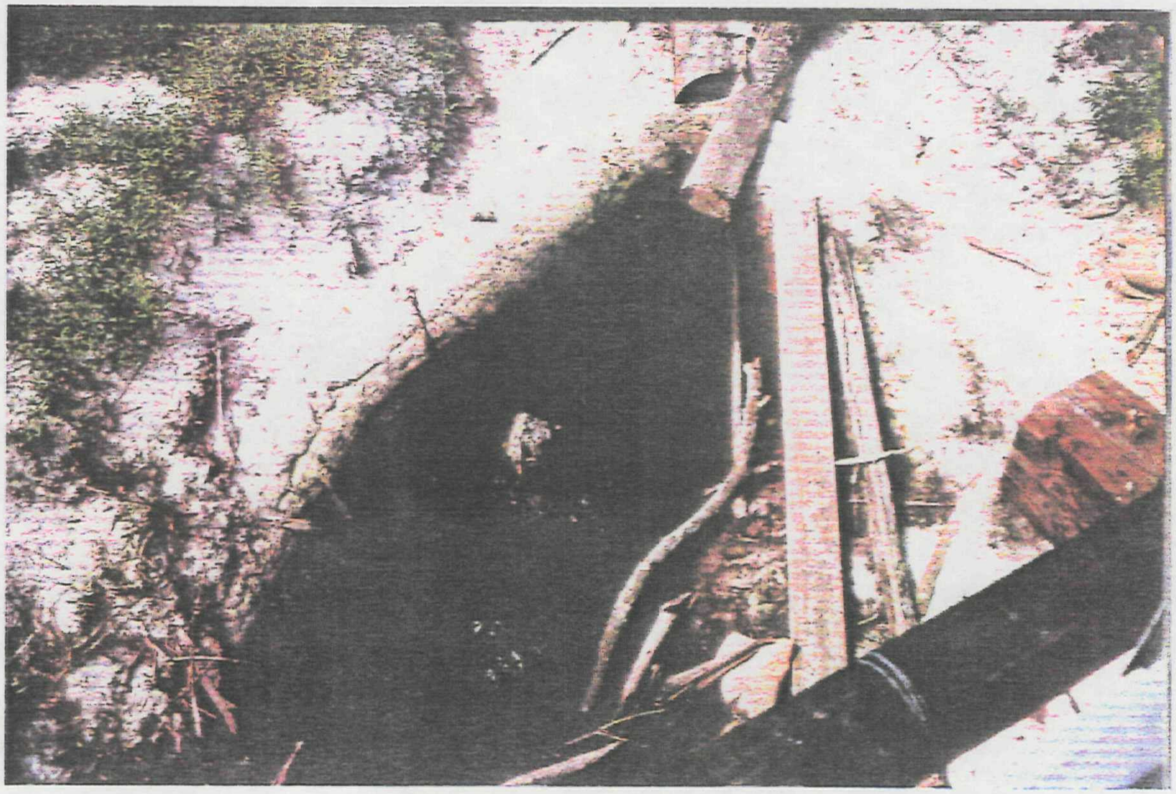
Exposure No. 2, Amoco Road Bridge -- Upper Swamp Zone

Exposure No. 3, Aerial View Showing
Upper Zone of Cold Creek Swamp

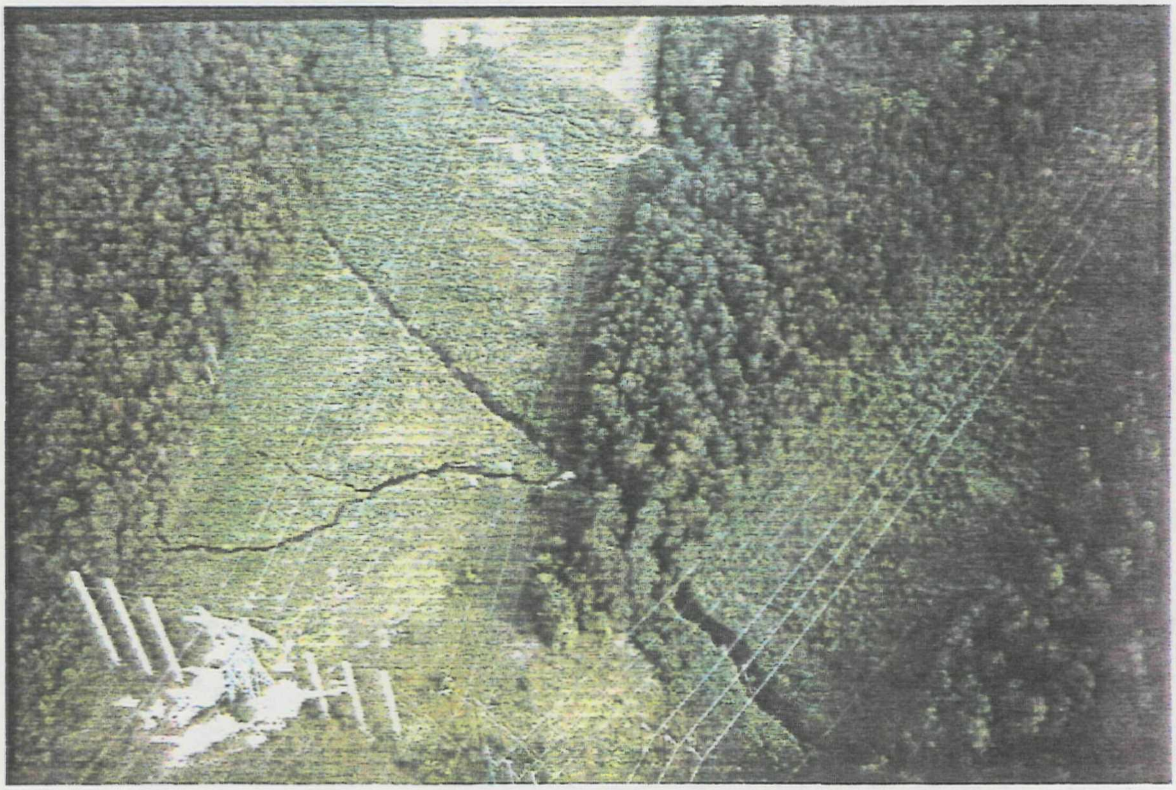


Exposure No. 4, Upper Zone of Cold Creek Swamp Showing
Standing Water of Unnamed Tributary to Cold Creek.
ICI Americas Cold Creek Chemical Plant is in Background

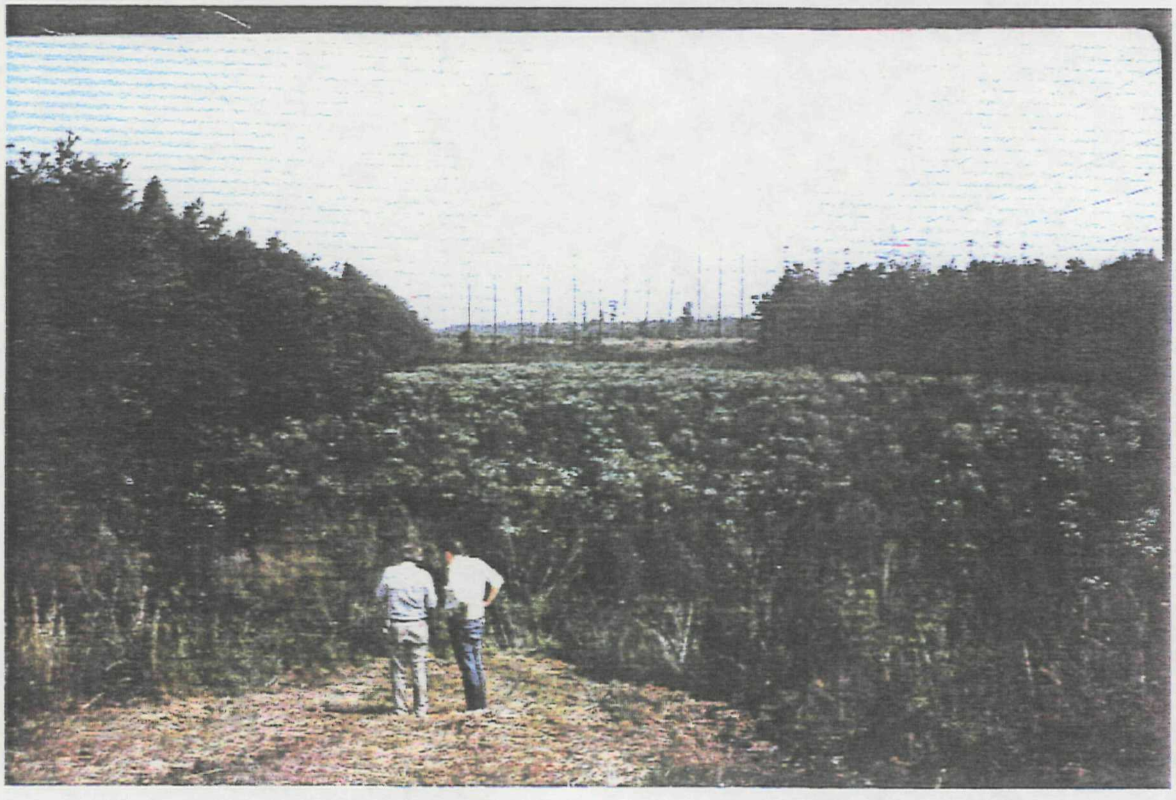
Exposure No. 5, Middle Zone of Cold Creek
Swamp Showing Erosional Nature of the Creek Channel



Exposure No. 6, Middle Zone of Cold Creek
Swamp at Virginia Chemicals Road Bridge



Exposure No. 7, Aerial View of Cold Creek
Swamp at the Power Line Right-of-Way



Exposure No. 8, Ground-level View of Power
Line Right-of-Way Intersection Looking North

Exposure No. 9, Aerial View of Cold Creek Swamp
Showing Lower Zone at Discharge to the Mobile River

Exposure No. 10, Lower Zone of Cold Creek
Swamp Showing Standing Water and Cypress Trees

APPENDIX B

ORIGINAL RI/FS EXECUTIVE SUMMARY AND COLD CREEK SWAMP CHARACTERIZATION DATA

3 4 0631

Document No. 6370-002

Remedial Investigation Report for the Cold Creek/LeMoyne Site Mobile County, Alabama

Final Report

Prepared for:

Akzo Chemicals, Inc.
Chicago, IL

ICI Americas
Wilmington, DE

May 1988

EXECUTIVE SUMMARY

Site Background

Stauffer Chemical Company previously owned and operated a multi-product inorganic chemical manufacturing plant at LeMoyne, Alabama and an agricultural chemical facility at the adjacent Cold Creek site. The LeMoyne plant, purchased by Akzo Chemie America, Inc. in 1987, began operations in 1953 with a retort carbon disulfide (CS_2) plant followed by a reactor CS_2 plant in 1956. Several other production facilities were subsequently added and include: a sulfuric acid plant (on-line in 1957), a carbon tetrachloride (CTC) plant (1963), a caustic/chlorine plant (1964) and a Crystex (a proprietary sulfur compound) plant (1974) (Stauffer Chemical Co., 1987). The Cold Creek plant has been in operation since 1966 and is currently owned by ICI Americas, Inc. This facility has also expanded its operations over the last 20 years and has manufactured, and continues to manufacture, a variety of herbicides and pesticides. Halby Chemical Company (later part of Witco, Inc.) also operated a small facility for a time on a leased section of the LeMoyne property.

Until 1973, industrial wastes from these operations were disposed in unlined disposal areas and, in the case of wastewater, to unlined ponds or, after treatment, by discharge to Cold Creek Swamp. Presumably as a result of these practices, a ground-water contamination problem developed. This was recognized in the early 1970's, and many improvements and waste-handling modifications were made. Lined ponds were installed, solid wastes were diverted for off-site treatment and/or disposal, and the existing disposal sites were cleaned, consolidated, and capped with impermeable liners and clay. The ground-water problem was addressed by installation of an intercept and treatment system. This latter work was conducted with the review of, and approval by, the Alabama Water Improvement Commission (AWIC), predecessor agency to the present Alabama Department of Environmental Management (ADEM).

In 1982, an assessment of the plant sites was made by the Alabama Department of Public Health in response to submissions made by Stauffer to the House Committee on Interstate Commerce ("the Eckhardt Survey"). At the request of the Alabama Department of Public Health, monitoring wells were installed around the three closed landfills. In spite of the previously identified ground-water problems already under remediation, data primarily from these monitoring wells were held by the Federal Environmental Protection Agency (EPA) to be the basis for inclusion of these facilities on the National Priorities List (NPL), which ranks hazardous waste disposal sites under provisions of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), commonly known as "Superfund".

Purpose of Investigation

Camp Dresser and McKee, Inc. (CDM), under contract to the EPA, conducted preliminary sampling at the site in May of 1985 and prepared a Work Plan which is the basis for this Remedial Investigation (RI). Based on the sampling and previous investigations of both the Cold Creek and LeMoyne sites, and offsite on Courtaulds North America's (CNA) property, CDM concluded that there was possible ground-water contamination (primarily mercury, carbon tetrachloride, carbon disulfide and thiocarbamates). Further, CDM suggested that some contaminants were moving offsite towards the CNA production wells. The major potential sources of contamination were considered to be the Cold Creek Swamp, unlined waste holding and treatment ponds, and the Cold Creek and LeMoyne landfills (see Figure ES-1).

For the purpose of the RI, the Cold Creek and LeMoyne properties are considered one site, as outlined in the Work Plan and agreed upon by the EPA. The purpose of this Remedial Investigation is to characterize the type and extent of contamination; to identify contamination sources, migration

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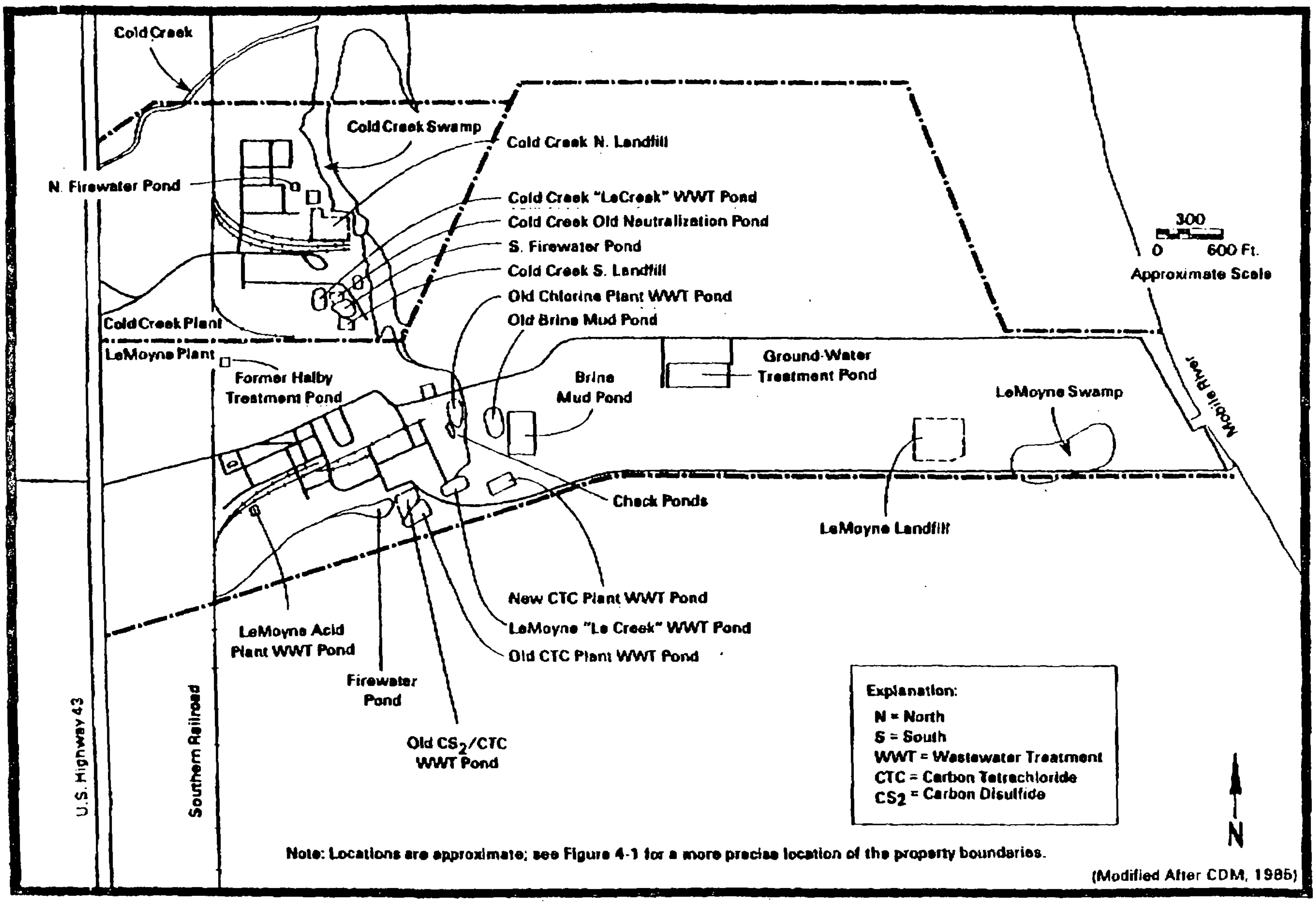

Figure ES-1 Cold Creek/LeMoyne Site Map

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pathways, and the potential for adverse environmental impacts; and to provide a basis for evaluation of the most cost-effective remedial action alternatives.

The Cold Creek/LeMoyne site is located just off U.S. Highway 43, approximately 20 miles north of Mobile, Alabama (see Figure 1-1 in Section 1.2). The site is surrounded by several other chemical production plants, and the site area is very sparsely populated, the nearest community being Creola, 5 miles to the south. The Cold Creek Swamp lies between the plant sites and the Mobile River, which is approximately 1 1/2 miles to the east of the main facilities. The swamp flows northeast, then east, discharging to the Mobile River.

The Cold Creek plant manufactures proprietary herbicides and pesticides used in agricultural farming. Among the principal products made are Betasan, Imidan, Dyfonate and several thiocarbamates. The LeMoyne plant manufactures carbon disulfide, carbon tetrachloride, sulfuric acid, caustic, chlorine and Crystex (a proprietary sulfur compound).

Previous Remedial Activities

As mentioned above, after ground-water contamination was discovered in the early 1970's, investigations of potential sources were initiated and clean-up activities begun. Two unlined waste burial sites at Cold Creek were capped as was the LeMoyne landfill. The use of unlined wastewater treatment ponds was discontinued, and several were closed. New lined ponds were installed, and the treated wastewater was discharged to the Mobile River. Spill control and storm-water recycling and drainage controls were put in place. Low-lying plant areas adjacent to the unnamed stream feeding the Cold Creek Swamp were selectively backfilled with clean fill material to control flooding. A number of monitoring wells were drilled and ground-water analysis commenced.

Finally, after a hydrogeologic investigation by Ground Water Associates, Inc. (GWA), Stauffer, in 1980, installed a ground-water intercept and treatment system. This system, which has been operating since 1981, consists of three interceptor wells with a total design capacity of 1500 gallons per minute (gpm). The wells are situated along the southern property line and are located just downgradient of the inactive carbon tetrachloride (CTC) plant wastewater treatment (WWT) pond. Contaminated ground water is pumped to an air stripping/aeration pond and, following treatment, is discharged to the Mobile River under provisions of an NPDES permit (see Appendix XXIII for a more detailed description of the ground-water intercept and treatment program). Since this installation, the ground water has steadily improved in quality.

The RI field investigation, as proposed in CDM's Work Plan, was carried out in total except for the conditional Phase II swamp sampling. Based on the initial swamp soil sampling and the ground-water sampling results, EPA decided to omit the Phase II sampling. A total of 311 samples were collected between May and August of 1986. Complete analytical results are included in Appendices I-1 through V-2, and summary tables are presented in Chapters 1 and 5.

Major Investigation Findings

The Cold Creek Swamp was sampled at 34 locations with 3-foot deep soil borings (see Drawing Number 1.3 in Appendix XVII for locations). The same technique was used at four locations in the LeMoyne Swamp (see Figure 5-3). Seven composite soil samples were analyzed for thiocarbamates, chlorides and priority pollutants (Tables 5-7 and 5-8), and 31 samples for mercury only (Table 5-9). Mercury was the only significant priority pollutant constituent detected within the samples. No other priority pollutants were detected except for other various trace metal constituents with concentrations that are considered to fall within trace element content ranges for natural soils based on EPA information (see Appendix XVIII). In addition, several of the metal constituents compare favorably with regional soil analytical data provided by the State of Alabama, Department of Environmental Management (see Appendix XV). It is noted however, that many of the trace metal constituents exceed the indicated average metal concentrations found within natural soils (Appendix XVIII), indicating probable impacts from local industry. Most thiocarbamates were found to be non detectable, with a few between 0.1 and 1.8 milligrams per kilogram (mg/kg, or parts per million, ppm). Mercury concentrations, as shown in Table 5-9 and Drawing 1.3 (Appendix XVII), indicated low to high (BMDL to 690 mg/kg) levels. No mercury was found in any of the ground-water samples indicating, as shown later, that mercury was not being transmitted from the swamp to adjacent underlying ground waters.

Fish samples were collected at five locations and analyzed for mercury. Levels ranged from 0.4 to 3.1 mg/kg whole fish. The species of fish collected are shown in Appendix XXI.

A total of twelve soil samples were taken around the three landfills (see Figure 5-1 and Tables 5-1, 5-2 and 5-3). No priority pollutants were found other than low parts per million (ppm) levels of a few heavy metals. A few samples showed above average values for antimony and mercury. The area around and under the Cold Creek landfills showed no detectable levels of site-specific (production-related) compounds with minor exceptions, the highest being 1.5 mg/kg molinate with an average value of 0.2 mg/kg. The presence of molinate in subsurface soils is considered to reflect residual contamination from prior facility operations. Vanadium levels were typically 1.1 to 30 mg/kg, which are low compared to those found in natural soil (20 to 500 mg/kg; see Appendix XVIII). The synthetic membrane covering of each of the landfills was exposed and sampled. These were found to be sound with no apparent deterioration (see Appendix XVI).

Eighteen (18) soil borings were made around nine ponds (see Figure 5-2, Tables 5-4 and 5-5). Analysis of composite samples did not detect priority pollutants except for background levels of some heavy metals. A sample taken inside the closed Halby pond showed high levels of copper (442 mg/kg), zinc (1,170 mg/kg) and cyanide (240 mg/kg), but samples taken adjacent to the pond were at or below background levels for these compounds. Heavy metals were not found in the ground water. Thiocyanate was detected in several soil samples collected from the Halby Pond borings. Low levels of thiocarbamates were detected in soil samples collected from under Cold Creek's closed neutralization pond. The presence of thiocarbamates in subsurface soils is considered to reflect residual contamination from prior facility operations. Priority pollutants were not detected in surface-water samples from two small unnamed tributaries to Cold Creek or in samples taken from three active ponds.

Ground-water samples were collected from 15 source wells and 36 area wells (see Figures 4-2 and 4-3 and Tables 5-11 and 5-12). Except for expected high levels of carbon disulfide (CS_2) and carbon tetrachloride (CTC) in wells 0-29 and 0-31, which are located just downgradient of the old CTC plant wastewater treatment pond (see Figure 5-6), all other samples showed essentially no detectable levels of priority pollutants. Three other wells in the immediate vicinity of the old carbon tetrachloride plant WWT pond showed low levels (0.8 to 1.5 milligrams per liter, mg/l, which is equivalent to ppm) of CTC. All well samples analyzed for site-specific compounds showed non-detectable to very low levels, except for 6 mg/l thiocyanate in well 0-79, which is just downgradient of the Halby pond.

Conclusions

Based on the Remedial Investigation findings, the following conclusions can be made:

- The existing ground-water intercept system has been very effective in capturing CTC and CS_2.

- Except for CTC found in source wells immediately downgradient of the old carbon tetrachloride plant WWT pond, essentially no priority pollutants were found in any ground-water samples.
- Although mercury was found in swamp soil samples, mercury has not been detected in downgradient ground-water samples. The absence of mercury in ground-water indicates that residual mercury in swamp soils is in a relatively insoluble form (as mercury sulfide) (refer to Appendix XXV).
- With two minor exceptions, all source wells sampled indicate thiocarbamates to be at very low levels (less than 0.06 milligrams per liter and most under 0.01 mg/l).
- All area wells south (immediately downgradient) of the property line contained less than 0.027 mg/l thiocarbamates, less than 0.046 mg/l CS_2, and less than 0.018 mg/l CTC. The one exception was NM-1, just downgradient of the LeMoyne landfill (one mile east of main facility), which contained 0.25 mg/l of CTC.

APPENDIX C

RELEVANT BORING LOGS

APPENDIX D

REGULATORY CORRESPONDENCE

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

MAY 04 1990

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RECEIVED-RICHMOND

MAY 09 1990

ENVIRONMENTAL SERVICES & OPERATIONS

FILE: CC: TO:

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Ms. Mariam Tehrani
Manager of Environmental Affairs
Chemical Division
Akzo Chemical, Inc.
300 South Riverside Plaza
Chicago, Illinois 60606

RE: Stauffer Chemical - LeMoyne and Cold Creek NPL Sites
Scope of Work for Cold Creek Swamp (Operable Unit #3)

Dear Ms. Tehrani:

This letter serves to accept the revisions of the Feasibility Study for operable unit #1 at the Stauffer Chemical site as well as to transmit the Scope of Work (SOW) for the Remedial Investigation (RI) and Feasibility Study (FS) for operable unit #3 (Cold Creek Swamp). Although the FS for operable unit #1 is accepted, the Agency has determined, pursuant to Section VI, Paragraph I of the Administrative Order on Consent #86-04-C (AOC), that supplemental investigatory work and/or engineering evaluation are necessary for both the Source Units (operable unit #2) and Cold Creek Swamp (operable unit #3). The enclosed SOW is for the Cold Creek Swamp operable unit only. A SOW for the second operable unit will be developed at a later date. Akzo/ICI may elect to implement the tasks outlined in the enclosed SOW; however, should they decline, pursuant to Section VI, Paragraph I, the Environmental Protection Agency (EPA) may proceed with the RI/FS of the swamp and pursue cost recovery at a later date. Please notify me within fourteen calendar days of receipt of this letter with their intent to comply.

The objectives of the previous study conducted under the terms set forth in the AOC have not been adequately met. Pursuant to Section II, the project objectives were "... (1) to determine fully the nature and extent of the threat to the public health or welfare or the environment, if any, caused by the release or threatened release of hazardous substances, pollutants, or contaminants from the Stauffer Chemical Company Sites... and (2) to evaluate alternatives for the appropriate extent of remedial action...". Due to deficiencies in the work previously conducted and the overall complexity of the Stauffer site, the project was divided into operable units. These operable units are documented in the September 27, 1989, Record of Decision. The project objectives must be met for all three operable units prior to satisfactorily complying with the terms of the AOC.

I look forward to hearing from you by the specified compliance date. If you have any questions regarding the SOW, please contact me at (404) 347-2643.

Sincerely,

James E. McGuire
Remedial Project Manager
South Superfund Remedial Branch

Enclosure

cc: Lee Erickson, ICI
Joe Downey, ADEM

RECEIVED-RICHMOND
MAY 09 1990
ENVIRONMENTAL SERVICES & OPERATIONS
FILE: CC: TO:

SCOPE OF WORK FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AT THE STAUFFER: COLD CREEK/LeMOYNE SITE COLD CREEK SWAMP - OPERABLE UNIT #3

INTRODUCTION

The purpose of this Remedial Investigation/Feasibility Study (RI/FS) is to investigate the nature and extent of contamination in and associated with Cold Creek Swamp at the Stauffer Site (the "Site"), assess the current and potential risk to public health, welfare, and the environment, and to develop and evaluate potential Remedial Action Alternatives. The RI and FS are interactive and shall be conducted concurrently so that the data collected in the RI influences the development of Remedial Action Alternatives in the FS, which in turn affects the data needs and the scope of Treatability Studies.

The Respondents shall conduct the RI/FS and produce an RI/FS Report that is in accordance with this Scope of Work, the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, (Interim Final) (U.S. EPA Office of Emergency and Remedial Response, October 1988) (the "RI/FS Guidance"), The National Oil and Hazardous Substances Pollution Contingency Plan, Subpart E; March 8, 1990, and other guidances used by EPA in conducting an RI/FS (a list of the primary guidances is attached), as well as any additional requirements in the Administrative Order. The RI/FS Guidance describes the report format and the required report content. Pertinent RI/FS Guidance section numbers are denoted in parenthesis throughout this Scope of Work. The Respondents shall furnish all necessary personnel, materials, and services needed, or incidental to, performing the RI/FS, except as otherwise specified in the Administrative Order.

At the completion of the RI/FS for Cold Creek Swamp (operable unit #3), EPA shall be responsible for the selection of a remedy to be implemented for the Site. EPA will document this selection of a remedy in a Record of Decision (ROD). The Remedial Action Alternative selected by EPA will meet the cleanup standards specified in §121 of SARA. That is, the selected remedial action will be protective of human health and the environment, will be cost-effective, will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, will be in compliance with, or include a waiver of, applicable or relevant and appropriate requirements of other laws or regulations, and will address the statutory preference for on-site treatment which permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants as a principal element. The Final RI/FS Report for the swamp, as adopted by EPA, will, with the remainder of the Administrative Record, form the basis for the selection of the remedy to be implemented for the Site and will provide the information necessary to support the development of the ROD.

As specified in §104(a)(1) of CERCLA, as amended by SARA, EPA must provide oversight of the Respondents' activities throughout the RI/FS. The Respondents shall support EPA's initiation and conduct of activities related to the implementation of oversight activities. However, the primary responsibility for conducting an adequate RI/FS to enable and support the selection of a remedy shall lie with the Respondents. EPA review and approval of deliverables is a tool to assist this process and to satisfy, in part, EPA's responsibility to provide effective protection of public health, welfare, and the environment. EPA approval of a task or deliverable shall not be construed as a guarantee as to the ultimate adequacy of such task or deliverable. A summary of the major deliverables that Respondents shall submit for the RI/FS is attached (Attachment A). In addition, a generalized schedule of deliverables is attached (Attachment B).

TASK 1 - SCOPING (RI/FS Guidance, Chapter 2)

Scoping is the initial planning process of the RI/FS and has been initiated by EPA to determine the site-specific objectives of the RI/FS prior to negotiations between the Respondents and EPA. Scoping is continued, repeated as necessary, and refined throughout the RI/FS process. In addition to developing the Site Objectives of the RI/FS, EPA has developed a Site Management Strategy. Consistent with the Site Management Strategy, the specific project scope shall be planned by the Respondents and EPA. The Respondents shall document the specific project scope in a Work Plan. Because the work required to perform an RI/FS is not fully known at the onset, and is phased in accordance with a Site's complexity and the amount of available information, it may be necessary to modify the Work Plan during the RI/FS to satisfy the objectives of the study.

The Site Objectives for the Stauffer: Cold Creek/ LeMoyne Site have been determined preliminarily, based on available information, to be the following:

1. Review the existing information pertaining to the Site. This includes information from local businesses such as local well drillers, facility records, and information from facility owners and employees, investigative documents previously prepared for the Stauffer: Cold Creek/LeMoyne site; including, but not limited to, Remedial Investigation (May 1988), Endangerment Assessment (May 1988), Feasibility Study (June 1989) and Heavy Metal Levels in Cold Creek Swamp Biota (June 1989).
2. Review of relevant guidance (see attached references) to understand the remedial process. This information shall be used in performing the RI/FS and preparing all deliverables under this SOW.

3. Identification of all Federal and State applicable or relevant and appropriate requirements (ARARs).

4. Determination of the nature and lateral and vertical extent of contamination (waste types, concentrations and distributions) for all affected media including air, ground water, soil, surface water and sediment, etc.

5. Performance of a well survey within a three mile radius of the Site including determining water uses, well construction methods used, the number and age of users, and the volume and rate of water usage.

6. Preparation of a Baseline Risk Assessment including the following four components:

- Contaminant Identification

- Exposure Assessment including a Determination of Actual and Potential Pathways and Receptors

- Toxicity Assessment

- Risk Characterization including:
  - Carcinogenic Risks
  - Noncarcinogenic Risks
  - Environmental Risks to Flora and Fauna

7. Identification and screening of potential treatment technologies along with containment/disposal requirements for residuals or untreated wastes.

8. Preparation of a site specific risk assessment for the development of potential remediation goals.

9. Assembly of technologies into Remedial Action Alternatives and screening of alternatives.

10. Performance of bench or pilot Treatability Studies as necessary.

11. Detailed analysis of Remedial Action Alternatives.

The Site Management Strategy for the Stauffer: Cold Creek/LeMoyne Site includes the following:

1. A complete investigation of the Cold Creek Swamp including any and all off-site contamination which may have been caused by contaminants originating from this operable unit of the Site.

2. Use of the RI to identify any other Potentially Responsible Parties that may be involved.

3. At this time the Site has been partitioned into separate operable units. This scope of work is specifically for operable unit # 3 (Cold Creek Swamp). It is anticipated that a Record of Decision (ROD) will be prepared for this Operable Unit.

4. EPA oversight of the Respondents' conduct of the work (i.e., the RI/FS and any response action) to ensure compliance with applicable laws, regulations and guidances and to ensure that the work proceeds in a timely fashion.

5. EPA management of the Remedy Selection and Record of Decision phase with input from State Agencies, Natural Resource Trustees and the Public (including the Respondents).

When scoping the specific aspects of a project, the Respondents must meet with EPA to discuss all project planning decisions and special concerns associated with the Site. The following activities shall be performed by the Respondents as a function of the project planning process.

a. Site Background (2.2)

The Respondents shall gather and analyze the existing background information regarding the Site and shall conduct a visit to the Site to assist in planning the scope of the RI/FS.

Collect and Analyze Existing Data and Document the Need for Additional Data (2.2.2; 2.2.6; 2.2.7)

Before planning RI/FS activities, all existing Site data shall be thoroughly compiled and reviewed by the Respondents. Specifically, this shall include currently available data relating to the varieties and quantities of hazardous substances at the Site and past disposal practices (what type of contaminants were dumped where, when, and by whom). This shall also include results from any previous sampling or other investigations that may have been conducted. It should be noted that a Remedial Investigation (May 1988) and a Biota Study (June 1989) have been previously conducted. The Respondents shall refer to Table 2-1 of the RI/FS Guidance for a comprehensive list of data collection information sources. This information shall be utilized in determining additional data needed for Site Characterization, better define potential applicable or relevant and appropriate requirements (ARARs), and develop a range of preliminarily identified Remedial Action Alternatives. Subject to EPA approval, Data Quality

Objectives (DQOs) shall be established that specify the usefulness of existing data. Decisions on the necessary data and DQOs shall be made by EPA.

Conduct Site Visit

The Respondents shall conduct a visit to the Site with the EPA Remedial Project Manager (RPM) during the project scoping phase to assist in developing a conceptual understanding of sources and areas of contamination as well as potential exposure pathways and receptors at the Site. During the visit to the Site the Respondents shall observe the physiography, hydrology, geology, and demographics of the Site as well as related natural resource, ecological and cultural features. This information shall be utilized to better scope the project and to determine the extent of additional data necessary to characterize the Site, better define potential ARARs, and narrow the range of preliminarily identified Remedial Action Alternatives.

b. Project Planning (2.2)

Once the Respondents have collected and analyzed existing data and conducted a visit to the Site, the specific project scope shall be planned. Project planning activities include those tasks described below as well as the development of specific required deliverables as described in paragraph c. The Respondents shall meet with EPA regarding the following activities and before the drafting of the scoping deliverables.

Refine the Site Objectives and Develop Preliminary Remedial Action Objectives and Alternatives (2.2.3)

Once existing information about the Site has been analyzed and a conceptual understanding of the potential risks posed by the Site has been obtained, the Respondents shall review and, if necessary, refine the Site Objectives and develop preliminary remedial action objectives for each actually or potentially contaminated medium. Any revised Site Objectives shall be documented in a technical memorandum and are subject to EPA approval prior to development of the other scoping deliverables. The Respondents shall then identify a preliminary range of broadly defined potential Remedial Action Alternatives and associated technologies. The range of potential alternatives shall include, at a minimum, alternatives in which treatment is used to reduce the toxicity, mobility, or volume of the waste, but varying in the types of treatment, the amount treated, and the manner in which long-term residuals or untreated wastes are managed; alternatives that involve containment and treatment components; alternatives that involve containment with little or no treatment; and a no-action alternative.

Document the Need for Treatability Studies (2.2.4)

If remedial actions involving treatment have been identified by the Respondents or EPA, Treatability Studies shall be required except where the Respondents can demonstrate to EPA's satisfaction that they are not needed. Where Treatability Studies are needed, initial Treatability Study activities (such as research and study design) shall be planned to occur concurrently with Site Characterization activities (see Tasks 3 and 5).

Begin Preliminary Identification of Potential ARARs (2.2.5)

The Respondents shall conduct a preliminary identification of potential State and Federal ARARs (chemical-specific, location-specific and action-specific) to assist in the refinement of remedial action objectives and the initial identification of Remedial Action Alternatives and ARARs associated with particular actions. ARAR identification shall continue as conditions and contaminants at the Site and Remedial Action Alternatives are better defined.

c. Scoping Deliverables (2.3)

At the conclusion of the project planning phase, the Respondents shall submit an RI/FS Work Plan, a Sampling and Analysis Plan, and a Health and Safety Plan. The RI/FS Work Plan and Sampling and Analysis Plan must be reviewed and approved and the Health and Safety Plan reviewed by EPA prior to the initiation of field activities. It should be noted that previously approved plans for operable unit #1 (Groundwater) may be modified, as appropriate, for this operable unit (Cold Creek Swamp).

RI/FS Work Plan (2.3.1)

A Work Plan documenting the decisions and evaluations completed during the scoping process shall be submitted to EPA for review and approval. The Work Plan shall be developed in conjunction with the Sampling and Analysis Plan and the Health and Safety Plan, although each plan may be delivered under separate cover. The Work Plan shall include a comprehensive description of the work to be performed, the medias to be investigated (i.e., Air, Ground Water, Surface Water, Surface and Subsurface Soils and Sediments, etc.), the methodologies to be utilized and the rationale for the selection of each methodology. A comprehensive schedule for completion of each major activity and submission of each deliverable shall also be included consistent with Attachment B.

Specifically, the Work Plan shall present the following:

- A statement of the problem(s) and potential problem(s) posed by the Site and the objectives of the RI/FS.

- A background summary setting forth the following:

    - a description of the Site including the geographic location, and, to the extent possible, a description of the physiography, hydrology, geology, demographics, ecological, cultural and natural resource features of the Site;

    - a synopsis of the history of the Site including a summary of past disposal practices and a description of previous responses that have been conducted by local, State, Federal, or private parties at the Site;

    - a summary of the existing data in terms of physical and chemical characteristics of the contaminants identified and their distribution among the environmental media at the Site.

- A conceptual "model" describing the contaminant sources and a preliminary risk analysis assessing potential migration and exposure pathways and receptors (both human and environmental).

- A description of the Site Management Strategy developed by EPA during scoping as discussed previously in this SOW and as may be modified with EPA's approval;

- A preliminary identification of Remedial Action Alternatives and data needs for evaluation of Remedial Action Alternatives. This shall reflect coordination with Treatability Study requirements (see Tasks 1 and 5).

- A process for identifying Federal and State ARARs (chemical-specific, location-specific and action-specific).

- A detailed description of the tasks to be performed, information needed for each task (e.g., for health and environmental risk evaluation), information to be produced during and at the conclusion of each task, and a description of the work products that shall be submitted to EPA. This includes the deliverables set forth in the remainder of this Scope of Work.

- A schedule for each of the required activities which is consistent with the RI/FS Guidance.

- A project management plan, including a data management plan (e.g., requirements for project management systems and software, minimum data requirements, data format and backup data management), monthly reports to EPA, and meetings and presentations to EPA at the conclusion of each major phase of the RI/FS.

The Respondents shall refer to Appendix B of the RI/FS Guidance for a comprehensive description of the contents of the required Work Plan.

Because of the unknown nature of the Site and iterative nature of the RI/FS, additional data requirements may be identified throughout the RI/FS process. The Respondents shall submit a technical memorandum documenting any need for additional data along with the proposed DQOs whenever such requirements are identified. In any event, the Respondents are responsible for fulfilling additional data and analysis needs identified by EPA consistent with the general scope and objectives of this RI/FS and the Administrative Order.

Sampling and Analysis Plan (2.3.2)

The Respondents shall prepare a Sampling and Analysis Plan (SAP) to ensure that sample collection and analytical activities are conducted in accordance with technically acceptable protocols and that the data generated will meet the DQOs established. The SAP provides a mechanism for planning field activities and consists of a Field Sampling and Analysis Plan (FSAP) and a Quality Assurance Project Plan (QAPP).

The FSAP shall define in detail the sampling and data-gathering methods that shall be used on the project. It shall include sampling objectives, sample location (horizontal and vertical) and frequency, sampling equipment and procedures, and sample handling and analysis. The QAPP shall describe the project objectives and organization, functional activities, and quality assurance and quality control (QA/QC) protocols that shall be used to achieve the desired DQOs. The DQOs will, at a minimum, reflect use of analytical methods for identifying contamination and addressing contamination consistent with the levels for remedial action objectives identified in the proposed National Contingency Plan, pages 51425-26 and 51433 (December 21, 1988). In addition, the QAPP shall address personnel qualifications, sampling procedures, sample custody, analytical procedures, and data reduction, validation, and reporting. These procedures must be consistent with the Region IV Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual. Field personnel shall be available for EPA QA/QC training and orientation as may be required.

The Respondents shall demonstrate, in advance and to EPA's satisfaction, that each laboratory it may use is qualified to conduct the proposed work. This includes use of methods and analytical protocols for the chemicals of concern (typically the Target Compound List (TCL) and the Target Analyte List (TAL)) in the media of interest within detection and quantification limits consistent with both QA/QC procedures and DQOs approved by EPA in the QAPP for the Site. The laboratory must have and follow an approved QA program. The Respondents shall provide assurances that EPA has access to laboratory personnel, equipment and records for sample collection, transportation and analysis. EPA may require that the Respondents submit detailed information to demonstrate that the laboratory is qualified to conduct the work, including information on personnel qualifications, equipment and material specifications. In addition, EPA may require submittal of data packages equivalent to those generated in the EPA Contract Laboratory Program (CLP) and may require laboratory analysis of performance samples (blank and/or spike samples) in sufficient number to determine the capabilities of the laboratory. If a laboratory not in the CLP is selected, methods consistent with CLP methods that would be used at this Site for the purposes proposed and QA/QC procedures approved by EPA shall be used. In addition, if the laboratory is not in the CLP program, a laboratory QA program must be submitted for EPA review and approval.

Health and Safety Plan (2.3.3)

A Health and Safety Plan shall be prepared in conformance with the Respondents' health and safety program, and in compliance with OSHA regulations and protocols. The Health and Safety Plan shall include the eleven elements described in the RI/FS Guidance, such as a health and safety risk analysis, a description of monitoring and personal protective equipment, medical monitoring, and site control. It should be noted that EPA does not "approve" the Respondents' Health and Safety Plan, but rather EPA reviews it to ensure that all necessary elements are included, and that the plan provides for the protection of human health and the environment.

TASK 2 - COMMUNITY RELATIONS (2.3.4)

The development and implementation of community relations activities are the responsibility of EPA. The critical community relations planning steps performed by EPA include conducting community interviews and developing a community relations plan. Although implementation of the community relations plan is the responsibility of EPA, the Respondents may be requested to assist by providing information regarding the history of the Site and participating in public meetings. The extent of the Respondents' involvement in community relations activities is left to the discretion of EPA. The Respondents' community relations responsibilities, if any, shall be specified in the community relations plan. All community relations activities conducted by Respondents shall be subject to oversight by EPA.

TASK 3 - SITE CHARACTERIZATION (RI/FS Guidance, Chapter 3)

As part of the RI, the Respondents shall perform the activities described in this task, including the preparation of a Site Characterization Summary and a RI Report. The overall objective of Site Characterization is to describe areas of the Cold Creek Swamp that may pose a threat to human health or the environment. This is accomplished by first determining physiography, geology, and hydrology of the Stauffer site, including Cold Creek Swamp. Surface and subsurface pathways of migration shall be defined. The Respondents shall identify the sources of contamination and define the nature, extent, and volume of the sources of contamination, including their physical and chemical constituents as well as their concentrations at incremental locations in the affected media. The Respondents shall also investigate the extent of migration of this contamination as well as its volume and any changes in its physical or chemical characteristics. This will provide for a comprehensive understanding of the nature and extent of contamination in Cold Creek Swamp. Using this information, contaminant fate and transport shall be determined and projected.

During this phase of the RI/FS, the Work Plan, SAP, and Health and Safety Plan shall be implemented. Field data shall be collected and analyzed to provide the information required to accomplish the objectives of the study. The Respondents shall notify EPA at least two weeks in advance of the field work regarding the planned dates for field activities, including installation of monitoring wells, installation and calibration of equipment, pump tests, field lay out of any sampling grid, excavation, sampling and analysis activities, and other field investigation activities. The Respondents shall demonstrate that the laboratory and type of laboratory analyses that will be utilized during Site Characterization meets the specific QA/QC requirements and the DQOs as specified in the SAP. In view of the unknown conditions at the Site, activities are often iterative and, to satisfy the objectives of the RI/FS, it may be necessary for the Respondents to supplement the work specified in the initial Work Plan. In addition to the deliverables below, the Respondents shall provide a monthly progress report and participate in meetings at major points in the RI/FS.

a. <u>Field Investigation</u> (3.2)

The field investigation includes the gathering of data to define physical characteristics, sources of contamination, and the nature and extent of contamination in Cold Creek Swamp. These activities shall be performed by the Respondents in accordance with the Work Plan and SAP. At a minimum, this shall include the following activities:

<u>Implementing and Documenting Field Support Activities</u> (3.2.1)

The Respondents shall initiate field support activities following approval of the Work Plan and SAP. Field support activities may include obtaining access to the Site, property surveys, scheduling, and procuring equipment, office space, laboratory services, utility services and/or contractors. The Respondents shall notify EPA at least two weeks prior to initiating field support activities so that EPA may adequately schedule oversight tasks. The Respondents shall also notify EPA in writing upon completion of field support activities.

<u>Investigating and Defining Site Physical Characteristics</u> (3.2.2)

The Respondents shall collect data on the physical characteristics of the Site and its surrounding areas including the physiography, geology, and hydrology, and specific physical characteristics identified in the Work Plan. This information shall be ascertained through a combination of physical measurements, observations, and sampling efforts and shall be utilized to define potential transport pathways and receptor populations. In defining the physical characteristics of the Site, the Respondents shall also obtain sufficient engineering data (such as pumping characteristics, soil particle size, permeability, etc.) for the projection of contaminant fate and transport and the development and screening of Remedial Action Alternatives, including information necessary to evaluate treatment technologies.

<u>Defining Sources of Contamination</u> (3.2.3)

The Respondents shall locate each source of contamination. For each location, the lateral and vertical extent of contamination shall be determined by sampling at incremental depths on a sampling grid or in another organized fashion approved by EPA. The physical characteristics and chemical constituents and their concentrations shall be determined for all known and discovered sources of contamination. The Respondents shall conduct sufficient sampling to define the boundaries of the contaminant sources to the level established in the QA/QC plan and DQOs. Sources of contamination shall be analyzed for the potential of contaminant release (e.g., long term leaching from soil), contaminant mobility and persistence, and characteristics important for evaluating remedial actions, including information necessary to evaluate treatment technologies.

Describing the Nature and Extent of Contamination (3.2.4)

The Respondents shall gather information to describe the nature and extent of contamination as a final step during the field investigation. To describe the nature and extent of contamination, the Respondents shall utilize the information on Site physical characteristics and sources of contamination to give a preliminary estimate of the contaminants that may have migrated. The Respondents shall then implement an iterative monitoring program and any study program identified in the Work Plan or SAP such that, by using analytical techniques sufficient to detect and quantify the concentration of contaminants, the migration of contaminants through the various media at the Site can be determined. In addition, the Respondents shall gather data for calculations of contaminant fate and transport. This process is continued until the lateral and vertical extent of contamination has been determined. Information on the nature and extent of contamination shall be utilized to determine the level of risk presented by the Site and will help to determine aspects of the appropriate Remedial Action Alternatives to be evaluated.

b. Data Analyses (3.4)

Evaluate Site Characteristics (3.4.1)

The Respondents shall analyze and evaluate the data to describe; (1) physical characteristics of the Site, (2) contaminant source characteristics, (3) nature and extent of contamination, and (4) contaminant fate and transport. The information on physical characteristics, source characteristics, and nature and extent of contamination is used in the analysis of contaminant fate and transport. The evaluation shall include the actual and potential magnitude of releases from the sources and lateral and vertical spread of contamination as well as mobility and persistence of contaminants. Where modeling is appropriate, such models shall be identified to EPA in a technical memorandum prior to their use. All data and programming, including any proprietary programs, shall be made available to EPA together with a sensitivity analysis. All models shall be approved by EPA prior to their use. Also, this evaluation shall provide any information relevant to characteristics for the Site necessary for evaluation of the need for remedial action in the Baseline Risk Assessment, the development and evaluation of Remedial Action Alternatives, and the refinement and identification of ARARs. Analyses of data collected for Site Characterization shall meet the DQOs developed in the QAPP.

c. Data Management Procedures (3.5)

The Respondents shall consistently document the quality and validity of field and laboratory data compiled during the RI. At a minimum, this shall include the following activities:

Documenting Field Activities (3.5.1)

Information gathered during characterization of the Site shall be consistently documented and adequately recorded by the Respondents in well maintained field logs and laboratory reports. The method(s) of documentation must be specified in the Work Plan and/or the SAP. Field logs must be utilized to document observations, calibrations, measurements, and significant events that have occurred during field activities. Laboratory reports must document sample custody, analytical responsibility, analytical results, adherence to prescribed protocols, nonconformity events, corrective measures, and/or data deficiencies. Supporting documentation described as the "CLP Data Package" must be provided with the sample analysis for all samples split or duplicated with EPA.

Maintaining Sample Management and Tracking (3.5.2; 3.5.3)

The Respondents shall maintain field reports, sample shipment records, analytical results, and QA/QC reports to ensure that only validated analytical data are reported and utilized in the development and evaluation of the Baseline Risk Assessment and Remedial Action Alternatives. Analytical results developed under the Work Plan shall not be included in any characterization reports for the Site unless accompanied by or cross-referenced to a corresponding QA/QC report. In addition, the Respondents shall establish a data security system to safeguard chain-of-custody forms and other project records to prevent loss, damage, or alteration of project documentation.

d. Site Characterization Deliverables (3.7)

The Respondents shall prepare the Preliminary Site Characterization Summary and, once the Baseline Risk Assessment (Task 4, Subtask 4.1) is complete, the Draft Remedial Investigation Report.

Preliminary Site Characterization Summary (3.7.2)

After completing field sampling and analysis, the Respondents shall prepare a concise Site Characterization Summary. This summary shall review the investigative activities that have taken place and describe and display data for the Site documenting the location and characteristics of surface and subsurface features and contamination in Cold Creek Swamp including the affected medium, location, types, physical state, concentration of contaminants and quantity. In addition, the location, dimensions, physical condition and varying concentrations of each contaminant throughout each source and the extent of contaminant migration through each of the affected media shall be documented. The Site Characterization Summary shall provide EPA with a preliminary reference for developing the Baseline Risk Assessment, evaluating the development and screening of Remedial Action Alternatives, and the refinement and identification of ARARs.

Remedial Investigation (RI) Report (3.7.3)

The Respondents shall prepare and submit a Draft RI Report to EPA for review and approval after completion of the Baseline Risk Assessment (see Task 4). This report shall summarize results of field activities to characterize the Site, sources of contamination, nature and extent of contamination, the fate and transport of contaminants, and results of the Baseline Risk Assessment. The Respondents shall refer to the RI/FS Guidance for an outline of the report format and contents. Following comment by EPA, the Respondents shall prepare a Final RI Report which satisfactorily addresses EPA's comments.

TASK 4 - RISK ASSESSMENT (3.4.2)

Subtask 4.1: A Baseline Risk Assessment shall identify and characterize the toxicity and levels of hazardous substances present, contaminant fate and transport, the potential for human and environmental exposure, and the risk of potential impacts or threats on human health and the environment (including both flora and fauna). It will provide the basis for determining whether or not remedial action is necessary and a justification for performing any remedial action that may be required. The procedures to perform a Baseline Risk Assessment for human health are outlined in EPA's Risk Assessment Guidance for Superfund - Human Health Evaluation Manual. These procedures are outlined below and must be followed by the Respondents. Other resources that the Respondents must utilize when performing the Baseline Risk Assessment include; EPA's Superfund Exposure Assessment Manual (SEAM), the Integrated Risk Information System (IRIS) or other similar databases, and the Interim Final Risk Assessment Guidance for Superfund - Environmental Evaluation Manual.

a. Human Health and Risk Assessment Components

The Baseline Risk Assessment process is divided into the four components listed below. During the scoping of the Baseline Risk Assessment, the Respondents shall discuss with EPA the format of the Baseline Risk Assessment Report as well as the references to be utilized during the Baseline Risk Assessment.

Contaminant Identification and Documentation

The Respondents shall review the information that is available on the hazardous substances present at the Site and shall identify the contaminants of concern. The contaminants of concern, also known as indicator chemicals, are not chosen solely on the basis of chemical-specific ARARs. Rather, they are selected based on quantity, the concentration of contaminants on-site as compared to levels that pose a risk, relative toxicity, and critical exposure pathways, such as drinking water. The Respondents shall submit to EPA for review and approval a technical memorandum listing all the hazardous substances present at the Site and the indicator chemicals with the known corresponding ambient concentrations of these contaminants. The data shall be tabulated to show the frequency of detection, the arithmetic mean and range of concentrations, and the sample collection date(s). In calculating the arithmetic mean, a chemical not detected in a sample shall be assumed to be present at a concentration of one-half its respective quantification limit as set forth in the QAPP. Chemical-specific ARARs shall also be identified at this time.

Exposure Assessment and Documentation

Using the information in the SEAM, the Respondents shall identify actual and potential exposure points and pathways. Exposure assumptions must be supported with validated data and must be consistent with Agency policy. Validation of data that has not previously undergone Agency review may be conducted as long as it does not delay the RI/FS schedule. For each exposure point, the release source, the transport media (e.g., ground water, surface water, air, etc.) and the exposure route (oral, inhalation, dermal) must be clearly delineated. The current number of people at each exposure point must be estimated and both sensitive and potentially exposed populations must be characterized. Both present and future risks at the Site must be considered and both current and maximum reasonable use scenarios weighed. The Respondents shall submit to EPA for review and approval a technical memorandum describing the exposure scenarios with a description of the assumptions made and the use of data. In addition, the Respondents shall include a description of the fate and transport models that will be utilized, including a summary of the data that will be used with these models. Representative data must be utilized and the limitations and uncertainties associated with the models employed must be documented.

Toxicity Assessment and Documentation

The Respondents shall utilize the information in IRIS, PHRED, other similar data bases and other information sources to provide a toxicity assessment of the indicator chemicals. This assessment shall include the types of adverse health and/or environmental effects associated with chemical exposures (including potential carcinogenicity), the relationships between magnitude of exposures and adverse effects, and the related uncertainties of contaminant toxicity (e.g., the weight of evidence for a chemical's carcinogenicity).

Risk Characterization

The Respondents shall integrate the ambient concentrations and reasonable worst case assumptions with the information developed during the exposure and toxicity assessments to characterize the current and potential risks to human health and the environment posed by the Site. This risk characterization must identify any uncertainties associated with contaminants, toxicities, and exposure assumptions.

b. Environmental Evaluation

In addition to the Baseline Risk Assessment for human health, the risks to the environment from exposure to the contaminants must be addressed. A technical memorandum providing an environmental evaluation shall be submitted to EPA for review and approval. At a minimum, the environmental evaluation shall include an assessment of any critical habitats and any endangered species or habitats of endangered species affected by contamination at the Site. It shall also provide the information necessary to adequately characterize the nature and extent of environmental risk or threat resulting from the Site.

The Respondents shall utilize the Interim Final Risk Assessment Guidance for Superfund - Environmental Evaluation Manual in preparing the environmental evaluation.

c. Baseline Risk Assessment Deliverables

The Respondents are required to prepare the three technical memoranda listed in Tasks 4a and 4b of this SOW. The three technical memoranda may be combined or submitted jointly. The Final Baseline Risk Assessment Report shall be submitted at the completion of Site Characterization and included in the Draft RI Report (see Task 3).

Baseline Risk Assessment Chapter of the RI Report

The Baseline Risk Assessment Report shall be included in the RI Report and submitted to EPA for review and approval. The report shall include a comprehensive description of the four components of the Baseline Risk Assessment and shall follow the principles established in the SPHEM. A discussion of sources of uncertainty, data gaps, incomplete toxicity information, and modeling characteristics must be included. The Respondents shall refer to the SPHEM for an outline of the report format. In addition, the Environmental Evaluation must be included in this chapter.

Subtask 4.2: In addition to a Baseline Risk Assessment, it will be necessary for respondent to conduct a site specific risk assessment for the purpose of evaluating potential remediation goals. The risk is calculated based on a maximum exposure scenario. This analysis should consider exposures under current use as well as potential future use conditions. For carcinogens, the 10-6 risk level should be used considered as a target level. For systemic toxicants, exposure levels shall represent concentration levels to which human population may be exposed without adverse effect during a lifetime, incorporating an adequate margin of safety. Remediation goals shall establish acceptable exposure levels that are protective of human health and the environment and shall be developed by considering current ARARs. The results of this assessment will be provided in the same chapter of the RI report with the Baseline risk assessment.

TASK 5 - TREATABILITY STUDIES (RI/FS Guidance, Chapter 5)

Treatability Studies shall be performed by the Respondents to assist in the detailed analysis of alternatives. In addition, if applicable, study results and operating conditions will later be used in the detailed design of the selected remedial technology. The following activities shall be performed by the Respondents.

a. Determination of Candidate Technologies and the Need for Treatability Studies (5.2; 5.4)

The Respondents shall identify in a technical memorandum, subject to EPA review and comment, candidate technologies for a Treatability Studies program during project planning (Task 1). The listing of candidate technologies shall cover the range of technologies required for alternatives analysis (Task 6a). The specific data requirements for the Treatability Studies program shall be determined and refined during Site Characterization and the development and screening of Remedial Action Alternatives (Tasks 2 and 6, respectively).

Conduct Literature Survey and Determine the Need for Treatability Studies (5.2)

Treatability Study Sampling and Analysis Plan (5.5)

If the original QAPP or FSAP is not adequate for defining the activities to be performed during the Treatability Studies, a separate Treatability Study SAP or amendment to the original RI/FS SAP shall be prepared by the Respondents for EPA review and approval. It shall be designed to monitor pilot plant performance. Task 1c of this Scope of Work provides additional information on the requirements of the SAP.

Treatability Study Health and Safety Plan (5.5)

If the original RI/FS Health and Safety Plan is not adequate for defining the activities to be performed during the Treatability Studies, a separate or amended Health and Safety Plan shall be developed by the Respondents. Task 1c of this Scope of Work provides additional information on the requirements of the Health and Safety Plan. EPA does not "approve" the Treatability Study Health and Safety Plan.

Treatability Study Evaluation Report (5.6)

Following completion of Treatability Studies, the Respondents shall analyze and interpret the testing results in a technical report to EPA. Depending on the sequence of activities, this report may be a part of the RI/FS Report or a separate deliverable. The report shall evaluate each technology's effectiveness, implementability, cost, and actual results as compared with predicted results. The report shall also evaluate full-scale application of the technology, including a sensitivity analysis identifying the key parameters affecting full-scale operation.

TASK 6 - DEVELOPMENT AND SCREENING OF REMEDIAL ACTION ALTERNATIVES (RI/FS Guidance, Chapter 4)

The development and screening of Remedial Action Alternatives is performed to select an appropriate range of waste management options to be evaluated. This range of options shall include, at a minimum, alternatives in which treatment is used to reduce the toxicity, mobility, or volume of the waste, but varying in the types of treatment, the amount treated, and the manner in which long-term residuals or untreated wastes are managed; alternatives that involve containment and treatment components; alternatives that involve containment with little or no treatment; and a no-action alternative. The following activities shall be performed by the Respondents as a function of the development and screening of Remedial Action Alternatives.

The Respondents shall conduct a literature survey to gather information on performance, relative costs, applicability, removal efficiencies, operation and maintenance (O&M) requirements, and implementability of candidate technologies. If practical candidate technologies have not been sufficiently demonstrated, or cannot be adequately evaluated for the Site on the basis of available information, Treatability Studies shall be conducted. The determination regarding the necessity for Treatability Studies shall lie with EPA.

Evaluate Treatability Studies (5.4)

Where EPA has determined that Treatability Studies are required, the Respondents and EPA shall decide on the type of Treatability Studies to use (e.g., bench versus pilot). Because of the time required to design, fabricate, and install pilot scale equipment as well as to perform testing for various operating conditions, the decision to perform pilot testing shall be made as early in the process as possible to minimize potential delays of the FS. To assure that a Treatability Study program is completed on time, and with accurate results, the Respondents shall either submit a separate Treatability Study Work Plan or an amendment to the original RI/FS Work Plan for EPA review and approval.

b. Treatability Study Deliverables (5.5; 5.6; 5.8)

In addition to the memorandum identifying candidate technologies, the deliverables that are required when Treatability Studies are to be conducted include a Treatability Study Work Plan, a Treatability Study Sampling and Analysis Plan, and a Final Treatability Study Evaluation Report. EPA may also require a Treatability Study Health and Safety Plan, where appropriate.

Treatability Study Work Plan (5.5)

The Respondents shall prepare a Treatability Study Work Plan or amendment to the original RI/FS Work Plan for EPA review and approval. This Plan shall describe the background of the Site, remedial technologies to be tested, test objectives, experimental procedures, treatability conditions to be tested, measurements of performance, analytical methods, data management and analysis, health and safety, and residual waste management. The DQOs for Treatability Studies shall be documented as well. If pilot-scale Treatability Studies are to be performed, the Treatability Study Work Plan shall describe pilot plant installation and start-up, pilot plant operation and maintenance procedures, and operating conditions to be tested. If testing is to be performed off-site, permitting requirements must be addressed.

a. Development and Screening of Remedial Action Alternatives (4.2)

The Respondents shall begin to develop and evaluate, concurrent with the RI Site Characterization task, a range of appropriate waste management options that, at a minimum, ensure protection of human health and the environment and comply with all ARARs.

Refine and Document Remedial Action Objectives (4.2.1)

The Respondents shall review and, if necessary, propose refinement to the Site Objectives and preliminary remedial action objectives that were established during the Scoping phase (Task 1). Any revised Site Objectives or revised remedial action objectives shall be documented in a technical memorandum as discussed in Task 1b. These objectives shall specify the contaminants and media of interest, exposure pathways and receptors, and an acceptable contaminant level or range of levels (at particular locations for each exposure route).

Develop General Response Actions (4.2.2)

The Respondents shall develop general response actions for each medium of interest defining containment, treatment, excavation, pumping, or other actions, singly or in combination, to satisfy the remedial action objectives.

Identify Areas and Volumes of Media (4.2.3)

The Respondents shall identify areas and volumes of media to which general response actions may apply, taking into account requirements for protectiveness as identified in the remedial action objectives. The chemical and physical characterization of the Site and the Baseline Risk Assessment shall also be taken into account.

Identify, Screen, and Document Remedial Technologies (4.2.4; 4.2.5)

The Respondents shall identify and evaluate technologies applicable to each general response action to eliminate those that cannot be implemented at the Site. General response actions shall be refined to specify remedial technology types. Technology process options for each of the technology types shall be identified either concurrent with the identification of technology types or following the screening of the considered technology types. Process options shall be evaluated on the basis of effectiveness, implementability, and cost factors to select and retain one or, if necessary, more representative processes for each technology type. The technology types and process options shall be summarized for inclusion in a technical memorandum. The reasons for eliminating alternatives must be specified.

Assemble and Document Alternatives (4.2.6)

The Respondents shall assemble selected representative technologies into alternatives for each affected medium or operable unit. Together, all of the alternatives shall represent a range of treatment and containment combinations that shall address either the Site or the operable unit as a whole. A summary of the assembled alternatives and their related action-specific ARARs shall be prepared by the Respondents for inclusion in a technical memorandum. The reasons for eliminating alternatives during the preliminary screening process must be specified.

Refine Alternatives

The Respondents shall refine the Remedial Action Alternatives to identify contaminant volumes to be addressed by the proposed process and sizing of critical unit operations as necessary. Sufficient information shall be collected for an adequate comparison of alternatives. Remedial action objectives for each medium shall also be refined as necessary to incorporate any new risk assessment information being generated from the Remedial Investigation. Additionally, action-specific ARARs shall be updated as the Remedial Action Alternatives are refined.

Conduct and Document Screening Evaluation of Each Alternative (4.3)

The Respondents may perform a final screening process based on short and long term aspects of effectiveness, implementability, and relative cost. Generally, this screening process is only necessary when there are many feasible alternatives available for detailed analysis. If necessary, the screening of alternatives shall be conducted to assure that only the alternatives with the most favorable composite evaluation of all factors are retained for further analysis.

As appropriate, the screening shall preserve the range of treatment and containment alternatives that was initially developed. The range of remaining alternatives shall include options that use treatment technologies and permanent solutions to the maximum extent practicable. The Respondents shall prepare a technical memorandum summarizing the results and reasoning employed in screening, arraying alternatives that remain after screening, and identifying the action-specific ARARs for the alternatives that remain after screening.

b. Alternatives Development and Screening Deliverables (4.5)

The Respondents shall prepare a technical memorandum summarizing the work performed and the results of each task above, including an alternatives array summary. These shall be modified by the Respondents if required by EPA's comments to assure identification of a complete and appropriate range of viable alternatives to be considered in the detailed analysis. This deliverable shall document the methods, rationale, and results of the alternatives screening process.

TASK 7 - DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES (RI/FS Guidance, Chapter 6)

The detailed analysis shall be conducted by the Respondents to provide EPA with the information needed to allow for the selection of a remedy for the Site. This analysis is the final task to be performed by the Respondents during the FS.

a. Detailed Analysis of Alternatives (6.2)

The Respondents shall conduct a detailed analysis of remaining alternatives. This analysis shall consist of an assessment of each option against a set of nine evaluation criteria and a comparative review of all options using the same nine evaluation criteria as a basis for comparison.

Apply Nine Criteria and Document Analysis (6.2.1 - 6.2.4)

The Respondents shall apply nine evaluation criteria to the assembled Remedial Action Alternatives to ensure that the selected Remedial Action Alternative will be protective of human health and the environment; will be in compliance with, or include a waiver of, ARARs; will be cost-effective; will utilize permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable; and will address the statutory preference for treatment as a principal element. The evaluation criteria include: (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume; (5) short-term effectiveness; (6) implementability; (7) cost; (8) State acceptance; and (9) community acceptance. Criteria 8 and 9 are considered after the RI/FS Report has been released to the general public. For each alternative, the Respondents shall provide: (1) a description of the alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative, and (2) a discussion of the individual criterion assessment. Since the Respondents do not have direct input on criteria (8) State acceptance and (9) community acceptance, these will be addressed by EPA after completion of the Draft FS Report.

Compare Alternatives Against Each Other and Document the Comparison of Alternatives (6.2.5; 6.2.6)

The Respondents shall perform a comparative analysis among the Remedial Action Alternatives. That is, each alternative shall be compared against the others using the nine evaluation criteria as a basis of comparison. No alternative shall be identified by Respondents as the preferred alternative in the Feasibility Study. Identification and selection of the preferred alternative is conducted by EPA.

b. Detailed Analysis Deliverables (6.5)

The Respondents shall prepare a Draft FS Report for EPA review and comment. This report, as ultimately adopted or amended by EPA, provides a basis for remedy selection by EPA and documents the development and analysis of Remedial Action Alternatives. The Respondents shall refer to the RI/FS Guidance for an outline of the report format and the required report content. The Respondents shall prepare a Final FS Report which satisfactorily addresses EPA's comments. Once EPA's comments have been addressed by the Respondents to EPA's satisfaction and EPA approval has been obtained or an amendment has been furnished by EPA, the Final FS Report may be bound with the Final RI Report.

ATTACHMENT A

SUMMARY OF THE MAJOR DELIVERABLES FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AT THE STAUFFER: COLD CREEK/LeMOYNE SITE COLD CREEK SWAMP - OPERABLE UNIT #3

TASK	DELIVERABLE	EPA RESPONSE
TASK 1	SCOPING	
	- RI/FS Work Plan (15)	Review and Approve
	- Field Sampling and Analysis Plan (15)	Review and Approve
	- Quality Assurance Project Plan (5)	Review and Approve
	- Site Health and Safety Plan (5)	Review and Comment
TASK 3	SITE CHARACTERIZATION	
	- Technical Memorandum on Modeling of Site Characteristics (where appropriate) (5)	Review and Approve
	- Preliminary Site Characterization Summary (15)	Review and Comment
	- Draft Remedial Investigation (RI) Report (15)	Review and Approve
TASK 4	RISK ASSESSMENT	
	- Technical Memorandum Listing Hazardous Substances and Indicator Chemicals (5)	Review and Approve
	- Technical Memorandum Describing Exposure Scenarios and Fate and Transport Models (5)	Review and Approve
	- Technical Memorandum Providing an Environmental Evaluation (5)	Review and Approve

	Risk Assessment Chapter of the RI Report (5)	Review and Approve
TASK 5	TREATABILITY STUDIES	
	- Technical Memorandum Identifying Candidate Technologies (10)	Review and Comment
	- Treatability Study Work Plan (or amendment to original Work Plan) (10)	Review and Approve
	- Treatability Study SAP (or amendment to original SAP) (10)	Review and Approve
	- Treatability Study Evaluation Report (10)	Review and Approve
TASK 6	DEVELOPMENT AND SCREENING OF REMEDIAL ACTION ALTERNATIVES	
	- Technical Memorandum Documenting Revised Remedial Action Objectives (5)	Review and Approve
	- Technical Memorandum on Remedial Technologies, Alternatives, and Screening (5)	Review and Comment
TASK 7	DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES	
	- Draft Feasibility Study (FS) Report (15)	Review and Approve

Note: The number in parenthesis indicates the number of copies to be submitted by Respondents. One copy shall be unbound, the remainder shall be bound.

ATTACHMENT B

STAUFFER: COLD CREEK/LeMOYNE
COLD CREEK SWAMP
SCHEDULE

ACTIVITY	DURATION (months)
1) Finalize Scope of Work	X
2) Draft Workplan Submitted	X + 1
3) Workplan Review Complete	X + 2
4) Final Workplan Submitted	X + 2.5
5) Initiate Fieldwork	X + 3
6) Fieldwork Complete	X + 4
7) Draft RI Received	X + 9
8) Comment on Draft RI	X + 10
9) Final RI Received	X + 10.5
10) Draft FS Received	X + 11
11) Comment on Draft FS	X + 12
12) Final FS Received	X + 13

3 4 0670 → Copy – Jeff Miller ~~Bill Smith~~ Dennis Smith

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

JUN 29 1990

RECEIVED-~~RICHMOND~~
JUL 02 1990
ENVIRONMENTAL SERVICES & OPERATIONS
FILE: CC: TO:

4WD-SSRB

Ms. Mariam Tehrani
Manager of Environmental Affairs
Chemical Division
Akzo Chemicals, Inc.
300 South Riverside Plaza
Chicago, Illinois 60606

RE: Stauffer Chemical - Cold Creek Swamp Remedial Investigation
Summary of June 28, 1990 Meeting

Dear Ms. Tehrani:

This letter serves to summarize a June 28, 1990, meeting between representatives from Akzo, ICI, Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (FWS), and Alabama Department of Environmental Management (ADEM) for the Stauffer Superfund sites in Mobile County, Alabama. The purpose of the meeting was to discuss concerns EPA, FWS, and ADEM have regarding the contamination in Cold Creek Swamp and the bioaccumlation of the contaminants in area biota. Based on a review of the May 1988 Remedial Investigation (RI) and the June 1989 Heavy Metal Levels in Cold Creek Swamp Biota Report, several data gaps have been identified regarding the extent of the contamination and the impact on the environment. The data gaps identified during the meeting, include, but are not limited to, a determination of the characteristics of the swamp, in-situ water quality in the swamp, nature and extent of site related contaminants, and the impact on biota as well as the aerial extent of the contaminated biota. It was emphasized several times during the meeting that the goal of the investigation of the swamp, as stated in the May 4, 1990, Scope of Work, requires Akzo and ICI to investigate the nature and lateral and vertical extent of contamination as well as to assess the impact to human health and the environment.

The boundary of the Cold Creek Swamp must be determined in order to evaluate the overall impact the contamination may have on the surrounding area. In addition, the influence the swamp has on area groundwater is required as part of the RI for the swamp. This information will be necessary during the development of potential alternatives. During the meeting it was estimated that the swamp was 300 to 500 acres. The RI need to be expanded on this and described concerning the usage of the property surrounding the swamp and the interconnection between the swamp and area groundwater.

Reduction of potential of sampling

A second data gap identified during the meeting was the need to determine in-situ water quality within Cold Creek Swamp. Specifically, information including, but not limited to, hardness, pH, and Eh should be obtained if not currently available for this site. Parameters which may influence the mobility and/or bioavailability of the contamination must be addressed in the swamp RI. A determination should be made whether the mercury known to be present in the swamp is "tied up" by sulfide in the water.

Based on information presented in the RI dated May 1988, there was a concern that the nature and extent of contamination in the swamp had not been well defined as discussed during the meeting. Composite soil borings were collected over a three foot interval at thirty-eight locations. Samples were analyzed for a limited number of inorganics. In addition, seven samples were analyzed for priority pollutants. Since the actual depth of contamination is not known in the swamp, additional information will be necessary regarding the depth of, and nature of, the contamination in the swamp. It was suggested a sampling interval of one foot may provide the detail necessary to determine the vertical migration of contaminants. Additional sample locations will also be necessary to determine the horizontal extent of the contamination. The swamp investigation should evaluate the type of mercury known to be present in the swamp as well as provide information regarding the impact of other potential contaminants, both inorganic and organic.

Finally, as discussed during the meeting, the June 1989 biota study has demonstrated the bioavailability of several inorganics in the swamp. The levels found in the biota collected exceeded background levels. Mercury, zinc and chromium were specifically noted has elevated in swamp biota. A comprehensive biota study needs to be included during the investigation of the swamp. This study should include soil chemistry, collection of additional invertebrates, determination of plant uptake and the collection of higher trophic species in the swamp (fish, small mammals, reptiles) and the Mobile River (fish). The detection limits for the analysis of the biota collected should be low enough to provide useful data.

The above discussion represents the concerns presented during the June 28, 1990, meeting. The purpose of the meeting was to assist Akzo and ICI during their development of the workplan for the investigation of the swamp. EPA reserves the right to provide additional comments following a review of the workplan. As agreed during the meeting, Akzo and ICI will provide a schedule for submittal of the workplan two weeks following receipt of this letter.

If you have any questions regarding the above concerns, please do not hesitate to contact me at (404) 347-2643. EPA appreciates Akzo's and ICI's continued interest in conducting the remedial investigation and feasibility study for Cold Creek Swamp.

Sincerely,

Arthur L. Collins

for James E. McGuire
Remedial Project Manager
South Superfund Remedial Branch

cc: Joe Downey, ADEM
Lee Erickson, ICI
John Johnson, Akzo
Lowell Martin, ICI

United States Department of the Interior
FISH AND WILDLIFE SERVICE
P.O. Drawer 1190
Daphne, Al 36526

October 6, 1989

RECEIVED OCT 16 1989 EPA - REGION IV ATLANTA, GA.

Mr. Douglas Mundrick, P.E., Chief
South Site Management Section
Superfund Branch
United States Environmental Protection Agency
345 Courtland Street N.W.
Atlanta, Georgia 30356

Dear Mr. Mundrick:

The following are our preliminary comments relative to the Stauffer Chemical Company Cold Creek Swamp biota study conducted by BCM Engineers Inc., during the fall of 1988.

The primary intent of this investigation was to assess bioavailability of the elevated levels of several metals, particularly mercury, found in Cold Creek Swamp sediments. It was also anticipated that if uptake was occurring through the biota some interpretation could be made regarding affect on the ecosystem. The ultimate value of the data was to determine if remedial actions were warranted and, if so, what those actions might entail.

In reviewing the data we find that the bioavailability of mercury reported in an earlier study of the swamp has been confirmed at all three trophic levels sampled. The maximum levels of mercury found in fish, 1.9 ppm, was compared with the most recently compiled data from the Fish and Wildlife Services' National Contaminant Biomonitoring Program (NCBP). During 1984-1985, 315 composite samples of whole fish from 109 stations located at contaminated as well as uncontaminated sites were analyzed for a number of pollutants. The mean concentrations of mercury during these 2 years were 0.10 ppm with a maximum of 0.37 ppm and an 85 percentile (the concentration not exceeded by 85% of the samples analyzed) 0.17 ppm. The maximum level was from a fish composite sample collected at a site on the Pee Dee River in South Carolina with a history of mercury contamination from a paper manufacturing industry. It is obvious that the mercury found in Cold Creek Swamp fish is far in excess of that reported by the national monitoring network.

The Food and Drug Administration (FDA) has established an action level in the edible portions of fish at 1.0 ppm methyl mercury. About 90% of the total mercury found in tissue is in the methyl form. Since approximately 70% of the mercury occurring in whole fish is concentrated in the muscle tissue (the edible portion) there is an excellent possibility that the FDA action level for methyl mercury may be exceeded in fish inhabiting Cold Creek Swamp. This may be of particular concern since an earlier study in the swamp found even higher concentrations in fish, 3.1 ppm. Because of the low water level in the swamp at the time of the BCM study, larger

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mature fish occupying the top trophic levels, i.e., largemouth bass, were not found. As mercury is primarily concentrated through the food chain, these final consumers usually contain the highest body burdens. During periods of high water, when these species migrate into the swamp, they could be biomagnifying mercury to levels previously unreported from this area.

In addition to fish, the other species sampled, crayfish and earthworms, also contained elevated levels of mercury, 1.2 ppm and 2.5 ppm, respectively. Notwithstanding the direct concern for these organisms, it must be recognized that they also provide an important food source for higher trophic level consumers. Lethal as well as sublethal effects on growth, development, reproduction, blood and tissue chemistry, metabolism, and behavior have been noted in a number of species fed diets containing mercury within the range of these concentrations.

We interpret the results of this study to show that the extremely high levels of mercury previously documented in Cold Creek Swamp sediments are now confirmed as being bioavailable and existing in elevated concentrations in all three tropic levels sampled. The levels are of such a magnitude to demand concern, particularly for the higher tropic level consuming organisms. There should also be consideration for the risk associated with any human activity in the swamp.

Copies of this report have been submitted to our Washington Office contaminant and research divisions for their input regarding any additional data needs and the possibility of remedial action. We anticipate the completion of our review and the submittal of specific recommendations no later than November 15. We appreciate the opportunity for this involvement and look forward to our continuing consultation regarding the mercury contamination of Cold Creek Swamp and the very real threat to this ecosystem.

Sincerely yours,

Larry E. Goldman
Field Supervisor

cc: Don Shultz, FWE, Atlanta, GA

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

P.O. Drawer 1190
Daphne, Alabama 36526

May 3, 1990

Mr. Don Schultz
U.S.Environmental Protection Agency
College Station Road
Athens, Georgia 30614

Dear Mr. Schultz:

The following are our final comments concerning the Stauffer Chemical Company Cold Creek Swamp biota study conducted by BCM Engineers Inc., during the fall of 1988.

On October 6, 1989, we submitted to EPA our preliminary comments relative to the study (see attachment). It had been Stauffer's position that although extremely high levels of mercury did exist in the swamp sediments it was not accessible to the swamp biota. This question of bioavailability is what prompted the BCM study.

There can now be no question of bioavailability since elevated mercury concentrations were found in all trophic levels sampled. In fact, the levels found in Cold Creek Swamp fish were far in excess of any values reported from the Fish and Wildlife Service's national monitoring network. A further indication of bioavailability is the comparison between Cold Creek Swamp samples and area background samples. Although measurable concentrations of mercury were found in all samples at every station in Cold Creek Swamp, the background samples collected from similar but unaffected habitats reported mercury as below the analytical detection limit (0.1 mg/kg).

The BCM study concluded that since the digestive tracts were not purged prior to analysis "some of the mercury reported may have been in part, or entirely, due to residual mercury contained in the sediment remaining in the animal." The point here being that sediments may contain varying ratios of organic (bioavailable) and inorganic (unavailable) mercury whereas tissues contain primarily the organic form. The report also stated that since only total mercury was analyzed there was no way to determine what fraction, if any, was the bioavailable organic form.

As was discussed in our preliminary comments, approximately 90 percent of mercury found in tissue is in the methyl (organic) form.

Since fish samples do not contain a significant amount of sediment, that medium would be eliminated as a mercury source resulting in a residue principally derived from tissues and of the organic form. Therefore, the majority of total mercury reported in the swamp fish samples would be bioavailable.

Approximately 70 percent of the mercury occurring in whole fish samples is found in the muscle tissue (edible portion). When the entire fish is analyzed, as was done in this study to assess food chain uptake, the tissues with less ability to concentrate mercury function to offset the higher concentrations in the muscle tissue, thereby resulting in lower overall residue values. Conversely, if only the muscle tissue had been analyzed, much higher values would have been anticipated. This should raise a particular concern from a human health standpoint since the whole body mercury concentrations, 1.9 ppm, were found at approximately twice the Food and Drug Administration action level.

The highest concentration of mercury found, 2.5 ppm, was in worms collected from Cold Creek Swamp sediments. It was anticipated that if the mercury was bioavailable these organisms, because of their direct contact with the sediments, would contain the highest residues. Although not in as direct contact with the sediments, crayfish and fish were selected based on this same criteria. A major concern of the Fish and Wildlife Service was that since these organisms constitute a major food source for higher trophic levels, i.e., birds and mammals, any mercury uptake could be transferred and biomagnified up through the food chain. A determination of mercury storage sites, whether in the tissue or in sediments associated with the gut, is of less concern in this assessment since the entire organism is consumed by the predator. Any mercury existing in the inorganic form could be rapidly transformed by microbial activity into the highly toxic methylmercury.

The objective of this study was to determine if the extremely high levels of mercury found in the swamp sediments were bioavailable and being incorporated by the swamp biota. It was agreed that if significant uptake was found to occur at the lower trophic levels the investigation would be expanded to assess biomagnification through the food chain and effects on population dynamics. There can be no doubt now that sediment mercury is bioavailable and is being concentrated at significant levels. This further evaluation is particularly important since the highest concentrations of mercury have historically been found in the top-level predators.

It is our recommendation that the following actions be taken:

1. An IMMEDIATE assessment of the potential human health dangers-that may be associated with elevated mercury concentrations in edible fish and other food items. If a health risk is concluded, methods to warn and even exclude the public from the swamp and affected areas should be implemented.

2. An expanded study in the swamp to assess mercury uptake through the food chain with particular emphasis on waterfowl and wading birds. A determination of any effects on reproduction and other important population dynamics.

3. An investigation of the Mobile River above and below the mouth of Cold Creek Swamp to determine if mercury contamination has impacted the river.

4. A comprehensive survey of swamp sediments to better define areas of mercury contamination.

5. The development of a longterm monitoring study to track the association and effects of mercury contaminated sediments with the swamp and possibly river biota.

6. The formation of an advisory group to design the investigative studies and assist in the data interpretation. The group should include, as a minimum, representatives of the Environmental Protection Agency, the Alabama Department of Environmental Management, Alabama Department of Conservation and Natural Resources-Game and Fish Division, AKZO Chemical Inc., and the U.S. Fish and Wildlife Service.

We are particularly concerned with maintaining a close contact with the progress of the FI/FS and the development of additional biological investigations in Cold Creek Swamp and the Mobile River. Please advise if we can be of additional service.

Sincerely yours,

Larry E. Goldman
Field Supervisor

cc Don Schultz, FWS, Atlanta, GA
Don White, FWS, Athens, GA

UNITED STATES DEPARTMENT OF COMMERC
National Oceanic and Atmospheric Administratic
NATIONAL OCEAN SERVICE

c/o USEPA
Emergency Response Section
345 Courtland Street
Atlanta, Ga. 30365
October 20, 1989

Diane Scott, Remedial Project Manager
USEPA/Superfund Branch
345 Courtland Street
Atlanta, Ga. 30365

Subject: Stauffer Chemical Cold Spring Site, Mobile, Alabama

NOAA has reviewed the report on Heavy Metals Levels in Cold Creek Swamp Biota and the Remedial Investigation, and offers the following comments.

Summary

Past activities at the Cold Creek site have led to contamination of two major types: mercury and pesticides/herbicides. The mercury was released with wastes from the chlor/alkalai plant, used to make chlorine and caustic (sodium hydroxide) from brine solutions. A variety of pesticides and herbicides were manufactured at the site. The RI investigations focussed on the thiocarbamate-based insecticides, but no clear statement was found describing the full product line that was produced. From the start of the facility in the late 1950s to the early 1970s, wastes of both types were placed as sludges in a number of unlined disposal areas and ponds on site, as well as being discharged directly to Cold Creek Swamp. Some NOAA resources are known to be present in the latter wetlands, and the Mobile River near the site is an area of major utilization by NOAA resources.

Mercury was found at marginally elevated concentrations (up to 24 mg/kg) in some soil samples from waste ponds on site, but these levels were lower than the very high concentrations observed in the sediments from Cold Creek Swamp. The latter ranged to a high value of 690 mg/kg, and averaged about 185 mg/kg. The expected concentration for natural soils/sediments would be approximately 0.05 to 0.1 mg/kg.

Mercury concentrations in the groundwater were below the detection limits, but the latter was 0.6 µg/l, substantially above the chronic EPA ambient water quality criteria (AWQC) for the protection of freshwater life of 0.012 µg/l (the acute AWQC is 2.4 µg/l).

Mercury was also measured in the tissue of fish, crayfish and "worms" from Cold Creek Swamp. The concentrations of mercury in the edible tissue did not exceed, but were very close to, the FDA limit of 2 mg/kg for edible tissue that is commonly used as a reference value for fish tissue.

Only marginal concentrations of the measured thiocarbamate pesticides were detected at the site in any media. Toxicity data are limited for aquatic organisms for the thiocarbamate pesticides, but indicate that concentrations in the hundreds of ppb (µg/l) to low ppm (mg/kg) are likely to be toxic to sensitive fish and invertebrates. The concentrations of the measured pesticides in the groundwater were generally less than 10 µg/l, below the levels expected to show substantial toxicity. These substances were detected, however, in the sediments of Cold Creek Swamp at concentrations up to nearly 2 mg/kg each (sum of the measured substances was up to 7 mg/kg in one sample). No measurements were made of any pesticides in biota samples.

Comments

There are two major points of concern regarding the Stauffer site: **1.** the threat (toxicity) of the sediments in Cold Creek Swamp and **2.** the possibility that migration of contamination from the disposal areas on site may be continuing periodically, or will in the future because of contact with shallow groundwater.

Firstly, no specific surveys have been performed to determine NOAA trust resource utilization of Cold Creek. Species of interest to NOAA believed to inhabit Cold Creek in the area near the site are blues crabs and white shrimp. Blue crab are known to use tributaries along the Mobile River as over-wintering areas. Many marine and estuarine species use the Mobile River near the confluence with Cold Creek. Important species are listed in Table 1.

Table 1. Species utilizing the Mobile River (Becassio et al. 1982)

Species	Nursery Area	Migratory Route	Fishery	Commercial Fishery	Recreational
Estuarine and Marine Fish					
Spotted Seatrout		X			X
Atlantic Croaker	X			X	
Red Drum	X			X	
Black Drum	X			X	
Spot	X				
Southern Kingfish		X			X
Sheepshead	X			X	
Southern Flounder		X			X
Striped Mullet	X			X	
Gulf Menhaden	X				
Bay Anchovy					
Ladyfish	X			X	
White Mullet	X			X	
Striped Bass		X		X	
Skipjack Herring		X		X	
Alabama Shad		X		X	
Alligator Gar				X	
Invertebrates					
Shrimp	X				
Blue Crab	X			X	

1. The greatest threat to NOAA trustee resources that has been clearly identified is the widespread distribution of mercury in the sediments of Cold Creek Swamp (see Table 2). The concentrations observed are on the order of 10,000 times what would be expected for "natural" levels. The maximum concentration that was measured was over 1500 times the lowest Apparent Effects Threshold value for mercury (to the extent that AET values are applicable to this situation).

Table 2. Maximum concentrations (mg/kg wet weight) of trace elements in biota samples from Cold Creek and background stations.

Species	Arsenic		Chromium		Copper		Lead		Mercury		Nickel		Zinc	
	CC	BG	CC	BG	CC	BG	CC	BG	CC	BG	CC	BG	CC	BG
Fish	<0.2	<0.2	2.0	2.3	12	0.8	2.5	4.4	1.9	<0.1	4.7	18	41	31
Crayfish	0.2	<0.2	1.0	0.5	27	13	5.9	<2.5	1.2	<0.1	7.1	<1.2	23	13
Worms	2.5	2.0	1.0	0.9	3.8	1.5	11	18	2.5	<0.1	<1.2	<1.2	24	16

CC: Cold Creek samples
BG: Background samples

Because only relatively low concentrations of mercury were found in the soils on site, it appears that the mercury in the wetlands is residual material from the past era of direct waste discharges. The RI report indicates that, because the mercury was discharged together with carbon disulfide, it is likely that the mercury accumulated in the wetland as mercuric sulfide, which has a very low solubility. The RI argues that this form of mercury is immobile and hence poses a minimal threat to humans or natural resources. However, mercuric sulfide would not be stable under aerobic conditions, but would oxidize and form much more mobile mercury phases. In addition, methylation of mercury may occur under either aerobic or anoxic conditions. The fact that the tissues of resident organisms are contaminated with mercury is a clear demonstration that the mercury in the sediments is not totally immobilized.

It is not possible to estimate the toxicity of the sediment-bound pesticides with available data. The concentrations in the water (surface and ground) at the site were low compared to the known water toxicity and the concentrations in the sediments were not extremely high compared to the concentrations that are observed for some substances at Superfund sites. The points of concern are that the pesticides are created to disrupt biological systems,

Hg S2

that the levels of the pesticides that were measured are not negligible, that there were multiple pesticides present, and that the wetland is also contaminated with mercury leading to possible synergistic toxicity. In addition, since the pesticide contamination likely arose from the discharge of waste water, it is possible that a number of other organic substances that are by products of the pesticide manufacture could be present as well but were not measured. As noted above, it is also possible that other pesticides were manufactured at the facility and hence may be present in the sediments.

The RI provides data to argue that the pesticides are not greatly persistent in the environment. However, the data provided indicate that sediment-bound thiocarbamate pesticides are much more stable than those in water or in biota and that they are even more stable under anoxic conditions. The fact that these compounds were detected in the sediments of the wetland indicates that either there is an ongoing source or that the pesticides have persisted since earlier discharges.

In summary, the data are sufficient to clearly demonstrate substantial contamination in the wetland. The data also indicate, but not entirely convincingly (see below), that this contamination is the result of past practices and is not from on-going sources. Additional evaluation of the groundwater flow would be helpful to answer the latter question. More importantly, because of the question of the availability of the mercury, the toxicity of the pesticides and the possible presence of other toxic substances, it is difficult to evaluate how toxic the contaminated sediments are based on the available data. The ecological risk assessment presented in the site reports did not appropriately address the possible direct impacts to resident organisms. The very high levels of mercury alone are probably worth some remedial response, but it is not clear to what extent the wetland should be destroyed for this cleanup. A conservative approach, using, for example, available sediment guidelines for mercury in sediments, may result in greater destruction of the wetland than is necessary for the protection of natural resources. The most appropriate approach would be to use sediment (solid-phase) bioassays on samples from the wetland to determine the specific areas that are toxic enough to warrant isolation from the biota and/or to develop site-specific action levels (concentrations in the sediments) to guide a cleanup action.

2. The status of the groundwater at the site is also of concern. The RI is careful to document that, under the present "normal" operating conditions, local groundwater withdrawal creates substantial depressions in the water-table aquifer in the vicinity of the site. These data indicate two important features: a) the landfill and ponds on site are well above the groundwater under present conditions and hence are not sources of groundwater contamination and b) the surface waters of Cold Creek Swamp are above the groundwater level and so, if there is a connection, the wetland would act to recharge the groundwater rather than being a discharge point for the contaminated groundwater. These interpretations appear to be correct for present conditions. However, the RI is less precise about the possible conditions that may have occurred historically, or may occur in the future when groundwater utilization may change. It is also not clear from the RI to what extent the present operations are in fact "normal," and to what extent they vary due to plant maintenance schedules, equipment breakdowns, strikes, and other changes in day-to-day operations.

The reported groundwater elevations in the vicinity of the site ranged from about 70 feet below the ground level to about 13 feet below the surface, but no attempt was made to clearly discern the probable natural (in the absence of pumping) groundwater level for the site or for any of the disposal areas that remain on site. If the shallow elevation is representative of natural conditions, then some of the deeper disposal areas could reach groundwater in the future, particularly under high-water conditions in the Mobile River. Higher water levels could also lead to discharges of groundwater to Cold Creek Swamp or the Mobile River, after contamination by contact with residual wastes in the disposal area.

GW

The proposed remedy for these areas is simple impermeable capping in place. Only as long as the groundwater in the shallow aquifer does not contact the wastes will the capping be reasonably effective in reducing/eliminating the migration of contamination. Therefore, it is important that the possible range of the groundwater excursion be defined, including what might seem to be rare or extreme situations (e.g., 100-year class flooding, possible sea-level rise, and local land subsidence).

Sincerely,

John A. Lindsay

John A. Lindsay
Coastal Resource Coordinator

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET. N.E.
ATLANTA. GEORGIA 30365

JUN 01 1990

RECEIVED-RICHMOND

JUN 07 1990

ENVIRONMENTAL SERVICES & OPERATIONS

FILE: CC: TO:

4WD-SSRB

Mr. Lee Erickson
Environmental Manager
ICI Americas
1391 South 49th Street
Richmond CA 94804

RE: Stauffer Superfund Sites - Cold Creek Swamp
Remedial Investigation Advisory Committee

Dear Mr. Erickson:

This letter serves to transmit copies of the May 1988 Remedial Investigation Report and the June 1989 Cold Creek Biota Study to members of the Stauffer Cold Creek and LeMoyne Advisory Committee. These documents contain the latest information the Agency has regarding the Stauffer sites. The committee is scheduled to meet on June 28, 1990 at 10:00 am in the Waste Planning Branch's Conference Room #1. The purpose of the meeting will be to identify data gaps which currently exist regarding the contamination in Cold Creek Swamp. If you are unable to attend this meeting, please provide me with written comments or contact me at (404) 347-2643 by June 27, 1990.

The Agency appreciates your support of the Superfund program.

Sincerely,

James E. McGuire
Remedial Project Manager
South Superfund Remedial Branch

Enclosure

3 4 0684

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

MAY 18 1990

4WD-SSRB

Ms. Mariam Tehrani
Manager of Environmental Affairs
Chemical Division
Akzo Chemical, Inc.
300 South Riverside Plaza
Chicago, Illinois 60606

RE: Stauffer Chemical - LeMoyne and Cold Creek Sites
Heavy Metal Levels in Cold Creek Biota

Dear Ms. Tehrani:

This letter serves to transmit comments recently developed by the Fish and Wildlife Service (FWS) regarding the June 1989 study titled Heavy Metal Levels in Cold Creek Biota. The enclosed information supplements the previous comments developed for this study by the FWS. I concur with the majority of the recommendations made by the FWS. In particular, I agree that it would be appropriate to form an advisory committee to assist in the development of the remedial investigation workplan for Cold Creek Swamp. The Agency will take the lead on forming the committee. Akzo and ICI are encouraged to participate.

If you have any questions, please contact me at (404) 347-2643.

Sincerely,

James E. McGuire
Remedial Project Manger
South Superfund Remedial Branch

Enclosure

cc: Lee Erickson, ICI
Joe Downey, ADEM

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