UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6
1445 ROSS AVENUE SUITE 1200
DALLAS, TEXAS 75202-2733

RECORD OF DECISION
VERTAC SUPERFUND SITE OFF-SITE AREAS

SEPTEMBER 1990

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE SUITE 1200
DALLAS TEXAS 75202-2733

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

VERTAC, INC., Jacksonville, Arkansas

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Vertac, Inc. in Jacksonville, Arkansas, which was chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

The State of Arkansas concurs with the selected remedy (see Appendix E).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This Record of Decision is for the Vertac off-site areas. The off-site areas include the active and abandoned sewage collection lines, abandoned Old Sewage Treatment Plant, active West Wastewater Treatment Plant, and the Rocky Branch Creek and Bayou Meto flood plain and sediments.

The major components of the selected remedy include:

- Sewage Collection Lines -- Sediments would be removed from the active sewage collection lines between the Vertac plant site and the West Wastewater Treatment Plant and incinerated onsite. Pipe liners would be installed in the cleaned sewer lines. The abandoned line would be filled with grout to reduce the migration of contaminants in the line.

- Old Sewage Treatment Plant -- The sludge would be removed from the sludge digester and incinerated onsite. The sludge drying beds would be capped with

one foot of clean soil. Accumulated water in the treatment units would be removed, treated and discharged, and the treatment units would be demolished and capped with one foot of clean soil. A notice would be placed in the deed recommending that the Old Sewage Treatment Plant site zoning remain commercial/industrial and access be restricted.

- o West Wastewater Treatment Plant -- The aeration basin would be drained, the dikes demolished, and the entire basin capped with one foot of clean soil. A notice would be placed in the deed recommending that the West Wastewater Treatment Plant site zoning remain commercial/industrial and access be restricted.

- o Rocky Branch Creek and Bayou Meto Flood Plain -- In order to minimize ecological damage to the floodplain and to the downstream areas, the floodplain areas that are currently residentially zoned will be resampled and only those areas with actual 2,3,7,8 tetrachloro-dibenzo-p-dioxin (2,3,7,8 TCDD) levels greater than 1.0 ppb will be removed and incinerated onsite.

- o Rocky Branch Creek and Bayou Meto -- Monitor fish in these streams for dioxin and continue ban on commercial fishing and advisory discouraging sport fishing as long as fish fillet tissue dioxin levels are above Food and Drug Administration alert level.

The residuals from wastewater dewatering and treatment (such as filter spools, spent activated carbon, etc.) would be incinerated onsite. Onsite refers to areas within the Vertac Plant fence line. Incinerator ash would be disposed of onsite.

The drummed wastes onsite are currently being incinerated under a state contract. The State of Arkansas is using the funds from a trust fund that was established when Vertac went bankrupt for this incineration project. A Remedial Investigation/Feasibility Study (RI/FS) for the onsite facility, structures, soils, groundwater, etc., is in progress. This RI/FS will be conducted under two operable units (OU). The RI/FS for OU #1 (tank contents, above-ground structures, etc.) will be completed by December 1990. The RI/FS for OU #2 (soils, groundwater, etc.) is scheduled for completion in March 1992.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial

action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technology, to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy will not result in hazardous substances remaining onsite (that is, in the off-site areas addressed by this ROD) above health-based levels, the five-year review will not apply to this action.

SEP 27 1999

Date

Robert E. Layton Jr.

Robert E. Layton, Jr., P.E.
Regional Administrator

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VERTAC SUPERFUND SITE
RECORD OF CONCURRENCES

The Vertac Superfund Site Record of Decision for the Off-Site Operable Unit has been reviewed and I concur:

M. S. Ramesh, Remedial Project Manager
Superfund Enforcement - Arkansas/Louisiana Section (6H-EA)

Garret Bondy, Chief
Superfund Enforcement - Arkansas/Louisiana Section (6H-EA)

Sam Becker, Chief
Superfund Enforcement Branch (6H-E)

Mark Peycke, Chief
Waste Enforcement, ALON Section (6C-WA)

George R. Alexander
Regional Counsel (6C)

Allyn M. Davis, Director
Hazardous Waste Management Division (6H)

Mel McFarland
Waste Enforcement, ALON Section (6C-WA)

THE DECISION SUMMARY
VERTAC OFF-SITE
JACKSONVILLE, ARKANSAS
SEPTEMBER 1990

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6, DALLAS, TEXAS

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SITE NAME AND LOCATION

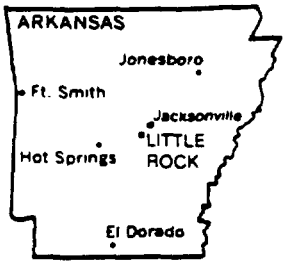
The Vertac, Inc. Superfund Site is located in Jacksonville, Arkansas (Figure 1) and consists of the Vertac Plant Site (or Onsite) and the Vertac Off-Site area (Figure 2). The Vertac Off-Site area addressed in this Record of Decision includes:

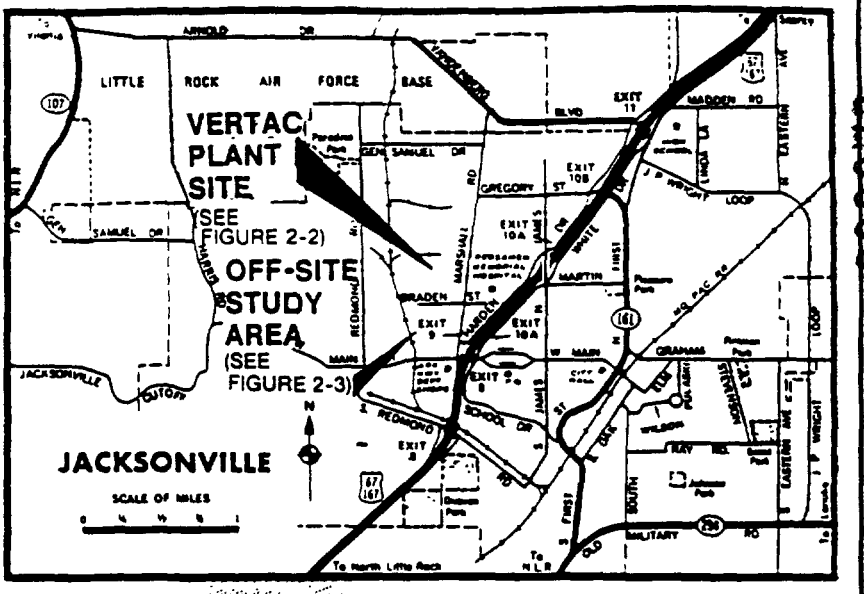
- Wastewater collection lines between the Vertac Plant site and wastewater treatment facilities, including 10,350 feet of active lines and 4,350 feet of the abandoned Rocky Branch Creek interceptor.
- Old (abandoned) sewage treatment plant (Old STP), including clarifiers, trickling filters, sludge digester, sludge drying beds, and surface soils.
- West Wastewater Treatment Plant (West WWTP), including the three-acre aeration basin (lagoon) and two 22-acre oxidation ponds.
- Rocky Branch Creek and Bayou Meto flood plain, including the residentially-zoned area south of the Vertac property line and north of the fork in Rocky Branch Creek.
- Rocky Branch Creek and Bayou Meto sediments.

GEOGRAPHY

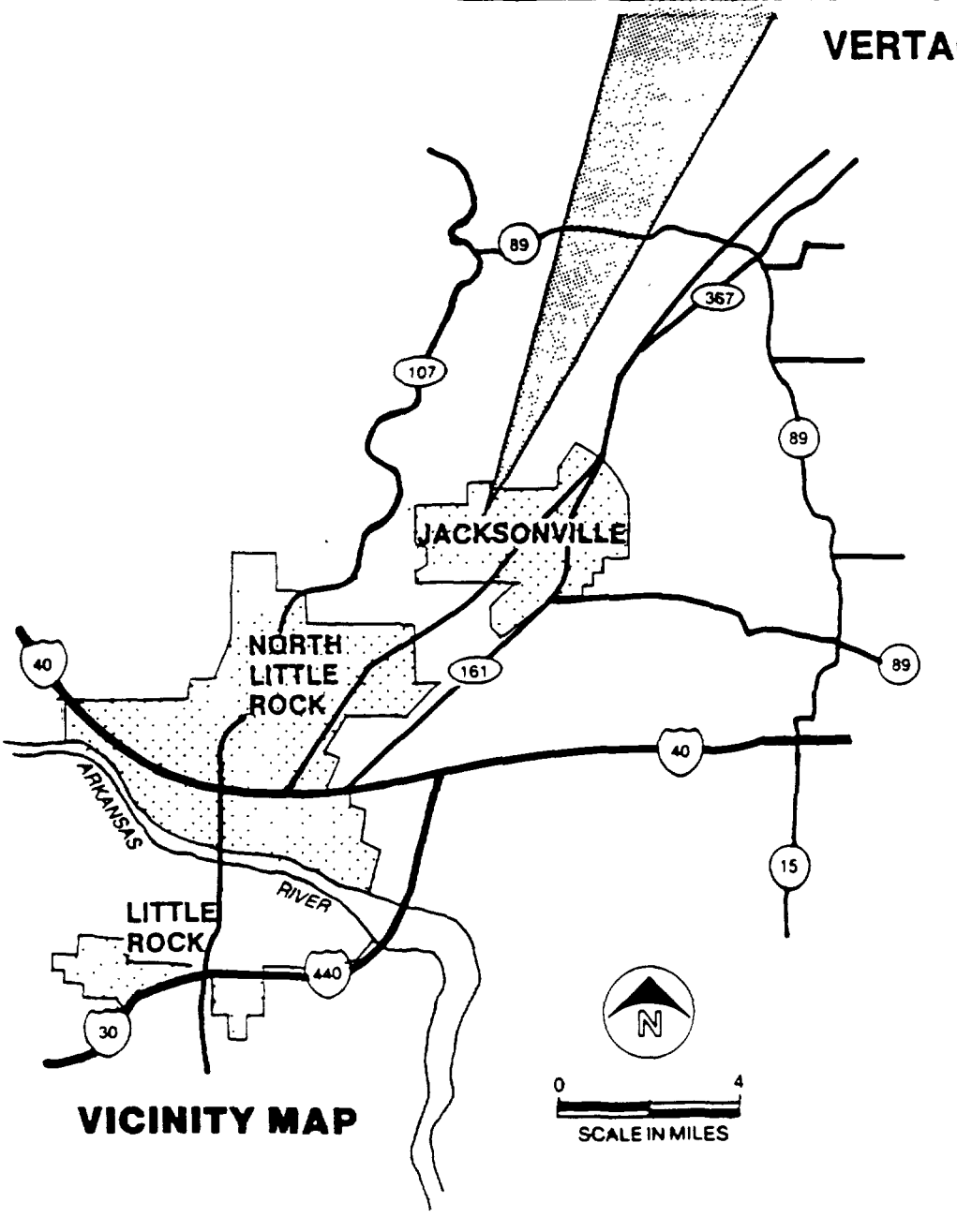
The investigation area occupies approximately 36 square miles in and to the west, south, and east of the City of Jacksonville, Arkansas. The surface gradient in the area is generally to the south-southeast. There are two major drainageways in the area, Rocky Branch Creek and Bayou Meto. Minor drainageways are intermittent streams that flow into Rocky Branch and Bayou Meto in the spring or during periods of heavy rainfall.

Rocky Branch originates near the northern boundary of Jacksonville and flows generally south, traversing the Vertac plant property along the west side. About two miles south of the Vertac plant it empties into Bayou Meto. Being a young stream, Rocky Branch is characterized by low sinuosity, low levels of suspended sediments, and a high bed-load potential. Sediment load of Rocky Branch is derived from erosion of upgradient and surrounding terrain. Average sediment depth is





VERTAC SITE MAP



VICINITY MAP

Figure 1

VERTAC SITE LOCATION

Vertac Off-Site FS
Jacksonville, Arkansas

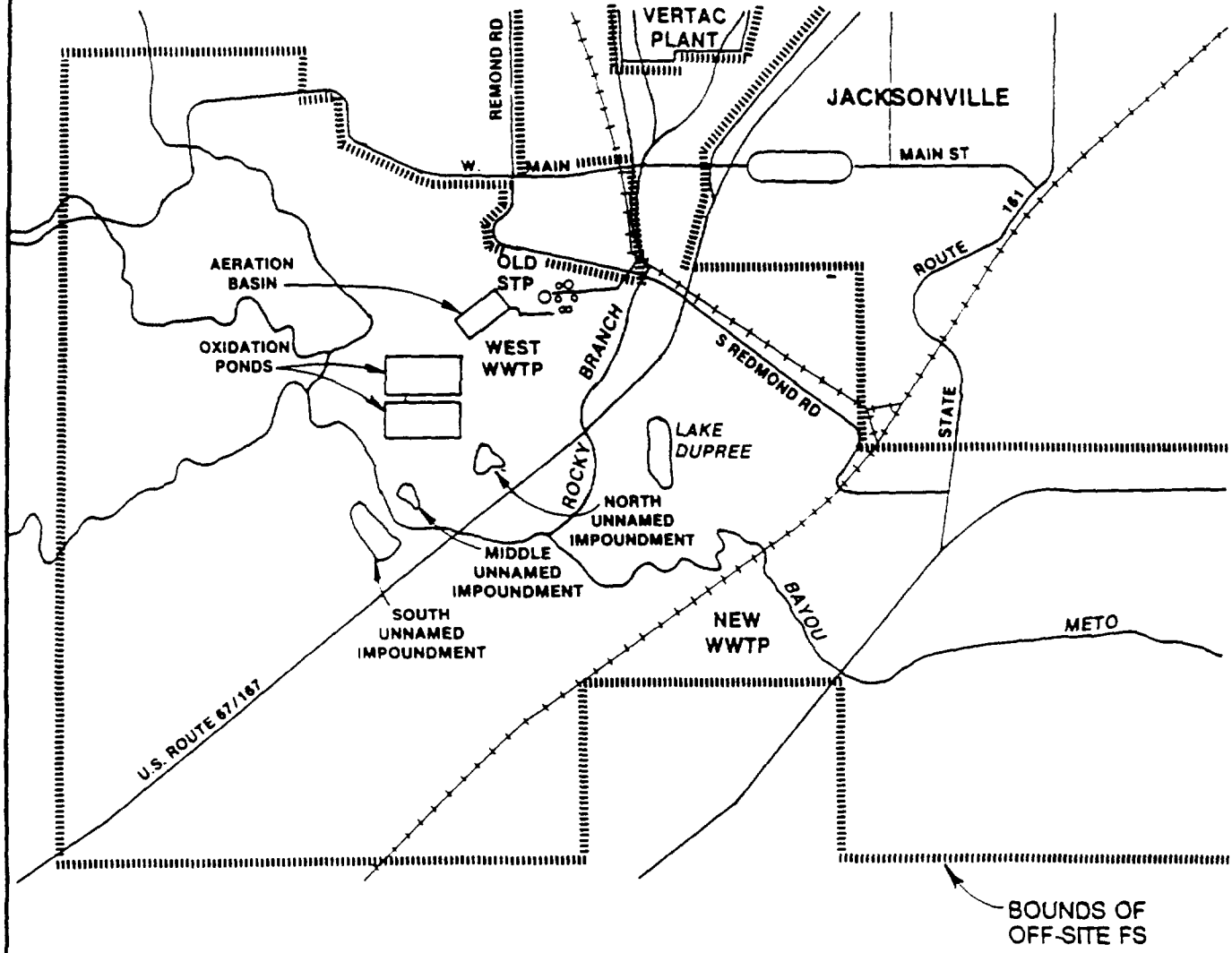


Figure 2

VERTAC OFF-SITE INVESTIGATION AREA

Vertac Off-Site FS
Jacksonville, Arkansas

about 10 inches. Channel deposits are predominantly silt and clay.

Generally, both banks are steep, but there are occasional small point bars at meanders. Lag gravels are found on point bars and along the upper reaches of the stream. As the stream approaches Bayou Meto, the channel becomes wider and deeper and the sediments become finer.

Bayou Meto begins in the Atoka Formation approximately one mile northwest of Jacksonville. At the Fall Line, Bayou Meto changes course from south to east, and due to bedrock changes, becomes broad and sinuous. Also, the gradient decreases, resulting in sluggish water flow. Abandoned and partly filled channels with interconnecting oxbow lakes, ponds, and minor tributaries are common.

Sediments in Bayou Meto are generally fine grained sand, silts, and clays. Due to the sluggish water flow, gravel deposits are rare. Organics from vegetation decay also make up a large portion of the sediment. About 130 miles southeast of Jacksonville, Bayou Meto empties into the Arkansas River.

Precipitation is well distributed throughout the year, though spring is the wettest season. August and October are the driest months. September is not a dry month, however, and high intensity rainfall is not uncommon. Thunderstorms are very common, particularly in the summer and fall. An average of 56 days a year have thunderstorms, often accompanied by strong winds and hail.

Evaporation is an important element in the area meteorological system. During the summer, as much as 1/3 inch of water per day evaporates. Abundant sunshine and high temperatures can result in drought and a significant loss of soil moisture. Severe droughts occur once every 10 to 15 years.

LAND USE/POPULATION

Land use in the investigation area is a mixture of residential and agricultural with extensive undeveloped and uninhabited woodlands in the area near the confluence of Rocky Branch Creek and Bayou Meto. Land use zoning is shown on Figure 3. The portion just south of the Vertac plant site, between Marshall Road and the Missouri-Pacific railroad tracks, south to W. Main Street, is residential, a combination of single-family homes and apartments. The section immediately west of the railroad tracks and north of W. Main Street is undeveloped. The area between W. Main Street and S. Redmond Road is commercial and light industrial. Just south of S. Redmond Road is undeveloped, uninhabited land that includes the Jacksonville Sewage Treatment Plant, DuPree Park, and Lake DuPree. The rest

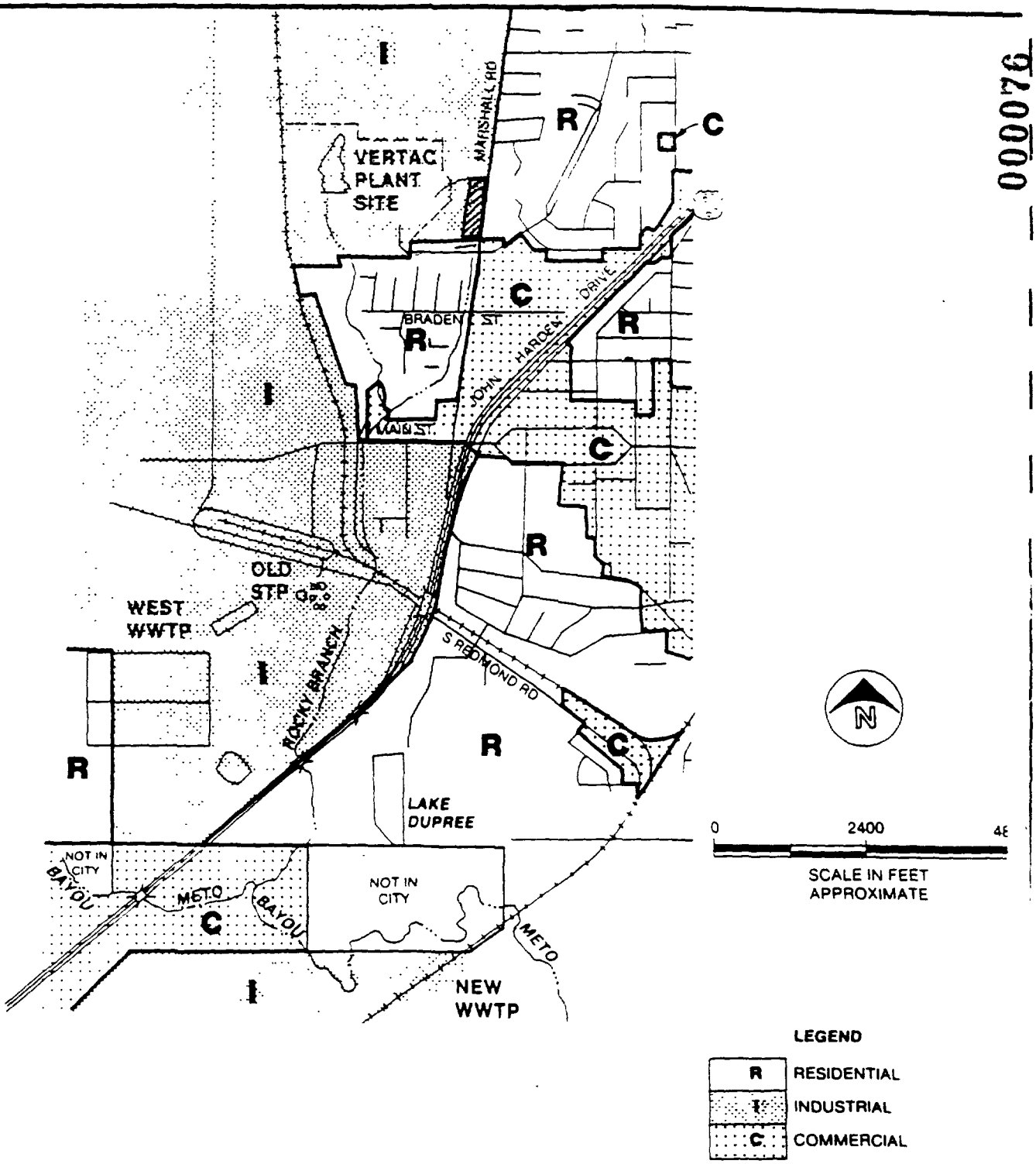


Figure 3

ZONING MAP
Vertac O: Site FS
Jacksonville, Arkansas

of the investigation area is either farmland, mainly irrigated rice fields in the area south of Jacksonville and Bayou Meto, woodlands, or residential. There is substantial suburban residential development on the strip of higher ground along Highway 161 and in the area north of Bayou Meto.

The investigation area is partly within and partly adjacent to the City of Jacksonville. The population growth of Jacksonville has been as follows: 1950 - 2,474; 1960 - 14,488, 1965 - 18,078; 1970 - 19,832; and 1980 - 26,788. The population in the area of investigation outside Jacksonville is estimated to be about 3,300.

GEOLOGY

The investigation area lies along the Fall Line, a boundary of major physiographic provinces in Arkansas. Northeast of the Fall Line, the Arkansas Valley Province generally consists of consolidated Paleozoic Era materials with recent alluvium in stream valleys. Southeast of the Fall Line are unconsolidated Quaternary sediments of the Mississippi Embayment.

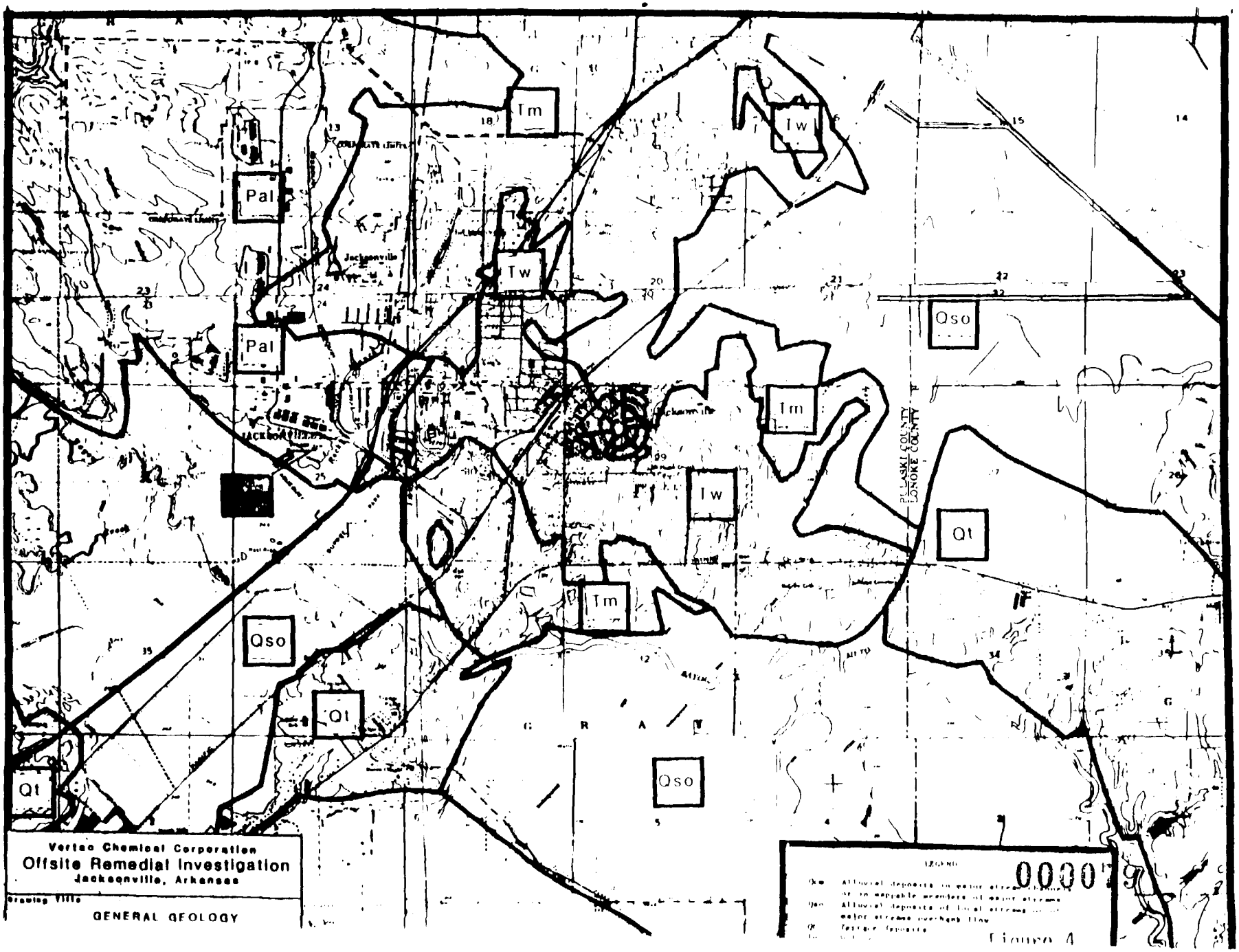
Table 1 presents a generalized geologic section of the investigation area. Figure 4 illustrates the general geology of the area. The central area of the City of Jacksonville lies on Wilcox Formation. Wilcox is made up of weathered brown shale, gray micaceous shale, gray and gray-green siltstones and clay, and thick sand beds. The general strike of Wilcox deposits is northeast-southwest, with a southeasterly dip at a rate of 20 to 50 feet per mile. Some of the thick sand beds make excellent aquifers.

Underlying the Wilcox and on the outskirts of the city is the Midway Formation. Most of the Vertac plant lies on Midway deposits. Midway is found throughout the Mississippi Embayment subsurface and outcrops along the Fall Line. In the Jacksonville area it lies unconformably on Paleozoic bedrock. In the study area, the Midway Group is undifferentiated, but in other locations it has been divided into two members. An upper member is blue-gray to dark gray, fissile, flaky shale, containing sideritic, concretionary layers. The lower member consists of soft gray, calcareous, fossiliferous shale with basal lenses of white limestone. Structurally, the strike of the Midway is northeast-southwest, with horizontal beds along the Fall Line. Under the embayment, beds dip slightly southeast. In the investigation area, the Midway Formation is not known to provide water for wells. The basal limestone and sandstone lenses furnish water to domestic wells southwest of Little Rock, however.

Outside Jacksonville to the south and east, and underlying approximately three-fourths of the study area are Quaternary

TABLE 1
Generalized Geologic Section in The Vertac, Inc. Study Area
(Adopted from Counts, H.B., 1957)

Era	System	Series	Subdivision	Thickness (feet)	Character of Materials	Water Supply
Cenozoic	Quaternary	Recent (?)	Alluvium	0-50	Clay, commonly red, in places gray; silt, generally sandy to gravelly.	Generally non-water-bearing. Locally domestic water supplies are obtained from basal part.
		Pleistocene (?)	Alluvium and terrace deposits	0-156	Sand and gravel in basal part, commonly overlain by fine sand, silt, and clay.	Basal part is most important aquifer in this area. Irrigation-well yields are as high as 2,000 gpm.
	Tertiary	Eocene	Wilcox formation	0-800	Clay, chocolate-brown or speckled light-gray and black; lignitic clay and lignitic fine sand.	Probably contains fresh water in narrow belt across area.
		Paleocene	Midway formation	0-500	Clay, dark-blue-gray to black, non-calcareous to very calcareous. A few very thin beds of white clay and dense fine-grained sandstone.	Generally non-water-bearing in this area.
Mesozoic	Cretaceous	Upper Cretaceous (Gulf)	Undifferentiated deposits	0-150	Sandstone, light-gray to white, fossiliferous, calcareous, glauconitic, overlain and underlain by sandy clay, shale, and marl.	Deeply buried where present and probably contains only salty water.
Paleozoic	Pennsylvanian	Atoka	Atoka formation	500?-1500?	Shale and sandstone interbedded. Sandstone generally tightly cemented. "Slate-rock" of drillers.	Water bearing only in area of outcrop. Locally contains small quantities of water in joints and other fractures, generally within 150 feet of the surface. Wells commonly yield 1-10 gpm.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PULASKI COUNTY
LONOKE COUNTY
Vertac Chemical Corporation
Offsite Remedial Investigation
Jacksonville, Arkansas
GENERAL GEOLOGY
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Figure 4

alluvial and terrace deposits of the Mississippi Embayment. These are Pleistocene Age deposits that are lithologically similar, overlain by fine sand, silt, and clay of recent age. The terrace deposits are on one or more terrace levels. Quaternary recent alluvium has been divided into two units on the basis of where the units are found:

- Deposits of local streams or of overbank flows of major streams (in some areas these include deposits in abandoned meanders of major streams);
- Deposits in major stream channels or in mappable meanders of major streams (in some areas these include alluvial deposits in natural levees).

These deposits can be further broken down into two distinct lithologic units:

- Surface or upper alluvium is predominantly clay or silt with basal sand and gravel;
- A lower alluvial unit consists of a coarse basal sand and gravel grading upwards to a fine sand, silt and clay.

The northwest part of the area of investigation is Atoka Formation. The Atoka Formation is the most commonly found surface formation in the Arkansas Valley and is thought to underlie most Mississippi Embayment sediments. A small portion of the Vertac plant lies on Atoka Formation. It outcrops along the Fall Line escarpment, or is often covered with a thin veneer of Quaternary recent deposits and soil. South of the Fall Line the Atoka dips steeply to the southeast. North of the Fall Line the formation is very thick, perhaps 7,000 to 9,000 feet, and thins rapidly to the east. Atoka Formation consists of gray to black, splintery, finely to coarsely textured micaceous shale containing lenses of white, tan, or gray siltstone and fine to medium grained shaly sandstone. The Lower Atoka member found in the study area may also be characterized by dark colored chert and an interval of medium to dark gray flaky shale.

Water is found in fractures in the rock, which become fewer and less open with depth. For this reason, water wells in the Atoka are shallow and rarely greater than 50 to 60 feet deep.

Isolated subsurface remnants of undifferentiated Cretaceous deposits are found near the Fall Line, though they do not outcrop in the investigation area. Hydrologically they are unimportant. Water found in them is often salty.

GROUNDWATER

In the investigation area, all rock formations are capable of containing groundwater. Figure 5 shows the local aquifers. In the relatively impermeable Atoka Formation rocks northwest of the Fall Line, most of the groundwater movement is through bedding planes and fractures. The unconsolidated rocks southeast of the Fall Line are more permeable, and so have greater quantities and higher rates of groundwater flow. In the area of investigation only the Wilcox and Quaternary formations can be considered aquifers.

Wilcox Aquifers

The Wilcox Formation provides two distinct aquifers. The Lower Wilcox aquifer is the most important. This aquifer can yield 500 gpm to 2,000 gpm in some places. It is utilized as a water source east of Jacksonville, but not in Jacksonville or the investigation area.

The other Wilcox aquifer is referred to as the Minor Wilcox aquifer. At this location the Wilcox can be considered a shallow aquifer. Throughout the rest of the area, however, where it underlies Quaternary alluvial and terrace deposits, it is considered a deep aquifer. Wilcox aquifers in the investigation area consist of thin sand beds interbedded with clay. The yield and chemical quality of water from Wilcox aquifers differs widely due to the discontinuous nature of the sand matrix.

Quaternary Aquifers

Quaternary aquifers are also found in alluvial and terrace deposits in the area of investigation. These are shallow aquifers and recharge is primarily by infiltration from precipitation. Substantial seasonal water level variations occur because the majority of wells in these aquifers are used for irrigation. During the summer growing season, water levels can drop 10 to 15 feet because of over-pumping. These aquifers are part of the Mississippi River Valley alluvial aquifer which extends 380 miles from north to south and covers most of the west side of the Mississippi Embayment.

Formerly, the Jacksonville municipal water source was from Quaternary alluvial aquifers. Currently, Jacksonville gets its water from sources outside the investigation area.

There are three categories of Quaternary alluvial aquifers in the investigation area: surface and lower alluvial aquifers, based on surface and lower lithologic units, and an alluvial aquifer in stream valleys overlying Atoka deposits. Except for

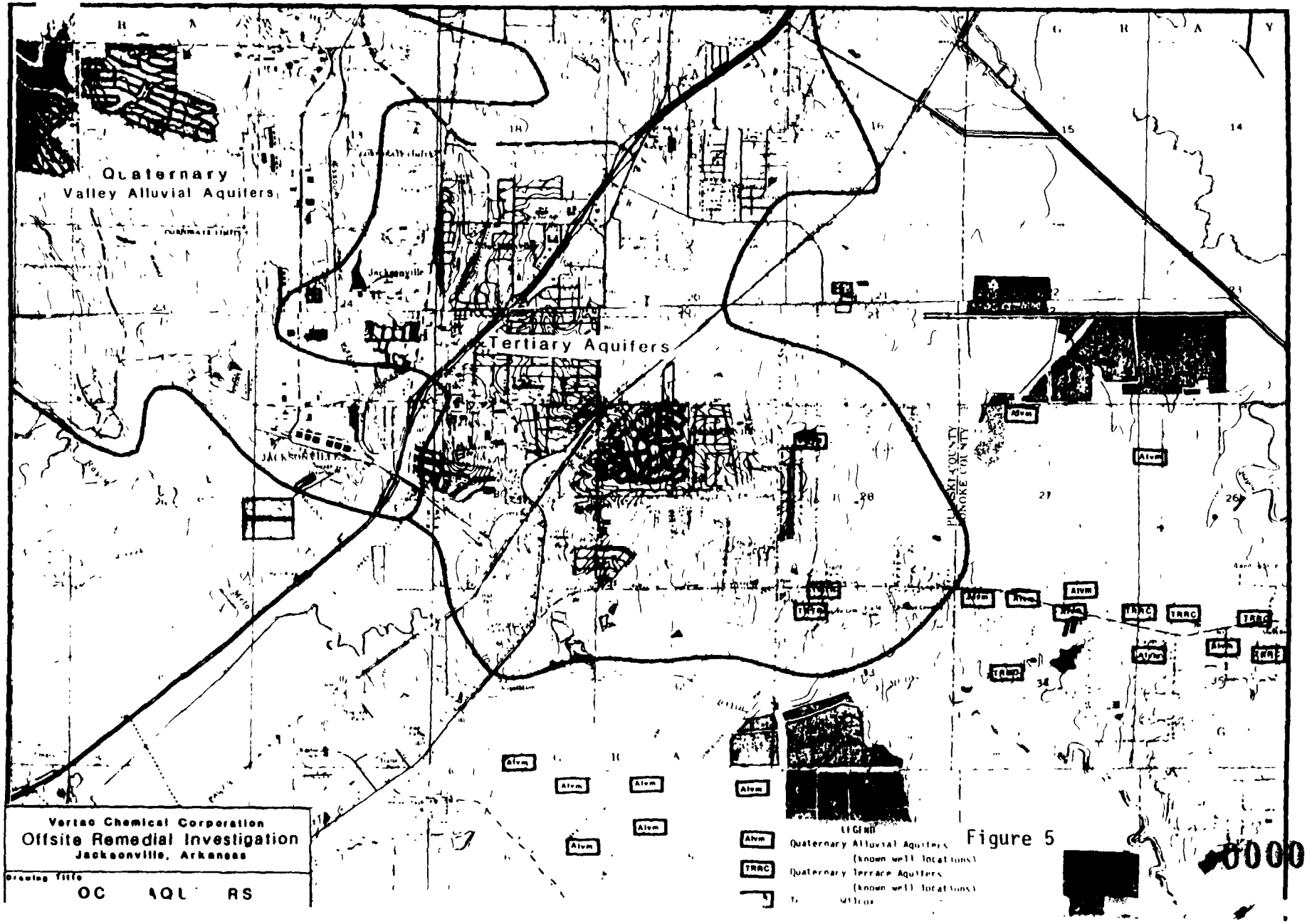

Quaternary
Valley Alluvial Aquifers
Tertiary Aquifers
PULASKI COUNTY
PERRY COUNTY
Alvm
TRRC
LEGEND
Quaternary Alluvial Aquifers
(known well locations)
Quaternary Terrace Aquifers
(known well locations)
Vertac Chemical Corporation
Offsite Remedial Investigation
Jacksonville, Arkansas
Drawing Title
OC AQL RS

Figure 5

low pumpage domestic wells, the surface aquifer is rarely used due to its low yield of less than 50 gpm. The lower alluvial aquifer constitutes the most important aquifer in the area, with yields similar to Wilcox, ranging from 500 gpm to 2,000 gpm. The alluvial aquifer in stream valleys overlying Atoka deposits exists in the northwest part of the area of investigation, but is not known to be used as a water source.

Major Quaternary water-bearing zones are generally confined, being overlain by sediments with lower permeability. Aquifer characteristics depend on the size and sorting of the host lithologic unit. Because these vary considerably from place to place, a quantitative statement on hydraulic characteristics cannot be made.

Quaternary alluvial water in the investigation area is typically of the calcium bicarbonate type. The calcium content ranges from 4 to 85 ppm; magnesium 1 to 21 ppm; sodium 3.4 to 20 ppm; and bicarbonate 15 to 282 ppm. Analysis of water from wells indicates that the water north of Bayou Meto is less hard and contains less calcium and dissolved solids than typical alluvial aquifer water. Most alluvial aquifers throughout the area have a high iron content, ranging from 0.12 to 6.8 ppm.

Other units in the area are the Atoka and Midway formations, and undifferentiated Cretaceous deposits. These do not yield sufficient water for domestic use, however.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

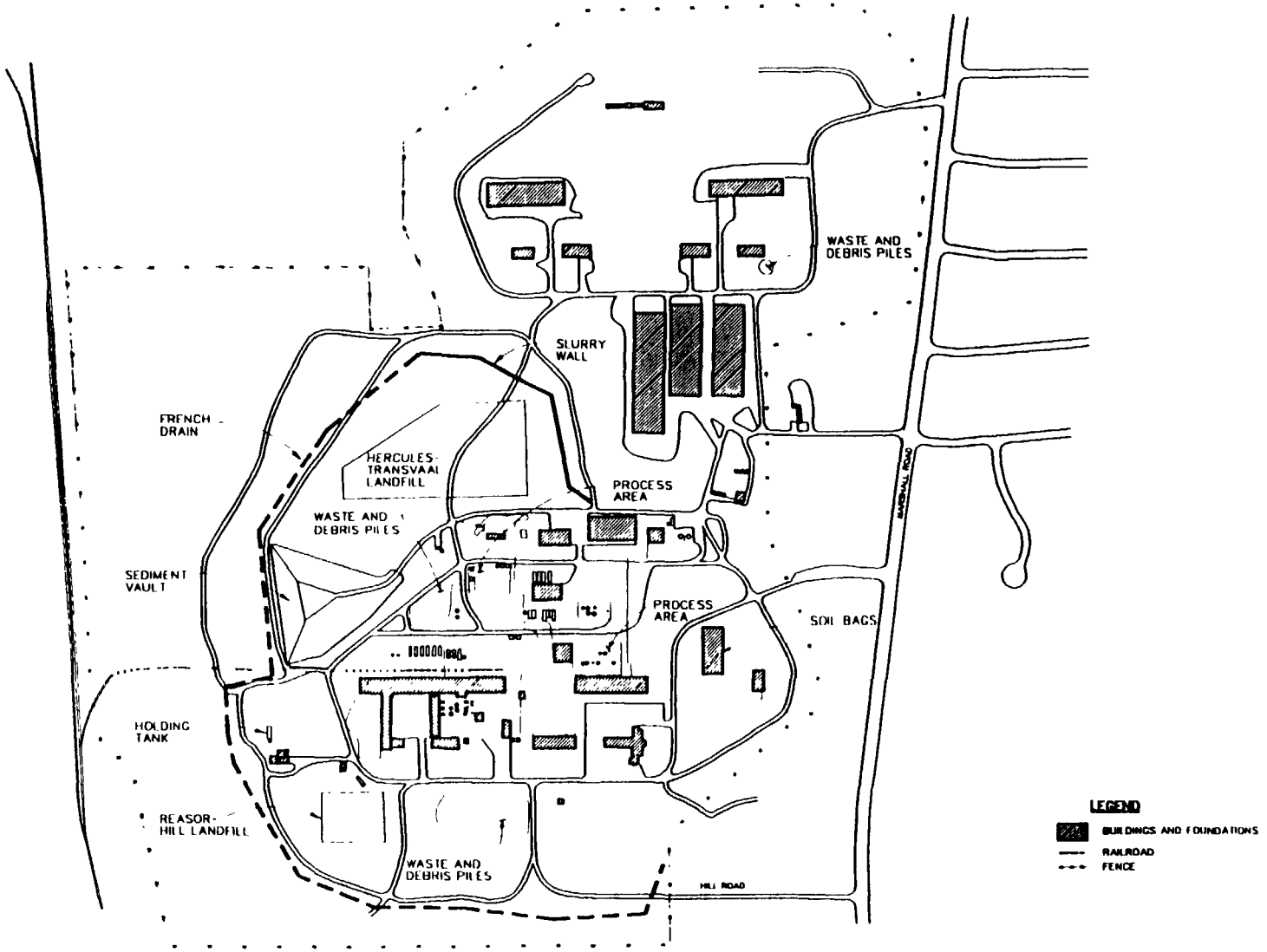
HISTORY OF THE VERTAC SITE

The Vertac plant was first used in the 1930's as the Arkansas Ordnance Plant, a federal government munitions factory (see Figure 6 for the plant's location.). In 1948, the Reasor-Hill Company purchased the site and built a plant to formulate insecticides and herbicides. At first, Reasor-Hill manufactured insecticides such as DDT, aldrin, dieldrin, and toxaphene. During the 1950's, Reasor-Hill began production of the herbicides 2,4-dichlorophenoxyacetic acid (2,4-D); 2,4,5-trichlorophenoxypropionic acid (2,4,5-TP or Silvex); and 2,4,5-trichloropehenoxyacetic acid (2,4,5-T). The dioxin compound 2,3,7,8-tetra-chlorodibenzo-p-dioxin (TCDD) is an impurity formed during the production of 2,4,5-T and is the major contaminant of concern at the site. During Reasor-Hill's operations, untreated process wastewater was discharged from the west end of the plant and channeled into Rocky Branch Creek. Rocky Branch Creek flows into Bayou Meto a few miles south of the site.

Jacksonville residents complained about odors from the Reasor-Hill discharge and about the quality of fish caught in the Bayou. In 1961, the City of Jacksonville's sewage treatment plant (referred to as the Old STP) was upgraded by adding a sludge digester, sludge-drying beds, and two 22-acre oxidation ponds. At that time, the city agreed to accept and treat wastes from the pesticide plant, and Reasor-Hill began discharging some of its process wastewater into the City of Jacksonville's sewage treatment plant.

In 1961, the Hercules Powder Company (now Hercules, Inc.) purchased the plant and continued to manufacture the same products. When Hercules purchased the site, drums containing organic wastes that had been stacked by Reasor-Hill northwest of the plant production area were buried there. The burial area became known as the Reasor-Hill landfill (see Fig. 6 for location).

In 1964, Hercules built a pretreatment facility consisting of equalization basins and neutralization systems. After complaints continued regarding water quality downstream of the Jacksonville sewage treatment plant, it was determined that the existing plant was overloaded. In 1969, Hercules and the City constructed a three-acre aerated lagoon upstream of the oxidation ponds, using a federal grant. After that time, all process wastewater from the plant was discharged into the Jacksonville wastewater treatment facilities.



SITE PLAN

Figure 6

VERTICAL PLANT SITE

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In 1964, Hercules began to treat its product using a solvent process. The process removed most of the dioxin from the product, resulting in contaminated liquid and solid waste residues. These contaminated still bottoms were pumped into drums and allowed to solidify. The drums were then buried in an area north of the plant production area. This area is commonly known as the Hercules-Transvaal landfill area (see Figure 6).

During 1967-68, Hercules produced "Agent Orange," a mixture of 2,4-D and 2,4,5-T, for the Department of Defense. Agent Orange was used as a defoliant in the jungles of Vietnam. A finding of possible teratogenic effects of Agent Orange by the National Cancer Institute resulted in a ban on the use of Agent Orange in Vietnam. Soon after the ban became effective, many other uses of 2,4,5-T were discontinued. Hercules then ceased operations at the Jacksonville plant.

From 1971-76, Hercules leased the plant to the Transvaal Corporation. Transvaal resumed production of 2,4-D and intermittently produced 2,4,5-T. In 1976, Transvaal purchased the property from Hercules. Transvaal buried toluene still bottom wastes in the Hercules-Transvaal landfill. However, in 1974 Transvaal discontinued burying these wastes and began storing drums of the waste above ground.

In 1978, Transvaal was reorganized through bankruptcy proceedings and the reorganized company, Vertac Chemical Corporation, operated the plant until 1987. When EPA banned most uses of 2,4,5-T in 1979, Vertac halted 2,4,5-T production. However, Vertac continued to produce 2,4-D, using the equipment previously used to formulate 2,4,5-T. Therefore, the 2,4-D waste may have been cross-contaminated with dioxin. In 1982, Vertac began recycling 2,4-D waste liquids and also reportedly eliminated the potential for cross-contamination by using new equipment. Vertac continued to accumulate drums of 2,4,5-T waste until 1979 and 2,4-D waste until 1987, when pesticide production at the site was discontinued.

In 1979, the Arkansas Department of Pollution Control and Ecology (ADPC&E) issued an order that required Vertac, Inc. to improve their hazardous waste practices, and in 1980 the U.S. Environmental Protection Agency (EPA) and ADPC&E jointly filed suit in federal district court against Vertac, Inc. and Hercules, Inc. A Consent Decree entered into by EPA, ADPC&E, Vertac, and Hercules in January 1982 required an independent consultant to assess the conditions of onsite wastes and to develop a proposed disposal method for the wastes. The proposal, called the "Vertac Remedy," was deemed by EPA to be unsatisfactory and EPA returned to court in early 1984 for a

resolution. The court decided in favor of the proposed remedy, which was implemented in the summer of 1984 and completed in July 1986.

As part of the remedy, the Vertac plant cooling water pond and the equalization basin were closed and sediments from these units were removed and placed in a sediment vault (shown on Figure 6). The burial area was capped and a French drain and leachate collection system were installed around the burial areas. Groundwater monitoring wells were also installed and a groundwater monitoring program was initiated. The remedy did not address: 1) 28,500 drums of still bottom wastes from the manufacturing process stored onsite or 2) contaminated process equipment, surface soils, and buildings.

Vertac abandoned the plant in February 1987. However, Hercules, Inc. remained onsite to operate and maintain the leachate collection system and treatment facilities. Since 1987, EPA and its contractors have made improvements to the site by repairing leaking tanks, constructing concrete storage buildings for drums, improving existing storage areas for drums, and overpacking leaking drums.

In 1989, ADPC&E signed a contract to have the 28,500 barrels of waste incinerated onsite. The State used funds from a trust fund that was established through litigation. Incineration of these wastes is scheduled to begin in Fall 1990.

HISTORY OF SITE INVESTIGATIONS

A great deal of data have been collected since the Vertac Plant was identified as a potentially hazardous site in 1978. These data have formed the basis for several reports covering onsite and off-site contamination, environmental conditions, groundwater, and geology. The major documents are listed in Table 2.

PRE-1985 REMEDIAL INVESTIGATION (RI) DATA

ADPC&E and EPA conducted preliminary environmental sampling for pesticide contamination in the Vertac off-site investigation area before the 1985 RI. This sampling occurred between June 1975 and May 1983. ADPC&E compiled the sampling results in their 1983 report. The pre-RI sampling was not conducted under rigorous field and laboratory quality control practices, and accurate records concerning sampling methods and locations are not available for all cases. Consequently, these data are of questionable quality. Subsequent data, described in the following discussions, are much more extensive and were collected, handled, and analyzed under strict data quality procedures. The data from more recent site investigations are

Table 2
Vertac Information Sources

Source	Description
Aerial reconnaissance of Vertac, Inc., Jacksonville, Arkansas; U.S. EPA, Las Vegas, Nevada, November-May 1979.	Historical photographs used to document changes at Vertac site and locations of spills and contamination.
Final Report for Environmental Assessment Study, Vertac Chemical Corp. Site, Jacksonville, Arkansas. Developers International Service Corp. (DISC), Memphis, Tennessee, October 1982.	Developed to satisfy the requirements of 1982 Consent Decree; contains assessment of onsite conditions.
Supplemental Report for Environmental *Assessment Study, Vertac Chemical Corp. Site, Jacksonville, Arkansas.* DISC, December 1982.	DISC response to EPA questions that followed review of previous DISC report. Includes results of recent testing and outlines proposed remedial measures.
Technical Report for Rocky Branch, Bayou Meto, and Lake DuPree. Environmental Toxicological Consultants, March 1983.	Summarizes off-site data collected since 1979 for the three water bodies. (Final report with recent sampling data published in late 1983.)
Summary of Technical Data, Jacksonville, Arkansas. Arkansas Department of Pollution Control and Ecology, no date (mid-1983).	Compiles data collected in conjunction with the Vertac Plant. Includes virtually all sampling data and excerpts of reports listed above.
Offsite Remedial Investigation Final Report. Prepared by CH2M HILL and Ecology and Environment for U.S. EPA Region 6, December 1, 1985.	Presents results of environmental sampling, plus special studies including delineating sonar survey, water use inventory, sewer lamping, and aquatic biota survey. Also, characterizes the off-site area and site history.
Vertac Off-site Endangerment Assessment, Final Report. Prepared by CH2M HILL for U.S. EPA Region 6, June 1986.	Evaluates potential for contaminant migration, exposure pathways and scenarios, and risks associated with off-site contamination.
Vertac Off-site Feasibility Study, Final Report. Prepared by CH2M HILL for U.S. EPA Region 6, June 1986.	Based on the 1985 RI. Includes an evaluation of alternatives for remediating potential hazards posed by off-site contamination. Identifies seven potential remedial alternatives.
Report on Fine Grid Sampling Plan (For TCDD and 2,3,7,8-TCDD). Prepared by IT Corporation for Hercules Inc., October 1988.	Summarizes off-site sampling results from 1988 sampling effort sponsored by Hercules Inc.
Vertac Chemical Plant Draft Report. Prepared by Jacobs Engineering Group Inc. for U.S. EPA Region 6, September 28, 1988.	Includes results of analysis of duplicate samples taken by IT Corporation.
TES IV Work Assignment #649-Vertac Soil Sampling. Prepared by Jacobs Engineering Group for U.S. EPA Region VI, June 1, 1989	Includes results of fine-grid and dust sampling.
Hercules/Vertac Off-site Study Final Report, May 1990	Includes results of 1987 Hercules-sponsored sampling.

assumed to best represent the nature and extent of contamination.

1985 OFF-SITE REMEDIAL INVESTIGATION

The RI for the Vertac off-site area was performed between the fall of 1983 and spring of 1985. The purpose was to determine if TCDD migrated beyond the plant site and, if it had, to identify contaminated areas.

Previous studies suggested that contamination in the investigation area would be concentrated in the sewage collection and treatment system and along the nearby watercourses (Rocky Branch Creek and Bayou Meto). TCDD is known to have an extremely low water solubility and a strong tendency to bind to soils or sediments. Therefore, the RI field work consisted of soil and sediment sampling and analysis, as well as a series of special investigations, including:

- A flood plain delineation study to estimate the amount of soil that may have been contaminated by flooding
- A sewer lamping study to estimate the amount of sediment in the sewage collection system
- A sonar survey to estimate the amount of sediment in the impoundments, including aeration basin and oxidation ponds
- An aquatic biota survey

The soil and sediment sampling results are tabulated in Volume II of the 1985 off-site RI report (EPA, December 1985). A total of 324 soil and sediment grab samples were collected during the RI and tested for TCDD. Of the 324 samples:

- 74 samples were taken in December 1983; 40 samples contained measurable quantities of TCDD
- 21 samples were taken in June 1984; one contained a measurable quantity of TCDD
- 225 samples were taken in August 1984; 79 contained measurable quantities of TCDD

TCDD method detection limits for these analyses generally were within the range of 0.01 to 1.0 ppb.

Groundwater sampling and analysis were not included in the study plan. EPA's decision to exclude groundwater sampling

was based on the low water solubility of TCDD and on the results of a limited testing of wells in the early stages of the RI, which showed no measurable TCDD in groundwater.

Air was considered a potential pathway of contaminant migration. Air monitoring off-site was not pursued because the area is heavily vegetated, minimizing airborne transport of soil and sediment.

Previous studies indicated the presence of contaminants other than TCDD in the investigation area, such as 2,4-D, 2,4,5-T, 2,4,5-TP, chlorinated benzenes, and chlorinated phenols. The RI concentrated on TCDD because it was determined to be the most hazardous contaminant in the area, and remediation for TCDD would likely remediate other contamination problems. Limited exploratory testing was performed for the other compounds. Elevated levels of chlorobenzenes, chlorophenols, and other contaminants were found principally in the sewage system, to a much lesser degree at surface locations near the Vertac Plant, and sporadically at locations distant from the plant in Rocky Branch Creek. Findings on these other contaminants appear consistent with the known tendency of these contaminants to degrade more readily than TCDD. In the areas where contaminants other than TCDD were found, TCDD was found at concentrations of greater concern than concentrations of the other contaminants. This supported the assumption that remediation for TCDD will also remediate other compounds.

1986 ENDANGERMENT ASSESSMENT

Based on the Remedial Investigation results, an endangerment assessment (EA) was performed in 1986 to evaluate the potential health and environmental effects if no remedial action is taken. Potential exposure pathways to contaminants include direct skin contact or ingestion of sediments or soils originating from the sewer system, sewage treatment plants, Rocky Branch, Bayou Meto, or the flood plains; inhalation of volatilized organics, if any, from contaminants in the sewer system, creek, or flood plain sediments or soils; ingestion of fish and other aquatic organisms from Rocky Branch or Bayou Meto; and ingestion of agricultural products that have been grown in contaminated soils.

1986 FEASIBILITY STUDY

The initial Feasibility Study was completed in June 1986. Several alternatives, including no action, onsite and offsite disposal, containment in place, and onsite or offsite incineration, were developed. A public meeting was held in Jacksonville on July 15, 1986, to explain the results of the Feasibility Study, answer questions, and accept comments. However, in October 1986, Congress passed the Superfund

Amendments and Reauthorization Act (SARA), which amended CERCLA and set new requirements for the Superfund RI/FS process. Because of this new development, the selection of a remedy was postponed.

POST-1985 RI DATA

Several sampling efforts have been conducted in the Vertac off-site area since 1985. A brief description of these sampling events is given below.

1. 1987 Hercules Grab Sampling. Samples were collected from many of the locations sampled in the 1985 RI studies. This investigation included:

   - o TCDD analysis of fish tissue from Lake DuPree
   - o TCDD and partial priority pollutant analysis of sediment samples from the West WWTP aeration basin and oxidation ponds, and TCDD analysis from areas in and around the Old STP and West WWTP
   - o TCDD analysis of soils and sediments from Rocky Branch Creek, Bayou Meto, and Lake DuPree, and land adjacent to Rocky Branch Creek and Bayou Meto

2. 1988 Hercules Fine-Grid Sampling. Soil and sediment samples were collected for TCDD analysis from the Rocky Branch Creek banks, the residentially-zoned flood plain immediately west of the east leg and immediately east of the west leg of Rocky Branch Creek, and the West WWTP facilities. Fish samples from Lake Dupree were also analyzed for TCDD. The results of this sampling effort are compiled in the Report on Fine Grid Sampling Plan (For TCDD and 2,3,7,8-TCDD), Volume I (Hercules Inc., October 1988).

3. 1988 EPA Fine-Grid Sampling. Soil samples were collected from the undeveloped residentially-zoned flood plain immediately west of the west leg of Rocky Branch Creek and south of the Vertac property. The samples were analyzed for TCDD.

4. 1989 EPA Fine-Grid Sampling. The extent of contamination was delineated by sampling areas surrounding the soil grids found to contain TCDD levels greater than 5.0 ppb in the 1988 EPA sampling effort.

5. Ongoing United States Fish and Wildlife Services (USFWS) Wood Duck Studies. The effect of contamination on wood duck reproduction is currently being studied.

REMOVAL ACTION BY HERCULES

In 1988, EPA signed an Administrative Order on Consent (AOC) with Hercules. The AOC required Hercules to remove soils from residential yards, South of Vertac plant, that were contaminated above 1 ppb TCDD. It also required Hercules to perform some onsite excavation and drainage control. Areas that were excavated are shown on Figure 8. Excavated soils were bagged and placed in a storage facility on the plant site. These bagged soils are being addressed as part of the onsite RI/FS.

1990 SUPPLEMENTAL FEASIBILITY STUDY

Several developments since the June 1986 report created a need to revise the 1986 Feasibility Study report. These developments included:

- Several major sampling efforts were conducted by Hercules, Inc. (one of the potentially responsible parties, or PRPs) and EPA that further defined the extent of offsite contamination by TCDD.

- The Agency for Toxic Substances and Disease Registry (ATSDR) and EPA have delineated TCDD remediation levels that are site-specific and area-specific.

- Remedial technologies that are potentially applicable to TCDD contamination, such as incineration, were further developed and evaluated.

- In October 1986, Congress passed the Superfund Amendments and Reauthorization Act (SARA), which amended CERCLA and set new requirements for the Superfund RI/FS process. Chief among these new requirements is the preference for remedial actions that (1) permanently reduce volume, toxicity, or mobility of hazardous substances and (2) meet Federal and State Requirements.

- Some remedial actions were taken in offsite areas at Vertac since 1986. Contractors for Hercules, Inc. removed some contaminated soils from developed residential areas in the Rocky Branch flood plain. Access to certain contaminated areas in the Rocky Branch flood plain was also restricted by fencing.

As a result of these developments, EPA revised the Feasibility Report in June 1990.

HISTORY OF ENFORCEMENT ACTIVITIES

A Potentially Responsible Party (PRP) search was not conducted since the Agency knew the identities of former owners, operators, and some generators of waste at the Vertac site, and since litigation was already going on prior to CERCLA activities. However, CERCLA Section 104(e) information request letters were mailed in March 1990 and later to several companies, some of which had "tolling agreements" with the Vertac Chemical Corporation and/or Hercules, Inc.

The following is a chronology of enforcement activity at the Vertac site:

1. Litigation was filed in 1980 under RCRA Section 7003 and other statutes by the United States and the State of Arkansas against Vertac Chemical Corp. and Hercules, Inc. (the "Parties"). In January 1982, EPA and the State of Arkansas entered into a Consent Decree with Vertac Chemical Corp. and Hercules, Inc. in the litigation for developing a remedial plan for certain onsite and off-site areas. After EPA invoked dispute resolution and a hearing on the remedy, the court ordered the implementation of "Vertac Remedy" in July 1984. (See Site History for a discussion of the action taken.)

2. On July 15, 1986, pursuant to an agreement between the parties and entered by the court, Vertac established a Trust Fund, as part of a bankruptcy agreement. Placed in this Fund were $6,700,000 and a $4,000,000 letter of credit to be used to remediate portions of the plant. Both EPA and the State of Arkansas have access to this fund, and it is being used to incinerate the 28,500 drums.

3. In August 1986, EPA issued a Unilateral Administrative Order to all PRP's to require posting of warning signs and the fencing of portions of the West Wastewater Treatment Plant and certain areas of Rocky Branch Creek. This work was performed by Hercules.

4. In January 1987 EPA issued a notice letter to Vertac Chemical Corp. that required Vertac Chemical Corp. to continue operation and maintenance of leachate collection and treatment system.

5. In June 1988 EPA signed an Administrative Order on Consent with Hercules to allow Hercules to implement fine grid sampling for off-site areas.

6. In September 1988 EPA signed an Administrative Order on Consent with Hercules that required Hercules to remove contaminated soils from residential yards.

7. In July 1989 EPA signed an Administrative Order on Consent with Hercules that required Hercules to conduct the onsite RI/FS.

8. In March 1990 EPA sent CERCLA Section 104(e) information request letters to several companies which had been involved in business deals with Vertac Chemical Corp. and Hercules, Inc., including "tolling agreements".

9. In July 1990 EPA sent General Notice letters to the PRP's regarding the proposed off-site remedial plan and other site actions.

10. A consent decree between the U.S. government and companies created from Vertac Chemical Corp. is currently pending before the court. These companies would contribute approximately $1,800,000 to the Trust Fund, plus a percentage of future profits over twelve years, in return for a release from liability.

11. In September 1990, Hercules, Inc. filed a motion in Federal court to stop EPA from selecting a remedy for the off-site areas. Hercules' position is that the entire Vertac facility and off-site areas are under the jurisdiction of the court, according to the 1982 consent decree. The U.S. government disagrees with this position, and the motion is still pending.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Community Relations Plan for the Vertac site was completed in 1983. This plan lists contacts and interested parties throughout government and the local community. It also establishes communication pathways to ensure timely dissemination of pertinent information. Numerous fact sheets, open houses and workshops have been conducted on the Vertac site. A satellite community relations office was established in Jacksonville in July 1990 to provide easy access to documents and information. The Supplemental Feasibility Study (SFS) and the Proposed Plan were released to the public in July 1990. These documents were made available at five local repositories. The Administrative Record is maintained at the City Hall. A public comment period was held from July 9 to September 7, 1990. In addition, an open house was held on July 12 and a public meeting on July 17 to present the results of the SFS and the proposed plan. All comments received by EPA prior to the end of the public comment period, including those expressed verbally at the public meeting, are addressed in the Responsiveness Summary section of this Record of Decision.

IV. SCOPE AND ROLE OF VERTAC OFF-SITE OPERABLE UNIT WITHIN SITE STRATEGY

Since the Vertac Superfund Site is a very large and complex site, the site is divided into the following operable units:

1. "Vertac Remedy". As required by the 1984 Consent Decree, the Vertac plant cooling water pond and the equalization basin were closed and sediments from these units were removed and placed in a sediment vault. The burial areas were capped and a French drain and leachate collection system were installed around the burial areas. Groundwater monitoring wells were also installed and a groundwater monitoring program was initiated.

2. Vertac Off-Site. This Record of Decision addresses the clean-up of the off-site areas that were contaminated as a result of untreated and partially treated surface and underground (city sewer) discharges of waste water from the plant.

3. Drummed Wastes Incineration. When Vertac abandoned the plant in 1987, approximately 28,500 drums of 2,4-D and 2,4,5-T wastes (mostly still bottoms) were left onsite. In 1989, ADPC&E signed a contract to have these drummed wastes incinerated onsite. EPA will provide incineration support, and has performed an engineering analysis/cost evaluation for incineration support. Incineration of these wastes is scheduled to begin in Fall 1990.

4. Onsite Operable Unit #1. In July 1989, Hercules, Inc. (a Potentially Responsible Party or PRP) signed an Administrative Order on Consent (AOC) with EPA to conduct a Remedial Investigation/Feasibility Study (RI/FS) for all above-ground items, such as buildings, process equipment, tanks and their contents, shredded trash and pallets, bagged soils (removed from dioxin contaminated residential yards). This RI/FS is scheduled for completion in late 1990.

5. Onsite Operable Unit #2. This operable unit addresses surface and subsurface soils, underground storage tanks and piping and groundwater. Hercules is conducting an RI/FS for this operable unit under the terms of the above-mentioned AOC and this RI/FS is scheduled for completion by March 1992.

The Vertac Off-Site Operable Unit RI/FS and this Record of Decision address the areas described below. Figure 7 shows the

study area. No further remedial actions are expected to be necessary for off-site areas following the implementation of the selected remedy.

- Wastewater Collection Lines. Included are approximately 10,350 linear feet of the active Rocky Branch Creek interceptor collection system and approximately 4,350 linear feet of the abandoned Rocky Branch Creek interceptor collection system.

- Old (Abandoned) Sewage Treatment Plant. Included are treatment units (clarifiers, trickling filters, sludge digester, sludge drying beds) and surrounding plant surficial soils.

- West Wastewater Treatment Plant. Included are a three-acre aeration basin and two 22-acre oxidation ponds.

- Rocky Branch Creek and Bayou Meto Flood Plain.

- Rocky Branch Creek and Bayou Meto Stream Sediments.

The following are not included in the scope of this study:

- Groundwater. Potential groundwater contamination was not included in the 1986 Off-site FS or the 1990 supplemental FS. Potential groundwater contamination is being addressed as part of the Onsite RI/FS. Groundwater contamination found to have migrated beyond the Vertac plant site will be investigated as part of the onsite investigation.

- Non-TCDD Contaminants. Previous studies indicated contaminants other than TCDD exist in the investigation areas, such as 2,4-D, 2,4,5-T, 2,4,5-TP, chlorinated benzenes, and chlorinated phenols. The 1985 RI and recent site investigations have concentrated on TCDD because it is considered the most hazardous contaminant in the area, and remediation for TCDD is presumed to remediate most other contamination problems.

- Bagged Onsite Soils. Soils removed from residential properties and excavated onsite soils currently stored in bags on the plant site are not within the scope of the Off-site FS. These bagged soils will be addressed during the Onsite RI/FS.

V. SUMMARY OF SITE CHARACTERISTICS

The Vertac off-site investigation area is shown in Figure 2. Surface runoff from the Vertac Plant site flows into Rocky Branch Creek, which flows into Bayou Meto, a larger watercourse that flows into the Arkansas River. Currently, Hercules operates an onsite system that collects and treats initial site runoff prior to discharge to Rocky Branch Creek. The treatment system consists of pH reduction, filtration, carbon adsorption, and pH neutralization. This system treats collected liquids from the French drain system as well as surface runoff to less than 1 ppb TCDD. Four sumps, with a total capacity of over 6,000 gallons, are used to collect initial site runoff for treatment.

The pesticide plant and adjacent residential, commercial, and industrial areas are served by a sanitary and storm sewerage system. Wastewater from these areas in the city and treated effluent from Vertac French drains are now conveyed directly to the aeration basin and treatment occurs in the aeration basin and oxidation ponds, collectively referred to as the West Wastewater Treatment Plant. Adjacent to the West plant is the abandoned or "Old" Sewage Treatment Plant that consists of sludge drying beds, two primary clarifiers, two trickling filters, two secondary clarifiers, and a sludge digester.

A new EPA-funded wastewater treatment plant has been constructed for the City of Jacksonville (see Figure 2). This facility treats Jacksonville municipal wastewater and is intended to treat sewage currently conveyed to the West WWTP. However, the federal construction grant for the new plant stipulates that the new plant not receive TCDD-contaminated waste. Therefore, before the collection lines serving residences south of the Vertac Plant site can be connected to the new wastewater treatment plant, the lines must be cleaned or replaced.

SOURCES OF OFF-SITE CONTAMINATION

Off-site contamination is the result of 1) direct discharges of process wastewater to Rocky Branch Creek; 2) discharge of pretreated process wastewater to the city sewer; and 3) stormwater runoff from Vertac plant site.

Release of TCDD-contaminants to off-site areas probably dates back to 1948, when pesticide production began, and became more substantial during the production of Agent Orange in the 1960's.

The Arkansas Ordnance Plant sewer lines were constructed in 1941 and were in operation when Reasor-Hill purchased the

plant. During the Reasor-Hill period, it is likely that pesticide wastes were continuously discharged into the sewer lines and into Rocky Branch Creek. Stormwater runoff and flooding probably contributed to the migration of contaminants from the Vertac Plant site to off-site areas.

It is likely that, prior to 1961, operational problems in the Old STP were caused by discharges from the pesticide plant, which did not have arrangements to treat pesticide wastes. A process waste outfall line was constructed in 1961 to convey plant wastes to the Rocky Branch Creek interceptor, the main line of the area's sewage collection system. Pretreatment of the process waste consisted only of pH neutralization and stabilization. However, other sewer lines existed between the Arkansas Ordnance Plant and the Rocky Branch Creek interceptor, and some plant wastes may have entered the sewer system through these lines before and after the construction of the process waste outfall.

Before arrangements were made to treat pesticide plant waste, commercial fishermen and residents along Bayou Meto frequently complained of odors in the Bayou, odd odors and tastes in fish, and occasional fish kills. After the Old STP began accepting the plant waste for treatment, the complaints continued but were fewer. As a result of the complaints, the Arkansas Pollution Control Commission conducted a special survey in the upper Bayou Meto basin in the first half of 1967. The study linked the problem with high 5-day biochemical oxygen demand (BOD) loading and ineffective phenolics removal in the sewage treatment system.

Since 1969, process wastewater from the Vertac Plant site was conveyed via the sewage collection lines to the aeration basin/oxidation ponds complex known as the West WWTP. Currently, the West WWTP receives sanitary sewage from residential and commercial areas and treated effluent from the onsite leachate collection and treatment system.

Because treated leachate and sanitary sewage are the only discharges from the plant, and because the initial site runoff is collected from a series of sumps and treated, no additional contamination is believed to be migrating from the Vertac plant facility to the off-site areas.

EXTENT OF CONTAMINATION

Figure 7 is a base map showing all areas sampled during the investigations referenced above. Data on TCDD concentrations in the off-site areas are available from several investigations. These areas are enlarged in Figures 8 through 14, which summarize the most recent TCDD sampling data available for the Vertac off-site investigation area.

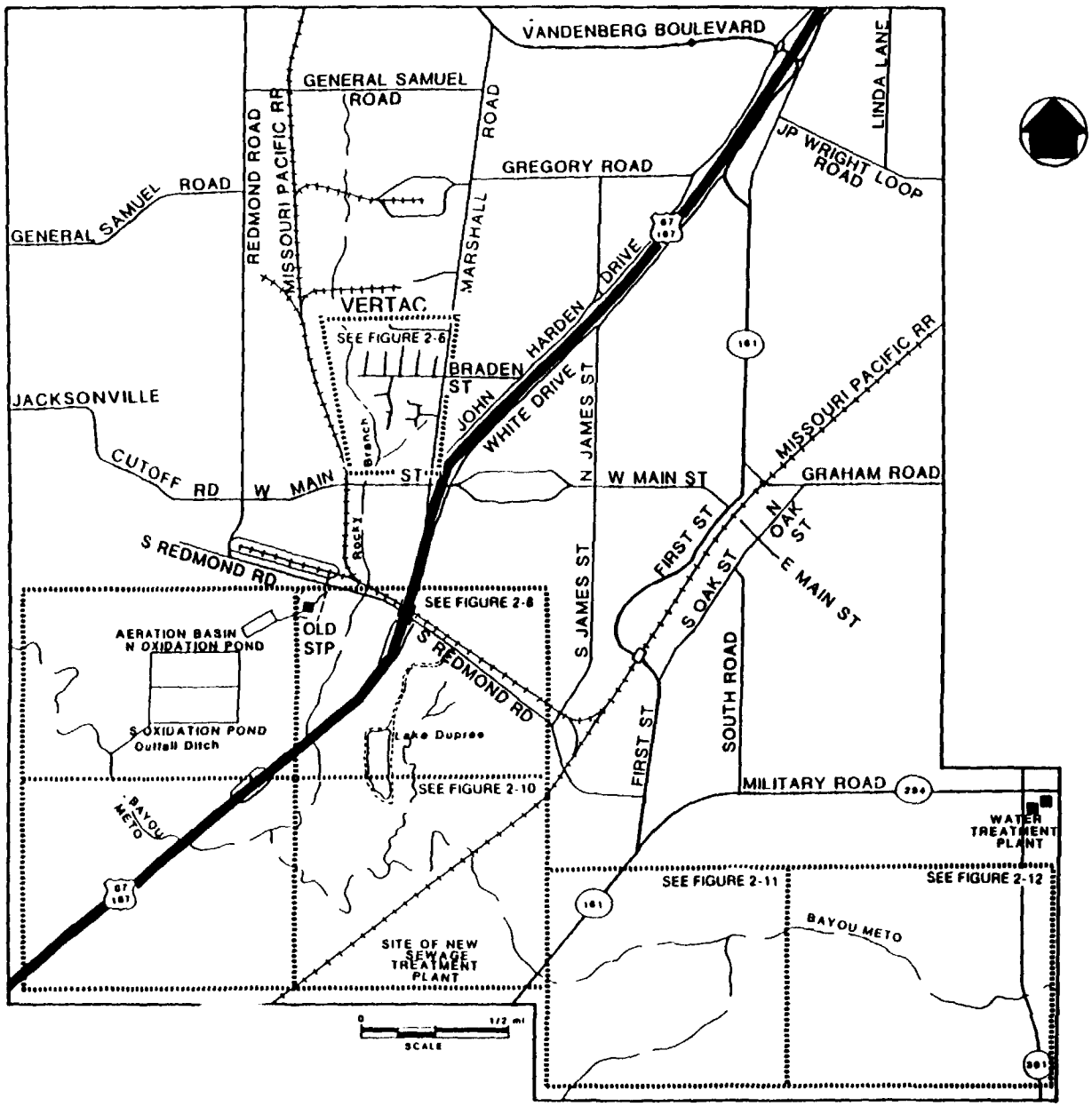
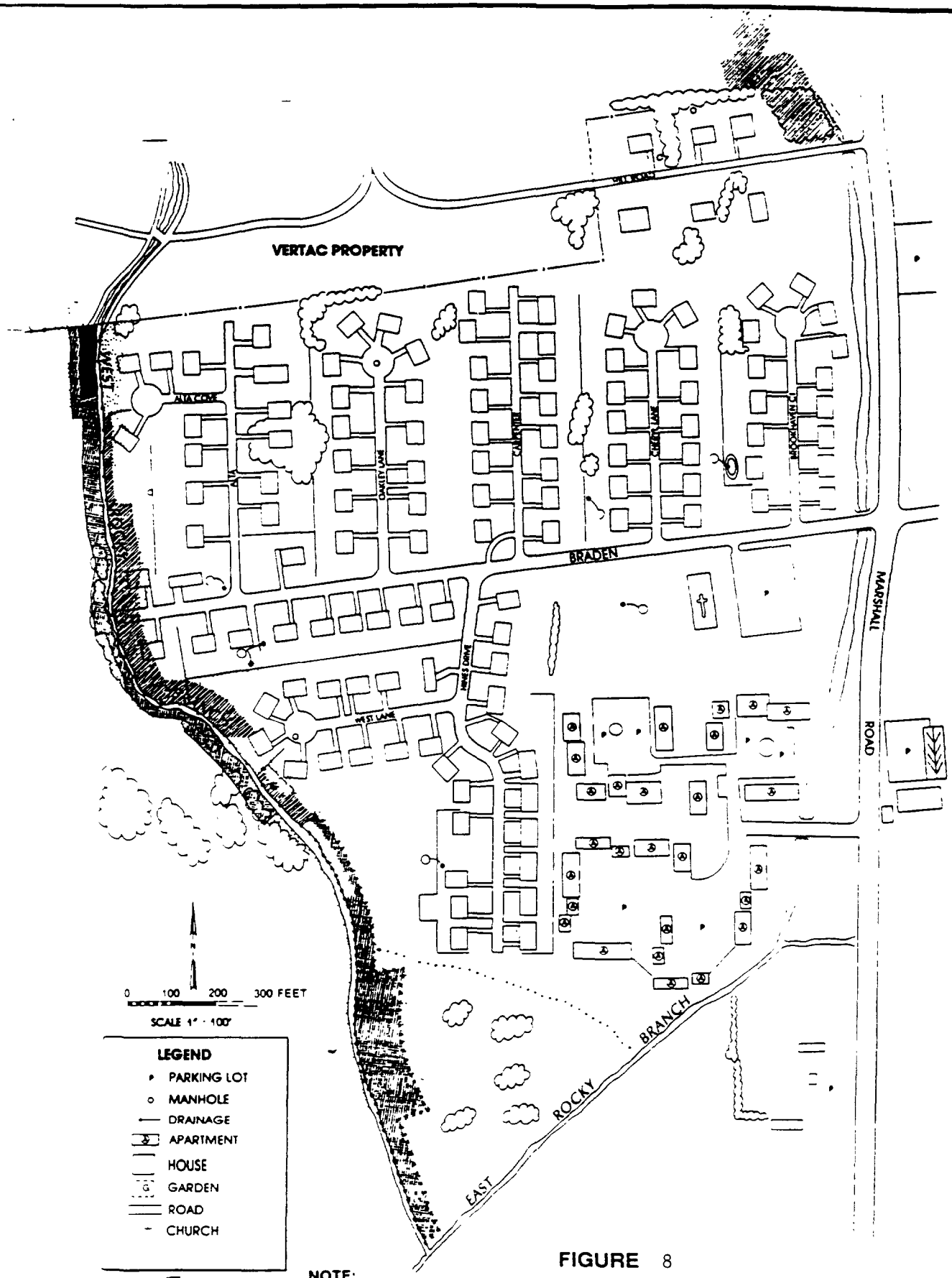


FIGURE 7

AREAS SAMPLED IN RECENT INVESTIGATIONS

Vertac Off-Site FS
Jacksonville, Arkansas



NOTE:
AVERAGE OF COMPOSITE SAMPLES WAS IN RANGE SHOWN.
BASED ON 1988 HERCULES AND 1988 AND 1989 EPA FINE GRID SAMPLING.

FIGURE 8

TCDD LEVELS MEASURED IN THE RESIDENTIAL AREA SOUTH OF THE VERTAC PLANT SITE

Vertac Off-Site FS
Jacksonville Arkansas

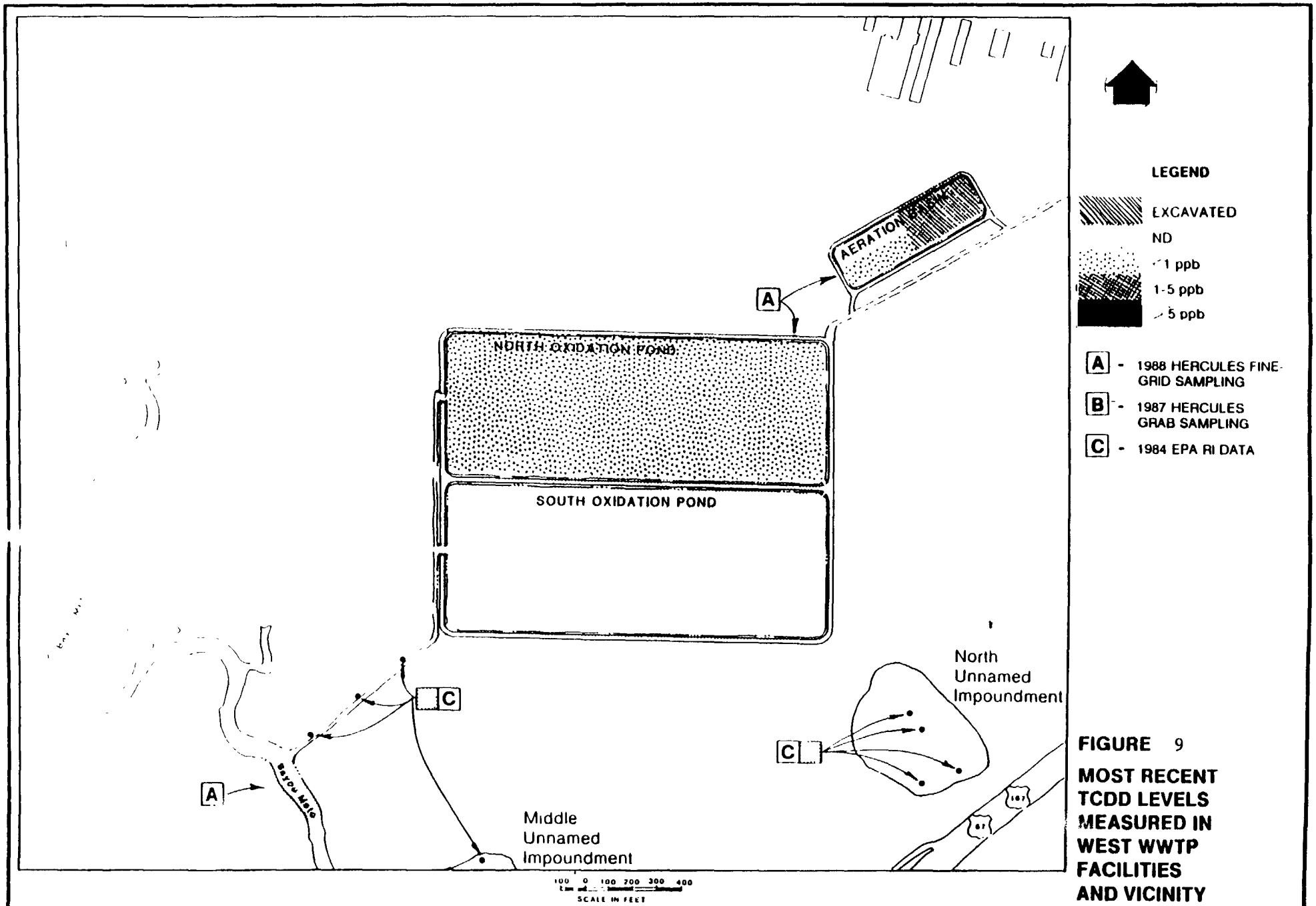


FIGURE 9

MOST RECENT TCDD LEVELS MEASURED IN WEST WWTP FACILITIES AND VICINITY

Vertac Off-Site FS
Jacksonville, Arkansas

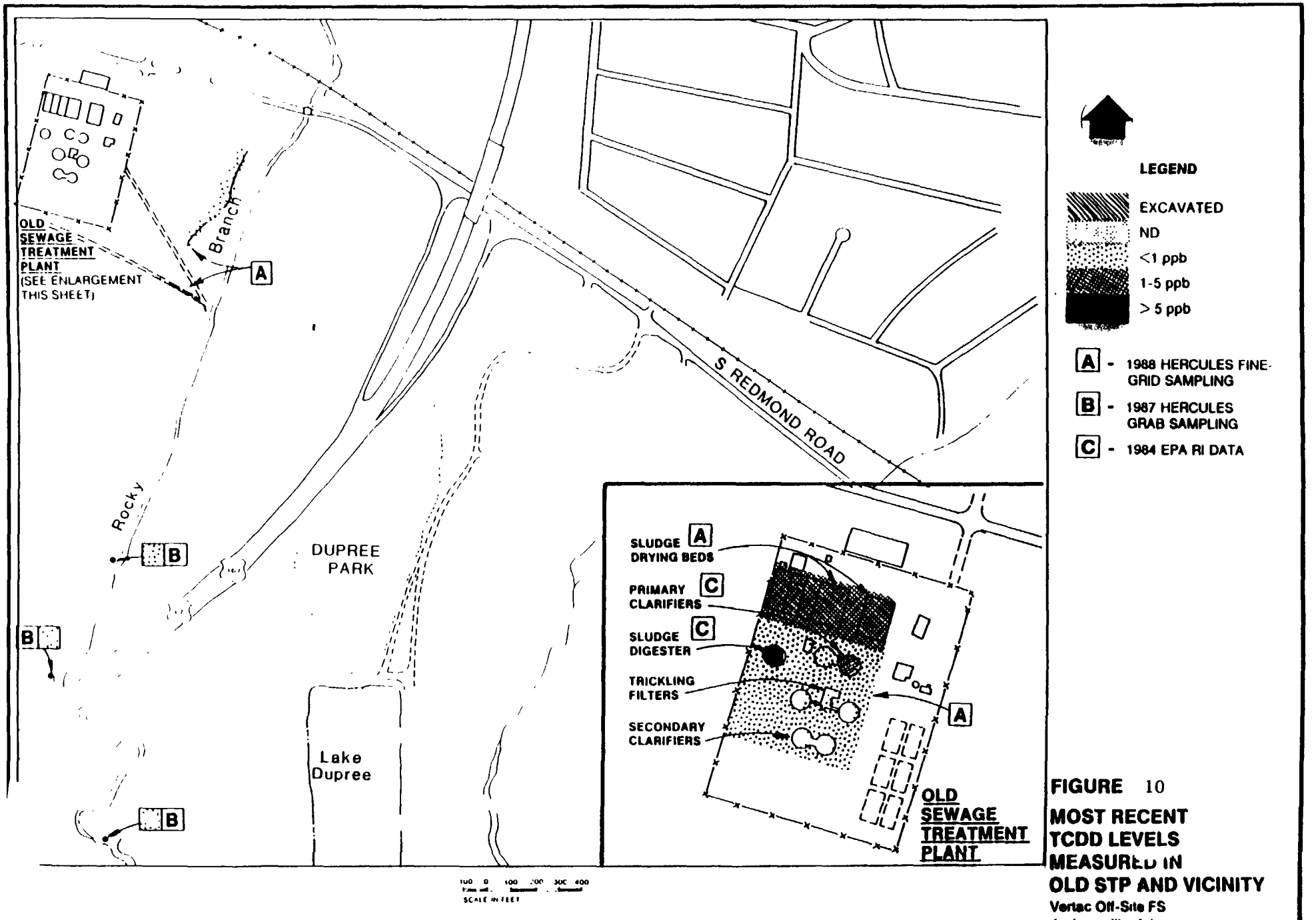


FIGURE 10

MOST RECENT TCDD LEVELS MEASURED IN OLD STP AND VICINITY

Vertac Off-Site FS
Jacksonville, Arkansas

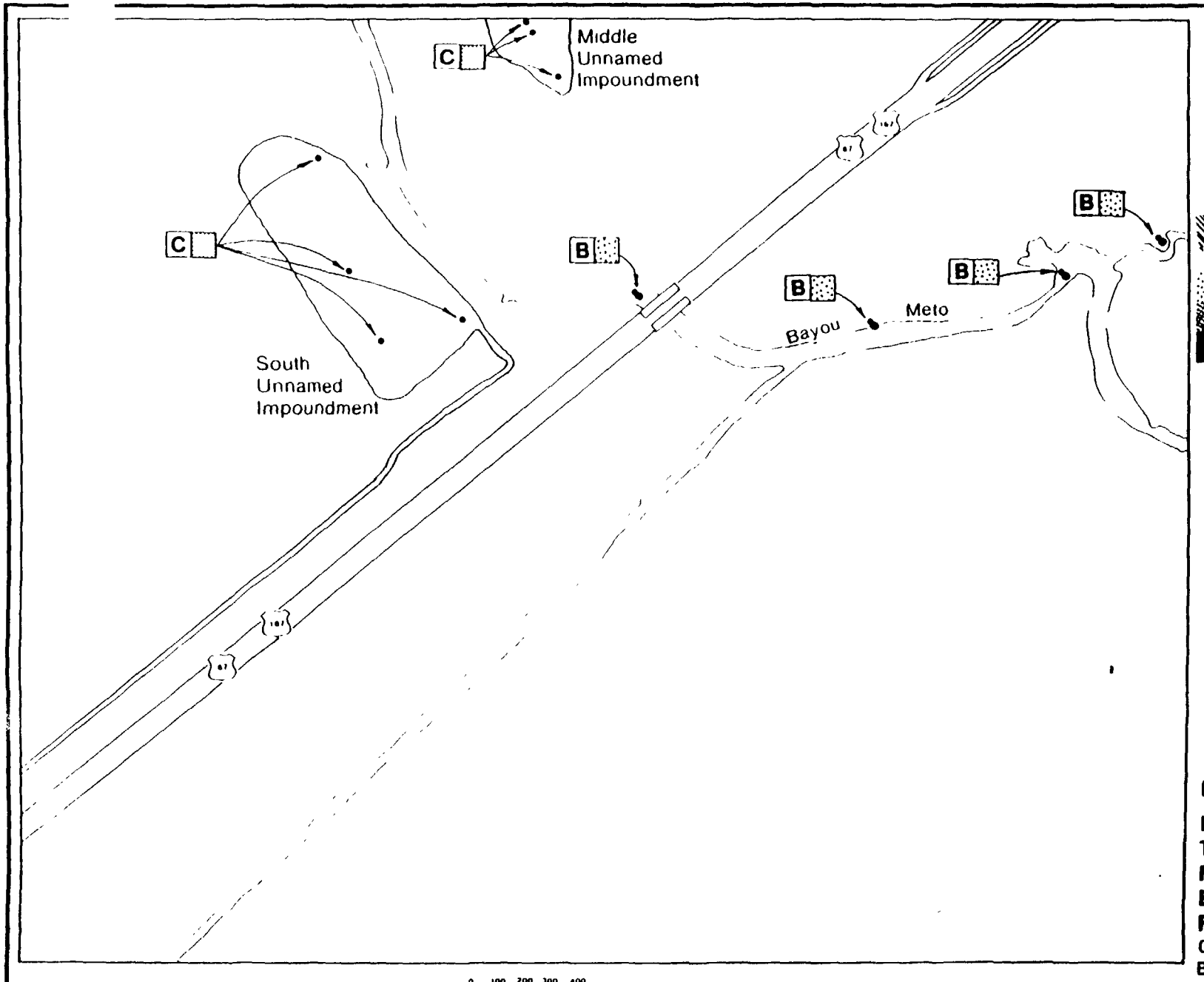


FIGURE 11

MOST RECENT TCDD LEVELS MEASURED IN BAYOU METO AND FLOOD PLAIN

0.1 TO 0.88 RIVER MILES BELOW WEST WWTP OUTFALL

Vertac Off-Site FS
Jacksonville, Arkansas

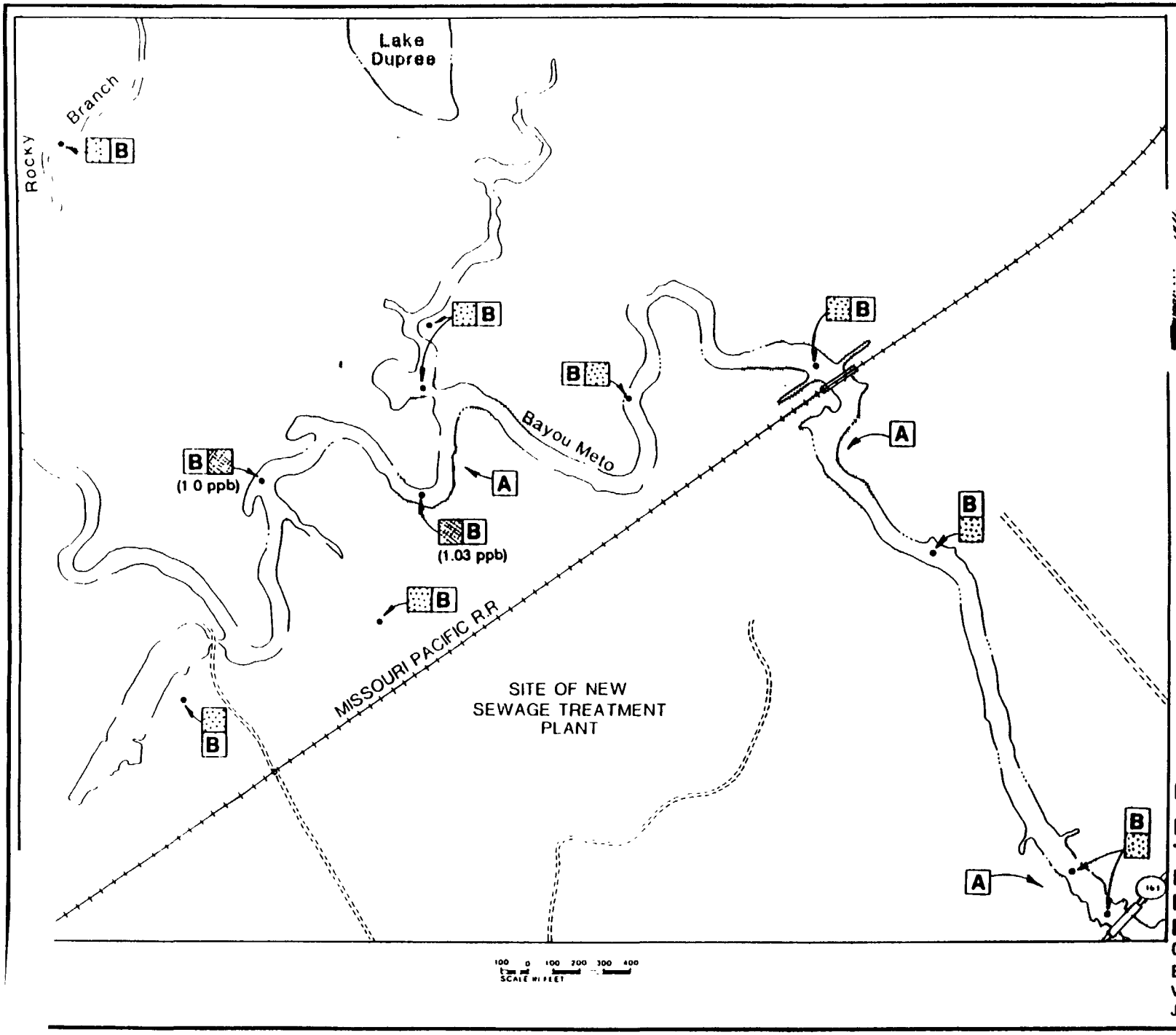


FIGURE 12

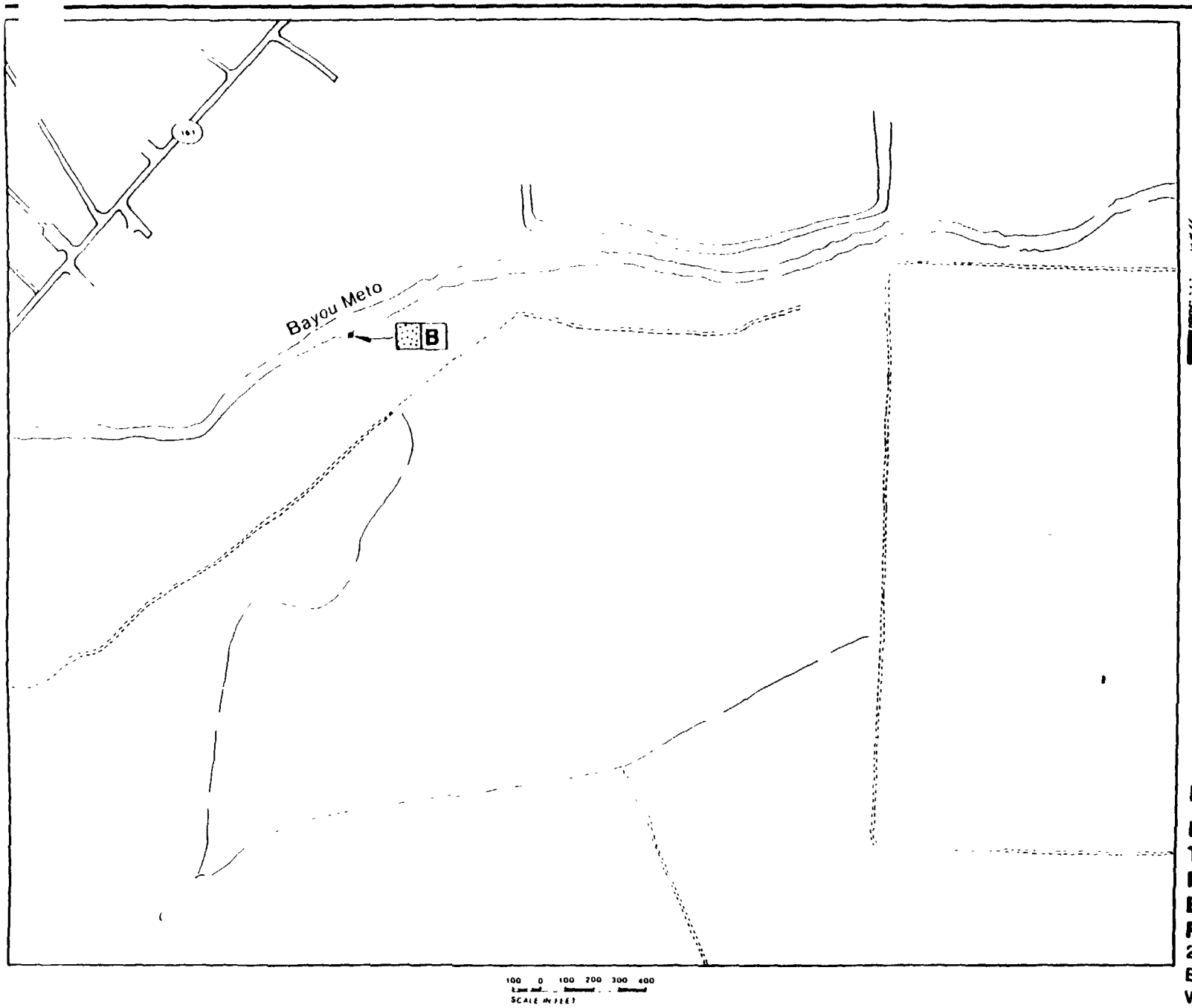
MOST RECENT TCDD LEVELS MEASURED IN BAYOU METO AND FLOOD PLAIN

0.88 TO 2.40 RIVER MILES BELOW WWTP OUTFALL

Vertac Off-Site FS

Jacksonville, Arkansas

000105



LEGEND

- EXCAVATED
- ND
- <1 ppb
- 1-5 ppb
- > 5 ppb

A - 1988 HERCULES FINE-GRID SAMPLING

B - 1987 HERCULES GRAB SAMPLING

C - 1984 EPA RI DATA

FIGURE 13

MOST RECENT TCDD LEVELS MEASURED IN BAYOU METO AND FLOOD PLAIN

2.40 TO 3.23 RIVER MILES BELOW WEST WWTP OUTFALL

Vertac Off-Site FS
Jacksonville, Arkansas

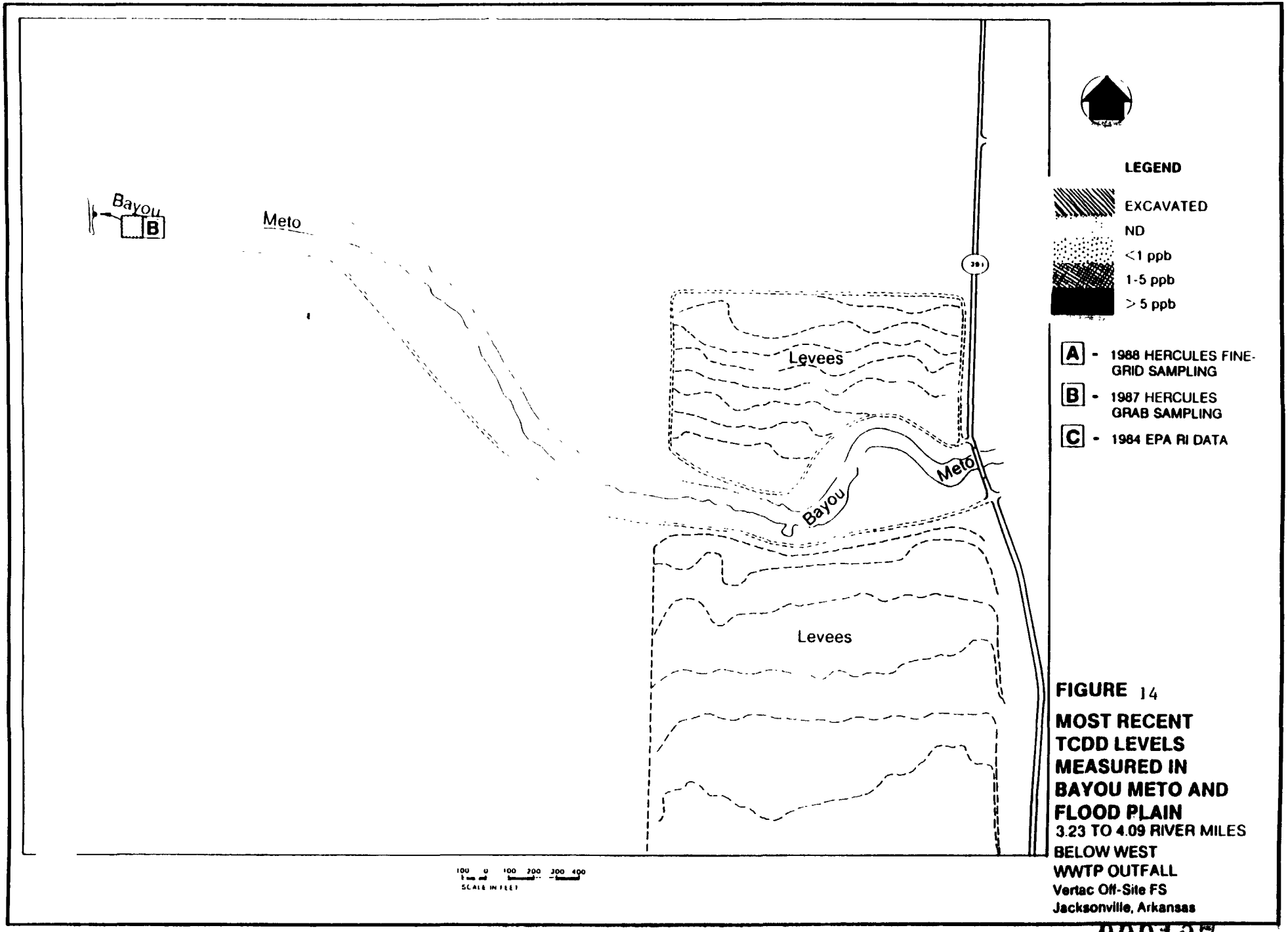


FIGURE 14

MOST RECENT TCDD LEVELS MEASURED IN BAYOU METO AND FLOOD PLAIN

3.23 TO 4.09 RIVER MILES BELOW WEST WWTP OUTFALL

Vertac Off-Site FS

Jacksonville, Arkansas

Different investigations and the resultant data vary with respect to time, sampling protocols, and quality assurance/quality control (QA/QC) procedures. This is discussed further in the subsequent data comparison section.

Figure 8 presents the sampling results for the floodplains immediately south of the Vertac plant site. This data represents fine grid sampling conducted by EPA in 1988 and Hercules in 1988-89. This land south of the Vertac Plant site is zoned for residential use. This figure shows where soil containing TCDD concentrations above the 1.0 ppb action level has already been excavated from currently developed residential areas. These soils were placed in bags and temporarily stored on the Vertac Plant site. However, there is still soil with TCDD levels greater than 1.0 ppb in undeveloped portions of this residentially-zoned area. A strip of land along the west flood plain of the west leg of Rocky Branch Creek contains TCDD concentrations between 1.0 and 5.0 ppb (Figure 8). In addition, the sections immediately south of the Vertac property in the same flood plain area contained greater than 5.0 ppb (maximum of 9.65 ppb) TCDD (Figure 8).

The land east of the west leg of Rocky Branch Creek north of the confluence with the east leg also contains TCDD levels between 1.0 and 5.0 ppb (Figure 8). The wide section of elevated contamination in the middle of this parcel of land encompasses the location of former creek meanders. Hercules Inc. has purchased this property and fenced the area to restrict access.

Other than the areas mentioned above, sampling has shown that the remaining soil within the Rocky Branch Creek flood plain residential area contains TCDD concentrations lower than the 1.0 ppb action level.

Figure 9 presents the results of sampling of the West WWTP facilities. This sampling was performed in both 1984 and 1988. As the figure indicates, only the eastern half of the aeration basin sediments contained TCDD levels greater than 1.0 ppb. Composite sample concentrations were 2.83 ppb in the southeast quadrant and 1.41 ppb in the northeast quadrant of the aeration basin. The most recent sampling of the western half of the aeration basin, the north and south oxidation ponds, the outfall ditch, and the outfall delta sediments in Bayou Meto found TCDD levels that were less than 1.0 ppb or nondetectable (Figure 9).

The old STP facility was sampled as shown on Figure 10. A composite sample of the sludge-drying beds contained 2.79 ppb TCDD. A composite sample of the soil surrounding the sludge beds contained 1.01 ppb TCDD. The soil surrounding the other

facilities of the Old STP contained less than 1.0 ppb of TCDD. The contents of the treatment units have not been sampled since 1984. At that time, the sludge in the digester contained a maximum of 12.46 ppb TCDD, the east primary clarifier contained 1.62 ppb TCDD, and the west primary clarifier contained 0.23 ppb TCDD. The trickling filters and the secondary clarifiers were not sampled. However, because the trickling filter and secondary clarifiers receive sewage already treated in the primary clarifiers, it is highly likely that any contamination in these units will be less than that in the primary clarifiers.

Figures 10 through 14 show that the most recent samples of the Bayou Meto flood plain and the Rocky Branch Creek flood plain downstream from the Old STP contained TCDD concentrations lower than 1.0 ppb.

The sewer collection line sediments were sampled only in 1984. The 1984 data are shown in Figure 15. At that time, the sediments in the active sewer line contained a maximum concentration in excess of 200 ppb TCDD. The abandoned Rocky Branch Creek interceptor contained a maximum sediment concentration of 70.5 ppb TCDD.

Rocky Branch Creek and Bayou Meto sediments have been sampled in 1984, 1987, and 1988. Figures 9-12 show the most recent sediment data. Three additional samples were taken in Rocky Branch Creek but are not shown on these figures. One was taken at the Vertac plant boundary in the west leg, one was taken near the plant boundary in the east leg, and the third was taken at the confluence of the two legs. Figure 12 shows that two sediment samples from Bayou Meto contained TCDD concentrations between 1.0 and 5.0 ppb. It should be noted that the actual concentrations in these samples were 1.0 and 1.03 ppb. All other samples were below 1.0 ppb.

DATA COMPARISON

Sampling Techniques and Locations

The 1985 RI report presented TCDD data for grab samples collected from the soils, sediments, and sludges from the wastewater collection and treatment system, flood plains, Rocky Branch Creek, and Bayou Meto. Most samples were collected in 1984. In 1987, Hercules Inc. sponsored a sampling effort designed to be comparable to the 1985 RI data. The 1987 effort consisted of grab samples collected from approximately the same locations and depths as in 1984. Soils/sediments were sampled at three-inch intervals down to 30 inches.

Sampling techniques changed considerably in 1988. Hercules sponsored another sampling effort, and IT Corporation

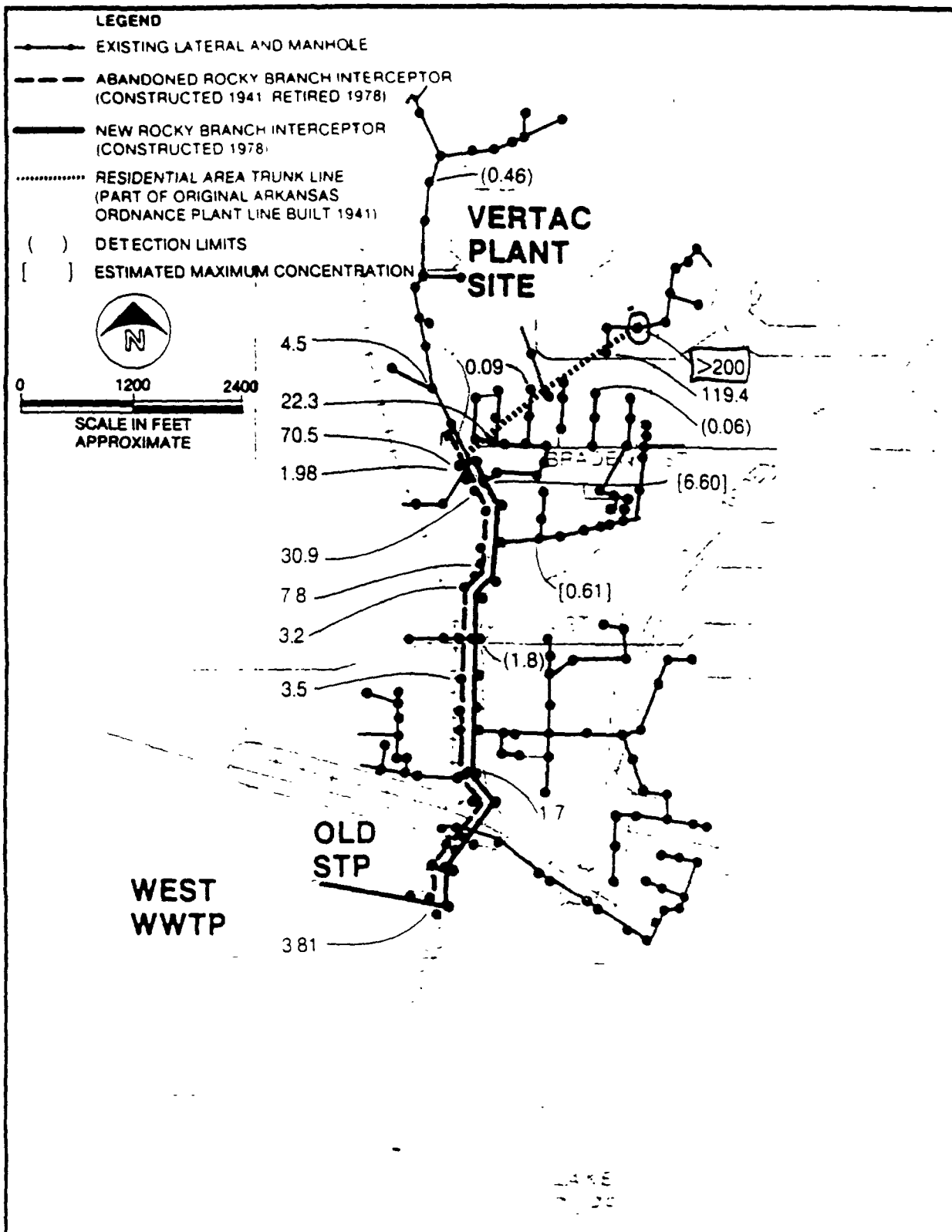


FIGURE 15

1984 TCDD LEVELS (ppb) I SEWAGE COLLECTION LIN

Vertac Off-Site FS
Jacksonville, Arkansas

(Hercules' contractor) sampled soils and sediments using grid sampling. In the grid sampling, aliquots of soil or sediment were collected from locations spaced 10 feet apart within a defined area (grid) not larger than 5,000 square feet. The individual aliquots were then composited for analysis. Soil and sediment samples were taken from 0 to 3 inches deep. Creek banks were sampled at distances of 6, 36, and 60 inches from the water line. Stream sediment was collected midstream in nearly dry creek beds. Sediment samples were collected at the sediment/water interface and at the interface between sediment and the clay bottom of the aeration basin and oxidation ponds.

In November 1988 EPA conducted fine-grid sampling of soil along the west side of the west leg of Rocky Branch Creek south of the Vertac property. Additional grid sampling was performed near the Vertac property line in January 1989.

Comparability of Data

The 1984 and 1987 TCDD sampling data are directly comparable, and comparison of these two data sets may identify trends, if any. The 1988 grid-sampling data are not directly comparable to the earlier findings; however, general comparisons can be made in some cases. Individual grab samples may either overestimate or underestimate contaminant concentrations present in a given area. Grid sampling gives a better estimate of representative concentrations, but does not identify "hot spots" (areas of severe contamination). Some of the grid-sampling data cannot be compared to earlier data because those locations were not previously investigated.

Historical Trends

The TCDD concentrations found in soil/sediment in the various sampling efforts between 1984 and 1988 are compared in Table 3. (This table presents only the data that can be compared. Data summary tables for each of the off-site areas can be found in the 1990 Feasibility Study report.) Once the source of contamination, i.e. releases from the plant site, is removed or reduced, TCDD levels in the environment are expected to decrease due to the combined actions of dispersion by wind and water, downstream transport of contaminated soil/sediment, dilution by mixing and covering with clean material, biotransformation, and physical/chemical transformation.

TCDD levels tended to decrease between 1984 and 1987. A total of 59 samples are directly comparable between the 1984 and 1987 sampling events (that is, sample aliquots were collected at the same location and depth and analyzed individually). These 59 samples compare as follows:

TABLE 3

SAMPLING DATA COMPARISON TABLE FOR 2,3,7,8-TCDD (ppb)

SAMPLING AREA	SAMPLING LOCATION	SAMPLE DEPTH	1984 DATA	1987 DATA	1988 DATA*
BACKGROUND	VANBERG BLVD	ABCD		ND-0.023	
OXIDATION POND	NW QUAD	A	3	1.2	
		D	0.7	0.4	
		S			0.29 [4]
		IN			NA (ND-0.3) [4]
	NE QUAD	A	3.6	1.5	
		A	1.8	1.8	
		D	0.98	ND-0.01	
		F	0.51	0.025	
		S			0.97 [4]
		IN			NA(ND-0.3)DU [4]
	SW QUAD	A	1.98	0.41	
		D	0.34	0.0061	
		S			NA (ND-0.3) [4]
		IN			NA (ND-0.3) [4]
	SE QUAD	A	0.92	1.3	
		A	0.2	0.022SP	
		A	1.3	1.1	
		C	0.57	0.0059	
		G	0.44	ND-0.029	
		J	0.15	0.015	
		S			NA (ND-0.3) [4]
		IN			NA (ND-0.3) [4]

A = 0-3 inch
B = 3-6 inch
C = 6-9 inch
D = 9-12 inch
E = 12-15 inch
F = 15-18 inch
G = 18-21 inch
H = 21-24 inch
I = 24-27 inch
J = 27-30 inch

S = surface sample
IN = interface smpl b/w bottom sedmnt & liner
X = deep bottom samples

NA = not analyzed for 2,3,7,8-TCDD when TCDD < 1
( ) = non-isomer-specifc TCDD concentration
ND = non-detectable at given detection concentration
DU = duplicate associated with sample; highest value shown
SP = split sample; highest value shown
* Highest value of sampling grid used
** samples taken at 6,36, and 60 inches
[ ] = number of grabs (surface samples) or cores (interface samples) taken in the sampling grid

TABLE 3
SAMPLING DATA COMPARISON TABLE FOR 2,3,7,8-TCDD (ppb)

SAMPLING AREA	SAMPLING LOCATION	SAMPLE DEPTH	1984 DATA	1987 DATA	1988 DATA*
OXIDATION POND					
OUTFALL	DELTA	A	0.74	0.45	
		S			NA(ND-0.3)DU [10]
	N BANK	A	2	1.2SP	
		**			NA(ND-0.3)DU [26]
	N BANK LEFT	A	3.5	0.5SP	
		B	1.1	0.6SP	
		C	2.1	0.68	
		**			NA(ND-0.3)DU [26]
AERATION BASIN	NW QUAD	S			NA (ND-0.3) [6]
		IN			NA (ND-0.3) [6]
	NE QUAD	A	37.9	2.9	
		E		1.5DU	
		F		1.7	
		S			1.41 [6]
		IN			NA (ND-0.3) [6]
	SW QUAD	A	6.5	2.7	
		E		0.8DU/SP	
		S			NA (0.71) [6]
		IN			NA (ND-0.3) [6]
	SE QUAD	A	16.2	7.6	
		G	2.08	1.9SP	
		S			2.83 DU [6]
		IN			NA(ND-0 3)DU [6]
BAYOU METO					
1- 88 mi below outfall	MIDSTREAM	A	0.27	0.024SP	
	N BANK	A	0.47	0.036SP	
	CONFLUENCE	A	0.53	0.29	
		D		ND-0.0065	
	N BANK	A	0.74	0.8SP	
88-2.4 mi below outfall	S DUPREE PRK	A	0.22	0.36DU	
	SOYBEAN FLD.	A	0.06	0.068DU	
	DRY CREEK	A	0.9	0.46SP	
	MIDSTREAM (1 mi)	A	0.37	1	
		A	0.1	1.03	
	N BANK (1 mi)	**			NA (ND-0 3) [50]

TABLE 3

SAMPLING DATA COMPARISON TABLE FOR 2,3,7,8-TCDD (ppb)

SAMPLING AREA	SAMPLING LOCATION	SAMPLE DEPTH	1984 DATA	1987 DATA	1988 DATA*
	S BANK (1mi)	A	0.81	0.34	
		B	1.2	0.12SP	
		C	1.1	0.33	
		**			NA (ND-0.3) [38]
	BAY MOUTH	A	0.86	0.41SP	
	WOODLAND	A		0.098	
		C	1.58	0.0046SP	
	N BANK	A		0.49	
		A	1.1	0.53	
		A	0.54	0.85SP	
		B	1.52	0.75SP	
		B	0.78	0.64	
		C		1.7SP	
	MIDSTREAM	A	0.39	0.22	
	RR TRACK	A	0.34	0.25	
	N BANK (2mi)	**			NA (ND-0.3) [50]
	S BANK (2mi)	**			NA (ND-0.3) [50]
	MIDSTREAM(2.25mi)	A	0.25	0.18	
		A	0.31	0.18	
		D		0.0029	
	N BANK (2.4mi)	**			NA (ND-0 3) [50]
	S BANK (2.4mi)	**			NA (ND-0 3) [42]
	HWY 161	A	0.79	0.14SP	
2.4-3.23 mi below outfall	S BANK	A		0.22DU	
		C	1 08	0.54DU/SP	
3.23-4 09 mi below outfall	IRRIGATION	A	0.09	ND-0.0055DU/SP	
ROCKY BRANCH FLOODPLAIN					
WEST LANE	RUNOFF DITCH	A	0.84	0.12	
		C	0.01	0.011SP	
HINES ST	WOODED PENN.	A		6.8	
	(end of st.)	C	7.58	1.3SP	
W LEG(0-250ft frm junct.of W and E legs)	0-20ft.frm crk	S			2.88 [150]
	20-40ft frm crk	S			1 98 [150]
	40-60ft.frm crk	S			NA (0 869) [150]

TABLE 3

SAMPLING DATA COMPARISON TABLE FOR 2,3,7,8-TCDD (ppb)

SAMPLING AREA	SAMPLING LOCATION	SAMPLE DEPTH	1984 DATA	1987 DATA	1988 DATA*
W.LEG(250-500ft. frm junct.of W and E legs)	0-20ft.frm crk	S			2.73 [150]
	20-40ft.frm crk	S			2.02 [150]
	40-60ft.frm crk	S		-	1.74 [150]
	60-80ft.frm crk	S			1.45 [150]
	80-100ft.frm crk	S			1.34 [150]
	100-120ft. frm crk	S			NA (0.96) [150
E.LEG(0-250ft. frm junct.of W and E legs)	0-20ft.frm crk	S			NA (ND-0.3) [150]
E.LEG(250-500ft. frm junct.of W and E legs)	0-20ft.frm crk	S			NA (ND-0.3) [150]
E.LEG(500-750ft. frm junct.of W and E legs)	0-20ft.frm crk	S			NA(ND-0.3) [150]
ROCKY BRANCH IN THE VICINITY OF STP					
	DRY CREEK	A	1.7	0.97SP	
	W BANK	A	0.05	0.0049	
		S			NA (0.569)DU [50]
	MIDSTREAM	A	0.17	0.098SP	
	DRY CREEK	A		0.64	
		S			NA (ND-0.3) [25]
		C	1.5	0.85SP	
	W BANK DELTA	A	0.11	0.63	
	BEND MIDDLE	A	0.15	0.46SP	
	MIDSTREAM	A	0.16	0.86	
		A	0.41	0.52	
OLD STP AREA					
	PERIMETER	S			1.01 [66]
	SLUDGE DRY BED	S			2.79DU [73]
		A	ND-0.01		

TABLE 3

SAMPLING DATA COMPARISON TABLE FOR 2,3,7,8-TCDD (ppb)

SAMPLING AREA	SAMPLING LOCATION	SAMPLE DEPTH	1984 DATA	1987 DATA	1988 DATA*
		A	0.77		
		B	6.59		
		B	0.58		
	CLARIFIERS	A	1.62		
		A	0.23		
	CLARIFIER AREA	S			NA (0.307) [39]
	SLUDGE DIGESTER	B	5.3		
		B	12.46		
	SLUDGE COLLCT.ARE	A	ND-0.76		
		A	ND-0.05		
		E	ND-0.21		
		E	0.42		
		X	ND-0.48		
		X	1.19		

- In 1987, 47 samples (80 percent) were lower than in 1984, with 32 samples (53 percent) at least 50 percent lower. The largest decrease was from 37.9 ppb in 1984 to 2.9 ppb in 1987 in the aeration basin.

- In 1987, 11 samples (19 percent) were higher than in 1984, and 5 samples (8.5 percent) were more than 50 percent higher. The greatest increase was from 0.92 ppb in 1984 to 1.3 ppb in 1987 in the oxidation pond.

- In 1987, one sample (2 percent) was exactly the same as in 1984.

It should be noted that this is not a statistical treatment of the data (e.g., lower than does not imply a statistically significant difference), but simply a mathematical comparison. TCDD levels at nearly half of the 1987 sampling stations were within plus or minus 50 percent of their 1984 concentration.

The elevated levels detected in aeration basin samples of 1984 (37.9 and 16.2 ppb) and 1987 (7.6 ppb) were not found in later samples. This decrease may stem from the sampling methods used (e.g., grab sampling of a hot spot versus dilution via composite sampling) or may reflect biodegradation or another attenuation process. In any case, the 1988 fine-grid sampling found TCDD levels of less than 5.0 ppb in the aeration basin and less than 1.0 ppb in the oxidation ponds.

VI. SUMMARY OF SITE RISKS

1986 Endangerment Assessment

An endangerment assessment (EA) was conducted to support the June 1986 FS. The objective of the EA was to evaluate the potential health and environmental effects if no remedial action is taken at the Vertac site. It defined the current or potential future exposures and risks attributable to contaminants at the site, primarily TCDD.

The EA is based upon the 1984 data and included a discussion of this RI data and how they are used, including soil, sediment, and fish sampling data. In some cases, chlorophenoxy herbicides, chlorinated benzenes, and chlorinated phenols were analyzed in addition to TCDD.

A discussion of the potential for migration of TCDD from the sewer system, Rocky Branch Creek, and Bayou Meto was included. The EA concluded that TCDD has the potential to migrate out of the sewage treatment plant, adsorb onto soils and sediments, and be transported in the creek beds and flood plains.

Potential exposure pathways to contaminated media were identified and included direct dermal contact or ingestion of sediments or soils originating from the sewer system, Rocky Branch Creek, Bayou Meto, or the flood plains; inhalation of volatilized organics, if any, from contaminants in the sewer system, creek, or flood plain sediments or soils; ingestion of fish and other aquatic organisms from Rocky Branch Creek or Bayou Meto; and ingestion of agricultural products that have been grown in contaminated soils.

From the estimate of intakes, and considering various exposure scenarios, risks were quantified. A range of risks were calculated based on the range of TCDD concentrations found in the media. A summary of the calculated risks in the 1986 EA is presented in Table 4.

Revised Risk Assessment

The 1986 EA was updated to reestimate off-site risks based on the most recent TCDD data and current EPA exposure and risk assessment guidelines. While the 1986 EA addressed several media and both TCDD and non-TCDD compounds, this update focuses specifically on ingestion of TCDD-contaminated soils and sediments. Since ingestion of TCDD contaminated soil and sediments presents the dominant risk, this exposure scenario was used to calculate baseline risk. In calculating the risks due to exposure to the various components of the study area

Table 4 1986 Endangerment Assessment

Summary of Site Problems and Associated Risk (sheet 1 of 2)

Contaminated Media	Pathway	Assessment
Sewer System Sediments	Direct/Ingestion	Risk ranges from 10^{-3} to 10^{-6} using occupational settings. Contact with sediments in the system on a daily basis is unlikely.
	Dermal	Was not quantified, may act to increase total risk. This is the most likely pathway for worker exposure to sediments within the sewer system.
	Inhalation	Was not quantified, may act to increase total risk. Inhalation of volatiles is a possibility. Quantification of volatiles was not done in the RI.
	Indirect/Ingestion, Dermal, Inhalation	Was not quantified. Could occur through overflow, backflow, exfiltration, etc. However, it is anticipated to be a minor risk.
	Migrating to creeks	Was not quantified. Anticipated to present a substantial risk to environment.
Rocky Branch Sediments	Direct/Ingestion	Risks range from 10^{-3} to 10^{-4} using the residential scenario and Kimbrough estimates of childhood soil intake. Risk ranges from 10^{-6} to 10^{-7} using the recreational scenario, 0-3" sediment depth and any age group.
	Dermal	Pathway was not quantified. May act to increase the total risk.
	Indirect/Secondary Contact (pets, etc.)	Pathways not quantified. Limited risk anticipated.
	Aquatic Uptake	Pathway not quantified. Data not available to determine risk to aquatic life.

Table 4 1986 Endangerment Assessment

Summary of Site Problems and Associated Risk (sheet 2 of 2)

Contaminated Media	Pathway	Assessment
Bayou Meto Sediments	Direct/Ingestion	Risk ranges from 10^{-5} to 10^{-7} using the recreational scenario, 0-3" sediment depth and any age group. Risk is about the same for all sediment depths.
	Dermal	Pathway was not quantified. May act to increase the total risk.
	Indirect/Secondary Contact (pets, etc.)	Pathways not quantified. Limited risk anticipated.
Fish	Direct/Ingestion	Risk ranges from 10^{-3} to 10^{-4} using the adult consumption setting. Risk is lower using TCDD concentrations in fish below 2.5 miles downstream of the confluence with Rocky Branch Creek
	Dermal	Pathway not quantified. Limited risk anticipated.
Flood plains	Direct/Ingestion	Risk ranges from 10^{-3} to 10^{-5} using the residential scenario and Kimbrough estimates of childhood soil intake. Risk ranges from 10^{-6} to 10^{-8} using the recreational scenario, 0-3" sediment depth and any age group. Risk is slightly higher for the 6-9" soil depth due to one maximum concentration (10^{-5}).
	Dermal	Pathway was not quantified. May act to increase the total risk.
	Inhalation	Pathway was not quantified, anticipated to be minor increase to total risk. Dust entrainment of soils in the flood plain not anticipated to be high due to dense vegetative cover.
	Indirect/Leaching to Groundwater	Not quantified. Considered not a major risk due to mobility of TCDD. No data available to assess pathway.

(e.g. floodplains, West STP, etc.), exposure to the concentrations found in each component was assumed. For each component, either a residential or occupational exposure scenario was assumed, based upon the zoned use for the area. A zoning map is shown on Figure 3.

The exposure parameters used to estimate cancer risks in both the 1986 and revised EA's are: fraction of the year that exposure occurs; fraction of the chemical that is absorbed in the gut; and lifetime average soil ingestion rate (LASI). The exposure fractions used in 1986 and the revised EA are the same since no new information is available that would change them. The exposure fraction for the occupational setting is 0.39 and is based upon time spent at work. The exposure fraction for the residential setting was based upon weather conditions (from meteorological data) that typically prohibit outdoor activities and was set at 0.58. No new information is available to change the absorption factor. Therefore, the same was used in both the 1986 and revised EA for both the occupational and residential settings and was 0.3. No new information on the LASI for the occupational setting is available and the same was used in 1986 and the revised EA. It was .0008 g/Kg/day. The LASI for the residential setting in 1986 was 0.028 g/Kg/day. However, new information is available which suggests that children ingest less soil than was used to calculate the LASI in 1986. Therefore, the revised EA used a LASI for the residential setting which was re-calculated, according to EPA's 1989 risk assessment guidance, at 0.0022 g/Kg/day.

The cancer potency factor used in the 1986 EA was 156,000 $(mg/Kg/day)^{-1}$. This continues to be the cancer potency factor used in EPA risk assessments for 2,3,7,8-TCDD (EPA, 1989).

The following subsections present revised exposure and risk estimates for each of the off-site areas.

Sewage Collection Lines

The sewer collection lines have not been sampled since the 1984 RI sampling, where the maximum concentration was found to be 200 ppb TCDD. The occupational exposure setting used in 1984 has not changed and, therefore, the risk estimates for the collection lines remain at 10^{-3} to 10^{-5}.

Old STP

As part of the 1988 fine-grid sampling conducted by Hercules, 73 surface (0 to 3-inch) samples were composited and analyzed from the sludge drying beds. The TCDD concentration in this composite sample was 2.79 ppb. Using the same occupational

exposure parameters used in the 1986 EA, the risks associated with ingestion of sludge from the drying beds would be 4×10^{-5} based on the 1988 data.

The only other areas of the Old STP where post-RI data are available are the perimeter of the sludge drying beds and the soil surrounding the clarifiers (available from 1988 fine-grid sampling). Neither of these specific areas were sampled during the 1985 RI. Sixty-six samples were composited from the perimeter of the sludge beds and 39 from the clarifier area. The concentrations in these composite samples were 1.01 and 0.307 ppb TCDD, respectively. The risks associated with these areas, using the occupational exposure setting, would be 1.5×10^{-5} and 4.5×10^{-6}, respectively.

WWTP

The 1984 RI data showed maximum and average concentrations from the aeration basin of 37.9 and 20.2 ppb TCDD, respectively. In 1988, composite samples were taken in each of the four quads of the aeration basin. Each composite consisted of six samples. The highest composite sample was 2.83 ppb TCDD. Using the occupational exposure parameters and a 2.83 ppb TCDD concentration, the risks associated with aeration basin sediments would be 4.1×10^{-5}.

The north oxidation pond showed maximum and average concentrations of 3.6 and 2.8 ppb TCDD, respectively, in 1984. In 1988, two composite samples were taken from the north pond. The highest composite sample showed a TCDD concentration of 0.97 ppb. The risk associated with this concentration, using the occupational exposure setting, would be 1.4×10^{-5}.

The maximum and average concentrations from the south pond in 1984 were 1.3 and 1.2 ppb TCDD, respectively. In 1988, both composite samples showed nondetectable concentrations. At the detection limit of 0.3 ppb TCDD, the risk would be 4.3×10^{-6}.

Rocky Branch Creek Flood Plain

In 1988 and 1989, EPA sponsored sampling of the flood plain soils along the west leg of Rocky Branch Creek. Samples were composited from grids that were approximately 20 feet by 250 feet. The highest composite sample showed a concentration of 9.6 ppb TCDD. The risk associated with this concentration, using the revised residential LASI, is 5.7×10^{-5}.

Rocky Branch Creek and Bayou Meto Sediments

Assuming a continued and effective State advisory discouraging ingestion of fish, the TCDD levels in the sediments should not pose an unacceptable health risk (see Appendix A).

TARGET CLEANUP AREAS AND ACTION LEVELS

In 1986, the ATSDR reviewed the Vertac off-site RI report and assessed the human health significance of the contamination and the need for off-site cleanup. Based on this evaluation, ATSDR developed guidelines and criteria for remediation of TCDD-contaminated materials in the Vertac off-site area. The following levels were derived from ATSDR recommendations (the ATSDR memorandum is included as Appendix B).

- Wastewater Collection System. Sewer lines indicated in the RI to have TCDD concentrations equal to or greater than 1.0 ppb require remediation. This action level was chosen because the contaminants in the sewer line could migrate downstream and contaminate the wastewater treatment facilities, Bayou Meto, and nearby flood plains.

- Old Sewage Treatment Plant. TCDD-contaminated sludges, wastes, soils, and sediments in the abandoned facilities would be remediated so that an action level of 5.0 ppb TCDD is not exceeded. The ATSDR recommended an action level of 5 to 7 ppb TCDD for soils in and around the abandoned sewage treatment facilities if the following conditions were imposed:

  - The site must not be developed for agricultural or residential use

  - The use and activities of the site must not become associated with the production, preparation, handling, consumption, or storage of food, other consumable items, or food-packaging materials

  - The site soils must be protected from erosion that would uncover or transport TCDD that could cause unacceptable human exposure at a future date

- West Wastewater Treatment Plant. An action level of 5 to 7 ppb was recommended for the aeration basin, oxidation ponds, outfall ditch, and

peripheral land zoned for manufacturing. This action level is subject to the same conditions listed above for the Old STP.

- Flood Plain--Residential and Agricultural. An action level of 1.0 ppb TCDD would be adopted for residential and agricultural areas.

- Flood Plain--Nonresidential and Nonagricultural. Nonresidential and nonagricultural areas in the flood plain (such as woodlands, industrial, and commercial areas) that are not subject to erosion and transport processes would have an action level of 5 ppb TCDD. If the areas are subject to erosion and transport processes (lack sufficient ground cover to inhibit erosion), the action level would be 1.0 ppb.

On several occasions in late 1988 and early 1989, representatives of EPA and ATSDR discussed the most recent sediment data and its potential risk to human health. The results of these discussions is the following conclusion regarding Rocky Branch Creek and Bayou Meto sediments. The basis for this conclusion is outlined in a memo in Appendix A. Assuming a continued and effective State advisory discouraging ingestion of fish, the TCDD levels in the sediment in Rocky Branch Creek and Bayou Meto should not pose an unacceptable health threat.

VII. DESCRIPTION OF ALTERNATIVES

The Vertac off-site area is complex in the number and variety of target cleanup areas; however, the number of potential remedial actions is constrained by the limited number of treatment/disposal processes that are implementable and proven effective for TCDD waste. Table 5 lists area-specific potential remedial actions, along with the maximum TCDD levels detected in the most recent sampling event, the TCDD action levels established for the site, and the reason for concern. Table 6 lists quantities of contaminated material that were considered for remediation. These quantities were based upon the most recent data available and upon area specific action levels.

A range of remedial action alternatives was assembled for the site as a whole using the area-specific potential remedial actions listed in Table 5. The assembled alternatives are briefly outlined in Figure 16 and described in detail below.

ALTERNATIVE 1

The no-action alternative consists of taking no further action to prevent human exposure to contaminated materials, prevent migration of contaminants, or protect the environment. However, the currently existing conditions, institutional controls, and studies would continue. These include:

- The fences that restrict access from the developed residential area to contaminated sections of Rocky Branch Creek.
- The access and use restrictions at the undeveloped residential area along the east side of the west leg of Rocky Branch Creek owned by Hercules Inc. This land is fenced and has signs to restrict access.
- The access and use restrictions at the Old STP and West WWTP. These facilities are only partially fenced.

ALTERNATIVE 2

Figure 17 is a flow diagram of Alternative 2.

Alternative 2--Collection Lines

The sewer collection lines under consideration include two interceptor lines running parallel to Rocky Branch Creek (Figure 15). The westernmost Rocky Branch Creek interceptor was abandoned in 1978 when the eastern most interceptor was constructed. In this alternative, only the active sewer lines would be cleaned; the

Table 5
Identification of Potential Remedial Actions (sheet 1 of 2)

Area	Maximum TCDD Concentration (ppb)/Year	TCDD Action Level (ppb)[a]	Concern	Potential Remedial Action
Collection Lines	>200/1984 (existing line)	1.0	Migration, Exposure (overflows)	No Action Remove Sediments and Incinerate Install Pipe Liners (Active Lines) Grout (Abandoned Lines) Remove Lines
Old STP				
Sludge Digester	12.5/1984	5.0	Exposure	No Action Restrict Access and Use Remove Sludge and Consolidate Remove Sludge and Incinerate
Sludge Drying Beds	2.8/1988	5.0	Exposure (gardening)	No Action Restrict Access and Use and Cap Remove and Consolidate Remove and Incinerate
Primary Clarifiers	1.6/1984	5.0	Exposure	No Action Restrict Access and Use Remove Sediment and Incinerate Demolish, Consolidate, and Cap
Trickling Filters	Not Sampled	5.0	Exposure	No Action Demolish, Consolidate, and Cap Restrict Access and Use
Secondary Clarifiers	Not Sampled	5.0	Exposure	No Action Demolish, Consolidate, and Cap Restrict Access and Use

Table 5
Identification of Potential Remedial Actions (sheet 2 of 2)

Area	Maximum TCDD Concentration (ppb)/Year	TCDD Action Level (ppb)[a]	Concern	Potential Remedial Action
West WWTP				
Aeration Basin	2.8/1988	5.0	Migration Exposure	No Action Restrict Access and Use Flood Protect Dewater and Cap Remove Sediments and Incinerate
Oxidation Ponds	0.97/1988	5.0	Migration	No Action Restrict Access and Use Flood Protect Dewater and Cap
Rocky Branch Creek and Bayou Meto Flood Plain				
Developed Residential Areas	1.135/1988	1.0	Exposure (contact, ingestion)	No Action
Undeveloped Residential Areas	9.7/1988	5.0 1.0		Restrict Access and Use Remove Soil and Incinerate
Nonresidential/Nonagricultural Areas	1.03/1987	5.0		Remove Soil and Consolidate
Rocky Branch Creek and Bayou Meto Sediments				
	2.3/1989	2.3[b]	Exposure (contact, ingestion)	No Action Advisory Against Fish Ingestion Continue Fish and Wood Duck Monitoring

[a]Based on ATSDR recommend actions (see Appendix B).
[b]Based on EPA memorandum to ATSDR (see Appendix A).

Table 6
1990 FS Estimated Volumes of Material Considered For Remediation (sheet 1 of 2)

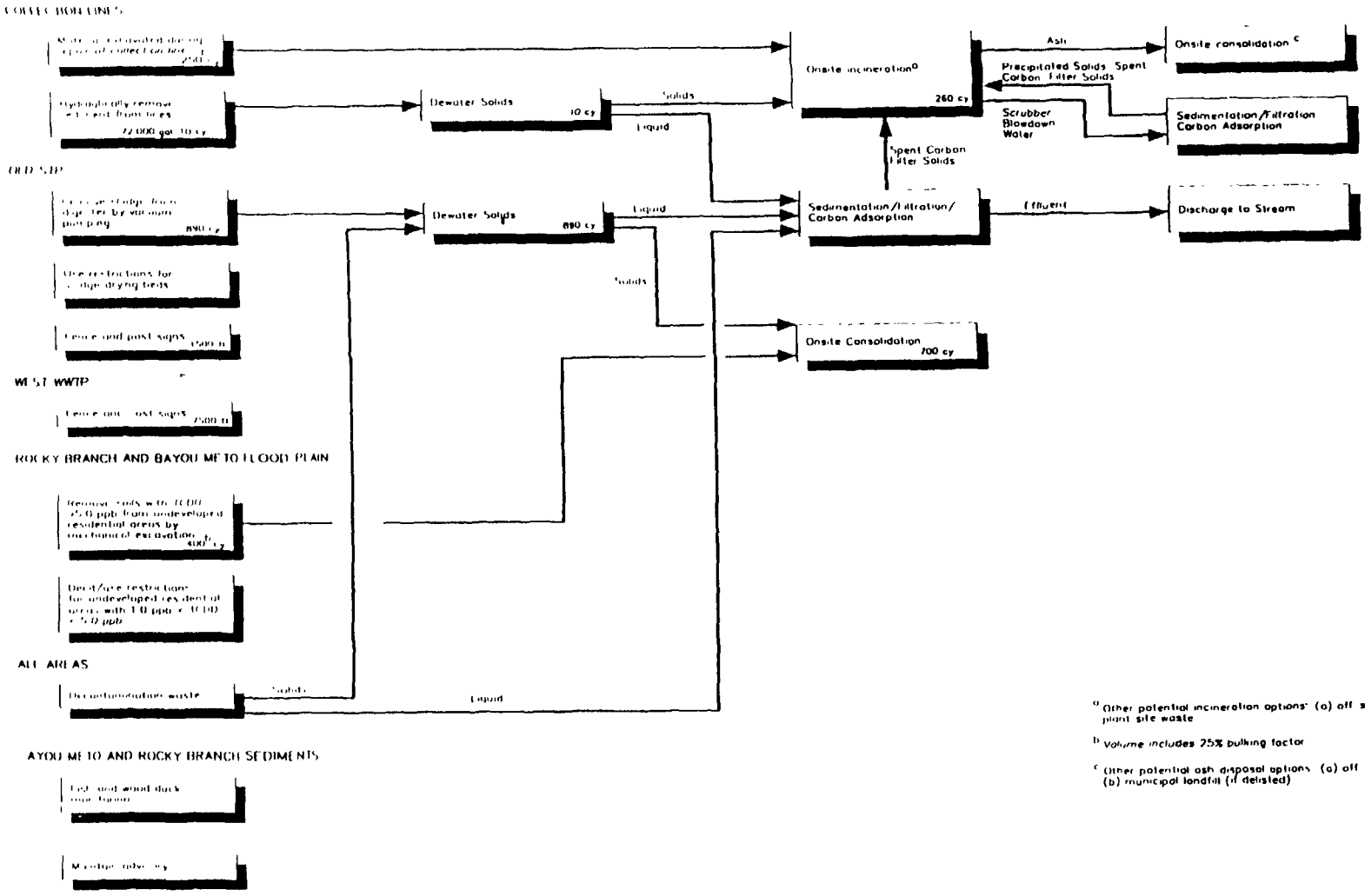
Area	Volume	Basis	Information Source
Sewage Collection Lines			
Sediment in active lines	10 cy	Volume estimate from sewer lamping study results for the 10,350-ft active sewer lines	1985 RI, Vol. I
Soil surrounding active lines	7,700 cy	Assumed 4-ft-by-4-ft contaminated cross section; 25% bulking factor	
Abandoned Rocky Branch interceptor and surrounding soil	3,200 cy	4,350-ft length; assumed 4-ft-by-4-ft contaminated cross section; 25% bulking factor	
Old STP			
Sludge in sludge digester	890 cy	Previous volume estimate; 40-ft diameter; assumed 19-ft sludge depth	1986 FS, Vol. I (p. 6-7)
Soil in sludge drying beds and surrounding soil	1,500 cy	267-ft-by-120-ft sampling area E-1; assumed 1-ft contaminated depth; 25% bulking factor	Hercules Inc., 1988 (p. 67)
Sediment in primary clarifiers	90 cy	Two 40-ft diameter basins; assumed 1-ft sediment depth	
Water in primary clarifiers	126,000 gallons	Assumed 7-ft water depth	
West WWTP			
Sediment in aeration basin	8,000 cy	Previous volume estimate; 3-acre basin; assumed 1.65-ft average sediment depth	1986 FS, Vol. I (p. 6-7)
Water in aeration basin	6.8 million gallons	Previous volume estimate; assumed 17-ft average water depth	1986 FS, Vol. I (p. 6-7)
Sediment in oxidation ponds	208,000 cy	Previous volume estimate; two 22-acre ponds; assumed 3-ft average sediment depth	1986 FS, Vol. I (p. 6-7)
Water in oxidation ponds	30 million gallons	Previous volume estimate; assumed 2-ft average water depth	1986 FS, Vol. I (p. 6-7)

Table 6
1990 FS Estimated Volumes of Material Considered For Remediation (sheet 2 of 2)

Area	Volume	Basis	Information Source
Rocky Branch Flood Plain			
Soil in undeveloped residential area owned by Hercules Inc. (1.0 ppb <TCDD < 5.0 ppb)	2,100 cy	Approximately 45,000 sf; assumed 1-ft contaminated depth; 25% bulking factor	1988 Fine-Grid Sampling Report
Soil in undeveloped residential area west of W. Rocky Branch and immediately south of Vertac property (TCDD > 5.0 ppb)	400 cy	Approximately 8,600 sf; assumed 1-ft contaminated depth; 25% bulking factor	1988 EPA Region 6 sampling results
Soil in undeveloped residential area west of W. Rocky Branch (1.0 ppb <TCDD < 5.0 ppb)	1,600 cy	Approximately 35,000 sf; assumed 1-ft contaminated depth; 25% bulking factor	1988 EPA Region 6 sampling results

AREA	SUB AREA OR VOLUME	REMEDIAL TECHNOLOGY	ALTERNATIVE						
			1	2	3	4	5	6a	6b
[illegible]	[illegible] sewer lines	No action	●						
		Hydraulically clean		●	●	●		●	●
		Install pipe liner			●	●		●	●
		Remove and incinerate/construct new sewer lines					●		
	Abandoned Rocky Branch interceptor	No action	●	●	●				
		Grouting						●	●
		Remove and incinerate				●	●		
Old WWTP	Grounds	No action	●						
		Restrict access and use		●	●	●	●	●	●
	Sludge digester	No action	●						
		Remove sludge and consolidate onsite		●					
		Remove sludge and incinerate			●	●	●	●	●
	Sludge drying beds	No action	●						
		Restrict access and use		●					
		Cover with asphalt cap			●				
		Cover with foot of soil						●	●
		Remove soil and incinerate				●	●		
	Primary clarifiers	No action	●	●	●	●			
		Remove sediment and incinerate					●		
		Treat water/demolish & cover with soil						●	●
	Secondary clarifiers and trickling filters	No action	●	●	●	●	●		
		Treat water/demolish & cover with soil						●	●
West WWTP	Aeration basin	No action	●						
		Restrict access and use		●	●	●	●	●	●
		Dewater and cap				●		●	●
		Remove sediment and incinerate					●		
	Oxidation ponds	No action	●						
		Restrict access and use		●	●	●	●	●	●
		Flood protect			●	●			
		Dewater and cap					●		
Rocky Branch Creek and Bayou Meto flood plain	Undeveloped residential soil with TCDD < 5.0 ppb	No action	●						
		Remove and consolidate		●					●
		Remove and incinerate			●	●	●	●	
	Undeveloped residential soil with 1.0 ppb < TCDD < 5.0 ppb	No action	●						
		Restrict access and use		●	●				
		Remove and incinerate				●	●	●	
		Remove and consolidate							●
Rocky Branch Creek and Bayou Meto sediments		No action	●	●	●	●	●	●	●
		Maintain advisory	●	●	●	●	●	●	●
		Fish and wildlife monitoring	●	●	●	●	●	●	●

FIGURE 16
ASSEMBLED REMEDIAL ACTION ALTERNATIVES
Vertac Off Site #5, Jacksonville, Arkansas



[a] Other potential incineration options: (a) off site, (b) with Vertac plant site waste

[b] Volume includes 25% bulking factor

[c] Other potential ash disposal options: (a) off site RCRA landfill (b) municipal landfill (if delisted)

FIGURE 17
ALTERNATIVE 2
FLOW DIAGRAM
Vertac Off Site I's
Jacksonville, Arkansas

abandoned interceptor would be left in place. The collection lines to be cleaned include the trunk line running diagonally through the residential area from the Vertac Plant site and the active Rocky Branch Creek interceptor.

Damaged manholes along the active sewer lines would be repaired or, if necessary, replaced. The 1985 RI evaluation of manhole structural integrity found that most of the defects occurred on the Vertac Plant site and along the abandoned Rocky Branch Creek interceptor, neither of which are part of the active sewage collection system. The 1985 RI findings indicate that defects in manholes along the active lines are minor and could be repaired using an epoxy grout lining. Other possible rehabilitation measures include preformed polyethylene liners, formed-in-place resin liners, or manhole replacement. It is assumed that grouting would be sufficient to rehabilitate most of the manholes but a more extensive restoration method would be employed if necessary.

The volume of sediment in the active collection lines is estimated to be 10 cubic yards (cy). This volume is based on the results of the 1985 RI sewer lamping study. It is assumed that upstream laterals and service lines tying into the Rocky Branch interceptor do not contain contaminated sediments and do not require remediation.

In this alternative, 10,350 feet of collection lines would be cleaned of contaminated sediments and debris by hydraulic flushing combined with vacuum pumping. The pipe-cleaning procedure is illustrated in Figure 18. An obstruction is placed in the pipe immediately downstream from a manhole. A hose, fitted with a nozzle that directs flow backwards, is fed through the manhole into the upstream pipe. The hydraulic force of the water jet is allowed to carry the nozzle upstream to the adjacent manhole. The flushing hose is then slowly retrieved to hydraulically flush the entire length of pipe with a pressurized stream of water. The water and sediment are simultaneously pumped through a hose at the downstream manhole into a tank truck. The obstruction is then removed and the procedure repeated in downstream segments. Additional vacuuming would be employed as needed to remove sediments from manholes.

The RI reported that the primary obstructions in the sewer lines were grease, roots, dirt, and gravel. Bricks and concrete from manholes have also fallen into sewer lines. The lines to be cleaned would be inspected with video cameras to locate obstructions. Some sections (5 percent of the total active pipe length is assumed) may require supplemental mechanical cleaning to remove major obstructions.

It is likely that damaged sections of pipeline would have to be repaired to allow hydraulic cleaning. Based on the lamping study conducted during the RI, it is assumed that three percent of the sewer lines, excluding the abandoned Rocky Branch Creek inter-

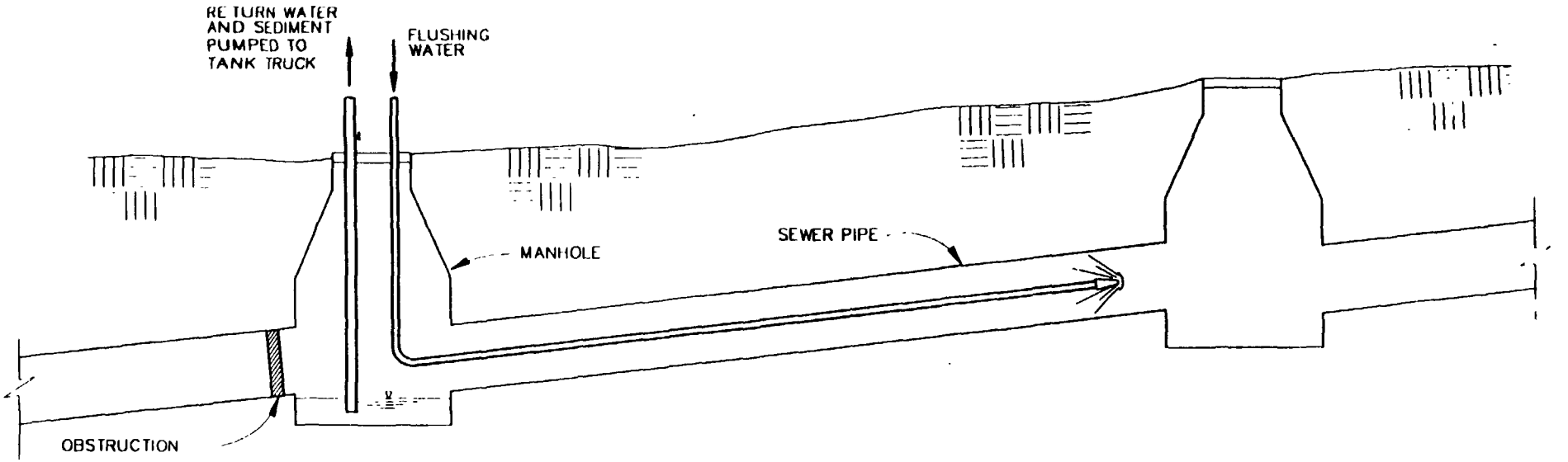


FIGURE 18

HYDRAULIC CLEANING PROCEDURE FOR SEWER LINE

Vertac Off-Site FS
Jacksonville, Arkansas

J:\INDUST\DEN69071\FIGURE-3.DWG

ceptor, would require repair. At least one foot of soil surrounding damaged pipe and (250 cy) would be excavated during repair and incinerated because of the likelihood of TCDD contamination.

The poor structural characteristics of the 4,350-foot abandoned Rocky Branch Creek interceptor, described in the 1985 RI, indicate that it cannot be hydraulically cleaned. It is plugged with concrete at both ends and there are no known interconnections, including exfiltration/infiltration, between the abandoned and active Rocky Branch Creek interceptors. As long as the abandoned interceptor remains undisturbed in the ground, there is no direct route for human exposure. Therefore, in this alternative, the abandoned Rocky Branch Creek interceptor would be left in place.

There are two main advantages of hydraulic cleaning: essentially all the sediment can be flushed to manholes and removed from the sewers, and there is little or no disruption of service. During the hydraulic cleaning, sanitary flow would be pumped to adjacent manholes.

Hydraulic flushing generates large quantities of water (estimated at seven gallons per foot of sewer). Further contamination of the aeration basin would be prevented by collecting the flushing water as each segment is cleaned. This water would be treated by sedimentation, filtration, and carbon adsorption (see "Wastewater Treatment" later in this section).

Sediments can be effectively removed from the water by sedimentation and dewatering (see "Solids Dewatering" later in this section). It is assumed that the 10 cy of sediment separated from the bulk liquid would contain 20 percent solids. This material would be dewatered to 6.7 cy at 30 percent solids. Because the sediments in the collection lines have been found to contain TCDD concentrations in excess of 200 ppb (1984 data), the dewatered solids would be incinerated.

Inspection of the sewers after cleaning would involve:

- Television inspection to determine the adequacy of the cleaning and required repairs and to detect any unauthorized connections
- Smoke testing to identify points of infiltration/exfiltration and unauthorized inflow

If television inspection indicated remaining obstructions, additional cleaning (probably mechanical followed by hydraulic flushing) would be required. It is assumed that the inspection would indicate that no additional cleaning and repair would be required.

After completion of sewer cleaning, the equipment involved (trucks, hoses, pumps) would be decontaminated. Decontamination procedures would include hydrocleaning, with water from the procedure captured for treatment. When the decontamination procedure is completed, the equipment would be wipe-tested and the wipe cloths analyzed for TCDD to assure that no contamination remained on the equipment. The equipment would be impounded until the test results indicated decontamination was complete.

Alternative 2--Old STP

Sludge would be removed from the sludge digester using a vacuum pumping system. The estimated 890 cy of digested biological sludge assumed to be 5 percent solids would be dewatered (as described under "Solids Dewatering" later in this section) to approximately 300 cy at 15 percent solids. The dewatered sludge would be consolidated on the Vertac Plant site and capped. This and other consolidated material would be covered with a multilayered cap consistent with RCRA requirements. Onsite consolidation and capping of waste materials is described in more detail under "Alternative 2--Rocky Branch Creek and Bayou Meto Flood Plain" later in this section.

The empty sludge digester would be cleaned with a hot, pressurized, biodegradable cleaning mixture. All other equipment would be decontaminated by hydrocleaning. The leachate from sludge dewatering and the used washing and decontamination solutions would be treated by sedimentation/filtration and carbon adsorption (see "Wastewater Treatment" later in this section).

No action would be taken on the remaining treatment units. The grounds of the Old STP would be fenced (1,500 linear feet) and signs posted every 100 feet to restrict access to contaminated areas of the plant.

Alternative 2--West WWTP

The oxidation ponds and aeration basin would be fenced (7,500 linear feet) and signs posted to restrict access to those facilities.

Alternative 2--Rocky Branch Creek and Bayou Meto Flood Plain

In developed residential areas, all soils with greater than 1.0 ppb of TCDD have already been excavated and are temporarily stored in plastic bags on the Vertac Plant site. The 1,623 bags contain 2,400 cubic yards of soil including: a) soil from the residential areas immediately east of the west leg of Rocky Branch Creek, b) soil from the residential area just south of the Vertac property line and west of the east leg of Rocky Branch Creek, and c) soil from a drainage area on the Vertac Plant site just north of the

Vertac property line and adjacent to (b) (see Figure 8). These stored soils will be addressed as part of the onsite FS.

Soils from undeveloped residential areas with TCDD levels greater than 5.0 ppb (see Figure 8) would be removed with backhoes to a depth of one foot. This category includes two sampling grids--Numbers 17 and 18 from EPA's 1988 sampling effort--just west of the west leg of Rocky Branch Creek and just south of the Vertac property line, and would result in 400 cubic yards of soil (assuming a 25 percent bulking factor). This soil would be consolidated on the Vertac Plant site and capped as part of Alternative 2. The excavated areas would be backfilled with clean soil and seeded with grass.

Residentially zoned, but undeveloped areas that contain 1-5 ppb TCDD (see Figure 8) would not be excavated. Rather, the zoning of these areas, which include privately owned land (approximately 0.8 acres) west of the west leg of Rocky Branch Creek and land owned by Hercules (approximately one acre) east of the west leg of Rocky Branch Creek would be changed to a commercial/industrial use.

The total of 700 cy of material to be consolidated in Alternative 2 includes 300 cy of dewatered sludge from the digester and 400 cy of soil. Since this material consists largely of contaminated native soil, it is assumed that it would be compactable and that compaction would reduce the volume of soil by 25 percent. For consolidation, the material would be placed on the plant site and compacted into a mound.

A multilayer cap would then be placed over the contaminated material. The cap would be consistent with federal and state RCRA requirements for landfill closures. The overall surface area required for consolidation would be roughly 0.3 acre. The native materials required for construction of the cap would be 162 cy of topsoil and sand; 475 cy of native soil; and 650 cy of clay. Based on soil type descriptions in the Jacksonville area, it is expected that materials suitable for cap construction are available locally.

Alternative 2--Rocky Branch Creek and Bayou Meto Sediments

The remedy for Rocky Branch Creek and Bayou Meto sediments is based on the recommendations contained in the 1989 memorandum from EPA to ATSDR (see Appendix A). These recommendations include a continued advisory against ingestion of fish taken from Rocky Branch Creek and Bayou Meto. The memorandum states that the levels of TCDD found in the sediments should not pose an unacceptable human health threat if this advisory is continued and is effective. This remedy also includes continued monitoring of fish.

ALTERNATIVE 3

Figure 19 is a flow diagram of Alternative 3.

Alternative 3--Collection Lines

The collection lines would be cleaned by hydraulic flushing as described in Alternative 2. Only the active lines would be cleaned; the abandoned Rocky Branch Creek interceptor would be left in place. Sediments removed from the sewer lines would be dewatered and the solids incinerated. The flushing water and the water from the solids dewatering would be treated by the wastewater treatment system.

Damaged manholes along the active sewer lines would be repaired as described in Alternative 2.

The hydraulically cleaned collection lines would be lined with a resin-type lining system. One such system employs a liquid thermosetting resin that is hardened in place to conform to the interior contours of the existing pipe. Installation of this type of pipe liner is illustrated in Figure 20. A resin-impregnated felt "sock" is fed into the pipe and filled with water to press the resin-coated side firmly against the pipe walls. Hot water is circulated to cure the resin. The sock is then removed, the resin pipe ends cut off, and the lateral connections reopened using a remote-controlled cutting device.

Rehabilitating the manholes and sewer lines would greatly reduce the probability of contaminant migration to the new WWTP. Soil surrounding the sewer lines may have been contaminated by exfiltration over the years that waste was conveyed from the Vertac Plant site. The liners would virtually eliminate infiltration of contaminated soil and water. Also, the resin-type liners can be made thick enough to provide structural integrity.

The main sewer line running through the residential area south of the Vertac Plant site consists of clay pipe installed in 1941. This pipe is approaching the end of its service life, and would soon require replacement if not rehabilitated. Excavation of this line in the future could constitute a hazard due to exposure to TCDD-contaminated soil. Rehabilitation of the active sewer lines with resin-type liners should provide sufficient structural integrity to preclude the need to replace those lines in the near future.

Alternative 3--Old STP

The sludge digester would be emptied and cleaned as in Alternative 2; however, in this alternative the 300 cubic yards of dewatered biological sludge from the digester would be incinerated rather than consolidated onsite. The digester sludge had a maximum

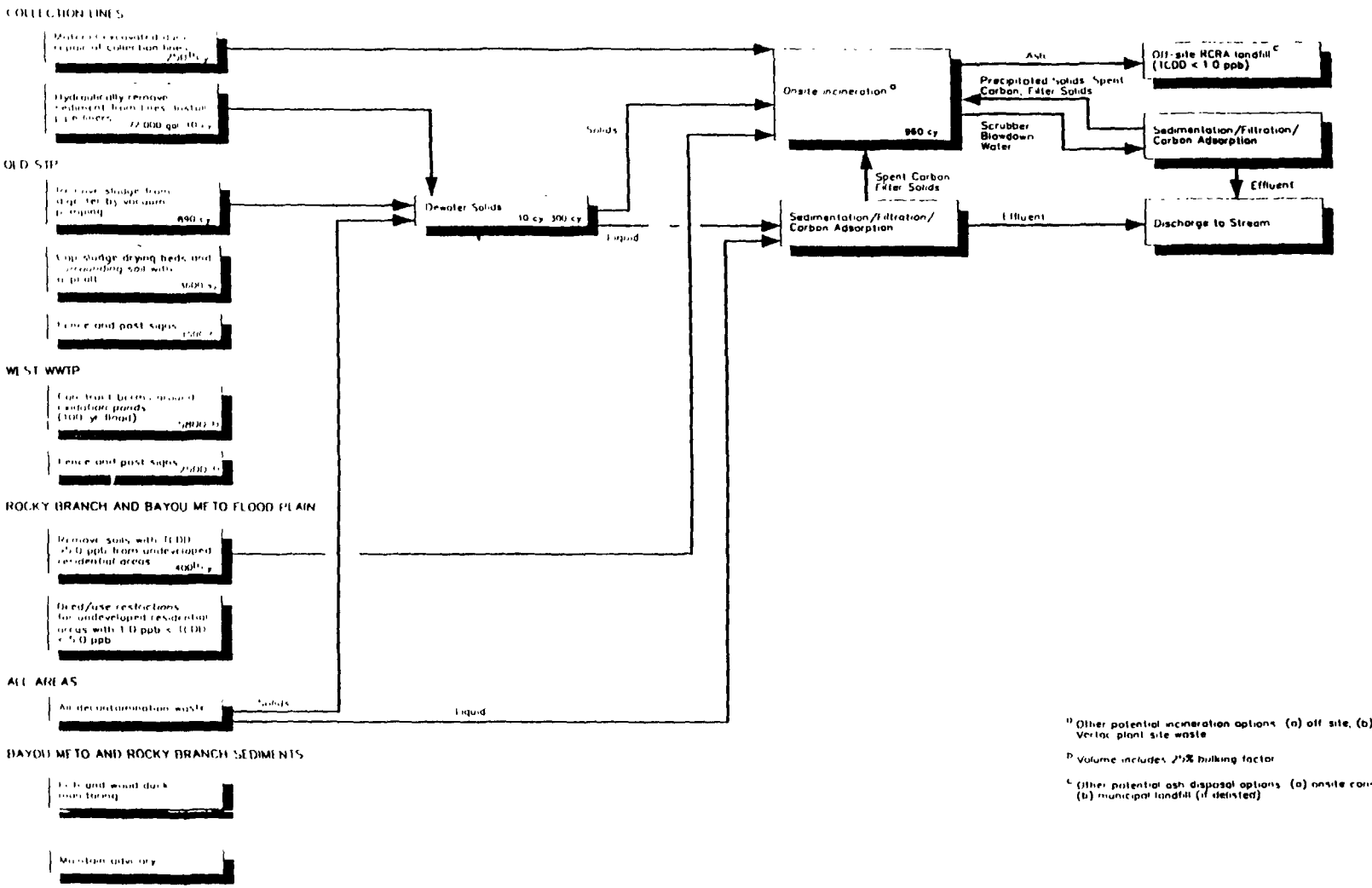


FIGURE 19
ALTERNATIVE 3
FLOW DIAGRAM
Vertac Off Site U.S.
Jacksonville, Arkansas

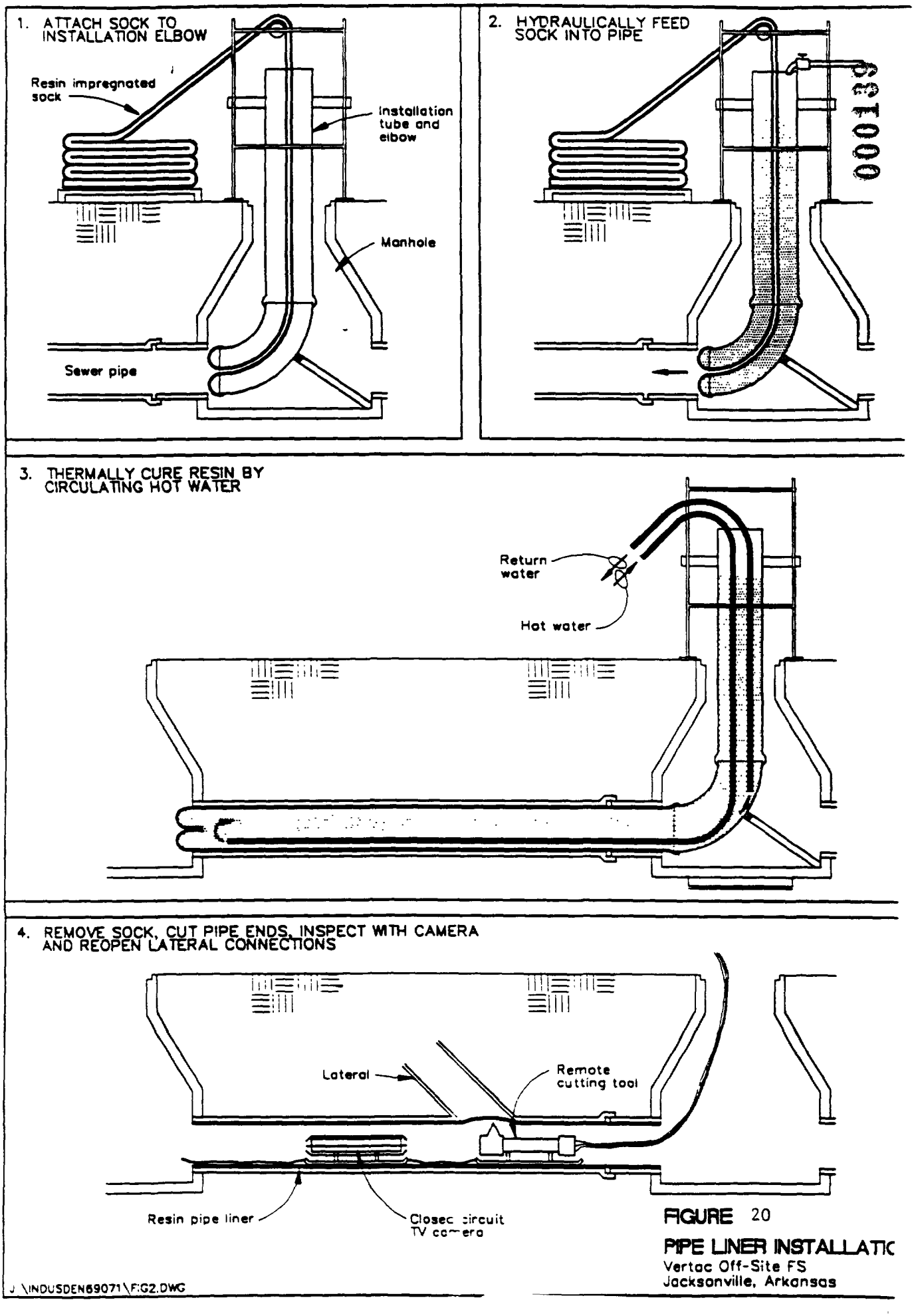


FIGURE 20

PIPE LINER INSTALLATIC

Vertac Off-Site FS
Jacksonville, Arkansas

J:\INDUSDEN69071\FIG2.DWG

TCDD concentration of 12.4 ppb in 1984. Incineration would destroy this contamination, as opposed to consolidating it as in Alternative 2.

The sludge drying beds and surrounding soils would be capped with asphalt. Sampling in 1988 found TCDD levels of 2.30 and 1.01 ppb in composite samples of the drying beds and surrounding soils, respectively (see Figure 10). Although these concentrations are less than the ATSDR 5.0 ppb action level for TCDD in nonresidential and nonagricultural areas, the sludge beds have been used for vegetable and flower gardening in the past. Paving this area with a hard asphalt cap would prevent gardening and direct human contact in the future.

The area to be paved would be prepared by demolishing the concrete curbs surrounding the sludge-drying beds and then grading. A small bulldozer and, if necessary, a light grader would be employed for these tasks. A geotextile would be rolled over the prepared subgrade. A layer of four to six inches of crushed gravel would be spread over the geotextile and compacted. The compacted gravel base would be covered with a two-inch layer of dense graded asphalt-concrete pavement. The pavement mixture would be designed with a high asphalt content to retard oxidation and subsequent thermal cracking. All equipment used to move or grade contaminated soil would be decontaminated.

No action would be taken at the other STP units. Fencing and posting signs would further deter access to or use of the Old STP grounds.

Alternative 3--West WWTP

The highest TCDD concentrations found in the 1988 grid sampling of the West WWTP facilities were 2.8 ppb in the aeration basin and 0.97 ppb in the oxidation ponds. Both of these values are below the ATSDR/EPA site-specific action level of 5.0 ppb for nonresidential and nonagricultural areas, and there is no known direct human use of these areas. However, this action level includes the condition that contaminated sediments be prevented from migrating and allowing exposure to humans.

The primary concern for the West WWTP is that sludge and sediment from the bottom of the oxidation ponds may be scoured during a flood event and transported to relatively uncontaminated areas. Information from the USGS indicates that the 100-year flood elevation in this area is 250.8 feet above mean sea level (msl). The walls of the aeration basin are higher than 253 feet above msl, placing that facility out of the 100-year flood plain. However, the oxidation ponds, with walls approximately 246 feet above msl, are in the five-year flood plain. In this alternative, the oxidation ponds would be protected against inundation during a 100-

year flood by constructing earthen berms around their perimeter (5,800 ft).

The berms would be constructed using a low permeability soil such as the local silts and clays and would feature a 252.8 foot elevation (msl) berm, vegetative cover, except for a crushed gravel road surface, and an exterior perimeter drainage ditch. Roughly 141,800 cy of material would be required to construct berms around the oxidation ponds (this number assumes an average ground surface elevation of 242 feet above msl and is an overestimate because it was not reduced by the volume of material in the existing berms, which would be incorporated into the new ones).

The West WWTP facilities (oxidation ponds and aeration basin) would be fenced and signs posted to restrict public access and use in Alternative 3.

Alternative 3--Rocky Branch Creek and Bayou Meto Flood Plain

As in Alternative 2, soils containing above 5 ppb TCDD would be excavated, and those areas would be backfilled and seeded. However, in this alternative, these soils (approximately 400 cubic yards) would be incinerated (see "Incineration" later in this section).

As in Alternative 2, zoning changes would be sought for undeveloped residential areas with soil TCDD levels between 1.0 and 5.0 ppb. A zoning change to nonresidential/nonagricultural would help prevent long-term direct human contact with contamination in those areas.

Alternative 3--Rocky Branch Creek and Bayou Meto Sediments

The remedy for this area is identical to Alternative 2.

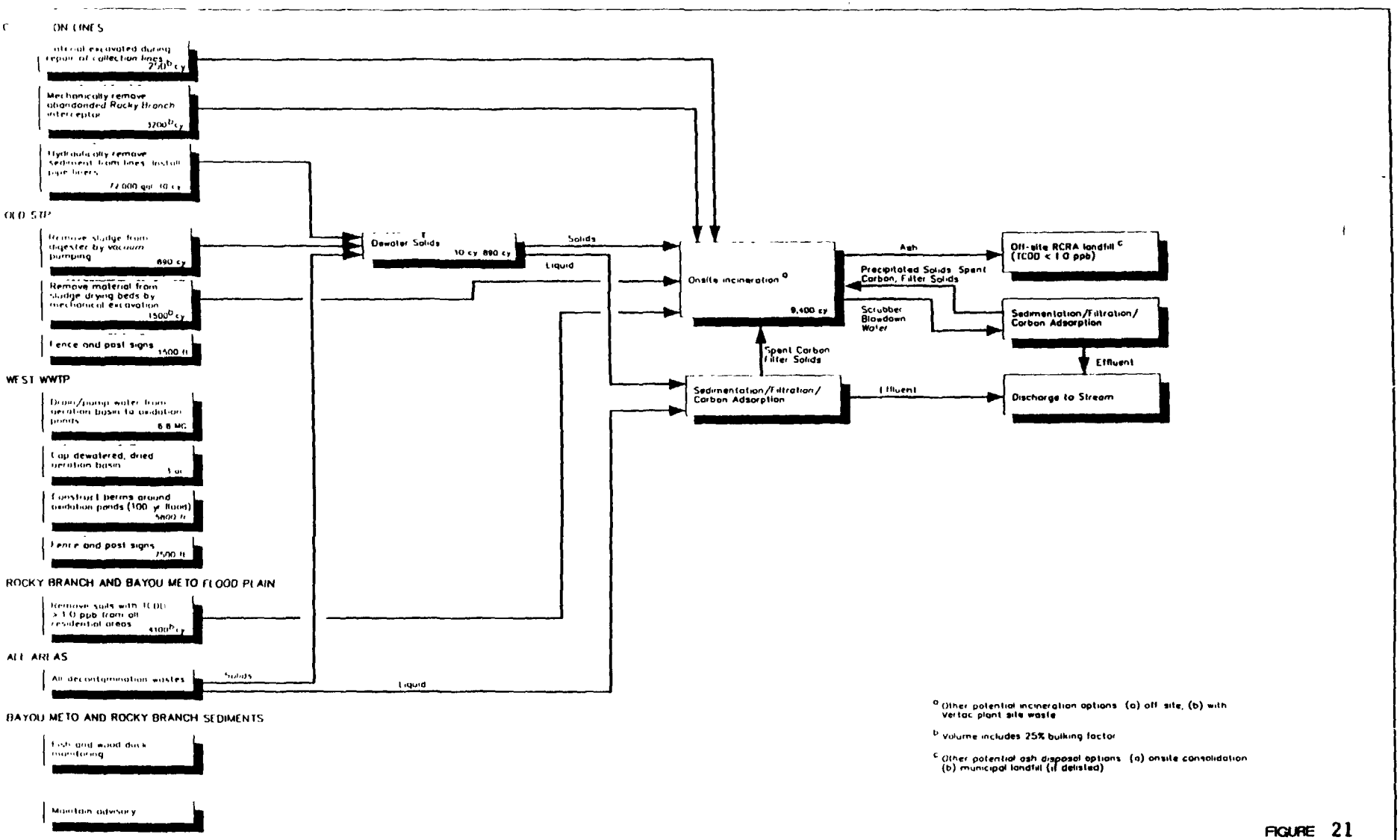
ALTERNATIVE 4

Figure 21 is a flow diagram of Alternative 4.

Alternative 4--Collection Lines

The active sewer lines would be cleaned by hydraulic flushing and the cleaned pipes would be lined, as described in Alternatives 2 and 3, respectively.

The abandoned Rocky Branch Creek interceptor (see Figure 15) contained TCDD levels as high as 70.5 ppb in 1984. In this alternative, mechanical trenching and excavation equipment, such as backhoes, would remove the 4,350-foot abandoned, along with contaminated sediments within the pipe, and a minimum of two feet of potentially contaminated soil surrounding the pipe (4 feet x 4 feet). These materials (approximately 3,200 cubic yards,



[a] Other potential incineration options (a) off site, (b) with Vertac plant site waste

[b] Volume includes 25% bulking factor

[c] Other potential ash disposal options (a) onsite consolidation (b) municipal landfill (if delisted)

FIGURE 21
ALTERNATIVE 4
FLOW DIAGRAM
Vertac Off-Site FS
Jacksonville, Arkansas

considering a 25 percent bulking factor) would be dewatered and incinerated (see "Solids Dewatering" and "Incineration" later in this section). The resulting trench would be backfilled with clean soil. All flushing and decontamination liquids would be treated by the onsite wastewater treatment system.

Alternative 4--Old STP

Backhoes would excavate to a depth of one foot the sludge drying beds and surrounding soil. Approximately 1,500 cubic yards of excavated material (assuming 25 percent bulking) would be incinerated. As in Alternative 3, the sludge would be pumped from the sludge digester, dewatered, and incinerated. No action would be taken at the other STP units. The Old STP grounds would be fenced and warning signs posted to restrict access.

Alternative 4--West WWTP

The 6.8 million gallons of water in the three-acre aeration basin would be drained and pumped into the oxidation ponds and the aeration basin would be allowed to dry. After dewatering and drying, the aeration basin would be capped. The purpose of the cap would be to provide a barrier against migration of contaminated basin sediments. The cap would consist of compacted native soil, six to 12 inches of topsoil, and a vegetative layer. The cap would be designed to grade naturally with the surrounding soil. Assuming an average depth of 10 feet in the aeration basin, the cap would require 46,000 cy of native soil and 2,400 cy of topsoil (compacted volumes).

As described in Alternative 3, berms would be constructed to protect the oxidation ponds against inundation during a 100-year flood. Water accumulating in the oxidation ponds from precipitation would be allowed to flow to Bayou Meto via an outfall designed to prevent sediment entrainment.

The West WWTP facilities would be fenced and warning signs posted.

Alternative 4--Rocky Branch Creek and Bayou Meto Flood Plain

Soil would be excavated from all residential areas (developed or undeveloped) with TCDD concentrations greater than 1.0 ppb. Removal of this soil would remove the risk associated with potential future development in areas zoned residential with TCDD concentrations greater than the 1.0-ppb action level for residential areas. These lands would be backfilled with clean soil and revegetated following excavation. The excavated soil (4,100 cubic yards, including a 25 percent bulking factor) would be incinerated.

Alternative 4--Rocky Branch Creek and Bayou Meto Sediments

Same as Alternatives 2 and 3.

ALTERNATIVE 5

Figure 22 is a flow diagram of Alternative 5.

Alternative 5--Collection Lines

In this alternative, all 14,700 feet of active and inactive sewer lines and all manholes would be mechanically removed, as would at least two feet of soil surrounding the pipes. The contaminated sediments and debris (approximately 10,900 cubic yards) would be dewatered. Solids would be incinerated, and liquids would be treated by the wastewater treatment system. Removal of the contaminated collection lines and installation of new lines would preclude contamination of the new WWTP.

Wastewater collection must continue during the removal of the contaminated sewer lines; therefore, a new sewerage system, running from the residential area south of the Vertac property to the new wastewater treatment plant, must be installed before excavating the existing lines. For this alternative as well as the others, the timing of various actions is critical for providing continuous wastewater collection and preventing contamination of the new wastewater treatment facility. Remedial actions that must be temporally coordinated include:

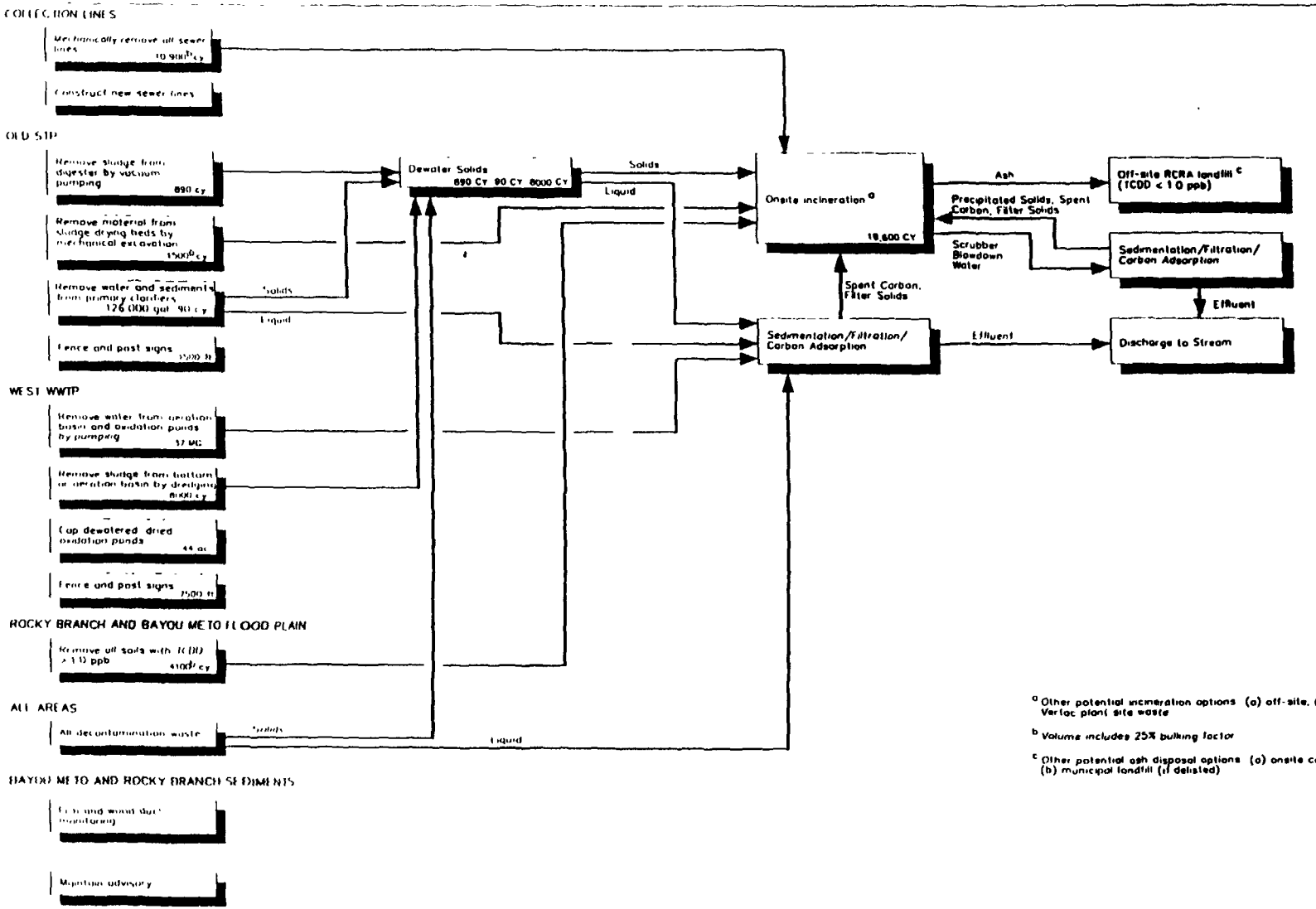
- Disconnection of sewer lines from the Vertac Plant site wastewater treatment system
- Cleaning, removal, and replacement of existing collection lines
- Connection of cleaned, new lines to the new WWTP
- Closeout of the West WWTP

Alternative 5--Old STP

As in Alternative 4, the sludge digester would be emptied and cleaned and the sludge drying beds excavated and backfilled. Material from both the digester and drying beds would be incinerated.

Other facilities that comprise the Old STP include two primary clarifiers, two trickling filters, and two secondary clarifiers. All are inactive.

The water and sediments would be removed from the primary clarifiers. The water (126,000 gallons) would be treated by



[a] Other potential incineration options (a) off-site, (b) with Vertac plant site waste

[b] Volume includes 25% bulking factor

[c] Other potential ash disposal options (a) onsite consolidation, (b) municipal landfill (if delisted)

FIGURE 22
ALTERNATIVE 5
FLOW DIAGRAM
Vertac Off Site I S
Jacksonville, Arkansas

filtration and carbon adsorption and the sediments (90 cubic yards) dewatered and incinerated. No action would be taken on the two trickling filters and two secondary clarifiers.

The Old STP grounds would be fenced and warning signs posted.

Alternative 5--West WWTP

Roughly 8,000 cubic yards of contaminated sludge estimated to be on the bottom of the aeration basin would be removed, dewatered, and incinerated. The sludge could be removed from the bottom using a pontoon-mounted, floating pumping system. The 37 million gallons of water would be pumped from the aeration basin and oxidation ponds to the onsite wastewater treatment system (see "Wastewater Treatment" later in this section). After dewatering, the oxidation ponds would be allowed to dry and then covered with a soil/vegetative cap. It is assumed that the bottom sediments would dry sufficiently to allow capping/compaction. The cap would consist of native compacted soil covered with six inches of topsoil and a vegetative layer, constructed so that its surface grades naturally with the surrounding soil. Assuming an average depth of three feet in the oxidation ponds, the cap will require 178,000 cy of native soil and 36,000 cy of topsoil (compacted volumes). Also, the outfall ditch from the oxidation ponds would be filled with clean native soil, and seeded. Fences and warning signs would be constructed around the West WWTP facilities.

Alternative 5--Rocky Branch Creek and Bayou Meto Flood Plain

Soils with TCDD concentrations greater than 1.0 ppb would be removed and incinerated as described in Alternative 4.

Alternative 5--Rocky Branch Creek and Bayou Meto Sediments

Same as Alternatives 2, 3, and 4.

ALTERNATIVES 6A AND 6B

Figure 23 is a flow diagram of Alternatives 6a and 6b.

Alternatives 6a and 6b--Collection Lines

The active sewer lines would be cleaned by hydraulic flushing as described in Alternative 2. Sediments removed from the active lines would be dewatered and incinerated onsite. Water from the collection lines would be treated through sedimentation, filtration, and carbon adsorption. Pipeliners would be installed in the clean active line as described in Alternative 3.

In Alternatives 6a and 6b, the abandoned section of the Rocky Branch Creek Interceptor will be filled with grout to reduce the migration of contaminants in the line.

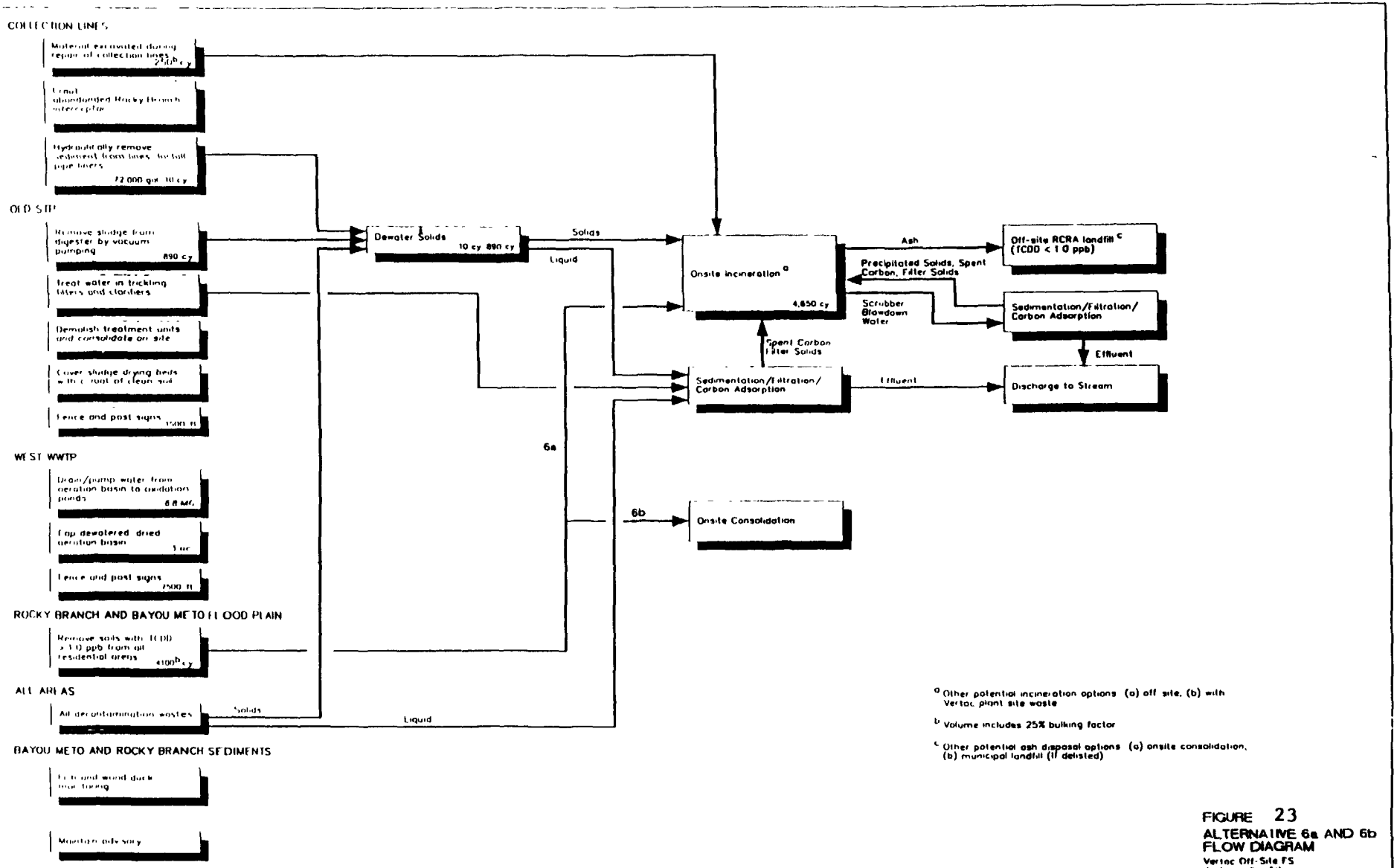


FIGURE 23
ALTERNATIVE 6a AND 6b
FLOW DIAGRAM
Vertac Off-Site FS
Jacksonville, Arkansas

The grout will be placed in the old interceptor directly from a ready-mix truck. Grouting will begin at the manhole on the lowest end of the line (near the treatment plant). The grout will be poured into the manhole, and a concrete vibrator will be used to force the grout into the interceptor. Pouring will be discontinued when the level is just above the interceptor, and no additional grout can be forced into the line. The operation will then move to the next manhole up the line, and continue until the end of the abandoned line is reached.

The new interceptor was installed in close proximity to the old interceptor. In several locations, the lines cross each other, and lateral lines pass through the old interceptor before connecting to the new interceptor. Care must be exercised to ensure that the new interceptor and the lateral lines are not affected by the grouting operation. The Jacksonville Sewage Treatment Authority should be consulted to safeguard the operation.

Alternatives 6a and 6b--Old STP

In both Alternatives 6a and 6b, the sludge in the digester would be pumped out, dewatered, and incinerated as in Alternative 5. Water contained in the trickling filters and clarifiers would be pumped out and treated through a filtration and carbon adsorption process. Clean water would be discharged to Rocky Branch Creek and the carbon and filter solids would be incinerated.

The old sewage treatment plant units will be demolished, and buried onsite. The primary clarifiers, sludge digester, trickling filters, and curbs from the sludge drying beds, along with the pump house and associated structures will be torn down, using conventional construction techniques, and the rubble reduced to debris suitable for burial. The secondary clarifiers, which are below grade, will be filled with demolition debris. Remaining debris, including filter media from the trickling filters, will be consolidated in an area over the secondary clarifiers, and compacted for stability. The fill area will be covered with a minimum of one foot of clean soil. The sludge drying beds will also be covered with one foot of clean soil.

The irregular nature of the demolition debris may cause settlement of the soil cover over time. Seeding of the cover soil will be required to reduce erosion. Periodic inspection and maintenance will be required, including addition of soil and seeding to repair the cover.

Deed notices will be sought to warn against access and development of the old STP area.

Alternatives 6a and 6b--West WWTP

The aeration basin would be dewatered, the water treated, and the carbon and filter solids incinerated as in Alternative 4. The dikes of the aeration basin would be demolished by mechanically pushing the dike soils into the basin. The entire basin would then be covered by one foot of clean soil.

Notices would be placed in the deeds to restrict access and use of the West WWTP.

Alternative 6a--Rocky Branch Creek and Bayou Meto Flood Plain

This alternative would be identical to Alternative 5: All soils with greater than 1 ppb TCDD would be excavated and incinerated.

Alternative 6b--Rocky Branch Creek and Bayou Meto Flood Plain

In Alternative 6b, all floodplain soils with greater than 1 ppb TCDD would be excavated. However, in this alternative, the excavated soils would be consolidated onsite and capped. Approximately 4,100 cy of soil would require consolidation. Since the material consists largely of contaminated native soil, it is assumed that it would be compactable and that compaction would reduce the volume of soil by 25 percent. For consolidation, the material would be placed on the plant site and compacted into a mound.

A multilayer cap would then be placed over the contaminated materials. The cap would be consistent with federal and state RCRA requirements for landfill closure. The overall surface area required for consolidation would be roughly one acre. The native materials required for construction of the cap would be 800 cy of topsoil and sand; 2,400 cy of native soil; and 3,250 cy of clay. Based on soil descriptions in the Jacksonville area, it is expected that materials suitable for cap construction are available locally.

Alternatives 6a and 6b--Rocky Branch Creek and Bayou Meto Sediment

Alternatives 6a and 6b would be identical to the previous alternatives: no action with a continued advisory against fish ingestion and further monitoring of fish.

COMMON REMEDIAL ACTIVITIES

Incineration, solids dewatering, and wastewater treatment are remedial activities that are common to more than one remedial action alternative. To reduce repetition, these activities are discussed under separate headings below.

Incineration

This section discusses onsite incineration and related issues for Alternatives 2 through 6. Each of these alternatives includes onsite incineration with an assumed "mobile" or "transportable" rotary kiln incinerator. The use of the rotary kiln process was selected for detailed development and evaluation because of its versatility in treating a range of wastes, its successful use at several hazardous waste sites, and its success in destroying TCDD wastes.

There is a range of trailer-mounted rotary kiln incineration equipment available from several incineration vendors. Three basic system sizes currently available on the market include:

- Small mobile system. Approximately 5,000,000 to 10,000,000 Btu per hour; one or two standard semitrailers; maximum processing rate of 0.5 to one ton per hour of low Btu content, low moisture content contaminated soils.

- Large mobile system. Approximately 30,000,000 Btu per hour; three to 10 standard semitrailers; maximum processing rate of four to five tons per hour of low Btu content, low moisture content contaminated soils.

- Transportable system. Approximately 60,000,000 Btu per hour; approximately 50 to 70 standard semitrailers (complete modularized ancillary support facilities, high degree of system redundancy); maximum processing rate of 15 to 25 tons per hour of low Btu content, low moisture content contaminated soils.

The trailer-mounted incineration technology has been developing rapidly in recent years. Several vendors are currently developing more efficient systems that minimize combustion air and allow higher waste throughput. Improvements in waste feed systems, process operation for wastewater minimization, and air emission control systems are also under development.

The actual size and type of incinerator would be determined by competitive bidding and would depend on waste volumes, waste characteristics, site location constraints, utility support requirements, and final performance specifications for incineration.

Potential alternative-specific incineration scenarios for the Vertac off-site wastes are shown in Table 7.

Table 7
Alternative-Specific Rotary Kiln Incineration Scenarios

Alternative	Assumed Waste Volume for Incineration Tons	Probably Rotary Kiln System	Approximate Footprint Size (acres)	Approximate Incineration Rate (tons/hour)	Incinerator Operating Time (months)[a]
2	260	Small mobile system	0.25 to 0.5	0.3 to 1	0.5 to 1.5
3	3,400	Small to large mobile system	0.5 to 1.0	1 to 3	2 to 7
4	11,900	Large mobile or transportable system	1.0 to 2.0	3 to 15	2 to 8
5	22,000	Large mobile or transportable system	1.0 to 2.0	3 to 15	3 to 14
6[a]	4,650	Small to large mobile system	.75 to 1.25	2 to 4	2 to 7

[a]Based on 70 percent operating factor (17 hours per day).

Basic Incineration System Description

A generic rotary kiln process flow diagram is shown in Figure 24. Onsite rotary kiln incineration systems for Alternatives 2 through 6 would include:

- Feed storage. Feed storage would include a minimum one-week inventory of solid wastes to allow for continuous operations. An enclosed feed building would likely be needed for control of fugitive particulate emissions. Conveyor systems or other feed systems would be enclosed.

- Feed preparation. The waste feed may require some waste size classification and/or size reduction processing prior to incineration. Any large rocks or heavy objects greater than four to six inches in diameter would require waste feed preparation. Depending on the quantity and nature of the objects they may be processed through shredders or crushers and fed to the incinerator or separated out, decontaminated, and sent to a RCRA or, if possible, a sanitary landfill.

- Primary and secondary combustion chambers. Organic wastes are destroyed by combustion in the primary and secondary combustion chambers. The efficiency of combustion is dependent on temperature, residence time, and contacting of fuel, combustion air, and waste materials. In accordance with the January 1989 Title 40 Code of Federal Regulations (CFR) Part 264 Subpart O, incinerators at Superfund sites must provide 99.9999 percent destruction and removal efficiency (six nines DRE) for F-listed hazardous wastes. Typical operating temperatures to achieve such DRE's are 1,800°F for primary combustion chambers and 2,200°F for secondary combustion chambers.

- Air pollution control system. Air emissions from incineration depend on several factors, including:

  - Waste composition
  - Feed rate and method
  - Combustion design
  - Combustion air rate
  - Air emission control systems

  The first four factors determine the type and rate of air pollutants generated, and the fifth determines the percentage of these pollutants discharged into the atmosphere. Typical air emissions control systems include a combination of quench towers, scrubbers, demisters, electrostatic

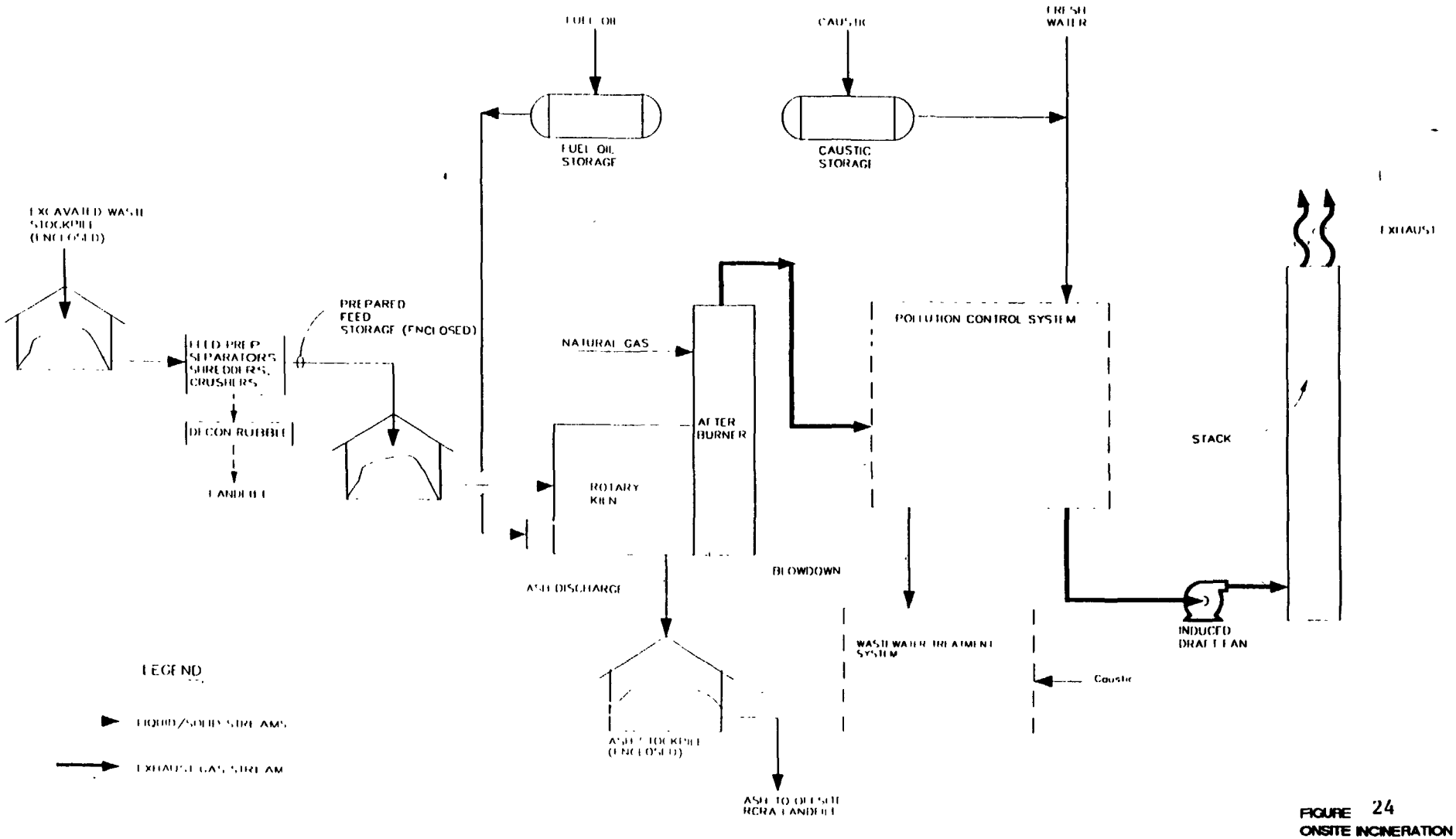


FIGURE 24
ONSITE INCINERATION PROCESS SCHEMATIC
Vertac OU Site 1,
Jacksonville, Arkansas

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precipitators, and fabric filters. For this study, the assumed air emission control systems include quench towers, wet scrubbers, and demisters.

Table 8 lists general air contaminants and pertinent air regulations and standards.

- Wastewater processing and treatment system. Typically, onsite rotary kiln incineration systems generate scrubber blowdown brine that must be treated before discharge. Scrubber water is typically recycled within the system to minimize blowdown. In this study, it is assumed that blowdown brine would be treated with a pH adjustment/precipitation system with filtration and solids dewatering. Dewatered solids would be managed as RCRA-listed wastes and probably would require disposal at a RCRA landfill. The TCDD concentration in the extract from the dewatered solids must be less than 1 ppb to meet land disposal restrictions (LDR), as determined by the toxicity characteristic leaching procedure. Treated wastewater would be managed as RCRA-listed wastes and probably would be discharged to surface water under National Pollutant Discharge Elimination System (NPDES) discharge criteria. Alternately, it may be possible to evaporate/concentrate the blowdown brine to form solid wastes that would likely require disposal at a RCRA landfill (subject to LDR).

- Ash storage. A one-week enclosed ash storage stockpile facility is assumed in this study. The ash would presumably be tested in batches for residual TCDD and other toxics and would be transported and disposed at a RCRA landfill.

- Ancillary support facilities. Ancillary support facilities would presumably include fuel storage, onsite analytical facilities, and site personnel, decontamination, and administration trailers.

Other Incineration Options

There are currently no incineration facilities off the site with permits to burn dioxin wastes.

At least one facility off the site currently has an approved RCRA Part B permit, is permitted to burn PCB wastes, and has applied for a permit to burn dioxin wastes. Even with the approval to burn dioxin wastes, incineration off the site would likely not be cost-

Table 8
Air Contaminants, Regulations, and Standards

Air Contaminant	Pertinent Air Regulation	Emission Standard
Particulate Matter (PM)	PM-10[a]	50 $\mu g/m^3$ annual arithmetic mean (AAM) 150 $\mu g/m^3$ (24-hour max)[d]
	40 CFR 264.340[b]	0.08 grains/dscf
Sulfur Dioxide (SO_2)	PAAQS[c]	80 $\mu g/m^3$ or 0.03 ppm (AAM) 365 $\mu g/m^3$ or 0.114 ppm (24-hour max)[d]
	40 CFR 264.340	10,000 $\mu g/m^3$ or 9 ppm (8-hour max)[d] 40,000 $\mu g/m^3$ or 35 ppm (1-hour max)[d] 100 ppm 1-hour rolling average) 500 ppm (10-minute rolling average)
Carbon Monoxide (CO)	PAAQS[c]	10,000 $\mu g/m^3$ or 9 ppm (8-hour max)[d]
Nitrogen Dioxide (NO_2)	PAAQS[c]	100 $\mu g/m^3$ (max. calendar quarter arithmetic mean)
Lead (Pb)	PAAQS[c]	1.5 $\mu g/m^3$ (max. calendar quarter arithmetic mean)
Ozone	PAAQS[c]	235 $\mu g/m^3$
Hydrochloric Acid (HCl)	40 CFR 264.340	Less than 4 lb/hr or 99 percent control efficiency

[a]PM-10 = Particulate matter less than 10 microns (respirable particulates).
[b]Superfund incinerators must meet RCRA requirements as outlined in Title 40 Code of Federal regulations Part 264, Subpart 0.
[c]PAAQS = Primary Ambient Air Quality Standards (criteria pollutants).
[d]Not to be exceeded more than once per year.

effective, even for the relatively small volume in Alternative 2. Incineration off the site probably would require:

- Drum purchase
- Handling and drumming of TCDD wastes
- Transport of drummed wastes several hundred miles
- Incineration at premium prices (costs would likely be significantly greater than the approximate $2,000 per ton rate to incinerate drummed PCB wastes)

Solids Dewatering

A mobile plate-and-frame filter press would be employed for dewatering sludge and sediment under Alternatives 2 through 5. Approximately 900 cy of material would be dewatered in Alternatives 2 through 4, and 6, whereas approximately 9,000 cy of material would be dewatered under Alternative 5. Table 9 lists the materials to be dewatered, their volumes, and assumed solids contents.

The mobile plate-and-frame filter presses available typically have capacities of 2.0 to 2.5 cy per cycle. Cycle times vary depending on the material being treated, but 1.5 hour is a representative duration. One of those dewatering units would be adequate for implementing Alternatives 2, 3, 4, or 6, while multiple units would be employed if Alternative 5 were implemented.

Wastewater Treatment

Use of a mobile water treatment system is assumed for treating miscellaneous wastewater in Alternatives 2 through 6. Table 10 lists wastewater information for these alternatives.

Figure 25 shows a wastewater treatment schematic for the mobile treatment processes conceptualized in these alternatives. The use of carbon adsorption treatment is consistent with e current onsite treatment of leachate collected in the French d n system.

All discharges would comply with the NPDES require ents and treatment standards. All solid residuals (filter spoo s, spent carbon, etc.) resulting from treatment would be incinerated.

ARARs FOR THE VERTAC OFF-SITE AREA

CHEMICAL-SPECIFIC ARARs FOR THE VERTAC OFF-SITE AREA

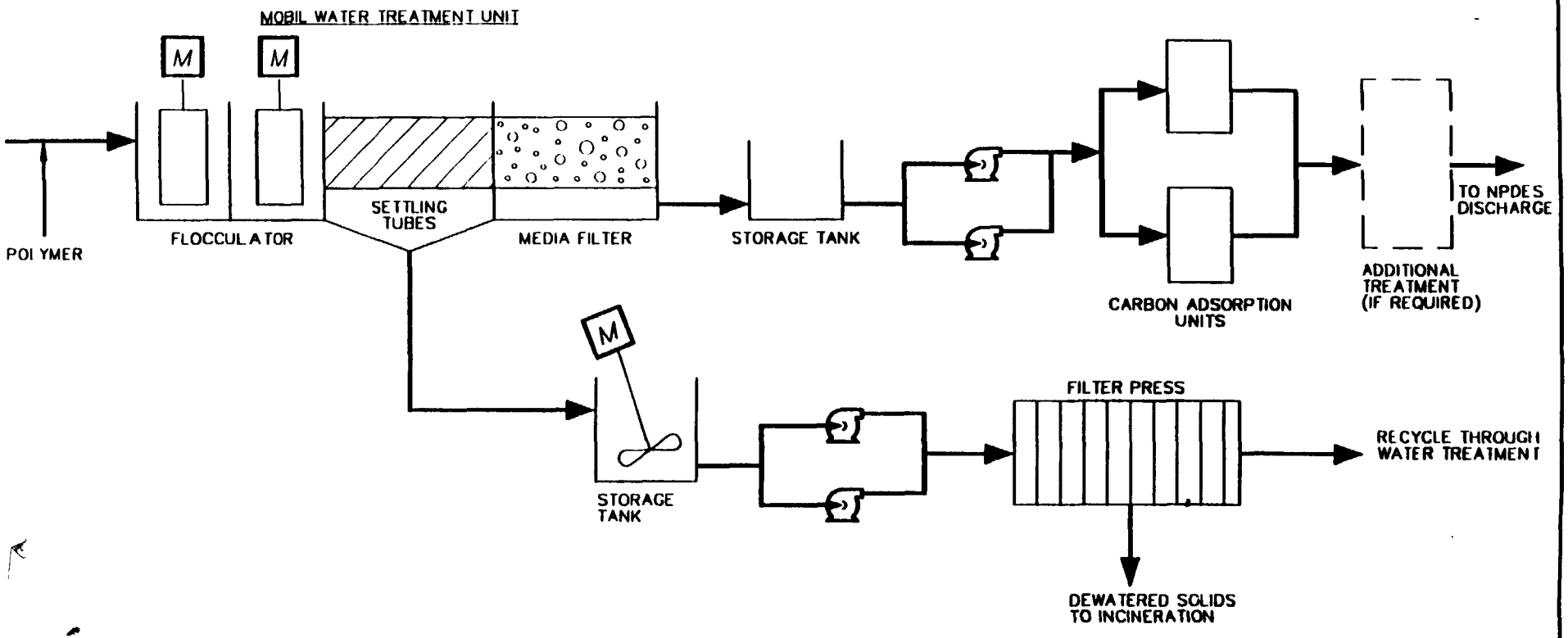
The scope of this study includes only 2,3,7,8-TCDD as the contaminant of concern. Currently, there are no chemical-specific ARAR's for 2,3,7,8-TCDD. There are, however, a number of health

Table 9 Solids Dewatering Data			
Alternative	**Material**	**Estimated Initial Volume (cy) Assumed Solids Content**	**Estimated Final Volume (cy) Assumed Solids Content**
2-4, and 6	Collection line sediment	10 (20%)	6.7 (30%)
	Digester sludge	890 (5%)	300 (15%)
5	Digester sludge	890 (5%)	300 (15%)
	Primary clarifier sediment	90 (5%)	30 (15%)
	Aeration basin sediment	8,000 (5%)	2,700 (15%)

Table 10
Volume and Disposition of Wastewater
From Alternatives 2 Through 6

Alternative	Description	Estimated Volume (gallons)	Disposition
2,3,4,6	Filtrate from dewatering sewer sediments after hydraulic flushing	72,000	Treat in mobile system; NPDES discharge
	Filtrate from dewatering sludge digester sludge	130,000	Treat in mobile system; NPDES discharge
	Decontamination and miscellaneous liquids	50,000	Treat in mobile system; NPDES discharge
	Pump water from aeration basin	6,800,000	Discharge to oxidation ponds
5	Wastewater from primary clarifiers	126,000	Discharge to oxidation ponds
	Wastewater from oxidation ponds and aeration basin	37,000,000	Treat in mobile system; NPDES discharge
	Decontamination liquids and miscellaneous collected wastewater	50,000	Discharge to oxidation ponds

Note: Scrubber blowdown discussed under general discussion of incineration. NPDES permit not required but must meet substantive requirements.



NOTE: MEDIA FILTER BACKWASH SYSTEM NOT SHOWN

FIGURE 25
WASTEWATER TREATMENT PROCESS SCHEMATIC
Vertac Off-Site
Jacksonville, Ar

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advisories and suggested cleanup criteria that could be TBC's for the Vertac off-site remedial action.

The most important TBC is in the April 24, 1986, memo from the Agency for Toxic Substances and Disease Registry (ATSDR) to EPA Region 6 (see Appendix B). This memo recommends cleanup levels specific to the Vertac off-site area. Another important TBC is the January 26, 1989, memo from EPA to ATSDR stating that the highest concentration of TCDD found in the Rocky Branch Creek and Bayou Meto sediments does not pose an unacceptable health threat (Appendix A).

The EPA 1-ppb action level previously employed at other TCDD-contaminated sites (EPA, 1987) is also an important TBC. That level was based on a Centers for Disease Control (CDC) recommendation developed primarily for long-term direct contact with TCDD-contaminated soils in residential areas (Kimbrough et al. 1984).

Other TBC's that could be of use include proposed advisories on protection of human health and aquatic life developed under the Clean Water Act. The advisories for aquatic life are specific to individual fish species, and may have to be adjusted for conditions in Rocky Branch Creek. These criteria should be consulted to determine design goals for the wastewater treatment system included in Alternatives 2 through 6.

LOCATION-SPECIFIC ARAR's FOR THE VERTAC OFF-SITE AREA

Location-specific ARAR's have been evaluated for the Vertac off-site area as a whole. Table 11 includes the location-specific requirements identified as ARAR's.

The federal regulations that form the list of potential location-specific ARAR's include the Resource Conservation and Recovery Act (RCRA), the National Archaeological and Historic Preservation Act, the National Historic Preservation Act, the Endangered Species Act, the Clean Water Act, the Wilderness Act, the Fish and Wildlife Coordination Act, the Scenic Rivers Act, the Coastal Zone Management Act, the Marine Protection Resources and Sanctuary Act, and the Executive Orders on the Protection of Wetlands and the Protection of Flood Plains. No State of Arkansas regulations were identified that addressed other location-specific requirements or that were more strict than federal regulations.

Location-specific ARAR's that will be applicable or relevant and appropriate to the Vertac off-site area include flood plain requirements and requirements under the Fish and Wildlife Coordination Act.

Flood Plain Requirements. Under RCRA, any hazardous waste treatment, storage, or disposal facility constructed within a

Table 11
Identification of Potential Location-specific ARARs
For Vertac Off-site Area (page 1 of 2)

Location	Requirement	Prerequisite(s)	Citation	ARAR	Comments
1. Within 61 meters (200 feet) of a fault displaced in Holocene time	New treatment, storage, or disposal of hazardous waste prohibited	RCRA hazardous waste; treatment, storage, or disposal	40 CFR 264.18(a)	Not ARAR	No Holocene faults are known to exist within 61 meters of the Vertac off-site area
2. Within 100-year flood plain	Facility must be designed, constructed, operated, and maintained to avoid washout	RCRA hazardous waste; treatment, storage, or disposal	40 CFR 264.18(b)	Applicable	These requirements would be applicable to the construction and operation of new RCRA units within the 100-year flood plain
3. Within flood plain	Action to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values	Action that will occur in a flood plain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood prone areas	Executive Order 11988, Protection of Flood Plains, (40 CFR 6, Appendix A)	Applicable	These requirements would be applicable to remedial actions within the flood plain
4. Within salt dome formation, underground mine, or cave	Placement of noncontainerized or bulk liquid hazardous waste prohibited	RCRA hazardous waste; placement of noncontainerized or bulk liquid hazardous waste	40 CFR 264.18(c)	Not ARAR	No salt domes, underground mines, or caves will be used for placement of hazardous wastes
5. Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Action to recover and preserve artifacts	Alteration of terrain that threatens significant scientific, prehistorical, historical, or archaeological data	National Archaeological and Historical Preservation Act (16 USC Section 469); 36 CFR Part 65	Not ARAR	No known scientific or historic artifacts within the boundaries of the Vertac off-site area
6. Historic project owned or controlled by federal agency	Action to preserve historic properties; planning of action to minimize harm to National Historic Landmarks	Property included in or eligible for the National Register of Historic Places	National Historic Preservation Act Section 106 (16 USC 470 et seq.); 36 CFR Part 800	Not ARAR	No historic landmarks are located within the boundaries of the Vertac off-site area
7. Critical habitat upon which endangered species or threatened species depends	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior	Determination of endangered species or threatened species	Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR Part 200, 50 CFR Part 402	Pending	No endangered or threatened species are known to exist on the site. Awaiting confirmation of site status
8. Wetland	Action to minimize the destruction, loss, or degradation of wetlands	Wetland as defined by Executive Order 11990 Section 7	Executive Order 11990, Protection of Wetlands, (40 CFR 6, Appendix A)	Not ARAR	No remedial actions are planned for areas that could be classified as wetlands
	Action to prohibit discharge of dredged or fill material into wetland without permit		Clean Water Act Section 404; 40 CFR Parts 230, 231	Not ARAR	No remedial actions are planned for areas that could be classified as wetlands

Table 11
Identification of Potential Location-specific ARARs
For Vertac Off-site Area (page 2 of 2)

Location	Requirement	Prerequisite(s)	Citation	ARAR	Comments
9. Wilderness area	Area must be administered in such a manner as will leave it unimpaired as wilderness and to preserve its wilderness character	Federally owned area designated as wilderness area	Wilderness Act (16 USC 1131 et seq.); 50 CFR 35.1 et seq.	Not ARAR	Not a wilderness area
10. Wildlife refuge	Only actions allowed under the provisions of 16 USC Section 668 dd(c) may be undertaken in areas that are part of the National Wildlife Refuge System	Area designated as part of National Wildlife Refuge System	16 USC 668 dd et seq.; 50 CFR Part 27	Not ARAR	Not a wildlife refuge
11. Area affecting stream or river	Action to protect fish or wildlife	Diversion, channeling, or other activity that modifies a stream or river and affects fish or wildlife	Fish and Wildlife Coordination Act (16 USC 661 et seq.); 40 CFR 6.302	Applicable	Any remedial actions that may adversely affect Rocky Branch or Bayou Meto must be discussed with the Department of Fish and Wildlife
12. Within area affecting National wild, scenic, or recreational river	Avoid taking or assisting in action that will have direct adverse effect on scenic river	Activities that affect or may affect any of the rivers specified in Section 1276(a)	Scenic Rivers Act (16 USC 1271 et seq. Section 7(a); 40 CFR 6.302 (e)	Not ARAR	Rocky Branch and Bayou Meto are not classified as wild and scenic rivers
13. Within coastal zone	Conduct activities in manner consistent with approved State management programs	Activities affecting the coastal zone including lands thereunder and adjacent shorelands	Coastal Zone Management Act (16 USC Section 1451 et seq.)	Not ARAR	The site is not within a coastal zone
14. Oceans or waters of the United States	Action to dispose of dredge and fill material into ocean waters is prohibited without a permit	Oceans and waters of the United States	Clean Water Act Section 404 40 CFR 125 Subpart M; Marine Protection Resources and Sanctuary Act Section 103	Not ARAR	No dredge disposal in oceans or waters of the United States is included in the remedial alternatives for the Vertac off-site area

100-year flood plain must be designed, constructed, operated, and maintained in a manner that will avoid washout of hazardous waste during a 100-year flood (40 CFR 264.18(b)). For any activity that occurs in a flood plain, Executive Order 11988, Protection of Flood Plains, requires action to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.

Since the Vertac off-site area is within a flood plain, Alternatives 2 through 6 must comply with the requirements listed above. For Alternatives 2 and 6b, the RCRA requirements would be especially important for onsite consolidation. Construction of treatment facilities in Alternatives 2 through 6 would also be subject to the RCRA requirements.

Fish and Wildlife Coordination Act. Any action that might modify or adversely affect a river or stream is subject to review by the state fish and wildlife agency under the Fish and Wildlife Coordination Act. This act requires protection of fish and wildlife in riparian areas. Discharge of treated wastewater effluent and continued discharge of water from the oxidation ponds would require coordination with ADPC&E.

ACTION-SPECIFIC ARAR's FOR THE VERTAC OFF-SITE AREA

Appendix D identifies potential action-specific ARAR's. Action-specific ARAR's are discussed further in the analysis of the alternatives and, in particular, in the analysis of the common elements of the alternatives.

RCRA ARAR's

EPA has made several determinations regarding RCRA ARAR's at the Vertac off-site areas. These are presented below and discussed in greater detail in Appendix D.

Wastes that are part of a permitted discharge to a publicly-owned treatment works (POTW), are regulated under the Clean Water Act, and are exempt from regulation under RCRA as long as the wastes remain in place. Therefore, RCRA hazardous waste management requirements are not applicable to wastes in the collection lines, Old STP, or West WWTP. For the collection lines, EPA has determined that RCRA may be relevant but not appropriate due to depth of the lines (three to 15 feet) and the absence of a direct exposure route. Similarly, for the Old STP and West WWTP, RCRA is relevant but not appropriate because of the low TCDD concentrations, which are below ATSDR action levels (except for sludge digester). EPA has determined that material removed from the collection lines or sludge digester must meet RCRA hazardous waste management requirements.

The Rocky Branch Creek and Bayou Meto flood plain soils do not represent a RCRA unit and, therefore, RCRA is not applicable. However, if soils or sediments are excavated, they must be managed in accordance with RCRA hazardous waste management requirements.

Another important RCRA determination addresses the ash generated from incineration in each of the alternatives. The status of ash from incineration depends on the material being burned:

- Ash from incineration of dioxin wastes must meet a treatment standard (less than 1 ppb of dioxin in extract from TCLP test) before it can be disposed of in land-based RCRA-hazardous-waste disposal units.

- The ash generated by incinerating F020-listed hazardous waste is classified as a hazardous waste (F028).

- The ash from incinerating wastes and soils not classified as hazardous is not classified as a hazardous waste.

- If the hazardous and nonhazardous ash are mixed, the mixture is a listed waste.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

EPA uses nine criteria to evaluate relative performance of each alternative. The nine criteria are categorized into three groups: Threshold criteria (overall protection of human health and the environment and compliance with ARAR's), primary balancing criteria (long-term effectiveness and permanence, reduction of toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost), and modifying criteria (State and community acceptance). The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major tradeoffs among alternatives. The modifying criteria are taken into account after public comment is received on the proposed plan.

Table 12 provides a comparative analysis of alternatives.

Overall Protection of Human Health and The Environment. All of the alternatives, with the exception of the "no action" alternative, would provide a certain level of protection of human health and the environment by eliminating, reducing, or controlling risks through treatment, capping, or deed and land use restrictions. Alternative 5 is the most protective action alternative since human health and environmental risks associated with exposure and migration of contaminated material in and around the active and abandoned sewer lines, sludge in the digester, contaminated soil in drying beds and Rocky Branch flood plain and contaminated sediments in the primary clarifiers, aeration basin, and oxidation ponds would be eliminated. Alternatives 4, 6a and 6b provide the same degree of overall protection relative to each other by eliminating or reducing risks associated with the contaminated sediments in the sewer lines, sludges and sediments in the sewage treatment plants and the contaminated soils in the residentially zoned areas. Alternative 3 is less protective than Alternatives 4, 5, 6a and 6b because contaminated soil with TCDD >5 ppb would remain in the Rocky Branch flood plain. Alternative 2 is the least protective action alternative because very few areas would be remediated in this alternative.

In addition to the protection of the environment provided by the action alternatives noted above, all of the action alternatives provide that the commercial fishing ban will remain in effect, that the advisory against ingestion of fish taken from Rocky Branch Creek and Bayou Meto will continue and that fish and wildlife will continue to be monitored. However, no TCDD-contaminated sediments will be removed from Rocky Branch Creek or Bayou Meto. The specified remedy for the creek and bayou sediments is the most protective remedy of the alternatives available. Any removal of contaminated sediments

UATION CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6a and 6b
	NO ACTION	COLLECTION LINES Hydraulically clean active lines and incinerate sediments. OLD STP Remove sludge from digester and consolidate dewatered solids onsite Fence grounds and post signs WEST WWTP Fence facilities and post signs ROCKY BRANCH FLOOD PLAIN Remove soil with TCDD > 5.0 ppb from undeveloped residential areas and consolidate it onsite. Restrict use of undeveloped residential areas with TCDD between 1.0 & 5.0 ppb ROCKY BRANCH AND BAYOU METO SEDIMENTS No action Continue fish advisory and monitoring	COLLECTION LINES: Hydraulically clean active lines and incinerate sediments. Install pipe liners OLD STP Remove sludge from digester and incinerate dewatered solids Cover sludge-drying beds with asphalt cap Fence grounds and post signs WEST WWTP Protect oxidation ponds from 100-year flood by berming Fence facilities and post signs ROCKY BRANCH FLOOD PLAIN Remove previously excavated soil Remove and and incinerate soil with TCDD > 5.0 ppb from undeveloped residential areas Restrict use of undeveloped residential areas with TCDD between 1.0 & 5.0 ppb ROCKY BRANCH AND BAYOU METO SEDIMENTS No action Continue fish advisory and monitoring	COLLECTION LINES: Hydraulically clean active lines and incinerate sediments. Install pipe liners. Remove abandoned Rocky Branch Interceptor. OLD STP Remove sludge from digester and soil from sludge drying beds and incinerate solids Fence grounds and post signs WEST WWTP. Cover dewatered, dried aeration basin with a soil/vegetative cap. Protect oxidation ponds from a 100-year flood by berming Fence facilities and post signs. ROCKY BRANCH FLOOD PLAIN Remove and incinerate soil with TCDD > 1.0 ppb from all residential areas ROCKY BRANCH AND BAYOU METO SEDIMENTS: No action Continue fish advisory and monitoring	COLLECTION LINES Remove all sewer lines and incinerate soil, sediment, and debris. Construct new sewer lines OLD STP Remove sludge from digester, soil from sludge drying beds, and sediment from primary clarifiers. Incinerate solids and treat wastewater. Fence grounds and post signs. WEST WWTP. Remove sediments from aeration basin and incinerate solids Cover dewatered, dryed oxidation ponds with soil/vegetative cap. Treat waste-water Fence facilities and post signs. ROCKY BRANCH FLOOD PLAIN: Remove and incinerate soil with TCDD > 1.0 ppb ROCKY BRANCH AND BAYOU METO SEDIMENTS No action. Continue fish advisory and monitoring	COLLECTION LINES Hydraulically clean active lines and incinerate sediments. Install pipe liners. Grout abandoned lines OLD STP: Remove sludge from digester, and incinerate dewatered sludge. Cover sludge-drying beds with soil cap Demolish, bury, and cap OLD STP structures. Fence grounds and post signs WEST WWTP: Cover dewatered, dried aeration basin with a soil cap Fence facilities and post signs. ROCKY BRANCH FLOOD PLAIN Excavate and incinerate (6a) or consolidate onsite (6b) soil with TCDD > 1.0 ppb ROCKY BRANCH AND BAYOU METO SEDIMENTS No action Continue fish advisory and monitoring
KE PROTECTIVENESS						
tion of Human Health	Does not reduce exposure/ingestion risks associated with contaminated materials in off site area	Eliminates risk of exposure to contaminated sediments in active sewer lines, sludge in digester, Rocky Branch flood plain soil with TCDD > 5.0 ppb Least protective action alternative	Eliminates human health risks as in Alternative 2 plus risk of exposure to contaminated soil in sludge drying beds Reduces risk of exposure to soil surrounding active sewer lines	Eliminates and reduces human health risks as in Alternative 3, plus exposure/ingestion risks associated with Rocky Branch flood plain soil with TCDD > 1.0 ppb, contaminated sediment in aeration basin, and contaminated material in and around abandoned Rocky Branch Interceptor	Eliminates human health risks as in Alternative 4, plus risk of exposure to contaminated soil associated with all sewerage collection lines and sediments in oxidation ponds Most protective action alternative	Eliminates human health risks as in Alternative 3, plus risk of exposure to contaminated STP structures Reduces migration and exposure through abandoned collection lines Eliminates risks associated with Rocky Branch flood plain soil with TCDD > 1.0 ppb
mental Protection	Does not reduce potential migration of contaminants	Eliminates potential migration of contaminated sediment in active sewer lines sludge in digester, Rocky Branch flood plain soil with TCDD > 5.0 ppb Least protective action alternative	Eliminates environmental risks as in Alternative 2, plus potential migration of contaminated soil surrounding active sewer lines and soil in sludge drying beds Reduces potential migration of contaminated sediments in oxidation ponds	Eliminates environmental risks as in Alternative 3, plus potential migration of Rocky Branch flood plain soil with TCDD > 1.0 ppb and sediments in aeration basin Reduces potential migration of contaminated sediment in oxidation ponds	Eliminates environmental risks as in Alternative 4 plus potential migration of contaminated sediments in oxidation ponds Most protective action alternative	Eliminates environmental risks as in Alternative 3, plus potential migration from abandoned lines and Rocky Branch flood plain soil with TCDD greater than 1.0 ppb
LIANCE WITH ARARs	ATSDR recommendations are not met by the No Action alternative	Collection line sediments, digester sludge, and excavated flood plain soils managed per RCRA Meets ATSDR recommendations for collection lines, old STP, West WWTP Does not meet ATSDR recommendations for flood plain soils between 1.0 & 5.0 ppb	Same as Alternative 2	Collection line pipe sediments, and soils managed per RCRA Digester sludge, drying bed sludge, and flood plain soils managed per RCRA Meets ATSDR recommendations for all areas	Same as Alternative 4	Collection line sediments, digester sludge, and flood plain soils managed per RCRA Meets ATSDR recommendations for all areas
TERM EFFECTIVENESS PERMANENCE						
duction of Residual Risk	Does not reduce potential migration of contaminants	Does not reduce risks associated with these contaminated materials • Soil surrounding sewage collection lines • Soil in sludge drying beds • Sediment in primary clarifiers aeration basin, and oxidation ponds • Rocky Branch flood plain soil with TCDD levels between 1.0 and 5.0 ppb Consolidating and capping reduces risks associated with contaminated sludge in digester and Rocky Branch flood plain soil with TCDD > 5.0 ppb but TCDD remains Has highest residual risk of the action alternatives	Does not reduce risks associated with these contaminated materials • Soil in and around abandoned Rocky Branch Interceptor • Sediment in primary clarifiers • Rocky Branch flood plain soil with TCDD levels between 1.0 and 5.0 ppb Lining pipes reduces risk associated with contaminated soil surrounding active sewer lines Capping reduces risk associated with contaminated soil in sludge drying beds Berming reduces risks associated with contaminated sediments in oxidation ponds	Does not reduce risk associated with contaminated sediment in primary clarifiers Lining pipes reduces risk associated with contaminated soil surrounding active sewer lines Cappu reduces risks associated with contaminated sediments in aeration basin Berming reduces risks of contaminated sediment in oxidation ponds	Capping reduces risks associated with contaminated sediments in oxidation ponds, but inherent hazard of waste remains Eliminates risk associated with all materials known or expected to be contaminated with TCDD > 1.0 ppb Has lowest residual risk of all alternatives	Demolition and capping of OLD STP treatment units reduces the potential to exposure from these units Grouting reduces risk from migration through abandoned lines Lining pipes reduces risk in active line Capping reduces risk with sediments in aeration basin Eliminates risk associated with all materials expected to be contaminated with TCDD > 1.0 ppb in flood plain
ability of Controls	Not applicable	RCRA cap (if maintained) will reliably contain contaminated materials in onsite consolidation Use and access restrictions have limited effectiveness and reliability	Asphalt cap will reliably contain contaminated soil in sludge drying beds and restrict its use Flood-control berms will reliably prevent migration of contaminated sediments in oxidation ponds (for up to 100 year-flood flows) Both cap and berms will require maintenance Use and access restrictions have limited effectiveness and reliability	Soil/vegetative cap will reliably contain contaminated sediment in aeration basin Flood control berms will reliably prevent migration of contaminated sediments in oxidation ponds (for up to 100 year flood flows) Both cap and berms will require maintenance Effectiveness of use and access restrictions is not essential because contaminated material with TCDD > 1.0 ppb will be removed	Soil/vegetative cap (if maintained) will reliably contain contaminated sediment in oxidation ponds Effectiveness of use and access restrictions is not essential because contaminated material with TCDD > 1.0 ppb will be removed	Soil cap will reliably contain contaminated sediment in aeration basin and Old STP Effectiveness of grouting is uncertain and difficult to measure

TABLE 12
COMPARATIVE ANALYSIS OF ALTERNATIVES
Vertac Off-Site FS
Jacksonville, Arkansas

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EVALUATION CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6a and 6b
4. REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT						
Amount Destroyed or Treated	None	Incineration destroys 99.9999% of TCDD in • 10 cy of sediment in active sewer lines • 250 cy of soil surrounding active sewer lines	Incineration destroys contamination as listed in Alternative 2, plus 99.9999% of TCDD in • 890 cy of sludge in digester • 400 cy of Rocky Branch flood plain soil	Incineration destroys contamination as listed in Alternative 3, plus 99.9999% of TCDD in • An additional 3,700 cy of contaminated Rocky Branch flood plain soil • 3,200 cy of material in and around abandoned Rocky Branch interceptor • 1,500 cy of soil in sludge drying beds	Incineration destroys contamination as listed in Alternative 4, plus 99.9999% of TCDD in: • 7,440 cy of material in and around active sewer lines • 90 cy of sediment in primary clarifiers • 8,000 cy of sediment in aeration basin Treats 37 million gallons of contaminated wastewater from primary clarifiers, aeration basin, and oxidation ponds	In Alternative 6a, incineration destroys: • 10 cy of sediment in active lines • 250 cy of soil surrounding active lines • 890 cy of sludge in digester • 4100 cy of Rocky Branch flood plain soil
Reduction of Toxicity Mobility, or Volume	None	Reduces MTV of sediments in collection lines Reduces mobility of digester sludge and flood plain soils <5.0 ppb	Reduces MTV of digester sludge, collection line sediments, and flood plain soils through incineration	Reduces MTV of collection line grav. soils and sediment, digester and drying bed sludge, and flood plain soils through incineration	Same as Alternative 4, plus MTV reduced for active line, primary clarifiers, and aeration basin through incineration	MTV reduced in Alternative 6a using incineration for collection line sediments and soils, digester sludge, and flood plain soils In Alternative 6b, mobility is reduced for flood plain soils through onsite consolidation
Irreversibility of Treatment	Not applicable	Incineration is irreversible. Wastewater treatment coupled with incineration of residues is irreversible	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
Type and Quantity of Residuals Remaining After Treatment	Not applicable	Ash from incineration of 260 cy of soil/sediment remains	Ash from incineration of 960 cy of soil/sediment/sludge remains	Ash from incineration of 9,400 cy of soil/sediment/sludge remains	Ash from incineration of 19,600 cy of soil/sediment/sludge remains	In Alternative 6a, ash from incineration of 4690 cy of sediment/soil remains In Alternative 6b, ash from 550 cy remains 4690 cy of sediment/soil remains.
5. SHORT TERM EFFECTIVENESS						
Community Protection	Not applicable	Implementation creates potential for contaminant transport into laterals, service lines, or homes (during sewer cleaning) and for increased dust production (during excavation and construction). Both risks can be greatly reduced by appropriate mitigative measures	Risks to community virtually the same as with Alternative 2	Risks to community essentially the same as in Alternatives 2 and 3, except that excavation is more extensive	Risk associated with sewer line cleaning does not exist in this alternative. Risk associated with dust production is greater than other alternatives because excavation and construction are more extensive	Same as Alternative 3
Worker Protection	Not applicable	Protection against dermal contact and inhalation of dust and vapors is required during remedial activities	Same as Alternative 2, except that larger volumes of material are involved	Same as Alternative 3, except that larger volumes of material are involved	Same as Alternative 4, except that larger volumes of material are involved	Same as Alternative 3
Environmental Impacts	Not applicable	Incineration will meet emission standards Potential for contaminant migration via dust stormwater runoff, or floodwater increases during excavation	Environmental impacts are the same as with Alternative 2, except that more material is incinerated	Environmental impacts are the same as with Alternative 3, except that more material is excavated and incinerated	Environmental impacts are the same as with Alternative 4, except that more material is excavated and incinerated	Same as Alternative 3
Time Until Action is Completed (After Implementation)	None	3 to 5 years	3 to 4 years	3 to 4 years	3 to 4 years	3 to 4 years

TABLE 12 (continued)

COMPARATIVE ANALYSIS OF ALTERNATIVES

Vertac Off-Site FS
Jacksonville, Arkansas

EVALUATION CRITERIA	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6a and 6b
6. IMPLEMENTABILITY						
Technical Feasibility	Not applicable	Design, construction, and operation are straightforward except in incineration, which is subject to upsets and delays. Cleanup effectiveness is readily determined by subsequent sampling and additional action can be easily implemented if necessary	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2	Similar to Alternative 2 except grouting of collection lines is dependent on the level of deterioration of the lines
Administrative Feasibility	Not applicable	NPDES permit not required to discharge treated wastewater effluent to surface water body. Must coordinate with Jacksonville wastewater authority and Hercules Inc. regarding closeout of West WWTP, sewer line cleaning, and connection with new WWTP. Must coordinate with state air quality agency regarding incinerator emissions. Must show that incineration satisfies RCRA requirements in 40 CFR 264.340 - 264.351. Use restrictions must be coordinated through city of Jacksonville for • Sludge drying beds • Undeveloped residential areas of Rocky Branch flood plain	Similar to Alternative 2 except • Use restrictions are not required for sludge-drying beds • Must coordinate with RCRA landfill authorities regarding disposal of incinerator ash • U.S. Army COE Section 404 permit required for construction in a flood plain	Same as Alternative 3, except no use restrictions	Same as Alternative 4	Same as Alternative 3
Availability of Services and Materials	Not applicable	Availability of mobile incinerators and filter presses depends on current demand. All other required equipment and services should be available. Capping material should be available locally	Similar to Alternative 2. Also, RCRA landfills for disposal of incinerator ash are within 500 miles of the site. Materials available for onsite disposal. Large amount of material required for berming may be difficult to obtain locally	Same as Alternative 3. Alternative 4 requires the largest volume of soil for berming, capping, and backfilling excavated areas	Same as Alternative 4. Large amount of material required for capping may be difficult to obtain locally	Same as Alternative 3
7. COST						
Capital cost	$0	3,900,000	7,600,000	20,000,000	38,000,000	6a - 13,400,000 6b 10,400,000
Annual O&M cost	$0	(first year) 35,000 (after first year) 33,000	(first year) 61,000 (after first year) 45,000 (additional every 5th year) 10,000	(first year) 110,000 (after first year) 68,000	(first year) 200,000 (after first year) 150,000	(first year) 6a - 57,000 6b 72,000 (after first year) 6a - 48,000 6b - 58,000
30 year present value cost (5% discount rate)	$0	4,000,000	8,000,000	21,000,000	40,000,000	6a 14,000,000 6b 11,000,[illegible]

TABLE 12
Vertac Off Site FS
Jacksonville, Arkansas

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from the creek or bayou could resuspend the sediments and release contaminated sediments downstream, resulting in exposing the environment, in particular fish, to additional TCDD exposure. Such removal of sediments would also very likely result in loss or destruction of fish habitat and more overall destruction of the environment than leaving the sediments in place. The U. S. Fish and Wildlife Service has recommended that the sediments in the creek and bayou not be disturbed for these reasons. Therefore, the remedy for the creek and bayou sediments is more protective of the environment than any removal of the sediments, even though it may result in fish and other biota being exposed to low levels of TCDD.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs). The "no action" alternative does not comply with ARAR's since contaminated soils/sludges with concentrations exceeding the ATSDR-recommended action level would be left. Alternatives 2 and 3 also would not comply with ARAR's, unless the zoning of the undeveloped residential area south of Vertac is changed from residential to commercial/industrial. Alternatives 4, 5, 6a and 6b meet or exceed the ARAR's and remedial action goals.

Long-Term Effectiveness and Permanence. Alternative 5 has the lowest residual risks of all the alternatives, since a large volume of contaminated material would be destroyed. Alternatives 2 and 3 have the highest residual risk of the action alternatives, since soils having a dioxin concentration higher than 1 ppb would remain in the Rocky Branch flood plain south of the plant and very little contaminated materials are destroyed. Alternative 4 provides more long-term protection and permanence than Alternatives 2, 3, 6a and 6b because more contaminated material is destroyed. Alternatives 6a and 6b are more protective and permanent than Alternatives 2 and 3. Alternative 6a is more protective and permanent because the contaminated floodplain soils are incinerated rather than consolidated onsite.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment. Alternative 1 does not reduce toxicity, mobility, or volume of contaminants present in the off-site areas. In Alternatives, 2, 3, 4, 5, 6a and 6b, approximately 260, 1,550, 9,950, 25,480, 5,250, and 1,150 cubic yards of contaminated soils/sludges/sediments would be treated by incineration, respectively. However, in Alternatives 4 and 5, buried sewer lines (abandoned line in alternative 4 and both abandoned and active lines in Alternative 5) would be excavated and incinerated. Excavation and incineration of the sewer lines is considered unnecessary for protection of public health.

Short-Term Effectiveness. This criterion is not applicable to Alternative 1, because no action will be taken. Alternatives 2 and 3 provide the greatest short-term effectiveness, assuming access to the contaminated areas is effective, and because they include the smallest amount of construction activities that could cause short-term adverse impacts on workers and the community. However, since land use controls are difficult to enforce and must be negotiated with landowners, the short-term effectiveness of these is questionable. Alternatives 4 and 5 offer the lowest degree of short-term effectiveness because they involve the largest amounts of construction activities and thus would result in the greatest impact to workers and the community. Alternatives 6a and 6b provide a moderate amount of short-term effectiveness because threats are addressed, yet the construction will cause a moderate amount of impacts to workers and the community.

Implementability. Alternative 1 is no action and therefore easily implementable. The remaining alternatives are implementable. Implementing Alternatives 2 and 3 require changing the zoning of undeveloped residential area south of the Vertac plant site from residential to commercial/industrial. This change in zoning may be difficult to accomplish because it would require negotiating these changes with landowners, particularly the owners of the western floodplain of the west fork of Rocky Branch Creek. For Alternatives 3, 4 and 5, the large amounts of material required for berming and/or capping oxidation ponds may be difficult to obtain locally. Alternatives 6a and 6b would be the easiest to implement among the action alternatives because no change in zoning would be required, and no large amounts of material would be required for berming and/or capping of oxidation ponds.

Cost. The cost of and time to implement each alternative is shown below:

Alternative	Capital Cost	Annual O&M First Year	Annual O&M After First Year (2-30 Yrs)	30-Year Present Value Cost (5% Discount Rate	Years to Implement
1	-0-	-0-	-0-	-0-	-0-
2	3,900,000	35,000	33,000	4,000,000	4
3	7,600,000	61,000	45,000	8,000,000	4
4	20,000,000	110,000	66,000	21,000,000	5
5	38,000,000	200,000	150,000	40,000,000	5
6a	13,400,000	57,000	46,000	14,000,000	4
6b	10,400,000	72,000	58,000	11,000,000	4

State Acceptance. The State of Arkansas is in general agreement with the proposed remedy. However, the State has requested EPA to carefully evaluate the advantages of excavating the contaminated soil in the Rocky Branch flood plain against the resulting ecological damage and cost from excavation, before selecting the remedy. The State also recommends that, since it has been some time since the sewer lines, sewage treatment plants and floodplains have been sampled, these areas be resampled prior to being remediated.

Community Acceptance. The community response was generally favorable to the proposed remedy, except that several citizens are opposed to onsite incineration. Specific responses to public comments are addressed in the responsiveness summary.

IX. THE SELECTED REMEDY

The remediation goals for the Vertac off-site area are:

1. Residential and agricultural areas should be remediated to 1 ppb TCDD.

2. For nonresidential/nonagricultural areas (Old STP, West WWTP), prevent direct public contact with contaminated soils containing TCDD concentrations above 1.0 ppb TCDD. For the Old STP and West WWTP, this action level is 1.0 rather than 5 to 7 ppb TCDD as recommended by ATSDR, because levels above 1 ppb still represent a low level risk to the public that can be eliminated through cost-effective measures such as soil capping. Public access to these areas was demonstrated when persons used the sludge drying beds for gardening.

3. Prevent migration of TCDD-contaminated soils into the waterways and surrounding flood plains.

4. Prevent migration of TCDD-contaminated sediments through the sewage collection lines to the new Jacksonville sewage treatment facility.

The selected remedy is Alternative 6a, with some minor modification to address comments by the State of Arkansas. The major components of the selected remedy include:

- Sewage Collection Lines -- Sediments would be removed from the active sewage collection lines between the Vertac plant site and the West Wastewater Treatment Plant and incinerated onsite. Pipe liners would be installed in the cleaned sewer lines. Cleaning the line and installing the pipe liner will allow the interceptor to be routed to the new Jacksonville sewage treatment facility, without contaminating the new facility. The abandoned line would be filled with grout to reduce the migration of contaminants in the line.

- Old Sewage Treatment Plant -- The sludge would be removed from the sludge digester and incinerated onsite. The sludge drying beds would be capped with one foot of clean soil. Accumulated water in the treatment units would be removed, treated and discharged, and the treatment units would be demolished and capped with one foot of clean soil. EPA will negotiate with the City of Jacksonville to place a notice in the deed recommending that the Old

STP site zoning remain commercial/industrial and access be restricted.

- o West Wastewater Treatment Plant -- The aeration basin would be drained, the dikes demolished, and the entire basin capped with one foot of clean soil. A notice would be placed in the deed recommending that the West WWTP site zoning remain commercial/industrial and access be restricted.

- o Rocky Branch and Bayou Meto Flood Plain -- In order to minimize ecological damage to the floodplain and to the downstream areas, the floodplain areas that are currently residentially zoned will be resampled and only those areas with actual 2,3,7,8 tetrachloro-dibenzo-p-dioxin (2,3,7,8 TCDD) levels greater than 1.0 ppb will be removed and incinerated onsite.

- o Rocky Branch Creek and Bayou Meto -- Monitor fish in these streams for dioxin and continue ban on commercial fishing and advisory discouraging sport fishing as long as fish tissue dioxin levels are above Food and Drug Administration alert level.

The implementation of the selected remedy will result in the reduction of carcinogenic risk from being as high as 10^{-3} due to the sewer line sediments to the 10^{-5} to 10^{-6} range, depending on the point of exposure.

X. THE STATUTORY DETERMINATIONS

The remedy selected must satisfy the requirements of Section 121 of CERCLA to:

- o Protect human health and the environment;
- o Comply with ARAR's (or justify a waiver);
- o Be cost-effective;
- o Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and
- o Satisfy the preference for treatment as a principal element or justify not meeting the preference.

A discussion of how the selected remedy satisfies these statutory requirements is presented below:

Protection of Human Health and The Environment. Implementation of the selected remedy would eliminate the risk of exposure or migration associated with contaminated sediments in the active sewer lines, sludge in the digester, and Rocky Branch Creek flood plain soils containing greater than 1 ppb TCDD. The removed sediments, sludge, and excavated contaminated soil would be incinerated. The grouting of the abandoned Rocky Branch interceptor will minimize the potential for further contaminant migration in those lines. Demolition of the old STP structures, burial onsite, and capping will reduce the potential for future exposure to these contaminated materials. Capping of sludge drying beds will eliminate the risk of agricultural use of the drying beds and the potential for migration of contaminated soil. Dewatering and capping of the aeration basin in the West Wastewater Treatment Plant will reduce the risk of exposure to contaminated sediments and eliminates the potential for migration.

Compliance with ARAR's. The selected remedy will comply with all ARAR's. The selected remedy addresses contamination in the active sewer lines, sludge digester, and Rocky Branch Creek flood plain soils to the levels recommended by ATSDR for each area. Sediments from active sewer lines, sludge from the digester, and Rocky Branch Creek contaminated floodplain soils would be incinerated. RCRA hazardous waste management requirements would be applicable for removal and treatment of these wastes.

Solids dewatering prepares solid wastes for treatment in the onsite incinerator. The RCRA hazardous waste management requirements are relevant and appropriate to the dewatering process and management

of residuals. (See Appendix D for RCRA requirements for container storage, tank storage, and treatment.)

Onsite incineration would treat (destroy) dioxin in contaminated materials, and would satisfy RCRA hazardous waste disposal requirements. (See Appendix D for RCRA requirements for incineration, treatment, and tank storage.)

The flushing water from collection lines, liquid from solids dewatering, liquid decontamination wastes, and scrubber blowdown water from incineration would be treated by an onsite filtration and carbon adsorption treatment system. Wastewater treatment standards for liquids contaminated by dioxin are not specified by RCRA. However, treated effluent would meet the substantive requirements of the National Pollutant Discharge Elimination System (NPDES). Effluents regulated by the Clean Water Act are not hazardous wastes, by definition. However, the RCRA hazardous waste management requirements would be applicable to management of the residuals from the treatment process. (See Appendix D for requirements for container storage, direct discharge of effluent, tank storage, and treatment.)

RCRA hazardous waste management requirements are considered relevant to the contamination in and around the abandoned collection lines, but not appropriate because there is little risk of exposure. Therefore, although there is no ARAR requiring grouting, this remedy component provides a cost-effective means of minimizing further contaminant migration through the collection lines.

Cost Effectiveness. The 30-year present value cost for the selected remedy is estimated to be $14,000,000 and is moderate when compared to the most expensive alternative, which would cost $40,000,000 (30-year present worth). The selected remedy provides a similar degree of protectiveness as the most expensive alternative but is much less expensive. The less costly alternatives do not afford adequate protection of human health and the environment and they are not considered appropriate.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologist to the Maximum Extent Practicable ("MEP"). The selected remedy meets the statutory requirement to utilize permanent solutions and treatment technologies, to the maximum extent practicable, because approximately 5250 cubic yards of contaminated materials would be permanently destroyed. Alternative 6a was selected because this alternative is protective of human health and the environment, complies with all ARAR's, reduces the toxicity, mobility, and volume of the contaminants to the maximum extent practicable, is implementable and is the most cost-effective. Alternatives 4, 5, 6a, and 6b provide similar degrees of protectiveness, but the costs for Alternatives 4 and 5 are much higher (1.5 times to about three

times higher than the cost for the selected remedy). These two alternatives involve tasks not considered necessary for protection of human health, such as excavation and incineration of sewer lines. Alternatives 6a and 6b are identical, except that in Alternative 6a the soils excavated from the Rocky Branch Creek flood plain would be incinerated, whereas in Alternative 6b the excavated soil would be consolidated onsite and capped. Alternative 6a was chosen because this alternative utilizes a more permanent solution and treatment technology to a greater extent than Alternative 6b.

Preference for Treatment As A Principal Element. By treating the dioxin contaminated soils/sludges/sediments in a thermal treatment unit, the selected remedy addresses the principal threats posed by the site through the use of treatment technologies. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

XI. DOCUMENTATION OF SIGNIFICANT CHANGES

The proposed Plan for the Vertac site was released for public comment in July 1990. The Proposed Plan identified Alternative 6a, incineration of removed soils/sediments/sludges, capping of drying beds, demolished STP structures, aeration basin, etc., as the preferred alternative. EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

XII. RESPONSIVENESS SUMMARY

The following is a summary of the questions and comments received at the public meeting and during the public comment period. Many of the comments received relate to the Vertac site, in general, and not specifically to the proposed plan for the Vertac off-site areas. Most of the questions and comments received regarding incineration were made with respect to the State of Arkansas incineration of the 28,500 drums of dioxin waste on the Vertac plant site. The responses to these questions are meant as a response to both the incinerator currently onsite and any incinerator to be built onsite for destruction of the contamination from the Vertac off-site areas. Comments received from Hercules, Inc., a potentially responsible party, are summarized separately in this Responsiveness Summary.

TOXICOLOGY AND HEALTH CONCERNS

COMMENT #1: What is the basis for the Toxicological Profile on dioxin which was distributed at the meeting?

RESPONSE: The Toxicological Profile was based on a review of all of the literature on dioxin. The profile was compiled by Syracuse Research Corporation for the Agency for Toxic Substances and Disease Registry and EPA.

COMMENT #2: What is the airborne standard for dioxin which is considered to be dangerous?

RESPONSE: The action level set by the Center for Disease Control for airborne dioxin is 5.5 picograms per cubic meter. This is the level which is considered safe. EPA has set a working action level of 3.0 picograms per cubic meter, which includes additional safety factors.

COMMENT #3: Why are silvex, xylene, chlordane, mirex, heptachlor, toluene, aldrin, dieldrin, DDT, lindane, and toxaphene not discussed with respect to the site?

RESPONSE: Dioxin is used as an indicator compound for the above listed compounds. Dioxin is considered to be much more toxic and if the soils are cleaned up to the dioxin cleanup levels, the other compounds will also be cleaned up. In addition, many of the compounds listed above are highly volatile or biodegradable, and therefore, are not likely to currently exist at levels of concern.

COMMENT #4: Why will a health study not be done until 1991? Is EPA not giving the citizens of Jacksonville a fair health study because Vertac produced Agent Orange for the Government?

RESPONSE: The Arkansas Department of Health has established a community panel so that the citizens of Jacksonville will have input on what they would like to see in a health study relating to the Vertac site. The Agency for Toxic Substances and Disease Registry will support the study by providing help on the final study design and review.

COMMENT #5: Will the results of the National Dioxin Study be used as a basis for the health assessment?

RESPONSE: The National Dioxin Study focused on levels of dioxin in the environment (i.e.,in the soil, water, and fish tissue) not on health effects from dioxin. However, there is a registry of workers exposed to dioxin, which is kept by the National Institute of Occupational Safety and Health. The institute monitors the health of these workers and their families. A series of initial reports are due to be published over the next six months.

COMMENT #6: Why is the cleanup level of 1 ppb dioxin being used when more recently published data indicates a higher value of 100 ppb for a cleanup level?

RESPONSE: The 1.0 ppb clean-up level for dioxin is used for residential areas by EPA because it is within the acceptable risk range set by the National Contingency Plan and is recommended by the Agency for Toxic Substances and Disease Registry. It has been used at numerous other dioxin sites. According to the EPA accepted methodology for calculating risks, a 100 ppb clean-up level would leave a residual risk in excess of 10^{-3}, which is far above the accepted risk range of 10^{-4} to 10^{-6}.

COMMENT #7: If the contamination has not caused any health problems or migrated in the last 40 years, why can't the material sit there for another 40 years?

RESPONSE: The offsite contamination does not appear to have caused any health problems, but uncertainties in this assessment do exist and the offsite contamination does pose a risk to human health and the environment and, thus, should be remediated. Dioxin has been seen to migrate downstream through the sediments and has been detected in fish tissue. Even though a decrease in dioxin concentrations in the stream sediments and the fish tissue has been observed, the removal of the contaminated materials in the floodplain will expedite the cleansing of the system.

INCINERATION

COMMENT #1: Will particulate matter and contamination be spread out over Jacksonville during incineration?

RESPONSE: No. The particulates are limited by the air standards, which are required to be met by the particulate removal system on

any hazardous waste incinerator. The removal system on the incinerator that is currently constructed onsite is designed to remove the particulates down to 1/6 of the air standard. With respect to contamination, any incinerator used to destroy dioxin contaminated waste at the Vertac site will be designed and required to destroy or capture 99.9999% of the contamination in the material. In addition, EPA will be monitoring air quality at the site regularly.

COMMENT #2: How will EPA monitor the performance of the incinerator?

RESPONSE: The performance of the incinerator currently built onsite and of any future incinerator built onsite will be monitored through the operating parameters which will be set during the test burn. The purpose of the test burn is to define the specific mode of operation needed to operate at the 99.9999% destruction removal efficiency level. Once these parameters are established, they must be met at all times during incinerator operation. In addition, EPA will be monitoring the air quality around the site during the operation of the incinerator.

COMMENT #3: Who will be responsible for shutting down the incinerator if there is a problem?

RESPONSE: During the State incineration of the drums, the State and their contractor will be responsible for shutting down the incinerator if there is a problem. EPA will be monitoring the performance and will coordinate closely with the State during the incineration of the drums. During the incineration of the off-site material, EPA will be responsible for shutting down the incinerator if there is a problem.

COMMENT #4: What is the danger to people living next to the site from the incineration, especially the children?

RESPONSE: There is no danger from the incineration to the people, including the children, living next to the site during incineration. The incineration performance regulations require a minimum destruction and removal efficiency of 99.9999% for dioxin wastes. These standards were set based on analyses of potential risks to the health or the environment and the levels of performance that have been measured for properly operated and well designed incinerators. Although the 99.99% destruction and removal efficiency is protective of public health and the environment, a more stringent standard of 99.9999% destruction and removal efficiency was set for wastes containing dioxin because of EPA's and the public's concern about this particularly toxic chemical.

COMMENT #5: How can the residents of Jacksonville be assured that the incinerator at Vertac will not be used to commercially burn hazardous wastes or to burn wastes from other Superfund sites,

other than from the Jacksonville and Rogers Road landfills, after the Vertac wastes are incinerated?

RESPONSE: In order to commercially burn hazardous waste at an incinerator, a permit under the Resource Conservation and Recovery Act would be required. This permitting process requires public comment prior to issuance of any type of permit. With respect to waste from other Superfund sites being brought to Vertac for incineration, Federal regulations only allow waste from one Superfund site to be brought to another site when sites are geographically close and contain similar wastes.

COMMENT #6: Why doesn't EPA know exactly how much soil needs to be incinerated at this time?

RESPONSE: The purpose of the Feasibility Study, which is culminated by the issuance of the Record of Decision, is to develop the conceptual remedy for the site. Not until the design and actual remediation process, which includes testing to verify the complete extent of the contamination, is the exact amount of soil, which needs to be incinerated, known.

COMMENT #7: How can EPA incinerate this material without a completed health assessment or environmental impact study?

RESPONSE: EPA has determined that the preparation of an Environmental Impact Statement is not required in connection with a Superfund cleanup because of the functional equivalency of the Remedial Investigation/Feasibility Study process. Since the procedures in the Superfund Remedial Investigation/Feasibility Study process result in a rigorous review of environmental and health considerations, the health and safety of the community and the environment can be ensured without a separate environmental impact statement.

COMMENT #8: Has an incinerator been used to burn dioxin waste in a residential neighborhood anywhere in the country before?

RESPONSE: The incineration of hazardous material has been occurring for many years. There are numerous facilities in operation throughout the country which incinerate many different types of hazardous wastes on an ongoing basis. Only a small fraction of the incinerators of this type are operated under the authority of Superfund. Instead, most are private or commercial facilities regulated under other Federal Laws such as the Resource Conservation and Recovery Act, the Hazardous and Solid Waste Amendments, and the Toxic Substances Control Act, among others. Additionally, there are other agencies besides EPA which oversee the operations of these facilities, for example, the Department of Energy and the Department of Defense.

Although there are known instances of hazardous waste (i.e., dioxin) incineration being conducted in or adjacent to cities and towns, information detailing the specific location of incinerators relative to population density within a known proximity is not readily available. However, it is known that dioxin contaminated soil was incinerated, in a residential area in Gulfport, Mississippi.

COMMENT #9: What will the incinerator be doing during times when there is no burning going on?

RESPONSE: If it will be a long time before the next time soil will be burned, the incinerator will be shut down. If incineration will begin again soon, the incinerator will continue to be heated.

COMMENT #10: Is it possible that the MRK incinerator will not be the incinerator used at Vertac after the drums have been incinerated?

RESPONSE: At present, it is not known what incineration contractor will be used to incinerate the off-site waste. If EPA performs the off-site cleanup action, EPA will follow the Federal procurement regulations and the competitive bidding process. If a potentially responsible party performs the off-site cleanup action, the potentially responsible party can contract with any qualified incineration contractor, with oversight by EPA.

COMMENT #11: How can EPA bypass a city ordinance which allows that only the 28,500 barrels be burned at Vertac?

RESPONSE: CERCLA mandates that Superfund response actions comply with all Applicable or Relevant and Appropriate Requirements (ARAR's). ARAR's consist of all Federal or State environmentally protective requirements that either address specific circumstances related to Superfund sites, or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Compliance with the substantive requirements of State regulations is required only when the regulation is uniformly applied on a State-wide basis. Local ordinances would not qualify under this criteria because they are not applied consistently across the state. Another reason that compliance with standards other than Federal and State regulations (i.e., local ordinances) is not required is that they might unduly restrict or otherwise encumber timely remedial response at Superfund sites.

COMMENT #12: If the destruction efficiency is 99.9999%, what happens to the 0.0001% that is left?

RESPONSE: The remaining 0.0001% is allowed to be discharged from the stack into the air. This standard was set based on the analyses of potential risks to health and the environment and the

levels of performance that have been measured for properly operated and well designed incinerators. 100% destruction is only theoretical and is not possible in reality.

COMMENT #13: Can the incinerator at Vertac withstand an earthquake, since one is predicted for the New Madrid fault?

RESPONSE: It is not possible to plan for all natural disasters, but EPA and the State are attempting to mitigate the effect of any natural disaster by destroying the waste now so that a natural disaster will not create a risk from the contamination as it sits today.

SAFETY

COMMENT #1: During the excavation of the Creek and Bayou floodplains, what precautions will be taken to ensure that the excavated material will not be blown, washed, or tracked into the community?

RESPONSE: The precautions to be taken to ensure that the excavated material will not be blown, washed, or tracked into the community will be thoroughly developed during the design phase of the project. These design elements are standard procedures in modern hazardous waste management projects.

COMMENT #2: Is there an evacuation plan for Jacksonville and who is responsible for implementing it?

RESPONSE: The City of Jacksonville is responsible for the evacuation plan. More information concerning the evacuation plan can be obtained from the Jacksonville Fire Department.

ROCKY BRANCH CREEK AND BAYOU METO

COMMENT #1: As part of the offsite remediation, can EPA post and identify Rocky Branch Creek with signs so that people are aware of where it is located?

RESPONSE: EPA and the State of Arkansas searched for signs along Rocky Branch Creek. Fourteen signs were found to already exist and the State of Arkansas posted several additional signs.

COMMENT #2: Is the contamination so extensive in Rocky Branch Creek to warrant the excavation of the Creek and Bayou? This could cause excessive damage to the ecological habitat.

RESPONSE: EPA believes that it is not necessary to excavate the Creek and Bayou sediment because the level of contamination does not pose an unacceptable risk to human health. However, EPA believes that it is necessary to excavate residentially-zoned areas, including floodplain, which are above the residential action

level of 1 ppb. This will ensure the safety of area residents exposed to the floodplain. In order to minimize ecological damage due to excavation, retesting of the floodplain areas prior to excavation will be required to ensure that only those areas with concentrations greater than 1 ppb will be excavated. In addition, the remedial design will require that great care be taken to minimize damage and tree removal during excavation and that grasses and tree saplings be planted in the excavated areas to minimize erosion.

COMMENT #3: The State of Arkansas commented that careful consideration should be given to the advantages of excavating the very low TCDD concentrations in the Rocky Branch Creek floodplain versus the ecological damage resulting from that action.

RESPONSE: EPA is very sensitive to this "trade off." EPA believes that the large area that contains greater than 1.0 ppb TCDD should be excavated, but that every effort should be made to minimize disruption to the area ecology. With this in mind, the remedy requires that all areas be resampled prior to excavation. Only those areas above 1.0 ppb will be excavated. Furthermore, the design will require that excavation procedures be used to minimize the removal of trees, and that the excavated areas be seeded with grasses and tree saplings planted.

COMMENT #4: Why hasn't there been a study to assess the impact of the contamination on the food chain?

RESPONSE: EPA has recently entered into an interagency agreement with the United States Fish and Wildlife Service for the Fish and Wildlife Service to conduct a study to assess the availability of dioxin to the food chain. The study is scheduled to begin in the winter of 1990 and to be completed in 1992.

WASTEWATER TREATMENT PLANT

COMMENT #1: How extensive was the EPA remedial investigation of the sewer system? Was the entire city investigated or just the system around and near Vertac? Is it possible that the contamination could have spread throughout the Jacksonville sewer system?

RESPONSE: Only the portions of the sewer system which serviced the Vertac plant were investigated. There is no evidence to indicate that any other parts of the system were impacted by the plant, and, therefore, were not investigated.

COMMENT #2: After the remediation, will the Vertac site continue to discharge from outfall 002 into the West Wastewater Treatment Plant? Jacksonville Wastewater Utility wants to close the West Wastewater Treatment Plant after completion of the offsite remediation. The Wastewater Utility also requests that all unused

building sewers be sealed off at the Vertac property line and that all active sewer lines on the plant be either replaced or lined before any water on the Rocky Branch interceptor is diverted to the new Johnson Wastewater Plant.

RESPONSE: After the remediation, outfall 002 will discharge directly to Rocky Branch Creek or Bayou Meto or discharge via the wastewater treatment plant. The exact details of this discharge will be determined during the remedial design/remedial action phase. All unused building sewers will be addressed in the remedial design. The selected remedy states that all active sewer lines will be replaced or lined before any wastewater in the Rocky Branch interceptor is diverted to the new treatment plant.

COMMENT #3: Will one foot of soil over the top of the old structures at the sewage treatment plant be enough considering soil erosion?

RESPONSE: Yes. The soil cover will be designed, seeded, and maintained to prevent soil erosion.

FURTHER INVESTIGATIONS AND ANALYSES

COMMENT #1: Request by Kelly Denise Jones to test her property.

RESPONSE: The sampling was conducted by EPA on August 20-21, 1990, and results from the sampling are expected in early October, 1990.

COMMENT #2: Request by Mr. Roy Hawks to test the property surrounding his house.

RESPONSE: The sampling was conducted by EPA on August 20-21, 1990, and results from the sampling are expected in early October, 1990.

COMMENT #3: Request for EPA to collect samples at Pinewood Elementary School.

RESPONSE: The sampling was conducted by EPA on August 20-21, 1990, and results from the sampling are expected in early October, 1990.

COMMENT #4: Request for EPA to test sewers across Marshall Road from the Vertac plant.

RESPONSE: While there is no reason to believe that Vertac could have discharged to these sewers, EPA will sample these sewers to allay community concerns. Results are expected in late October, 1990.

COMMENT #5: How can EPA and the public determine if a lab is qualified to test for dioxin?

RESPONSE: When EPA does sampling for dioxin, either the EPA Houston laboratory does the analysis or the sample is sent to a qualified contract lab that has met certification requirements for the EPA. These laboratories must meet stringent certification requirements and must adhere to very specific quality control procedures. The public can contact the EPA Region 6 Office of Quality Assurance to check on the qualifications of a laboratory.

COMMENT #6: Is it normal to have analyses done at local laboratories?

RESPONSE: Local laboratories can be used if they are qualified.

MISCELLANEOUS

COMMENT #1: How long will it take to complete the offsite project?

RESPONSE: It will likely be a number of years before construction is completed. After the Record of Decision is signed in September 1990, the design will begin. The design phase of the project will take at least 18 months. After that the construction can begin. However, there may be advantages to coordinating the onsite construction with the off-site construction, which could delay the off-site construction.

COMMENT #2: How long will it take to complete the onsite project, besides the drummed wastes?

RESPONSE: A remedy is scheduled to be selected for the above ground material, located onsite, in mid-1991. The remedy for the soils and the below ground contamination onsite, will be selected in 1992. Since the extent of these remedies is unknown at this time, the timeframes to complete the remedies are unknown.

COMMENT #3: In 1981, Vertac applied for a water discharge permit, requesting to discharge 30,000 pounds per day of 2,4-D and 15,000 pounds per day of 2,4,5-T into Rocky Branch Creek.

RESPONSE: The 30,000 pounds per day of 2,4-D and the 15,000 pounds per day of 2,4,5-T which were shown in the Vertac permit application were not discharge limits requested, but were the production rates of each compound at the Vertac facility, at that time. The water permit was issued to Vertac in 1984 and contained very stringent discharge limits for these substances.

COMMENT #4: What were the results from the broken water pipe at Vertac?

RESPONSE: The pipe was repaired and drinking water samples were collected from several homes of area residents. No dioxin was found in any of the samples.

COMMENT #5: Is there creosote on the Vertac site?

RESPONSE: No, there is no creosote on the Vertac site.

COMMENT #6: Is Rebel Drive on the Reasor-Hill landfill?

RESPONSE: No, Rebel Drive is not located on the Reasor-Hill landfill.

COMMENT #7: Has there ever been a surface or ground water study done for the Vertac site? Why wasn't the ground water study for the Vertac site not initiated earlier?

RESPONSE: The surface water samples from Rocky Branch Creek and Bayou Meto and the fish tissue samples from the Creek and Bayou do show the presence of dioxin. The ground water study is being conducted as part of the onsite investigation. The first priority of each of the operable units being addressed at the Vertac site is the removal of the largest amount of contamination first. Therefore, incineration of the drums and the off-site removal were moved to the forefront. The onsite investigation and ground water study were sequenced after the drums and the off-site study, and are ongoing.

The following is a summary of written comments received from Hercules, Inc., a Potentially Responsible Party at the Vertac site. Some of the Hercules comments contained general objections or were somewhat vague. EPA has, in the responses below, addressed all comments and has given specific responses where specific comments were made. However, EPA has not speculated regarding the exact meaning of Hercules' comments which were not clear.

COMMENT #1: According to the 1990 Feasibility Study, the areas proposed for remediation, other than the sewage collection lines, pose a risk of 10^{-4} to 10^{-6}. Since the 1990 National Contingency Plan (NCP) states that for known or suspected carcinogens, acceptable exposure levels are generally between 10^{-4} and 10^{-6}. Since the calculated risk for the sewage lines is overly conservative, there are no health or environmentally based reasons for the proposed remedy.

RESPONSE: The areas proposed for remediation pose a threat to both human health and the environment. The NCP states that an acceptable level of lifetime cancer risk is the 10^{-4} to 10^{-6} range. It also states that other factors, such as ARAR's and protection of the environment , should also be considered in remedy selection. The 1990 Feasibility Study states that the risk posed by the sewage collection lines is on the order of 10^{-3} and that the risk posed by the residentially zoned floodplains is 5.7×10^{-4}. Both of these risks exceed the range considered acceptable by the NCP, and warrant the selected remediation. The selected remedy is also

necessary to protect the environment. Fish tissue samples show the presence of dioxin and a commercial fishing ban is in effect for the Bayou Meto and a sports fishing advisory is in place. The selected remedy is designed to minimize the migration of any additional contamination from the floodplain, sewage lines and sewage treatment plants, into the Creek and Bayou.

COMMENT #2: Hercules, Inc. suggests that higher dioxin action levels for both residential and industrial areas may be more appropriate (ChemRisk™ paper). According to the ChemRisk paper, 28 ppb TCDD should be the residential action level, compared to 1 ppb used by EPA, and 113 to 209 ppb should be the industrial action level compared to 10 ppb used by EPA.

RESPONSE: Hercules, Inc. submitted a report prepared by ChemRisk, which calculates alternative cleanup goals for dioxin, The report calculates these alternative cleanup goals using calculations and assumptions that are contrary to EPA guidance. The resultant cleanup levels are, therefore, much higher than those used by EPA. The paragraphs below discuss some of the assumptions and calculations advocated in the report that are contrary to EPA policy. All section references in the paragraphs below refer to the ChemRisk report.

A cancer potency factor for 2,3,7,8-tetrachloro-dibenzo-p-dioxin (2,3,7,8-TCDD) of 9,700 $(mg/kg-day)^{-1}$ is presented in Section 2 (Dose-Response Assessment for Dioxin). This cancer potency factor or slope factor has not been verified by the EPA Carcinogenic Risk Assessment Verification Endeavor (CRAVE) workgroup and is not in accordance with EPA policy. The CRAVE workgroup is responsible for reviewing and verifying cancer slope factors for EPA. Review by CRAVE is the mechanism by which EPA ensures consistency in the slope factors used by EPA and others, such as Potentially Responsible Parties. The EPA slope factor for 2,3,7,8-TCDD is 1.56×10^{5} $(mg/kg-day)^{-1}$.

Several exposure parameters used in Section 4 (Recommended Action Levels for TCDD-Contaminated Soil) are not in accordance with EPA guidance. The Hercules, Inc. submission used a soil contact rate or adherence factor of 0.5 mg/cm^2, which underestimates by a factor of 3 to 6 the quantity of soil adhering to the skin, which results in an underestimate of dermal absorption. This, in turn, results in the calculation of higher allowable contaminant concentrations.

The Hercules, Inc. submission used soil ingestion rates of 10 mg/day for children aged 0 to 1 years, 50 mg/day for children aged 1 to 5 years, and 10 mg/day for older children and adults. EPA guidance (OSWER Directive 9850.4) recommends soil ingestion rates of 200 mg/day for children aged 1 to 6 years, and 100 mg/day for older children and adults. Use of lower ingestion rates as done

in the ChemRisk report results in the calculation of higher allowable contaminant concentrations.

The Hercules, Inc. submission used fish consumption rates of 0 g/day, 0.49 g/day, and 1.48 g/day for ages 0 to 1 years, 1 to 12 years, and 12 to 70 years, respectively. The EPA guidance recommends fish consumption rates of 38 g/day for the 50th percentile daily intake. This rate represents per capita consumption and may underestimate the risk for recreational fishermen who consume larger amounts of fish than the general population.

The National Contingency Plan states that the acceptable risk range is one excess cancer case in ten thousand individuals (10^{-4}) to one excess cancer case in a million individuals (10^{-6}). Using the EPA risk assessment approach, the cleanup levels advocated by the ChemRisk report would result in a residual risk, in the residentially zoned floodplain areas, in excess of 10^{-3}, which greatly exceeds the acceptable risk according to the NCP.

COMMENT #3: The EPA Endangerment Assessment, which assumes exposure to the highest concentration, is too conservative, and exposure to an area's average concentration is more appropriate.

RESPONSE: The risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual states that actions at Superfund sites should be based on the reasonable maximum exposure (RME). Because of the uncertainty associated with sampling, the 95 percent upper confidence limit on the arithmetic average is often being used as a conservative estimate of the exposure concentration contacted over time. The use of the highest concentration in the EPA Endangerment Assessment is more appropriate than the use of the average concentration. The use of the average concentration does not account for the uncertainty associated with sampling.

COMMENT #4: The presentation of data in Table 2-2 of the 1990 Feasibility Study (FS) is misleading because there is no distinction made on the depth of the 1988 "surface sampling" as compared to the 1984 data collected at a depth of 0-3".

RESPONSE: The 1988 sampling was conducted by collecting two spoonfuls of soil from the top 3" with a stainless steel table spoon. Therefore it was assumed that the data would be comparable with the 0-3" collection method cited for the 1984 data.

COMMENT #5: There is no indication on Figure 2-6 of the 1990 FS that the west side of the east leg of Rocky Branch was sampled.

RESPONSE: This area is identified on Figure 2-6 with a lightly shaded marking. The legend identifies this marking as ND which is not detected with the method detection limit of 0.3 ppb.

COMMENT #6: While not discussed in the 1990 FS, sampling was also done by Hercules in 1988 in areas surrounding manholes which are part of the sewer collection system.

RESPONSE: If true, these data were not available to EPA at the time the 1990 Feasibility Study was prepared. In addition, since these samples were taken from areas surrounding manholes, they do not impact the selection of the remedy for the sewer system.

COMMENT #7: There is no indication in the 1990 FS that ATSDR has reviewed post-1985 RI data for the off-site areas or that they have concurred with the EPA proposed plan.

RESPONSE: EPA summarized the post-1985 RI data and discussed the proposed plan with ATSDR during a meeting held on May 3, 1990. ATSDR concurred with the EPA proposed plan by letter dated June 11, 1990 (Appendix C to this ROD).

COMMENT #8: EPA Region 6 has not followed ATSDR recommendations for the Vertac off-site areas or TCDD cleanup levels at sites in other EPA regions. The remedy proposed for the Vertac off-site areas is also not consistent with the proposed remedy for the landfills in Jacksonville.

RESPONSE: The proposed plan is consistent with the ATSDR action levels for the off-site areas. See responses to comment number 10, regarding residential action levels, comment number 12, regarding the Old Sewage Treatment Plant, and comment number 13, regarding the West Wastewater Treatment Plant. Regarding the cleaning of the sewer lines, the proposed remedy at Vertac (remove contaminated sediments and incinerate sediments) is the same as that employed for sewer lines at Love Canal site in EPA Region 2. Regarding consistency with the landfills, the residentially zoned floodplain areas that contain above 1 ppb TCDD should not be capped with clean soil, as proposed at the landfills where TCDD is between 1 and 10 ppb, because this residentially zoned area is subject to erosion and any capping could be washed out, allowing contaminant migrations.

COMMENT #9: ATSDR action levels are overly conservative and recent information about TCDD supports a soil cleanup level for TCDD that is greater than 1 ppb for residential and greater than 7 ppb for industrial areas. ATSDR should have been consulted on whether the 1 ppb was still appropriate for residential areas.

RESPONSE: See response to Hercules comment #2. In addition,ATSDR was consulted and has concurred on the remedy. In addition, according to ATSDR, it is unlikely that these action levels will be changed in the near future.

COMMENT #10: The undeveloped residentially-zoned areas south of the Vertac plant are not readily accessible, less than 10% of the

area has TCDD concentrations greater than 1 ppb and one acre is fenced. This area has an average concentration below 1 ppb and need not be remediated.

RESPONSE: The 1 ppb TCDD action level for residential areas is a well-established and widely-accepted level. Over two acres of floodplains along Rocky Branch Creek contain more than 1 ppb TCDD, some areas contain as much as 9.6 ppb TCDD. This large area, while undeveloped, is zoned residential, and still poses a direct contact threat to nearby residents. Since this area is zoned residential, it is possible that it could be used as such. If this were the case, then under the residential use scenario, the residents would be exposed to these concentrations in their yards, not an average concentration for the entire two-acre area, as suggested by Hercules. Therefore, it is inappropriate to use an average concentration, under this scenario, for the entire two-acre area. In addition, this large area of contamination still acts as a source of contamination to Rocky Branch Creek, Bayou Meto, and the already contaminated fish in the Creek and Bayou, and thus poses a risk to the environment. By removing these contaminated soils in the floodplains, a source of contamination to the aquatic life will be removed, possibly expediting the removal of the ban and advisory against fishing in the Bayou.

COMMENT #11: The undeveloped, residentially zoned area south of the Vertac plant should be re-zoned as non-residential, thus removing the need to remediate the area.

RESPONSE: According to the NCP, institutional controls may be used only as a supplement to engineering controls and should not be substituted for active response measures as the sole remedy, unless active response measures are not practicable. Since excavation of floodplain soils in the undeveloped residentially-zoned areas is practicable and desirable to prevent migration of these contaminated soils into the waterways, EPA is not in favor of changing the zoning in order to leave the contaminated soils.

COMMENT #12: ATSDR has recommended a cleanup level of 5-7 ppb TCDD for the Old Sewage Treatment Plant and the Region had selected 5 ppb in 1986. Despite this recommendation and precedent, an action level of 1 ppb has been selected in the 1990 FS and the proposed plan.

RESPONSE: The sludge in the digester contained 12.4 ppb TCDD, which is above the ATSDR action level. Therefore, the sludge will be removed and incinerated. The ATSDR recommendation also included that migration of contaminants via surface runoff be prevented. The drying beds will be capped with one foot of clean soil to prevent contaminant migration. This would prevent unexpected exposure by humans to these contaminants and would protect the environment by preventing migration into the environment. The other treatment units, such as clarifiers and trickling filters,

pose a safety problem and contain small amounts of contaminated sediments. Because of the safety concerns and the SARA requirement that the selected remedy utilize permanent solutions, the treatment units would be demolished and covered with a foot of clean soil. This additional measure is considered to be a cost-effective way to further reduce the risks posed by the area.

COMMENT #13: In 1986, ATSDR recommended a cleanup level of 5-7 ppb for the West Wastewater Treatment Plant, but the 1990 FS and the proposed plan select an action level of 1 ppb TCDD.

RESPONSE: The ATSDR action level of 5-7 ppb includes the stipulation that contaminants be prevented from migrating from the plant. Grab sampling in 1984 showed that the aeration basin sediments contained TCDD as high as 37.9 ppb. 1988 grid sampling showed the aeration basin sediments to contain TCDD as high as 2.8 ppb. While the 1984 samples were grab samples, which can identify hot spots, and the 1988 samples were composites from a grid, which tend to average the concentrations over the area sampled, such a large reduction in sediment concentration indicates that the TCDD contaminated sediments may be flushing into the environment. In order to prevent further degradation of the environment, closure of the aeration basin is considered necessary. The two oxidation ponds contain sediments with less than 1 ppb TCDD and, therefore, will not be remediated.

COMMENT #14: CDC approved capping an area that contained 51 ppb TCDD in an industrial area in Midland, Michigan and an area with 20 ppb TCDD at Times Beach, Missouri.

RESPONSE: CDC/ATSDR provided site-specific cleanup levels for the Vertac off-site areas and also concurred with the EPA proposed remedy for the Vertac off-site areas. The selected remedy incorporates the ATSDR recommendations for Vertac off-site areas.

COMMENT #15: The assumption that a sewer worker would ingest 0.1 grams of the sediment each day during his/her working years in developing the risk for excess lifetime cancer for sewage collection lines is overly conservative. The risks of disease, e.g., from viral hepatitis, are greater than from the infrequent exposure that might occur from the TCDD in the sewer line.

RESPONSE: The cancer risk estimate for sewage collection lines is based on a worst-case scenario. However, this risk estimate is not the basis for the remediation. Rather, prevention of migration of contaminated sediments to the new STP and into the environment, in general, require that these actions be taken.

APPENDIX A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D C. 20460

000194

January 26, 1989

MEMORANDUM

SUBJECT: Remediation of Dioxin-Contaminated Sediments Near the Vertac NPL Site

FROM: J. Winston Porter, Assistant Administrator
Office of Solid Waste and Emergency Response (WH-562)

THRU: Renate Kimbrough, M.D. Renate Kimbrough, M.D.
Office of the Administrator (A-101)

TO: Barry Johnson, Director
Agency for Toxic Substances and Disease Registry

Sediments in and along the West Leg of Rocky Branch Creek and Bayou Meto downstream from the Vertac NPL site are contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). This memorandum is intended to provide the rationale used by EPA in determining appropriate remedial actions regarding these sediments. Your comments are requested.

A limited number of channel sediment samples from Rocky Branch Creek and Bayou Meto were analyzed in 1984. Additional sampling was conducted in 1987 and again in 1988. TCDD concentrations in these channel sediments reportedly ranged from <0.3 ppb to 2.3 ppb. Rocky Branch Creek bank sediments were sampled in September, 1988. TCDD concentrations in ten composited samples reportedly ranged from 0.50 ppb to 2.30 ppb.

EPA has previously employed 1 ppb as an action level for remediation of TCDD in creek sediments (EPA, 1987). The use of 1 ppb as an action level is based on a Centers for Disease Control (CDC) recommendation developed primarily for direct contact with TCDD-contaminated soils in residential areas. The CDC recommendation is derived from Kimbrough et al. (1984), which described 1 ppb as "...a reasonable level at which to begin consideration of action to limit human exposure to contaminated soil." It also stated, "Environmental situations may vary widely, and whether a certain level of TCDD in soil will give rise to concern has to be evaluated on a case-by-case basis." As this statement indicates, the 1 ppb action level was not intended to be interpreted or applied as an all-encompassing standard.

Rather, the assumptions and uncertainties underlying its development need to be understood and compared to site-specific circumstances. It should also be noted that 1 ppb does not represent a fine line between safe and unsafe conditions as the term "action level" implies. Rather, it was intended to represent a level of concern. In addition, soil ingestion data developed subsequent to publication of the Kimbrough et al. (1984) article should also be considered.

Evaluation of the risk assessment assumptions used to derive the 1 ppb level in the context of site-specific exposure scenarios applicable to Rocky Branch Creek and Bayou Meto sediments indicates that it is inappropriate to apply this directly as the action level for these sediments.

There are two plausible scenarios by which humans may be exposed to TCDD contaminating Rocky Branch Creek and Bayou Meto sediments. One is direct contact with the affected sediments (resulting in TCDD intake by ingestion, transdermal absorption and/or inhalation). This scenario would be more applicable to exposed bank sediments than to the submerged channel sediments, as the latter are less accessible for direct contact.

The 1 ppb level was developed primarily for residential soils, as opposed to creek sediments. It was based on a cancer risk assessment which incorporated numerous conservative exposure and toxicity assumptions. Prominent among these were assumptions that young children would come into contact with the contaminated soils on a daily basis, and that young children ingest 10 grams of soil per day. Since these two assumptions "drove" the risk assessment (Kimbrough, personal communication), their relevance to the potential for contact with Rocky Branch Creek and Bayou Meto sediments is of particular importance.

The daily contact assumption can be reasonable for residential soils, which would be readily accessible to children. In contrast, the affected Rocky Branch Creek sediments are not as readily accessible, and may be essentially inaccessible to young children. It is also unlikely that children would come into daily contact with Bayou Meto sediments since these are not in a residential area. In addition, the assumption of 10 grams/day soil ingestion has since become viewed as overly conservative; less than 1 gram/day is now viewed as a more reasonable assumption for soil ingestion by "typical" young children (Binder et al., 1986; Clausing et al., 1987; EPA, 1988; LaGoy, 1987). In other words, both of the critical assumptions supporting 1 ppb as a level of concern appear overly conservative for application to Rocky Branch Creek and Bayou Meto sediments.

Another pertinent assumption in Kimbrough et al. (1984) involves the distribution of TCDD in the contaminated areas. More specifically, the 1 ppb designation was predicated on the assumption that 100% of the affected soils are contaminated at peak levels (i.e., assuming uniform distribution of 1 ppb TCDD throughout the area of potential soil contact). The sampling from residential areas near Rocky Branch Creek has shown a few areas (mostly near the creek) with average soil concentrations for TCDD equivalents greater than 1 ppb. Removal of these contaminated soils is in progress. Upon completion of this removal action the average TCDD contamination in surface soil of this residential area will be substantially less than 1 ppb. While the bank of Rocky Branch Creek can be considered a portion of the residential area, it comprises less than 1 percent of the area. The nearly vertical banks of the creek make access to the contaminated soil difficult for the young child. In addition, it is separated from the residential area by a fence. These factors combine to reduce the opportunity for the young child to have even the normal frequency of exposure opportunities to these contaminated soils. Figure 2 in Kimbrough et al. (1984) shows that if 1 percent of the area is contaminated at the maximum concentration, the estimated lifetime excess cancer risk is two orders of magnitude less than if the entire area is contaminated at a uniform concentration. Thus, if the entire creek bank, which represents less than 1 percent of the residential area, is contaminated at a maximum concentration of 2.3 ppb, the estimated excess lifetime cancer risk is equivalent to that if the entire residential area were contaminated to less than 0.023 (0.02) ppb.

The second plausible human exposure scenario leading to TCDD intake from the contaminated sediments is food-chain ingestion.

Based on concern regarding exposure to TCDD via this route, the State of Arkansas Department of Health has imposed an advisory discouraging consumption of fish taken from the affected waterways. For the same reason, ATSDR has previously recommended that an interim action level of less than 1 ppb be achieved in Rocky Branch Creek and Bayou Meto sediments (ATSDR, 1986). ATSDR also recommended monitoring of TCDD levels in edible fish portions, to assist in determining the need for continuation of the State advisory.

Kimbrough et al. (1984) provided no specific acceptable sediment concentrations pertaining to this exposure route. It was stated, however, that acceptable levels for soils which might contaminate waterways (i.e., creek sediments) might have to be lower than 1 ppb due to the potential for bioconcentration of TCDD in fish tissue. A potential for 20,000 fold or greater TCDD

bioconcentration in fish (National Research Council of Canada, 1981) was mentioned in support of this position.

Results of fish sampling conducted downstream from the Vertac site in 1984 are noteworthy in this regard. TCDD levels were evaluated in fish sampled from sections of Bayou Meto in which sediment TCDD concentrations were less than 1 ppb. TCDD levels in edible portions of those fish ranged from 136 ppt to 704 ppt, well in excess of the 25 ppt FDA concern level.

Both these data and the potential for TCDD bioconcentration would indicate that the ATSDR recommendation to achieve levels less than 1 ppb should not be interpreted as a recommendation to achieve 1 ppb or less. Rather, remediation to levels substantially lower than 1 ppb may be necessary to achieve TCDD levels in edible fish tissue which meet the current FDA concern level of 25 ppt.

To date, neither EPA nor ATSDR have specified sediment TCDD concentrations permissible for unlimited fish ingestion. Therefore, an action level for Rocky Branch Creek and Bayou Meto sediments based on potential risks to human health posed by fish ingestion cannot readily be designated. However, action levels can be based on potential human health risks posed by direct contact with the sediments, in conjunction with continuation of the State of Arkansas Department of Health advisory against consumption of fish taken from the affected waterways. In addition, EPA will be conducting long-term monitoring of TCDD levels in fish and other wildlife in Bayou Meto and Rocky Branch Creek, in accordance with the ATSDR recommendation.

The recommendation of 1 ppb as a level of concern was qualified with, "The appropriate degree of concern for which management decisions are made should consider an evaluation of the specific circumstances at each contaminated site." (Kimbrough et al., 1984). It is clear that the derivation of the 1 ppb concern level was based on soil exposure assumptions which were more than several-fold greater than the exposures to sediments expected in and along Rocky Branch Creek and Bayou Meto. Therefore, assuming a continuing and effective State advisory discouraging ingestion of fish taken from the affected areas, the reported <0.3 ppb to 2.3 ppb TCDD levels in these sediments should not pose an unacceptable health threat. Based on the above evaluation, EPA has determined that no clean up of either the West Leg of Rocky Branch Creek or Bayou Meto to protect human health is necessary.

REFERENCES

ATSDR, 1986. Memorandum dated April 24, 1986 from Jeffery A. Lybarger, ATSDR, to Carl Hickam, Public Health Advisor for U.S. EPA Region VI

Binder, S., D. Sokal and D. Maughan. 1986. Estimating soil ingestion: the use of tracer elements in estimating the amount of soil ingested by young children. Arch. Environ. Health 41:341-345

Clausing, P., B. Brunekreef and J.H. van Wijnen. 1987. A method for estimating soil ingestion by children. Int. Arch. Occup. Environ. Health 59:73-82

Kimbrough, R.D., H. Falk, P. Stehr, and G. Fries. 1984. Health implications of 2,3,7,8-tetrachlorodibenzodioxin (TCDD) contamination of residential soil. J. Toxicol. Environ. Health 14:47-93

LaGoy, P.K. 1987. Estimated soil ingestion rates for use in risk assessment. Risk Analysis 7:355-359

National Research Council of Canada (NRCC). 1981. Polychlorinated dibenzo-p-dioxins. Publ. NRCC No. 18574 of the Environmental Secretariat. Ottawa, Canada: National Research Council of Canada

U.S. EPA, 1987. Superfund Record of Decision: Minker Stout/Romaine Creek, MO. EPA/ROD/R07-87/007. September, 1987

U.S. EPA, 1988. Superfund Exposure Assessment Manual. EPA/540/1-88/001. April, 1988

APPENDIX B

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Agency for Toxic Substances
and Disease Registry

Memorandum

Date APR 24 1986

From Acting Director
Office of Health Assessment

Subject Health Assessment, Off-site Remedial Investigation,
Vertac Chemical Corporation, Jacksonville, Arkansas SI-85-079

To Mr. Carl Hickam
Public Health Advisor
EPA Region VI

EXECUTIVE SUMMARY

The Environmental Protection Agency (EPA), Region VI Office, submitted data indicating that sludges and sediments in the Jacksonville wastewater treatment plant system (WWTP), Rocky Branch, Bayou Meto, and associated floodplains are contaminated with several compounds including tetrachloro-dibenzo-p-dioxins (TCDD). Because of the potential for human exposure to these compounds, and the potential for a major release of these compounds from the WWTP to downstream water and land resources, the Agency for Toxic Substances and Disease Registry (ATSDR) offers the following recommendations: (1) restrict general public access to the abandoned and existing WWTP, and to the channel and floodway soils of the west leg of the Rocky Branch in the residential area just south of Vertac; (2) prevent additional migration and flood releases of contaminants from the WWTP system, other environmental sinks in Rocky Branch, Bayou Meto, and their floodways, and from Vertac; (3) residential land uses on the Vertac site would constitute an unacceptable health risk; (4) provide additional characterization of both on-site and off-site contamination to determine the need for additional remediation; and (5) implement a health and safety plan for all on- and off-site remedial activities.

STATEMENT OF PROBLEM

The ATSDR has been requested by the U.S. Environmental Protection Agency (EPA), Region VI, to review and comment on the Draft Off-site Remedial Investigation (RI) for the Vertac Chemical Corporation plant,

Jacksonville, Arkansas. In addition, EPA has asked us to address the following concerns:

1. The public health significance of the contaminant levels found in environmental pathways.

2. The need for off-site cleanup.

3. Assistance in developing guidelines and criteria for off-site remediation of dioxin-contaminated soils/sludges/sediments to protect public health.

SITE DESCRIPTION AND BACKGROUND

The Vertac Chemical Corporation pesticide plant lies on the site of a former World War II ordnance plant. Pesticides have been produced on the site since 1948 by three former companies. Residential subdivisions lie immediately south and east of the Vertac plant site. The land use to the north and west is primarily undeveloped or commercial/light industrial. For additional background information on the site, please refer to our reports to EPA Region VI dated April 11, 1983, and January 15, 1986, on the Vertac Site and February 25, 1986, on fish data.

LIST OF DOCUMENTS REVIEWED

1. Off-site Remedial Investigation, Draft Report Volume I-Report & Bibliography, Draft Report Volume II- Tables & Appendices, Draft Report Volume III- Maps & Figures, Project No. CH313-6, Site No. 98-6L04, prepared for the EPA under Contract No. 68-01-6692 by CH2M Hill, Inc. and Ecology and Environment, Inc., July 12, 1985.

2. Supplement to the Off-site Remedial Investigation, Draft Report-Delineations & Volumes/A Working Paper, Project No. CH313-6, Site No. 98-6L04, prepared for the EPA under Contract No. 68-01-6692 by CH2M Hill, Inc. and Ecology and Environment, Inc., July 19, 1985.

3. Memorandum dated September 3, 1985, from Mr. Larry P. Rexroat, Superfund Enforcement Section, EPA Region VI, to Mr. Carl Hickam, Public Health Advisor, CDC/EPA Region VI.

4. ATSDR project file.

LIST OF PRINCIPLE CONTAMINANTS

The primary contaminants of concern in off-site areas include: 2,3,7,8-TCDD, 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), silvex, chlorinated phenols and benzenes. The RI focussed on 2,3,7,8-TCDD, and used the generic term "dioxin" for 2,3,7,8-TCDD (p. 1-1, Vol. I).

QUALITY CONTROL(QC)

To date, only the 1984 sampling data have received QC. An acceptable evaluation of the QC for the 1984 data was provided in Appendix 10 (Vol. III).

SITE INSPECTION

On March 5 and 6, 1986, ATSDR conducted a site inspection and met with Mr. Larry Rexroat, Project Officer, and Mr. Larry Right of EPA Region VI, and Richard Saterdal of CH2M Hill. Please refer to Attachment 1 summarizing ATSDR's itinerary, information obtained, and problems observed during the site inspection. Photographs were taken of both the Vertac site and off-site areas.

ENVIRONMENTAL SAMPLING

In December 1983, seventy-four sediment and soil samples were collected in the off-site study area and analyzed for "dioxin," 2,4-D, 2,4,5-T, silvex, chlorinated benzenes, chlorinated phenols, and other organics. Forty of the seventy-four samples contained "dioxin" (See Tables 5-1 & 5-2, Vol. II, and refer to Attachment 2).

In June 1984, twenty-one soil samples were collected in areas within 600 feet of Bayou Meto that, judged by visual inspection, had been frequently flooded. These samples were analyzed for "dioxin." Only one of these contained measurable levels (0.43 ppb) of "dioxin."

In August 1984, 225 field samples of soil and sediments were collected for "dioxin" analysis; 29 additional samples were collected for background and quality control. Seventy-nine of the 225 field samples contained measurable amounts of "dioxin" ranging from 1.0 ppb to more than 200 ppb. Until this particular sampling effort, the abandoned WWTP and the existing WWTP aeration pond "...had never been sampled..." (p. 5-7, Vol. I). In addition, Rocky Branch and Bayou Meto had only been sampled at road and railway crossings; this sampling effort included other sediment sampling locations in the stream channels as well as soils throughout the 2-year and 5-year floodplains. Please refer to Attachment 2 for a summary of the "dioxin" data.

The highest 2,4-D level (20,000 ppm) and the highest 2,4,5-T level (7,200 ppm) were found in a 1984 sludge sample from WWTP manhole #77 (I016A). This same sludge sample also contained the highest "dioxin" level (>200 ppb) found during the 1984 sampling and analysis effort. The highest concentrations of silvex were found in 1983 in sludge samples from an abandoned interceptor/manhole #2 (67 ppm, I-5) and a new interceptor/manhole #19 (<100 ppm, I-4). Hexachlorobenzene (300 ppm, I-3), pentachlorophenol (300 ppm, I-3), chlordane (48.3 ppm, I006A), and 2,4,6-trichlorophenol (5.7 ppm, I016A) were also found in the WWTP collection system sludge. In the vicinity of Hines Cove along Rocky Branch west leg, 2.8 ppm PCB 1254, 1.5 ppm 2,4-D, and 2.7 ppm 2,4,5-T (N030A) were found in a 1984 floodplain soil sample (N030A).

ENVIRONMENTAL PATHWAYS

Food Chain Uptake

Bioconcentration has been documented in aquatic organisms downstream of both the Vertac plant in Rocky Branch and the Bayou Meto and the WWPT outfall in the Bayou Meto. Fish samples collected as far as 15 miles downstream from Rocky Branch contained levels of 2,3,7,8-TCDD in the edible portions that exceeded FDA's Great Lakes advisory level. Whole fish samples collected in Bayou Meto as far as 75 miles downstream (Bayou Meto Wildlife Management Area) of Rocky Branch have been found to be contaminated.

Air Transport

Large ground surface areas are exposed on the site to water and wind erosion. This raises the possibility of off-site migration of contaminants through the air. In addition, the potential for subsurface transport of volatile gas vapors from the waste landfills should be explored.

Surface Water/Sediment Transport

Sediment transport of 2,3,7,8-TCDD and other hazardous substances from the site to Rocky Branch, Bayou Meto, and the sewage treatment plant has been observed. The Rocky Branch and the Bayou Meto downstream of the Vertac site flow adjacent to several residential subdivisions, individual homes, agricultural lands, industrial and commercial areas, and recreational areas such as Dupree Park.

Rocky Branch:

In the Rocky Branch channel and floodplain, "dioxin" levels in the 1984 sediment samples ranged from the detection limit (i.e., varies from 0.02 to 0.70 ppb) to 7.58 ppb. The levels appear to decrease with distance from the Vertac plant site to 0.74 ppb (questionable result) just above

leg of Rocky Branch near the West Lane dead end (3.01 ppb, N026C) and near the end of Hines Drive (7.58 ppb, N030C). These levels are of particular concern because of their proximity to residences. Detectable "dioxin" levels ranged from 0.15 to 0.74 ppb for in-stream sediments.

While no 1984 samples were collected from the east leg of Rocky Branch, seven locations were sampled in 1983 in the east leg watershed. Three of the sample locations (N-8, N-12, & N-16) were below Vertac's East Ditch discharge. The data results indicate the need for additional sampling to assure that TCDD contamination does not exist in the residential areas east and south of the Vertac plant.

Bayou Meto:

Bayou Meto channel and floodplain sediment samples in 1984 showed concentrations of "dioxin" ranging from the detection limit to 2.1 ppb. The highest "dioxin" concentrations were found between the WWTP outfall and a point about 2000 feet downstream of the Highway 161 bridge. The highest "dioxin" level found in 1984 was the estimated maximum concentration of 3.5 ppb (F047A) in a near-stream, near-surface sediment sample; this was found about 25 feet downstream of the WWTP outfall in Bayou Meto and 150 feet from the left bank's water edge. The detectable "dioxin" levels found in the 1984 in-stream sediment samples ranged from 0.10 to 0.39 ppb in shallow sediments and from 0.10 to 1.10 ppb for deeper sediments.

Wastewater Treatment Plant (WWTP) System:

Sludge and sediment samples in the WWTP collection and treatment system revealed an average concentration of 21.5 ppb "dioxin" which included the three highest values (70.5, 119.4, and >200 ppb). Sampling in 1984 of the abandoned WWTP found 6.59 ppb "dioxin" in the sludge drying beds and 12.46 ppb "dioxin" in the digestor. In the existing WWTP facilities, 1984 sludge samples in the aeration lagoon were found to have maximum levels as high as 37.9 ppb (S018A, invalid or questionable data)

and 16.2 ppb (S019A). Sludge samples in the oxidation ponds were found to contain maximum "dioxin" values of 8.37 ppb in 1979, and 3.6 ppb in 1984.

According to the RI, manhole #106 (200 feet south of Vertac property in the west leg of Rocky Branch between Braden & Alta Cove) was noted during the 1984/1985 sewer sampling investigation (Table 4-6, Vol. II) to overflow. The RI also described manholes #1198, #1202, #1206, and #301 to overflow. The overflow potential for other manholes in the residential areas immediately south and east of the Vertac site during major storms should be described. The interceptor which serves the residential subdivision immediately south of Vertac was found to contain the three highest "dioxin" concentrations (see above) in sewer sludges/sediments.

Agricultural Uses Downstream:
Efforts have not been made to identify existing or zoned agricultural areas along Bayou Meto downstream of the WWTP or Rocky Branch to a point upstream of Southeastern Avenue that may have been affected by flooding and contaminated sediments. Of these agricultural areas, feedlot and grazing areas in the floodplain are the most important since 2,3,7,8-TCDD accumulates in the tissues of grazing cattle and rooting swine. Cattle grazing areas and other agricultural activities were observed during the site inspection. Each of these areas should be sampled. Note that levels of 2,3,7,8-TCDD in soils from 0.0062 to 0.079 ppb have been projected by Kimbrough et al.[4] to produce maximum allowable residues of 2,3,7,8-TCDD in foods (i.e., beef, pork, and milk).

Sediments in the vicinity of three Bayou Meto surface water withdrawal points may be of public health concern for certain agricultural uses. We note that site 25 (about 500 feet upstream of Highway 67/167) withdraws for waterfowl purposes, site 13 (near Highway 161) withdraws for 60-acres of rice, and site 11 (about 0.3 miles upstream of Southeastern Ave.) withdraws for 280-acres of rice. While site 25 lies about 1000 feet downstream of the sediment sampling station containing the two highest

"dioxin" values (2.1 and 3.5 ppb) found in the Bayou Meto, the Bayou Meto channel sediments next to the lake at site 25 were not found to contain "dioxin." The collection and analyses of a few additional sediment and biologic samples may be prudent if (1) the waterfowl may be consumed, or (2) flooding may have occurred since the last sampling period. The Bayou Meto sediments in the vicinity of site 13 appear to have a history of exceeding 1 ppb "dioxin."

EXPOSURE PATHWAYS

The most likely exposure pathways for local residents, City Beautification employees, and WWTP employees to the contaminants of concern would be by direct contact with contaminated sludges/sediments/soil and inhalation of contaminated dust. If small children play in contaminated yards or garden soils, in the west leg of Rocky Branch just south of the Vertac plant, or live in the immediate area, they may be subject to exposures through direct contact and ingestion of contaminated soil or dust. Other probable exposure pathways include the ingestion of food crops grown in contaminated sludges and soils, ingestion of local fish (and possibly other local wildlife), and ingestion of farm animals that graze on or are confined to lands containing contaminated soils/sediments.

HEALTH EFFECTS

For ATSDR's discussion on the health effects of 2,3,7,8-TCDD, 2,4-D, and 2,4,5-T, please refer to our Health Assessment report on the Jacksonville Landfill dated October 23, 1985.

The section of the RI dealing with the toxicologic and carcinogenic effects of TCDD exposure is adequate. However, the "Human Effects" section requires several revisions. First of all, it should be noted that the reproductive data collected following the Seveso incident are still being evaluated. Secondly, the concluding statements derived from the case study of the 55-year-old woman need to be re-examined. The elimination half-life for TCDD in a variety of animal species ranges

from 10 to 43 days. In addition, McNulty reported the TCDD elimination half-life in the fat of monkeys was approximately 365 days. For the case in question, 58 percent of the recovered TCDD was taken from adipose tissue. It is impossible, in the absence of human data, to predict whether twenty, several, or no half-lives may have occurred in the seven month period. Therefore, it is inaccurate to definitively state "...the people included in this study accumulated large amounts of dioxin..." Furthermore, it is unacceptable to compare actual amounts (ug, mass units) of an absorbed toxicant between differing species without normalization to factors such as body weight, surface area, metabolic rate, or life span. If the total amount of dioxin (40 ug) calculated for the case in question, is normalized to body weight (70 kg), the actual absorbed dose (0.57 ug/kg) is not 1000 to 3000 times higher than the tolerable dose calculated (LD_{50}= 0.6 ug/kg) using guinea pig acute toxicity data.

OTHER DISCUSSION

Existing and Abandoned WWTP:

Of special concern is the fact that the WWTP's oxidation ponds would be subject to inundation by floods equal to or greater than a 5-year flood (p. 3-20, Vol. I; Table 4.1, Vol. II; Plates 4-1 & 4-2, Vol. III). Because a mass release from the oxidation lagoons as a result of major storm could spread 2,3,7,8-TCDD-contaminated materials to an extensive area downstream, remedial effort must be taken to reduce this potential impact.

In inspecting the site and the RI exhibits (Plate No. 3-10, Vol. III) of the "Old Sewage Treatment Plant," the police shooting range portrays features that reveal the possible existence of some previous treatment works that may have been covered after being abandoned. This area should be sampled if it was a part of the old treatment works.

Rocky Branch/Bayou Meto:

Multiple land uses exist downstream of the Vertac site and the existing WWTP. These include residential, industrial, commercial, agricultural, and unzoned areas. Cleanup levels for 2,3,7,8-TCDD in sediments/soils in downstream land use areas should depend upon the potential human exposure associated with these land uses. The future development potential and realization of the undeveloped floodplain areas depend upon the Flood Damage Prevention Ordinance dated September 15, 1977. Since this floodplain ordinance does permit construction of new structures, cleanup levels for currently undeveloped floodplain/floodway land uses should still apply.

Existing residences along both the east and west leg of Rocky Branch may be subject to a variety of flood events. Residences on Alta Cove, Alta Lane, Hill Road, and the ends of Braden, West Lane, Hines Lane, and Hines Cove, and at the Willow Bend Apartments off Marshall Road lie within the 100-year floodplain, the designated floodway, or the 2-year or 5-year floodplain. Many of the residential yards incorporate the Rocky Branch creek banks as part of the yard and lack any physical barrier between the yard and the creek. Toys, play areas, and human paths were observed in and next to the Rocky Branch channel and banks.

Currently, health advisory levels for 2,3,7,8-TCDD in fish have been developed only for the Great Lakes. The ATSDR has previously recommended that FDA determine whether the Great Lakes health advisory for 2,3,7,8-TCDD in fish should be revised for the Jacksonville area. The justification for a cleanup level for 2,3,7,8-TCDD in waterway sediments, and/or soils subject to erosion, should depend upon the potential for human exposure. If the existing fish ban for the Jacksonville area is ineffective in preventing human exposure from the affected food-chain, additional remedial efforts would be required. If soil sampling of agricultural land uses along the Bayou Meto channel and floodway downstream and subsequent biological sampling reveal unacceptable exposure

to farm animals, additional remedial measures would be required.

RECOMMENDATIONS

The ATSDR offers the following recommendations to safeguard public health from the contamination of off-site areas and to better assess the public health hazard associated with this contamination. These recommendations are made assuming the term, "dioxin," that is used in the RI is meant to be equivalent to 2,3,7,8-TCDD. This is stated in the RI (p. 1-1, Vol. I).

1. Specify what dioxin isomers were analyzed for in the RI "dioxin" data.

2. Obtain total and isomer specific data for determining the 2,3,7,8-TCDD equivalents in off-site soil/sediment/sludge samples.

3. Restrict general public access, including the Jacksonville Department of Beautification employees, to the abandoned WWTP facilities (i.e., sludge drying beds, adjacent surface soils, digestor, trickling filter(s), clarifiers, sewage interceptors, pump house, and possible other contaminated facilities), the existing WWTP facilities (distribution/bypass pipelines and boxes, aeration lagoon, oxidation lagoons), and adjacent soils at the existing WWTP.

4. Develop a health and site safety plan for workers in accordance with OSHA standards. Outline the activities associated with contaminated areas in this plan and require individuals who engage in those activities to wear personal protective gear/clothing in accordance with OSHA standards and NIOSH guidelines.

5. Restrict all general public access to both the channel and the floodway of the west leg of Rocky Branch from the Vertac property line to West Main Road in the residential area south of Vertac until up-to-date soil and sediment sampling data are made available.

6. Insure that migration of contaminants via surface runoff on the Vertac site to off-site areas, particularly Rocky Branch, is no longer occurring.

7. Insure the adequacy of existing control measures on the Vertac site to avoid unacceptable releases, spills, or discharges of 2,3,7,8-TCDD and other contaminants of concern to the WWTP. Where existing measures are determined ineffective, implement additional on-site remedial measures.

8. Prevent existing pretreatment sumps on the Vertac site from bypassing site contaminants to Rocky Branch. Monitor discharges from Vertac site periodically.

9. Sample and analyze sediments for 2,3,7,8-TCDD and other contaminants of concern on the Vertac site in the Rocky Branch, East Ditch, South Ditch, the Central Ditch, and other drainage ditches.

10. Investigate the need for additional remediation of certain on-site areas (i.e., portions of Rocky Branch and drainage ditches that have not received any previous remediation, or drainage ditches that appear to bypass the pretreatment system) before implementing off-site remediation of contaminated channel sediments or floodplain soils downstream.

11. Request local authorities to prohibit residential land uses within the Vertac site boundary (Plate 5-2, V.III). Request that action be taken to permit no one to live on the site. Include anyone currently residing on the Vertac site in the State's exposure study.

12. Sample the surface soils in the immediate vicinity of the mobile home found on-site and its interior dusts for 2,3,7,8-TCDD and other contaminants of concern. Insure that the mobile home residence on the

site is properly cleaned if it is found to be contaminated and moved off-site.

13. Perform sampling and analysis of surface soils around manholes that are downgradient of the Vertac site, have a history of overflow, or have the potential to overflow.

14. Investigate the potential for wastewater overflows in any building floor drains that may be connected to a 2,3,7,8-TCDD-contaminated WWTP interceptor having a history of surcharge.

15. Prevent the continued degradation of Bayou Meto and Rocky Branch by the transport of contaminants of concern from both on-site and off-site sources of contamination.

16. Perform detailed (fine grid) sampling and analysis of channel sediments and floodplain soils for 2,3,7,8-TCDD and other contaminants of concern in and along the west leg and east leg of Rocky Branch between the Vertac property line and the confluence point of both Rocky Branch legs.

17. Perform fine grid sampling and analysis of channel sediments and floodplain soils for 2,3,7,8-TCDD and possibly other contaminants of concern in depositional areas of Rocky Branch, upstream of its confluence with Bayou Meto, and Bayou Meto between the WWTP outfall and 2000 feet downstream of the Highway 161 bridge. Conduct this sampling or additional sampling after remediation of the upstream areas.

18. Perform fine grid sampling and analyses of soils/sediments for 2,3,7,8-TCDD in the Bayou Meto floodplain adjacent to and in the Woodhaven Mobile Home Park near Highway 161.

19. Perform sampling and analyses of floodplain soils/sediments for 2,3,7,8-TCDD and other contaminants of concern in any pastures, feedlots, or farms upstream of the Southeastern Avenue bridge in the Bayou Meto floodplain. Conduct sampling to a depth greater than that which would be disturbed by local farm equipment.

20. Perform monitoring and analyses of surface waters for contaminants of concern and other priority pollutants in Rocky Branch and in Bayou Meto adjacent to residential areas. Designated uses and applicable water quality standards should be disclosed for the affected waterways and compared with the monitoring data.

21. Consider the following guidance criteria for dioxin remediation:

a. Municipal Wastewater Collection System

(1) Prevent human exposure to sludges, wastes, and sediments containing 2,3,7,8-TCDD and other contaminants of concern in the affected sanitary sewer and/or stormsewer collection system (abandoned and existing).

(2) Prevent the above contaminants from contaminating the future sewage treatment plant and any new interceptors.

b. Abandoned WWTP Facilities

(1) Prevent exposure of the general public to contaminated sludges, wastes, soils, and sediments in the abandoned sewage treatment facilities.

(2) Prevent these contaminated materials from contaminating the future sewage treatment plant and collection system via any subsurface sewer connections or surface runoff.

(3) Consider requiring surface soils in and around the abandoned sewage treatment facilities to meet an action level of not more than 5-7 ppb 2,3,7,8-TCDD after remediation. [This is justified because of the infrequent contact with surface soils by the general public, and because the present land use practices in the vicinity of the abandoned WWTP do not appear to be any more intensive than the commercial areas of the Ironbound District near Newark, New Jersey, where EPA Region II established a similar action level[6].]

(4) Impose the following conditions on the above 5-7 ppb action level:

-The uses and activities of the site must not become associated with the production, preparation, handling, consumption, or storage of food or other consumable items, and food packaging materials.

-Site soils must be protected from erosion that would uncover or transport 2,3,7,8-TCDD causing unacceptable human exposure at a future date (refer to section on EXPOSURE PATHWAYS for possible exposure pathways).

(5) Reevaluate the applicability of the 5-7 ppb action level if present land use is changed and 2,3,7,8-TCDD is left on the site in surface or subsurface soils at levels greater than 1 ppb.

c. <u>Existing WWTP Facility</u>

(1) Prevent exposure of the general public to contaminated sludges, wastes, sediments, and soils.

(2) Prevent effluent discharges or surcharge releases of 2,3,7,8-TCDD-contaminated materials and other contaminants of concern in the treatment system to Bayou Meto and make every possible effort to achieve desired wastewater treatment in the interim until the future WWTP is on-line in July 1987.

(3) Reduce the potential for a major release of 2,3,7,8-TCDD-contaminated materials and other contaminants of concern from the oxidation lagoons due to a major flood event.

(4) Prevent the contaminated materials from contaminating the future WWTP and collection system.

(5) Prevent the sludges, sediments, wastes, and soils containing 2,3,7,8-TCDD and other contaminants of concern in the treatment system and adjacent soils from migrating to and contaminating additional off-site areas.

(6) Consider using an action level less than 1 ppb 2,3,7,8-TCDD to prevent unacceptable human exposure in the future for those lands in and west of the oxidation lagoons that are zoned residential, or requesting local authorities to investigate the feasibility of rezoning lands contaminated with 2,3,7,8-TCDD to a less sensitive land use.

(7) Implement remedial measures to eliminate future releases of 2,3,7,8-TCDD from the site and avoid bioaccumulation in the foodchain, particularly food fish, and prevent adverse impacts upon other sensitive land uses downstream.

(8) For areas on the existing WWTP site which are zoned for manufacturing and which would be protected from erosion by surface runoff or potential flood events, consider using the action level of not more than 5-7 ppb 2,3,7,8-TCDD with the conditions discussed above under 21.b.(3), (4),& (5).

d. <u>Rocky Branch and Bayou Meto Channels and Floodplains</u>

(1) Insure that existing residential yards contain levels < than 1 ppb 2,3,7,8-TCDD in surface soils and sediments to minimize unacceptable human exposure.

(2) Recognize that "adequate cleanup of residential areas, from a public health perspective, requires that the concentration of TCDD left in surface soil be less than one ppb."[5] [Note that Kimbrough et al.[4] and Dr. Vernon Houk [3,5] of CDC stated that levels at or above 1 ppb 2,3,7,8-TCDD in residential soils cannot be considered safe and "...constitute an unacceptable risk to human health."]

(3) For currently undeveloped lands zoned for residential land use, consider using an action level less than 1 ppb 2,3,7,8-TCDD to prevent unacceptable human exposure in the future, or requesting local authorities to investigate the feasibility of rezoning contaminated lands to a less sensitive land use.

(4) For floodplain areas along the affected channel and floodways which are used or zoned for industrial or commercial uses,and which would be protected from erosion by surface runoff or potential flood events, consider using an action level of not more than 5-7 ppb 2,3,7,8-TCDD with the conditions discussed above under 21.b.(3), (4),& (5).

(5) For agricultural areas in the affected floodplains, make site-specific requests for a health assessment where justified by additional soil sampling and soil levels of 2,3,7,8-TCDD and other contaminants of concern, or by biological data.

(6) To minimize the bioaccumulation potential of 2,3,7,8-TCDD in the aquatic foodchain, consider achieving an interim action level of less than 1 ppb 2,3,7,8-TCDD in channel sediments and floodplain soils subject to erosion and transport processes. [This recommendation is based on existing sampling data that reveals that (a) all edible fish samples (136 ppt to 704 ppt 2,3,7,8-TCDD) collected in 1984 downstream of the Vertac site and the WWTP outfall to a point (BM3) 3 1/2 miles downstream on Bayou Meto from its confluence with Rocky Branch

exceeded FDA's Great Lakes health advisory (25 ppt) for 2,3,7,8-TCDD in fish, and (b) in-stream, near-surface sediments collected in 1984 were equal to or less than 0.39 ppb 2,3,7,8-TCDD in the Bayou Meto from a point 200 feet upstream of the Highway 161 bridge (a point far upstream of BM3)]. Conduct future evaluations of Bayou Meto edible fish tissue portions in accordance with FDA's procedures to assist appropriate State authorities determine the necessity for maintaining the present fish ban.

22. Develop and implement special erosion control criteria and a contigency plan for remedial operations to avoid any further transport of contaminants downstream.

22. Revise the human effects section of the RI to reflect the comments made under HEALTH EFFECTS above.

23. To obtain information on the possible disposition of previously dredged sediments, contact the U.S. Army Corps of Engineers for information on any permits for maintenance of channels near bridges and construction of new roads that may have been performed in Rocky Branch and Bayou Meto.

REFERENCES

Please refer to Attachment 3.

We appreciate the opportunity to provide recommendations on this off-site remediation. We thank you and Messrs. Rexroat, Right, and Saterdal for their assistance in our inspection of the site.

Ralph Tomlin
for
Jeffrey A. Lybarger, M.D.

Attachments

ATTACHMENT 1: SITE INSPECTION

000218

Itinerary

March 5, 1986:

1. Visited Mr. Dick Morris, manager of the City of Jacksonville Wastewater Utility, for general information on how the wastewater collection and treatment system is affected by the Vertac Plant. Visited the existing wastewater treatment plant (WWTP) which receives wastes from the Vertac Plant. Observed the abandoned portion of the old WWTP (clarifiers, trickling filters, digestor, and sludge drying beds), as well as those WWTP facilities (aerator, oxidation lagoons) currently be used.

2. Flew over the Vertac Plant, adjacent residential areas, downstream floodplain areas of Rocky Branch and Bayou Meto, and the WWTP.

3. Drove on the Vertac Plant site to see drainage pathways and how effective past remedial measures have been in containing on-site wastes.

March 6, 1986:

1. Drove off the site to see potentially affected residential areas, recreation areas, and drainage pathways and their association with adjacent land uses.

2. Visited Mr. Duane Reel, City Engineer, for information on current and projected land use zoning in areas around the Vertac Plant and downstream in the floodplain. Zoning maps and flood maps were obtained.

Problems Observed

1. According to the City Engineer, the WWTP is in violation of its discharge permit effluent limitations but the City has indicated that they are unable to do anything about it because of the dioxin contamination in the WWTP system. The oxidation lagoons are nearly

full and have inadequate retention time left. The City is waiting for EPA to take action on cleaning up the existing WWTP system and ponds. The connection of the new interceptor to the future WWTP (scheduled for completion in July 1987) will depend upon the approved cleanup of the WWTP interceptor system.

2. Possible evidence of air pollution exist around the existing WWTP aerator. The City Engineer pointed out numerous dead trees on the northwest side of the aeration lagoon, and suggested that air pollution from the aeration lagoon may be responsible.

3. The public has excess to the abandoned WWTP areas which are contaminated. Both potential health and safety hazards exist. The City is using the contaminated sludge drying beds for growing garden vegetables (i.e., tomatoes, cabbage, etc.) and other plants. Photos were taken. Levels of 2,3,7,8-TCDD as high as 7 ppb have been found in the sludge drying beds. A potential health hazard exists because of human contact, possible transport of contaminants to the home — environment, and ingestion of possible contaminants in and on vegetables. No record exists of past people who have removed sludge for home garden use.

4. The oxidation lagoons could be inundated by a 5-year flood event. The lagoons contain many contaminants including 2,3,7,8-TCDD.

5. No sampling has been done after on-site remedial work in the upper portions of Rocky Branch for either the east leg or west leg.

6. Noxious odors were apparent both on the Vertac site and in downwind areas in residential areas south and east of the Vertac Plant site. It could not be determined if these odors were related to current production activities or wastes disposed or stored on-site.

7. Drainage (East Ditch, South Ditch, & Central Ditch) from the Vertac Plant does not receive proper pretreament because of sump bypass

ATTACHMENTS 1 Con't.

features and inadequate capacity during storm periods. Photos were taken.

8. Portions of Rocky Branch exist on the Vertac site that were not included in the on-site remedial work.

9. Despite the newly installed french drain, seeps were observed between the new slurry wall and Rocky Branch in the area of the on-site burial site. Aerial photos were taken.

10. Evidence exists that children probably play in Rocky Branch immediately downstream of the Vertac Plant property line. Toys and numerous footpaths were found in and along Rocky Branch in the subdivision immediately south of the Vertac Plant. Photos were taken.

11. A mobile home residence was observed on the Vertac site (Plate 5-2, Vol. III) about 800 to 1000 feet from the highly contaminated "T-wastes" (drums containing 30 ppm 2,3,7,8-TCDD), and 1000 feet from 25,000 drums containing "D-wastes." The residents of this mobile home appear to have access to the site by a locked backgate. A dog and toys were seen observed in the yard. Photos were taken.

12. Some residential yards immediately downstream of the Vertac Plant share an intimate association with both the west and east legs of Rocky Branch.

13. Some Bayou Meto floodplain areas downstream of the Vertac Plant and the WWTP are used for grazing, crop production (rice and soybeans), and possibly other agricultural purposes.

though a flood prevention ordinance exists, portions of the ...plain can still be developed for residential purposes and other

ATTACHMENT 2: SUMMARY OF DIOXIN LEVELS FOUND IN OFF-SITE AREAS, JACKSONVILLE, ARKANSAS

000321

Location	Sample Date	Dioxin (ppb)	(Sample No. or (Reference)	Laboratory	Quality Control
Residential yard:	1979	4.2 (Braden St.)	(p.2-4,V.I)	-	
	1979	2.6 (W. Lane)	(p.2-4,V.I)	-	
	1982	ND	(p.2-5,V.I)	-	
Abandoned WWTP:					
Sludge drying beds	1984	6.39	(SO28B)	DF004010	
Digester	1984	12.46	(SO22B)	DF004305	
Clarifier	1984	1.62	(SO26A)	DF004304	
Sludge Collection Area	1984	1.19 (30'NE of kennel)	(SO22X)	DF004309	
Existing WWTP:					
Aeration lagoon	1984	37.9	(SO18A)	DF003609	e_2
Oxidation lagoon	1979	8.37 (north pond)	(p.2-4,V.I)	-	
	1979	7.75 (south pond)	(p.2-4,V.I)	-	
	1981	3.4 (composite)	(p.2-4,V.I)	-	
	1984	3.6 (north)	(SO11A)	DF003612	e_1
Sewerline	1979	1.13	(p.2-4,V.I)	-	
Manhole	1981	10.9 (Braden & Alta)	(p.2-4,V.I)	-	
Manhole #71	1983	32.4 (Braden & Alta)	(N-11)	-	
Manhole #77	1984	>200 (nr SE of Vertac)	(I016A)	DF003604	$e_{1,3}$
Manhole #76	1984	119.4 (Hill Rd.)	(I013A)	DF004116	e_1
Manhole	1984	22.3 (Braden & Alta)	(N011A)	DF004105	e_1
Rocky Branch:					
West leg[a]	1981[b]	0.27	(p.2-4,V.I)	-	
	1983[a]	3.2 (near Alta Cove)	(N-21)	-	
	1984	3.01 (nr W. Lane end)	(N026C)	DF003514	
	1984[a]	7.58 (near Hines Cove)	(N030C)	DF003913	
East leg[a]	1981	0.61 & duplicate=0.535 (Marshall Rd ditch)	(Table 5-1,V.III)		
	1981	0.535 (Hill Rd)	(Table 5-1,V.III,p.5-20)		
	1981	0.8 (SE corner Vertac)	(Table 5-1,V.III,p.5-20)		
	1983	0.17 (Hill Rd)	(N-8)	-	
2-Yr Floodplain	1984	1.7 (near WWTP)	(F104A)	DF004212	
	1984	1.5 (near WWTP)	(F105C)	DF004210	
At Highway 67/167	1979	<2.5	(p.2-4,V.I)	-	
	1981	<1.0	(p.2-4,V.I)	-	
	1983	1.15	(F-10)	-	
At Bayou Meto	1984	0.74 (100 ft above BM)	(F014A)	DF003620	e_1
Bayou Meto:					
At WWTP discharge	1984	2.1	(F047C)	DF003315	e_1
Floodpl. S Lk. Dupree	1984	1.38	(F085C)	DF003817	
Just Above Mo-Pac.RR	1984	1.52	(F060B)	DF003405	
At Mo-Pac.RR	1983	1.02	(F-17;Plate 5-1,V.III)	-	
At Highway 161[a]	1979	1.6	(p.2-4,V.I)	-	
	1981	<1.0	(p.2-4,V.I)	-	
	1984[a]	1.10 (200 ft upstream)	(F071X)	DF004001	
Below Highway 161	1984	1.08 (2000 ft downstr)	(FS025C)	DF004004	

Data prior to the RI are limited due to inadequate quality control.
The 1983 oxidation lagoon samples were taken from hard bottom sediments.
a=Sample locations lie very near and/or in intimate association with residential areas.
b=Can not be verified by Table 5-1 in Vol. II for the west leg; however, 0.27 was found at West Main & Rocky Branch.
c=Dioxin was used generically throughout RI; however p. 1-1,V.I identified dioxin as 2,3,7,8-TCDD.
e=Laboratory precision for duplicates can not be determined due to one of the duplicates being nondetectable.

ATTACHMENT 3:

REFERENCES

1. U.S. Environmental Protection Agency, National Interim Primary Drinking Water Regulations, Appendix A Background Document, EPA-570/9-76-003, 1976.

2. Sax, N. Irving, Dangerous Properties of Industrial Materials, Sixth Edition, 1984.

3. Letter dated July 8, 1984, from Dr. Vernon Houk, CDC, ATSDR, to Mr. Morris, U.S. EPA, Region VII.

4. Kimbrough, Renate D., Falk, Henry, and Stehr, Paul of Center for Environmental Health, CDC, and Fries, George of Department of Agriculture, Health Implications of 2,3,7,8-TCDD Contamination of Residential Soil, Journal of Toxicology and Environmental Health, 14:47-93, 1984.

5. Letter dated July 9, 1984, from Dr. Vernon Houk, CDC, ATSDR, to Mr. Dowling, Regional Administrator, U.S. EPA, Region II.

6. Memorandum dated October 26, 1984, from Ms. Georgi Jones, Chief, Superfund Implementation Group, CDC/ATSDR, to Mr. David P. Knorowski, Public Health Advisor, EPA Region II.

APPENDIX C

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

June 11, 1990

Mr. Sam Becker
Chief, Superfund Enforcement Branch (6H-E)
United States Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Dear Mr. Becker:

I have received your letter of May 29, 1990 requesting the Agency for Toxic Substances and Disease Registry (ATSDR) to approve, in terms of public health protection, the remedial plans for the Vertac, Jacksonville Landfill, and Rogers Road Landfill Superfund sites located in Jacksonville, Arkansas.

On May 3, 1990 a meeting was held in Atlanta to discuss, in depth, the proposed remediation at these Superfund sites. Present at the meeting were members of your staff and representatives of the Centers for Disease Control and ATSDR. A brief synopsis of your proposed remedies follows:

VERTAC SITE

Sewer Lines and Manholes:

The 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) contaminated sediments from the active interceptor and manholes will be removed by hydraulic flushing, followed by remote TV camera inspection to assure that all sediments have been removed. Sediments will be dewatered and incinerated. A pipe liner will be installed in the active interceptor to improve structural stability and to avoid possible recontamination by inflow. The abandoned interceptor will be filled with grout to immobilize any contaminated sediments and to prevent flow into and out of the line.

Abandoned Trickling Filter Plant:

The accumulated water in the trickling filters and clarifiers will be treated in activated carbon columns prior to discharge, and the spent carbon and filter spools will be incinerated. The digester sludge will also be incinerated. All of the units in the trickling filter plant will be demolished, and the debris covered with a foot of clean soil. The sludge drying beds will also be covered with a foot of clean soil. The abandoned trickling filter plant will continue to be fenced and access restricted.

Active West Wastewater Treatment Plant:

The aeration basin will be dewatered, and the water treated with activated carbon prior to discharge. The dikes of the aeration basin will be demolished, and the basin covered with a foot of clean soil. The oxidation ponds will, most likely, be used for storage and release of effluent from the Vertac leachate collection and treatment system. The wastewater treatment plant will continue to be fenced and access restricted.

Rocky Branch Creek and Bayou Meto Flood Plain:

In these flood plains, soil containing more than 1 ppb TCDD in undeveloped residentially zoned areas, will be excavated and hauled back to the Vertac site for ultimate disposal.

Rocky Branch Creek and Bayou Meto Sediments:

The TCDD concentrations in the sediment are as high as 2.3 ppb in the creek, and as high as 1.03 ppb in the Bayou. A fishing ban will remain in place.

JACKSONVILLE AND ROGERS ROAD LANDFILLS

All material with TCDD concentrations greater than 10 ppb will be excavated for treatment and the dioxins will be destroyed to levels below 1 ppb. Residual contamination exceeding 1 ppb will be capped by a foot or more of clean fill. The fence around these sites will be maintained by the City and the deeds will indicate that the sites are considered unacceptable by EPA for residential use.

I believe that the above briefly but accurately summarizes your proposed remedies. The ATSDR in consultation with the Centers for Disease Control believes that with the following clarifications the proposed cleanup strategies for these Superfund sites will be protective of human health:

1. Erosion controls are necessary to protect the additional soil used as clean cover.

2. With regard to the Rocky Creek and Bayou Meto sediments, the fish tissue concentrations must be monitored for dioxin and the fishing ban should remain in effect until the fish are determined to be safe for unlimited human consumption.

If you have any questions or require additional clarification please do not hesitate to contact me.

Sincerely yours,

Edwin Kent Gray
Chief, Emergency Response
and Consultation Branch
Division of Health Assessment
and Consultation

APPENDIX D

Table C-1
PRELIMINARY IDENTIFICATION OF POTENTIAL ACTION-SPECIFIC ARARs
VERTAC OFF-SITE FS

Actions[a]	Requirements	Prerequisites	Citation
Capping	Placement of a cap over waste (e.g., closing a landfill, or closing a surface impoundment or waste pile as a landfill, or similar action) requires a cover designed and constructed to: o Provide long-term minimization of migration of liquids through the capped area o Function with minimum maintenance o Promote drainage and minimize erosion or abrasion of the cover o Accommodate settling and subsidence so that the cover's integrity is maintained, and o Have a permeability less than or equal to the permeability of any bottom liner system or natural sub-soils present.	Significant management (treatment, storage, or disposal) of hazardous waste will make requirements applicable; capping without disturbance will not make requirements applicable, but technical requirements are likely to be relevant and appropriate.	40 CFR 264.228(a) (Surface Impoundments) 40 CFR 264.258(b) (Waste Piles) 40 CFR 264.310(a) (Landfills)
	Eliminate free liquids, stabilize wastes before capping (surface impoundments).		40 CFR 264.228(a)

[a] on a ...ati... rom ...keyw... nde...

Actions[a]	Requirements	Prerequisites	Citation
Capping (Continued)	Restrict post-closure use of property as necessary to prevent damage to the cover.		40 CFR 264.117(c)
	Prevent run-on and run-off from damaging cover.		40 CFR 264.228(b) 40 CFR 264.310(b)
	Protect and maintain surveyed benchmarks used to locate waste cells (landfills, waste piles).		40 CFR 264.310(b)
Clean Closure (Removal)	General performance standard requires minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products.	Disturbance of RCRA hazardous waste (listed or characteristic) and movement outside the unit or area of contamination. May apply to surface impoundment; contaminated soil, including soil from dredging or soil disturbed in the course of drilling, or excavation, and returned to land.	40 CFR 264.111
	Disposal or decontamination of equipment, structures, and soils.		40 CFR 264.111
	Removal or decontamination of all waste residues, contaminated containment system components (e.g., liners, dikes), contaminated subsoils, and structures and equipment contaminated with waste and leachate, and management of them as hazardous waste.	Not applicable to undisturbed material Disposal of RCRA hazardous waste (listed or characteristic) after disturbance and movement outside the unit or area of contamination.	40 CFR 264.228(a)(1) and 40 CFR 264.258
	Meet health-based levels at unit.		40 CFR 244.111

[a]Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
sure with Waste in Place ›ping)	Eliminate free liquids by removal or solidification.		40 CFR 264.228(a)(2)
	Stabilization of remaining waste and waste residues to support cover.		40 CFR 264.228(a)(2) and 40 CFR 264.258(b)
	Installation of final cover to provide long-term minimization of infiltration.		40 CFR 264.310
	Post-closure care and groundwater monitoring.		40 CFR 264.310
Closure with Waste in Place (Hybrid Closure)	Removal of majority of contaminated materials.	Proposed rule, not yet applicable	52 FR 8712 (March 19, 1987)
	Application of cover and post-closure monitoring based on exposure pathway(s) of concern.	Proposed rule, not yet applicable	52 FR 8712 (March 19, 1987)
Consolidation	Area from which materials are removed should be cleaned up.	Disposal by disturbance of hazardous waste (listed or characteristic) and moving it outside unit or boundary of contaminated area.	See Closure
	Consolidation in storage piles/ storage tanks will trigger storage requirements.		See Container Storage, Tank Storage, Waste Piles in this Exhibit.
	Placement on or in land outside unit boundary or area of contamination will trigger land disposal requirements and restrictions.	After November 8, 1988	40 CFR 268 (Subpart D)

[a] ... from HSWD keyword index

Actions[a]	Requirements	Prerequisites	Citation
Container Storage (Onsite)	Containers of hazardous waste must be:	RCRA hazardous waste (listed or characteristic) held for a temporary period before treatment, disposal, or storage elsewhere, (40 CFR 264.10) in a container (i.e., any portable device in which a material is stored, transported, disposed of, or handled).	
	o Maintained in good condition		40 CFR 264.171
	o Compatible with hazardous waste to be stored		40 CFR 264.172
	o Closed during storage (except to add or remove waste)		40 CFR 264.173
	Inspect container storage areas weekly for deterioration.		40 CFR 264.174
	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.		40 CFR 264.175
	Keep containers of ignitable or reactive waste at least 50 feet from the facility's property line.		40 CFR 264.176
	Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier.		40 CFR 264.177

[a] Action alternatives from ROD keyword index.

..ctions[a]	Requirements	Prerequisites	Citation
Container Storage (Onsite) (Continued)	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers, liners.		40 CFR 264.178
Containment (Construction of New Landfill Onsite) (See Closure with Waste in Place.)	Install two liners or more, a top liner that prevents waste migration into the liner, and a bottom liner that prevents waste migration through the liner.	RCRA hazardous waste (listed or characteristic) currently being placed in a landfill.	40 CFR 264.301
	Install leachate collection systems above and between the liners.		40 CFR 264.301
	Construct run-on and run-off control systems capable of handling the peak discharge of a 25-year storm.		40 CFR 264.301
	Control wind dispersal of particulates.		40 CFR 264.301
	Inspect liners and covers during and after installation.		40 CFR 264.303
	Provide groundwater monitoring adequate to detect releases from the unit.		40 CFR 264 Subpart F
	Inspect facility weekly and after storms to detect malfunction of control systems or the presence of liquids in the leachate collection and leak detection systems.		40 CFR 264.303

Actions[a]	Requirements	Prerequisites	Citation
Containment (Construction of New Landfill Onsite) (See Closure with Waste in Place.) (Continued)	Maintain records of the exact location, dimensions, and contents of waste cells.		40 CFR 264.304
	Close each cell with a final cover after the last waste has been received.		40 CFR 264.310
	No bulk or non-containerized liquid hazardous waste or hazardous waste containing free liquids may be disposed of in landfills.		40 CFR 264.314
	Containers holding free liquids may not be placed in a landfill unless the liquid is mixed with an absorbent or solidified.		40 CFR 264.314
	Treatment by Best Demonstrated Available Technology before placement.	Placement, after November 8, 1988, of RCRA hazardous waste subject to land disposal restrictions.	40 CFR 268 (Subpart D)
Containment (Construction of New Surface Impoundment Onsite) (See Closure with Waste in Place and Clean Closure.)	Use two liners, a top liner that prevents waste migration into the liner and a bottom liner that prevents waste migration through the liner throughout the post-closure period.	RCRA hazardous waste (listed or characteristic) currently being placed in a surface impoundment.	40 CFR 264.220
	Design liners to prevent failure due to pressure gradients, contact with the waste, climatic conditions, and the stress of installation and daily operations		40 CFR 264.221

[a] Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Containment (Construction of New Surface Impoundment Onsite) (See Closure with Waste in Place and Clean Closure.) (Continued)	Provide leachate collection system between the two liners.		40 CFR 264.221
	Use leak detection system that will detect leaks at the earliest possible time.		40 CFR 264.221
	Provide groundwater monitoring adequate to detect releases from the unit.		40 CFR 264 Subpart F
Dike Stabilization	Design and operate facility to prevent overtopping due to overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms, and other equipment; and human error.	Existing surface impoundments containing hazardous waste or creation of new surface impoundments.	40 CFR 264.221
	Construct dikes with sufficient strength to prevent massive failure.		40 CFR 264.221
	Inspect liners and cover systems during and after construction.		40 CFR 264.226
	Inspect weekly for proper operation and integrity of the containment devices.		40 CFR 264.226
	Provide groundwater monitoring adequate to detect releases from the unit.		40 CFR 264 Subpart F
	Remove surface impoundment from operation if the dike leaks or there is a sudden drop in liquid level.		40 CFR 264.227

Actions[a]	Requirements	Prerequisites	Citation
Dike Stabilization (Continued)	At closure, remove or decontaminate all waste residues and contaminated materials. Otherwise, free liquids must be removed, the remaining wastes stabilized, and the facility closed in the same manner as a landfill.		40 CFR 264.228
	Manage ignitable or reactive waste so that it is protected from materials or conditions that may cause it to ignite or react.		40 CFR 264.227
Direct discharge of treatment system effluent	Applicable federal water quality criteria for the protection of aquatic life must be complied with when environmental factors are being considered.	Surface discharge of treated effluent.	50 FR 30784 (July 29, 1985)
	Applicable federally approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Surface discharge of treated effluent.	40 CFR 122.44 and state regulations approved under 40 CFR 131
	The discharge must be consistent with the requirements of a Water Quality Management plan approved by EPA under Section 208(b) of the Clean Water Act.		

[a] Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Direct discharge of treatment system effluent (Continued)	Use of best available technology (BAT) economically achievable is required to control toxic and nonconventional pollutants. Use of best conventional pollutant control technology (BCT) is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis.	Surface discharge of treated effluent	40 CFR 122.44(a)
	The discharge must conform to applicable water quality requirements when the discharge affects a state other than the certifying state.	Surface water discharge affecting waters outside Colorado	40 CFR 122.44(d)(4)
	Discharge limitations must be established for all toxic pollutants that are or may be discharged at levels greater than those which can be achieved by technology-based standards.	Surface discharge of treated effluent	40 CFR 122.44(e)
	Discharge must be monitored to assure compliance. Discharge will monitor: o The mass of each pollutant o The volume of effluent o Frequency of discharge and other measurements as appropriate.	Surface discharge of treated effluent	40 CFR 122.44(i)

[a] Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Direct discharge of treatment system effluent (Continued)	Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided.		
	Permit application information must be submitted including a description of activities, listing of environmental permits, etc.		40 CFR 122.21
	Monitor and report results as required by permit (minimum of at least annually)		40 CFR 122.44(i)
	Comply with additional permit conditions such as: o Duty to mitigate any adverse effects of any discharge; and o Proper operation and maintenance of treatment systems.		40 CFR 122.41(i)
	Develop and implement a Best Management Practices (BMP) program and incorporate in the NPDES permit to prevent the release of toxic constituents to surface waters.	Surface water discharge	40 CFR 125.100
	The BMP program must:		40 CFR 125.104

[a] Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Direct discharge of treatment system effluent (Continued)	o Establish specific procedures for the control of toxic and hazardous pollutant spills. o Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure. o Assure proper management of solid and hazardous waste in accordance with regulations promulgated under RCRA		
	Sample preservation procedures, container materials, and maximum allowable holding times are prescribed.	Surface water discharge	40 CFR 136.1-136.4
Discharge to POTW[b]	Pollutants that pass-through the POTW without treatment, interfere with POTW operation, or contaminate POTW sludge are prohibited. Specific prohibitions preclude the discharge of pollutants to POTWs that: o Create a fire or explosion hazard in the POTW o Are corrosive (pH<5.0)		40 CFR 403.5

[a] Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Discharge of dredge and fill material to navigable waters	The four conditions that must be satisfied before dredge and fill is an allowable alternative are: o There must be no practicable alternative o Discharge of dredged or fill material must not cause a violation of State water quality standards, violate any applicable toxic effluent standards, jeopardize an endangered species, or injure a marine sanctuary o No discharge shall be permitted that will cause or contribute to significant degradation of the water o Appropriate steps to minimize adverse effects must be taken Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem.		40 CFR 230.10 33 CFR 320-330
Dredging	Removal of all contaminated soil.	Disposal by disturbance of hazardous waste and moving it outside the unit or area of contamination.	See discussions under Clean Closure, Consolidation, Capping
Excavation	Area from which materials are excavated may require cleanup to levels established by closure requirements	Disposal by disturbance of hazardous waste and moving it outside the unit or area of contamination.	40 CFR 264 Disposal and Closure requirements

[a]

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Actions[a]	Requirements	Prerequisites	Citation
Excavation (Continued)	Movement of excavated materials to a previously uncontaminated, onsite location, and placement in or on land may trigger land disposal restrictions.	Materials containing RCRA hazardous wastes subject to land disposal restrictions.	40 CFR 268 (Subpart D)
Gas Collection	Proposed standards for control of emissions of volatile organics (CAA requirements to be provided.)	Proposed standard; not yet ARAR.	52 FR 3748 (February 5, 1987)
Groundwater Diversion	Excavation of soil for construction of slurry wall may trigger cleanup or land disposal restrictions.	Disposal by disturbance of hazardous waste and moving it outside the unit or area of contamination.	See Consolidation, Excavation in this Exhibit.
Incineration (Onsite)	Analyze the waste feed.	RCRA hazardous waste.	40 CFR 264.341
	Dispose of all hazardous waste and residues, including ash, scrubber water, and scrubber sludge.		40 CFR 264.351

[a] Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Incineration (Onsite) (Continued)	No further requirements apply to incinerators that only burn wastes listed as hazardous solely by virtue of the characteristic of ignitability, corrosivity, or both; or the characteristic of reactivity if the wastes will not be burned when other hazardous wastes are present in the combustion zone; and if the waste analysis shows that the wastes contain none of the hazardous constituents listed in Appendix VIII which might reasonably be expected to be present.		40 CFR 264.340
	Performance standards for incinerators:		
	o Achieve a destruction and removal efficiency of 99.99 percent for each principal organic hazardous constituent in the waste feed and 99.9999 percent for dioxins		40 CFR 264.343
	o Reduce hydrogen chloride emissions to 1.8 kg/hr or 1 percent of the HCl in the stack gases before entering any pollution control devices		40 CFR 264.342

[a]Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Incineration (Onsite) (Continued)	Monitoring of various parameters during operation of the incinerator is required. These parameters include: o Combustion temperature o Waste feed rate o An indicator of combustion gas velocity o Carbon monoxide		40 CFR 264.343
	Special performance standard for incineration of PCBs.		40 CFR 761.70
Land Treatment	Ensure that hazardous constituents are degraded, transformed, or immobilized within the treatment zone.	RCRA hazardous waste.	40 CFR 264.271
	Maximum depth of treatment zone must be no more than 1.5 meters (5 feet) from the initial soil surface; and more than 1 meter (3 feet) above the seasonal high water table.		40 CFR 264.271
	Demonstrate that hazardous constituents for each waste can be completely degraded, transformed, or immobilized in the treatment zone.		40 CFR 264.272
	Minimize run-off of hazardous constituents.		40 CFR 264.273

Actions[a]	Requirements	Prerequisites	Citation
Land Treatment (Continued)	Maintain run-on/run-off control and management system.		40 CFR 264.273
	Special application conditions if food-chain crops grown in or on treatment zone.		40 CFR 264.276
	Unsaturated zone monitoring.		40 CFR264.278 —
	Provide groundwater monitoring adequate to detect releases from the unit.		40 CFR 264 Subpart F
	Special requirements for ignitable or reactive waste.		40 CFR 264.281
	Special requirements for incompatible wastes.		40 CFR 264.282
	Special requirements for RCRA hazardous wastes.		40 CFR 264.283
	Design system to operate odor free.		CAA Section 101[c] and 40 CFR 52[c]
Operation and Maintenance (O&M)	Post-closure care to ensure that site is maintained and monitored.		40 CFR 264.1
Slurry Wall	Excavation of soil for construction of slurry wall may trigger cleanup or land disposal restrictions.	Disposal by disturbance of hazardous waste and moving it outside the unit or area of contamination.	See Consolidation, Excavation in this Exhibit.

[a] Action alternatives from ROD keyword index.

[c] All of the Clean Air Act ARARs that have been established by the federal government are covered by matching state regulations. The state has the authority to manage these programs through the approval of its implementation plans (40 CFR 52 Subpart G).

Actions[a]	Requirements	Prerequisites	Citation
Surface Water Control	Prevent run-on and control and collect runoff from a 24-hour, 25-year storm (waste piles, land treatment facilities, landfills).	Land-based treatment, storage, or disposal units.	40 CFR 264.251(c)(d) 40 CFR 264.273(c)(d) 40 CFR 264.301(c)(d)
	Prevent over-topping of surface impoundment.		40 CFR 264.221(c)
Tank Storage (Onsite)	Tanks must have sufficient shell strength (thickness), and, for closed tanks, pressure controls, to assure that they do not collapse or rupture.	RCRA hazardous waste (listed or characteristic) held temporarily in a tank before treatment, disposal, or storage (40 CFR 264.10).	40 CFR 264.191
	Waste must not be incompatible with the tank material unless the tank is protected by a liner or by other means.		40 CFR 264.192
	Tanks must be provided with secondary containment to prevent releases.		40 CFR 264.193
	Tanks must be provided with controls to prevent overfilling and sufficient freeboard maintained in open tanks to prevent overtopping by wave action or precipitation.		40 CFR 264.194

[a] Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Tank Storage (Onsite) (Continued)	Inspect the following: overfilling control, control equipment, monitoring data, waste level (for uncovered tanks), tank condition, above-ground portions of tanks (to assess their structural integrity), and the area surrounding the tank (to identify signs of leakage).		40 CFR 264.195
	Repair any corrosion, crack, or leak.		40 CFR 264.196
	At closure, remove all hazardous waste and hazardous waste residues from tanks, discharge control equipment, and discharge confinement structures.		40 CFR 264.197
	Store ignitable and reactive waste so as to prevent the waste from igniting or reacting. Ignitable or reactive wastes in covered tanks must comply with buffer zone requirements in "Flammable and Combustible Liquids Code," Tables 2-1 through 2-6 (National Fire Protection Association, 1976 or 1981).		40 CFR 264.198

[a]Action alternatives from ROD keyword index.

Actions[a]	Requirements	Prerequisites	Citation
Treatment	Standards for miscellaneous units (long-term retrievable storage, thermal treatment other than incinerators, open burning, open detonation, chemical, physical, and biological treatment units using other than tanks, surface impoundments, or land treatment units) require new miscellaneous units to satisfy environmental performance standards by protection of groundwater, surface water, and air quality, and by limiting surface and subsurface migration.	Treatment of hazardous wastes in units not regulated elsewhere under RCRA.	40 CFR 264 (Subpart X)
	Treatment of wastes subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste.	Effective date for CERCLA actions November 8, 1988, for F001-F005 hazardous wastes, dioxin wastes, and certain "California List" wastes. Other restricted wastes will have different effective dates as to be promulgated in 40 CFR 268.	40 CFR 268 (Subpart D)
	BDAT standards are based on one of four technologies or combinations: for wastewaters (1) steam stripping, (2) biological treatment, or (3) carbon absorption (alone or in combination with (1) or (2), and for all other wastes (4) incineration. Any technology may be used, however, if it will achieve the concentration levels specified.		

Actions[a]	Requirements	Prerequisites	Citation
Waste Pile	Use liner and leachate collection and removal system.	RCRA hazardous waste, noncontainerized accumulation of solid, nonflammable hazardous waste that is used for treatment or storage.	40 CFR 264.251

[a]Action alternatives from ROD keyword index.

CVR134/032

APPENDIX E

STATE OF ARKANSAS
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
8001 NATIONAL DRIVE, P.O. BOX 9583
LITTLE ROCK, ARKANSAS 72209
PHONE: (501) 562-7444
FAX: (501) 562-4632

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September 7, 1990

Ms. Ellen Greeney
Community Relations Coordinator
U.S. EPA, Region 6 (6H-MC)
1445 Ross Avenue
Dallas, TX 75202-2733

RE: Vertac Off-Site Proposed Remedies

The Arkansas Department of Pollution Control and Ecology presents the following comments regarding the proposed plan for Vertac Off-Site:

1. The extremely low concentration of TCDD in the Rocky Branch Creek Flood Plain requires careful evaluation of the advantages of remedial action, verses the ecological damage resulting from that action.

2. The analytical data for the sewer lines, sewer treatment plant, and lagoons were derived from samples taken in 1984. The flood plain was sampled over two years ago. All of these areas should be resampled prior to any remedial action.

3. The cleanup levels in the flood plain are based on health risks associated with the residential soil contamination. Rezoning the flood plain area from residential to commercial, in the flood plain areas where no development has occurred, would eliminate the remedial action needs based on a change in health risk scenario. It would serve to save millions of dollars and remain protective of human health and the environment and be non-destructive to the existing ecology. These issues should be seriously considered while finalizing a Record of Decision.

We concur with the balance of the proposed remedy as outlined by EPA in the proposed plan. We appreciate your consideration of the State's comments.

Sincerely,

Mike Bates
Chief
Hazardous Waste Division

MB:cw

STATE OF ARKANSAS
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY
8001 NATIONAL DRIVE, P.O. BOX 9583
LITTLE ROCK, ARKANSAS 72209
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September 18, 1990

Garret Bondy
Chief, AR/LA Superfund Enforcement Section
U.S. EPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

RE: Vertac Off-Site Proposed Remedy

Dear Mr. Bondy:

It has come to my attention that my September 7, 1990, letter to Ms. Ellen Greeney regarding the Vertac off-site proposed remedies may have been mis interpreted by EPA. The comments relative to the proposed remediation of the flood plain areas was not intended to suggest our nonconcurrence. We understand the basis for selection of the clean-up criteria and agree that application of said criteria (clean-up to 1 ppb TCDD) should be accomplished based on this criteria.

Our comments were intended to point out the ability to use or provide flexibility in the application of cleanup criteria during the decision making process. We urge EPA to exercise as much flexibility as feasible in the application of the clean-up standard (and particularity in the design and implementation of the remedy).

I hope this clarifies any questions EPA may have regarding our position on the Proposed Plan.

Sincerely,

Mike Bates
Chief
Hazardous Waste Division

MB:cw