United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R06-90/064
September 1990

ENVIRONMENTAL
PROTECTION
AGENCY
DALLAS, TEXAS
LIBRARY

EPA

Superfund Record of Decision:

Arkwood, AR

OCLC #26607740 12-18-91

9364208

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R06-90/064	2.	3. Recipient's Accession No.
4. Title and Subtitle SUPERFUND RECORD OF DECISION Arkwood, AR First Remedial Action - Final			5. Report Date 09/28/90 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Orgainization Name and Address			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460			13. Type of Report & Period Covered 800/000 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 15-acre Arkwood site is a former wood treatment facility in Boone County, Arkansas. Land use in the vicinity of the site is primarily agricultural and light industrial. Approximately 200 residences are located within one mile of the site, and 35 domestic water supply wells are within 1.5 miles of the site. In addition, numerous springs including New Cricket Spring, are found on, and adjacent to the site. The site is characterized as karst terrain formed by the solution of limestone and dolomite by ground water. Ground water on, or near the site is highly susceptible to contamination as a result of underground cavities, enlarged fractures and conduits which hinder monitoring and pumping. From 1962 to 1973, Arkwood operated a PCP and creosote wood treatment facility at the site. Subsequently from 1973 to 1984, Mass Merchandisers, Inc. (MMI) leased the plant and continued operations until the lease expired, and MMI removed all remaining inventory and materials offsite. In 1986, the site owner dismantled the plant. State investigations conducted during the 1980s documented PCP and creosote contamination in surface water, soil, debris, and buildings throughout the site. Contaminated surface features at the site include the wood treatment facility, a sinkhole area contaminated with oily waste, a ditch area, a wood storage area, and an

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Arkwood, AR
First Remedial Action - Final
Contaminated Media: soil, sludge, debris, gw, sw
Key Contaminants: organics (dioxin, oils, PAHs, PCP)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 96
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

ash pile. In 1987, EPA ordered the site owner to perform an immediate removal action, which included implementing site access including fencing and sign postings. This Record of Decision (ROD) addresses remediation of all affected media, and provides the final remedy for the site. The primary contaminants of concern affecting the soil, sludge, debris, ground water and surface water are organics including pentachlorophenol (PCP), PAHs, and dioxin; and oils.

The selected remedial action for this site includes excavating approximately 21,000 cubic yards of contaminated soil and sludge from the railroad ditch, wood treatment facility, storage areas and ash pile; pretreating these materials by sieving and washing the soil; incinerating approximately 7,000 cubic yards of pretreated materials exceeding cleanup levels onsite; backfilling washed coarse materials pretreated to below cleanup levels as well as any residual ash; decontaminating onsite structures and debris, followed by onsite or offsite disposal; covering the site with a soil cap and revegetating the area; onsite pumping and treatment of 3,000 gallons of oily sinkhole liquids and any waste water from decontamination activities using filtration and granular activated carbon, followed by onsite discharge of treated liquids, and incineration of any free phase oil; disposing of any residuals offsite; implementing site access restrictions including fencing; monitoring drinking water and ground water; providing municipal water lines to affected residences; monitoring New Cricket Spring for a two-year period to measure the success of natural attenuation. If PCP levels still exceed State standards after two years, a treatment system will be implemented for the spring. The estimated present worth cost for this remedial action is $10,300,000. O&M costs were not provided.

PERFORMANCE STANDARDS OR GOALS: Action levels for soil excavation and treatment include PCP 300 mg/kg (based on the leachability of PCP from site soil), carcinogenic PAHs 6.0 mg/kg (10^{-5} excess cancer risk), and dioxin 20 ug/kg (ATSDR).

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

ARKWOOD, INC.
OMAHA, ARKANSAS
RECORD OF DECISION

DECLARATION

SITE NAME AND LOCATION
Arkwood, Inc. Site
Omaha, Boone County, Arkansas

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Arkwood, Inc. site in Omaha, 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 the site.

The State of Arkansas concurs with the selected remedy.

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

The principle threat from this site is direct contact with the site soils that are contaminated above health based levels, and the long term threat to the ground water. The low level threat from this site is from direct contact with soils that are contaminated below the health based levels, and from New Cricket Spring which contains pentachlorophenol above the Maximum Contamination Level. The site soils are contaminated with pentachlorophenol (PCP), polynuclear aromatic hydrocarbons (PNAs), and dioxin to an approximate depth of one to two feet on the main site, and four to five feet in the railroad ditch area. The selected remedy will destroy the site contaminants that are above health based levels, thereby eliminating the principle threat from the site. The topsoil cap and the remedy for New Cricket Spring will adequately reduce the low level threats.

The selected remedy for the contaminated soils is;

- Construct a temporary incinerator on the site,
- Excavate all soils that contain greater than 300 mg/kg PCP, or greater than 20 µg/kg dioxin as 2,3,7,8 TCDD equivalents, or greater than 6.0 mg/kg PNAs as Benzo-a-pyrene equivalents (affected soils).
- Excavate the soils from the on-site sinkhole,
- Sieve and wash the excavated soils,
- Backfill the washed coarse materials that no longer meet the definition of affected soils,
- Incinerate on-site all washed materials that still meets the definition of affected soils,
- Backfill ash in the excavated areas,
- Place a top soil cap over the entire site,
- Seed the site with native grasses.
- Fence the entire site to prevent access

Shallow ground water on the site is contaminated with PCP. Only one spring in the area, New Cricket Spring, which lies approximately 1000 feet northwest of the site, has consistently shown contamination with PCP. No drinking water wells have been shown the presence of site contaminants. The area is underlain by karst geology which prevents the use of monitor wells as a method of predicting contaminant movement, or recovery wells as a method of remediation. Therefore, ground water remediation focuses on New Cricket Spring. The source remediation described above is expected to reduce the degree and amount of ground water contamination. The selected ground water remedy is;

- Monitor area springs during, and two years after the soils remediation to determine the degree to which natural attenuation is taking affect,
- If pentachlorophenol levels are above State of Arkansas water quality standards after a post-remedial monitoring period of two years, erect a water treatment system at New Cricket Spring to treat to State of Arkansas Water Quality Standards,
- Treat New Cricket Spring until levels fall below state standards.
- Monitor selected drinking water wells for 30 years.
- Provide selected well water users with city water lines to remove any uncertainty in their water supply.

DECLARATION

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 technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility , or volume as a principle element.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, the five-year review for site soils will apply to this action. Five year reviews for New Cricket Spring, and the ground water monitoring program, will also be required.

Robert E. Layton Jr. SEP 28 1989 SEP 28 1990

Robert E. Layton
Regional Administrator
Region VI
Environmental Protection Agency

ARKWOOD, INC. SUPERFUND SITE
RECORD OF CONCURRENCE

The Arkwood, Inc. Superfund site Record of Decision has been reviewed by me, and I concur:

Garret Bondy, Chief
Hazardous Waste Management Division
Superfund Enforcement Branch
Arkansas/Louisiana Section (6H-EA)

Mark Peycke
Office of Regional Counsel
ALON Section (6C-WA)
Hazardous Waste Branch

George Alexander
Regional Counsel (6C)

Sam Becker, Chief
Hazardous Waste Management Division
Superfund Enforcement Branch (6H-E)

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

Marvin Benson 9/27/90
Asst. Regional Counsel

TABLE OF CONTENTS
DECISION SUMMARY

I. Site Name, Location and Description 1
A. Name, Location and Address 1
B. Area and Topography of Site 1
C. Adjacent Land Uses 1
D. Natural Resource Uses 1
E. General Surface and Subsurface Conditions 5
F. Location and Distance to Nearby Human Populations . 11
G. Site Surface and Subsurface Features 11

II. Site History and Enforcement Activities 14
A. History of Site Activities 14
B. State and Federal Removal and Remedial Actions . . . 15
C. CERCLA Enforcement Activities 15

III Highlights of Community Participation 16

IV. Scope and Role of Response Action Within Site Strategy . 17

V. Summary of Site Characteristics 19

VI. Summary of Site Risks 33
A. Human Health Risks 33
B. Environmental Risks 38

VII. Description of Alternatives 39
A. Common Design Elements 39
B. Description of Alternatives 43
A. No Action 43
B. Site Monitoring and Restricted Access 44
C. Incinerate Sludges 44
C1. Incinerate Sludges/Topsoil Cap Over Entire Site 45
D. Incinerate Sludges/Consolidate and Cap-In-Place Affected Soil 45
E. Incinerate Sludges/Consolidate, Sieve-and-Wash and Cap-n-Place Affected Soils 47
F. Incinerate Sludges/Sieve-and-Wash, Biologically Treat Sand/Fines and Cap-In-Place Affected Soils 49
G. Incinerate Sludges/Landfill Affected Soils On-Site 50
H. Incinerate Sludges and Affected Soils On-Site 51

VIII. Summary of Comparative Analysis of Soil Alternatives . 52
A. Threshold Criteria 52
B. Primary Balancing Criteria 55
C. Modifying Criteria 59

IX. Description of Ground water Alternatives 60
A. Natural Attenuation with Monitoring 61

B. Ground water Recovery/Treatment/Surface Discharge . 61

X. Summary of Comparative Analysis of Ground water Alternatives 61
A. Threshold Criteria 63
B. Primary Balancing Criteria 63
C. Modifying Criteria 64

XI. The Selected Remedy 64
A. Soil 64
B. Ground water 65

XII. Statutory Determinations 66
A. Protection of Human Health and the Environment . . . 66
B. Compliance With Applicable or Relevant and Appropriate Requirements 67
C. Cost-Effectiveness 68
D. Utilization of Permanent Solutions and Alternative . 68
E. Preference For Treatment As a Principal Element . . 68

XIII. Explanation of Significant Differences 68

XIV. Responsiveness Summary 70

LIST OF FIGURES

Figure I-1 State of Arkansas 2

Figure I-2 Site Location Map 3

Figure I-3 Site Location Map 4

Figure I-4 Site Geology 6

Figure I-5 Area Springs 8

Figure I-6 Area Wells 10

Figure I-7 Site Features Map 12

Figure IV-1 Excavation Limits 18

Figure V-1 Site Features Map 23

Figure V-2 Railroad ditch PCP Concentration 0-6" 26

Figure V-3 PCP Concentrations 0-6" Main Site 28

Figure V-4 PCP Concentrations 1-2' Main Site 29

Figure V-5 Site Monitoring Wells 31

Figure VII-1 Affected Soils 46

LIST OF TABLES

Table V-1 Migration Pathways 21

Table V-2 Concentrations 25

Table V-3 Well Flow Rates 32

Table VI-1 Contaminant Mass 34

Table VI-2 Carcinogenic Risk Summary 36

Table VI-3 Non-carcinogenic Risk Summary 37

Table VIII-1 Summary of Comparative Analysis 53

Table X-1 Summary of Comparative Alternatives 62

I. Site Name, Location and Description

A. Name, Location and Address

The Arkwood, Inc. site is located west of U. S. Highway 65 and one-half mile southwest of Omaha, Boone County, Arkansas (Figure I-1, I-2.) It occupies portions of Section 27, T.21 N., R.21 W. A branch line of the Missouri Pacific Railroad borders the northeastern limit of the property. The southern and western limits are bounded by Cricket Road. Highway 65 forms the eastern property boundary (Figure I-3).

B. Area and Topography of Site

The site is relatively flat and gently sloped to the northwest, having been excavated for fill for the railroad. It is roughly triangular shaped and covers approximately 15 acres. It is surrounded by hilly terrain dominated by ridges and steep-sided valleys.

C. Adjacent Land Uses

Within the vicinity of the Arkwood site, many of the ridges and hilltops have been clear-cut to be used as pasture land for grazing livestock. Many of the steeper valley sides and "V" shaped valley floors remain heavily wooded and provide timber to local sawmills.

Many of the local farmers are involved in the poultry industry and raise chickens and turkeys for a major food chain supplier. These local producers raise chickens and turkeys in numerous large poultry houses.

Other small industrial operations are located within a short distance of the Arkwood site including a charcoal plant and a relatively small scale sawmill that also does minor amounts of wood preserving.

D. Natural Resource Uses

The only known major natural resource use in the vicinity is timber. Softwood trees (predominantly pines) are harvested for pulpwood and manufactured building materials such as chipboard and plywood. Hardwood trees are harvested for lumber and charcoal.

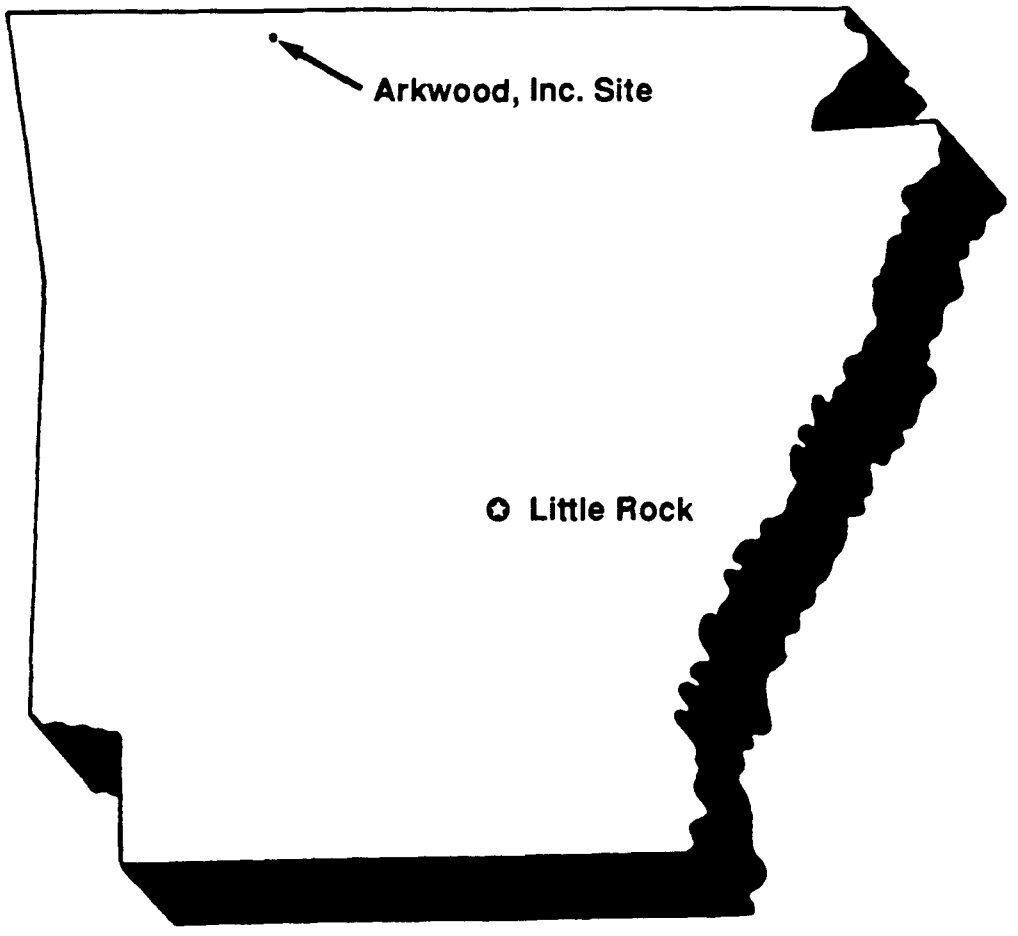


Figure I-1
State of Arkansas
Arkwood, Inc. Site
U.S. Environmental Protection Agency

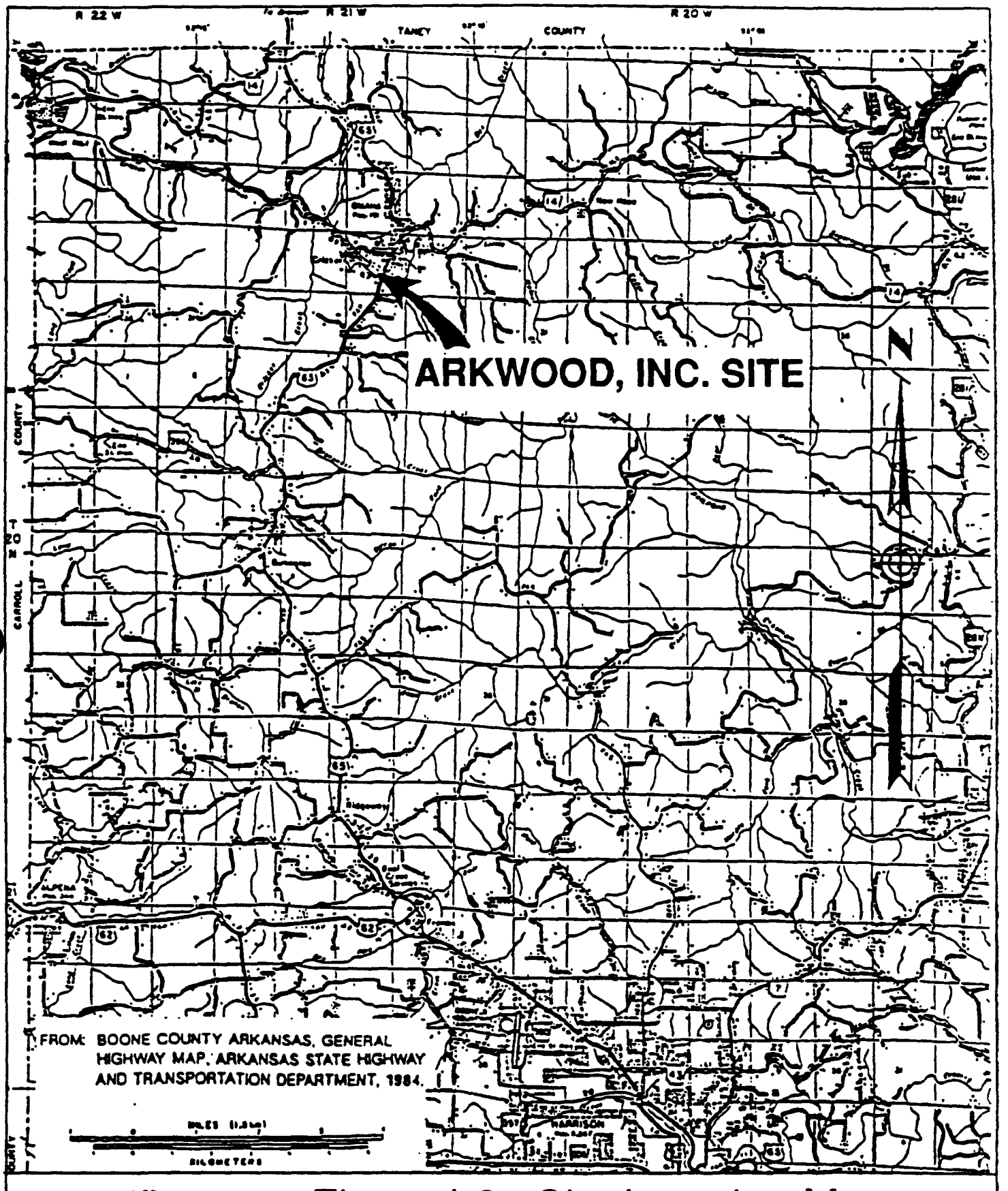


Figure I-2 Site Location Map

Arkwood, Inc. Site
Omaha, Arkansas

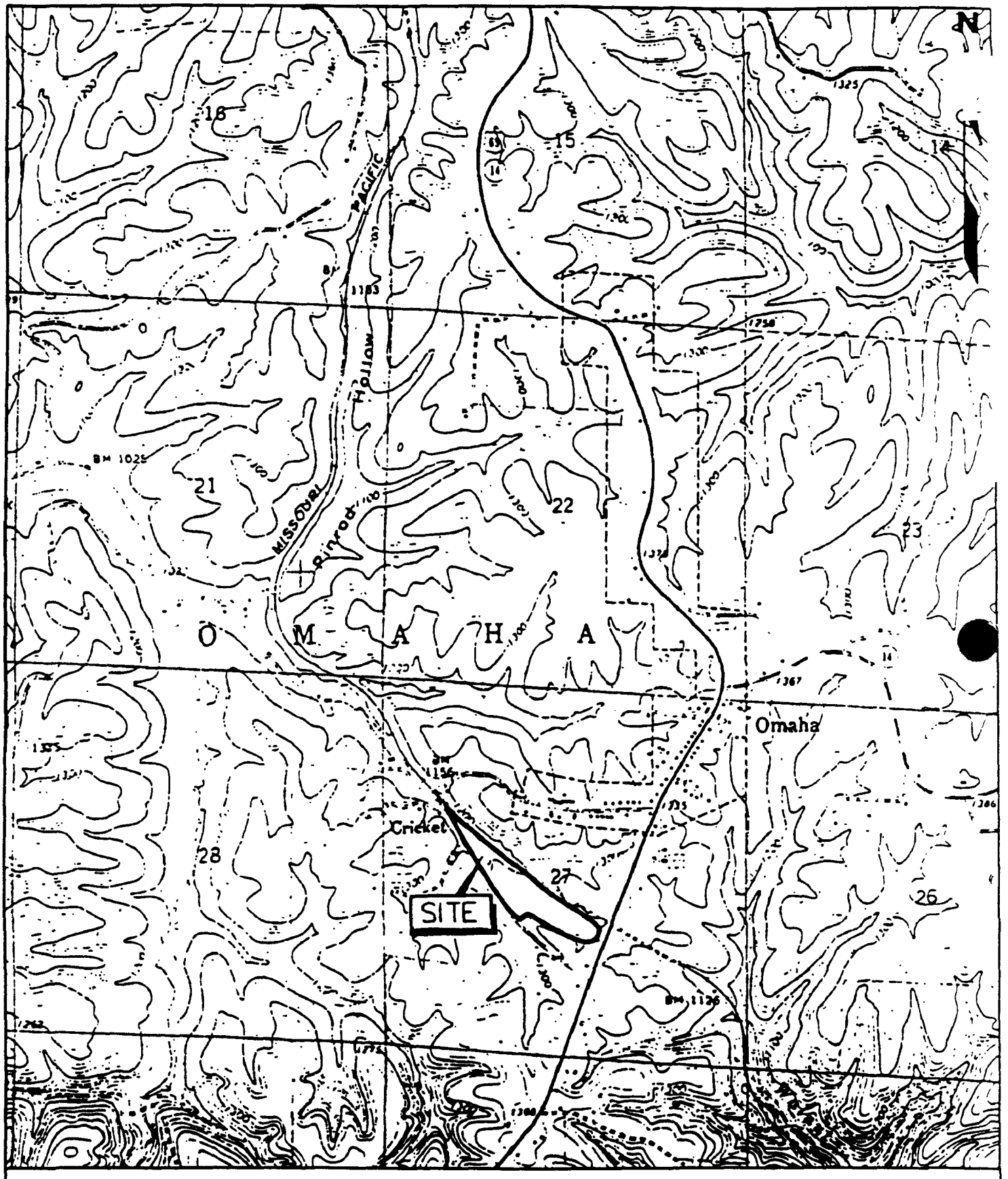


Figure I-3 Site Location Map

Arkwood, Inc. Site
Omaha, Arkansas

The sawmill and the charcoal plant located southeast of the site utilize local timber.

E. General Surface and Subsurface Conditions

Area Geology

The Arkwood, Inc. site is located in the Springfield Plateau province of the Ozark Highlands region of Northwestern Arkansas. Much of this area is underlain by rocks of Ordovician to Mississippian ages. Much of the area, including the Arkwood, Inc. site is located in a karst terrain (see Figure I-4) formed by the solution of limestone and dolomite by ground water.

The deepest formation of interest at the Arkwood site is the Roubidoux. The top of the Roubidoux is approximately 500 feet below the ground surface in the site area and is a major water supply in northwestern Arkansas. The site supply well produces water out of the Roubidoux between 900 and 1000 feet below the ground surface. The Cotter and Powell formations that overlie the Roubidoux, are generally not good water producers across the region. They are present at the site (Cotter depth is approximately 120 feet, and the Powell depth is approximately 65 feet) below the near surface formations and, where they were encountered in on-site monitoring wells, they were dry.

The near surface formations at the site are the Sylamore sandstone, and the St. Joe and Boone limestones. On the site the uppermost formation, the Boone, has been deeply weathered and most of the resulting soils have been excavated. A schematic diagram of the site geology is shown on Figure I-4.

Area Ground Water

The Arkwood site is located in a karst terrain formed by the solution of limestone and dolomite by groundwater. This results in the enlargement of underground fractures and joints in the rock, eventually resulting in caves and sinkholes, and leads to the replacement of surface runoff by underground drainage through the enlarged fractures and joints. As a result, surface drainage can become intermittent and widely spaced or absent.

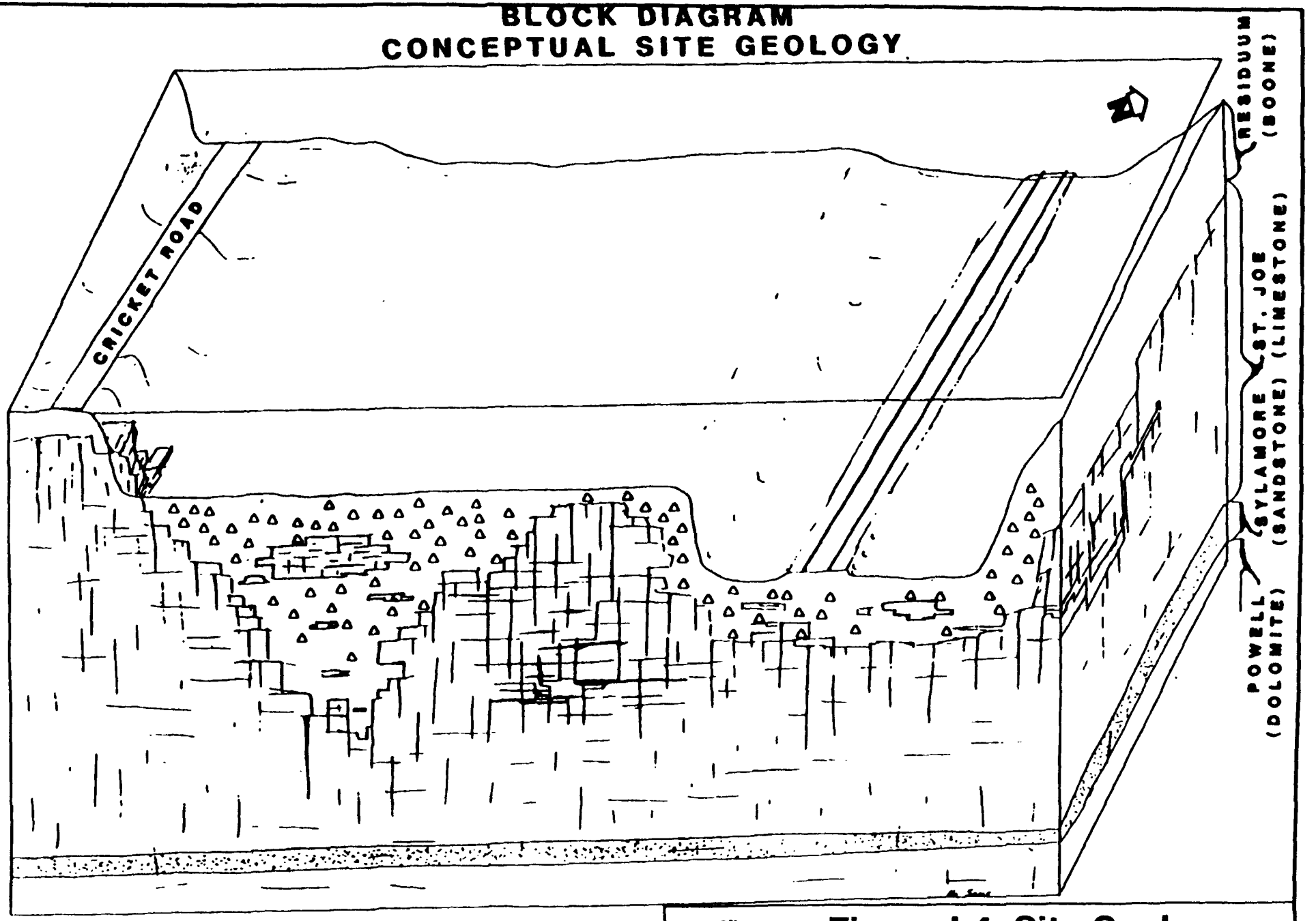


Figure I-4 Site Geology

Arkwood, Inc. Site Omaha, Arkan

Ground water flow occurs by one of two primary methods in a karst environment; flow along fine fractures and bedding planes, and turbulent conduit flow along solutionally enlarged pathways. If monitoring or recovery wells are drilled into karst geology, three general flow scenarios are possible. First, the well could be dry, having not intercepted either fractures or conduits. Second, the well may intercept small fractures bearing low flow rates of groundwater with the well having a very small area of influence (i.e. on the order of feet). Third, the well could intercept a conduit, possibly resulting in high pumping rates. However, it is not possible to predict where to drill in order to intercept these conduits. This was demonstrated during the Arkwood RI, in which two wells drilled on site were dry, and the rest had very low production rates. No conduits that transmitted substantial water were encountered.

Springs

A total of 54 springs have been identified within a 1.5-mile radius of the site (Figure I-5). These springs discharge from hillsides or in valley bottoms. Five are used as domestic water supplies. Only one spring, New Cricket Spring, has been demonstrated to be hydraulically connected to the site in a down gradient direction. However, during one sampling after very heavy rains, PCP was detected in the Railroad Tunnel spring. Pentachlorophenol (PCP) has been detected in two of the 54 springs, New Cricket Spring and the railroad tunnel spring.

New Cricket Spring is approximately 1,000 feet northwest of the site. It issues from a small cave-like opening in a hillside. There are no known users of the water from New Cricket Spring. The flow from the spring is variable with base flow over the last several years at about 15 gallons per minute. Under base flow conditions the water from the spring disappears back into the ground within 200 feet. PCP has been detected in this spring at levels of 0.3 to 3.9 mg/l.

The Railroad Tunnel Spring is located in the south wall of the railroad tunnel immediately north of the site. The flow from this spring is also highly variable. At times there is barely enough flow to wet the wall of the tunnel. At others it pours out of the wall with enough force to hit the other side of the tunnel. Pentachlorophenol was found in this spring only once

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Figure I-5
SPRING LOCATIONS
Arkwood, Inc. Site
Omaha, Arkansas

late in the RI at a level of 0.061 mg/l after a major rainfall. There are no known users of the Railroad Tunnel Spring.

Wells

A total of 35 wells have been identified within 1.5 miles of the site (Figure I-6). The major use for well water is as domestic water supply. Most of the wells on which data was obtainable are producing from more than 200 feet below the ground surface. None of the wells are completed in the soil horizon upon which the site lies, and none have been confirmed as being contaminated with constituents of concern from the site[1,2].

Shallow Aquifer Classification

The shallow karst aquifer beneath the site may be classified as a Class IIb aquifer. While it is not currently used as a drinking water source, similar water-bearing units that discharge to springs in the area are. The base flow of 15 gpm also classifies the aquifer as Class IIb based on the "sufficient flow" criteria[3]. This particular part of the shallow karst aquifer is closely connected to the surface, has no apparent connection with deeper, water supply aquifers, and is not currently being used as a drinking water supply.

Deep Aquifer

There appears to be no connection between the shallow karst aquifer and deeper water supply aquifers. The water chemistry has been demonstrated as being sufficiently different to confirm this lack of connection[4].

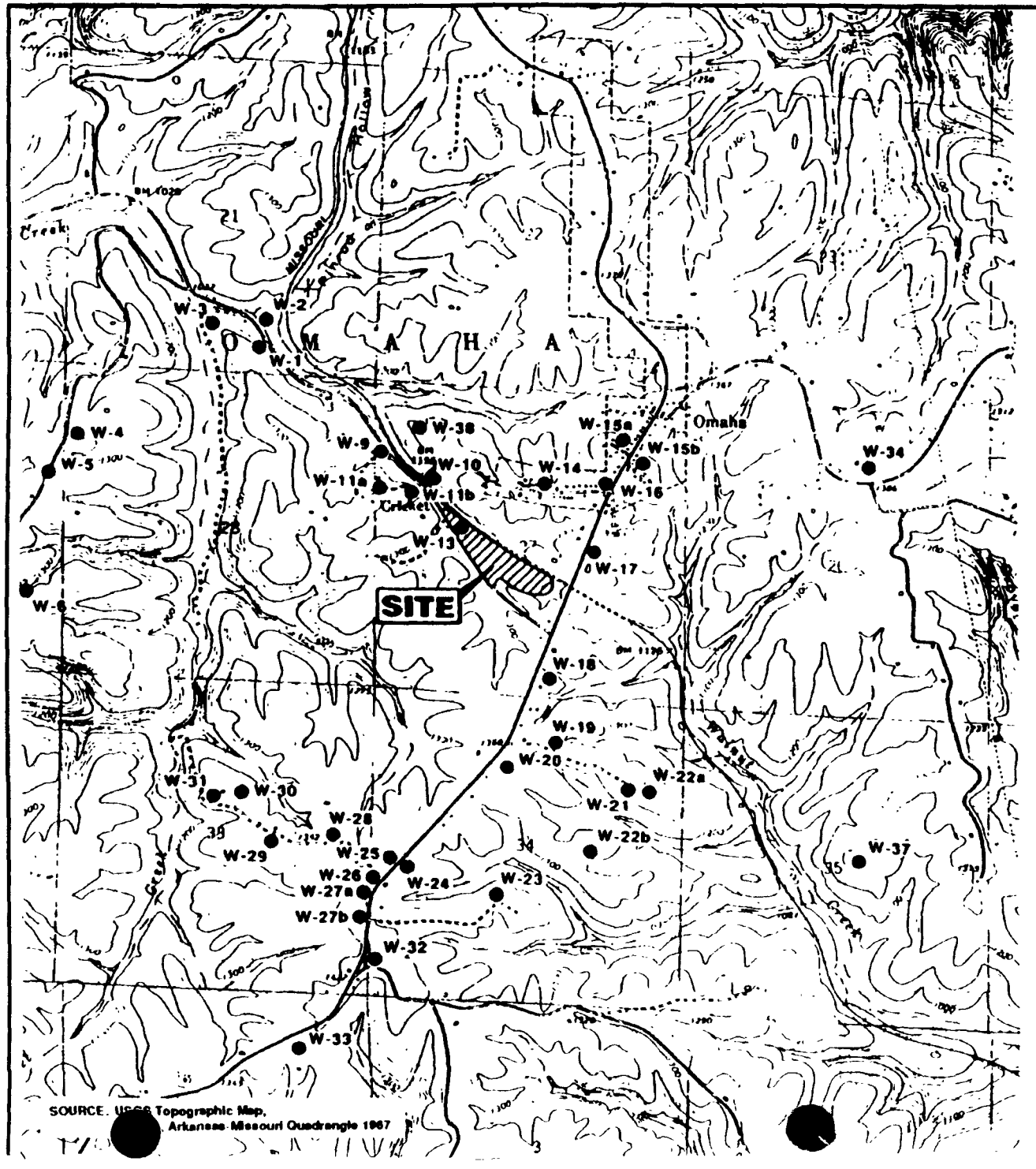
---

[1] **During the RI one well showed contamination during a sampling event. The contamination did not appear to be connected with the site. In an immediate follow up sampling, the well showed no contamination, thus it is believed that the contamination was due to lab contamination.**

[2] **Remedial Investigation, Arkwood, Inc Site, Volume I, March 30, 1990, Section 4.6.3**

[3] **Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, EPA/540/G-88/003, page 2-4 to 2-6**

[4] **Remedial Investigation Report, Arkwood, Inc. Site, Volume I, March 30, 1990, Section 4-7**



N

WELLS	OWNER
W-1	WHITE
W-2	MILES
W-3	TATE
W-4	TIZEN
W-5	POTT
W-6	COOK
W-9	LETHERMAN (BEHREN NEW)
W-10	BISHKEY (BINAM)
W-11a	BIRMINGHAM (NEW)
W-11b	BIRMINGHAM (OLD)
W-13	ARKWOOD
W-14	OMAHA CITY SCHOOL
W-15a	OMAHA CITY WELL
W-15b	OMAHA CITY WELL
W-16	ROSE
W-17	COX
W-18	BRUCE
W-19	SHAFFER
W-20	McMAHON
W-21	JONES
W-22a	GODDARD
W-22b	GODDARD
W-23	ROYAL OAK INC
W-24	CHRISTLEY
W-25	KEYS
W-26	ROBERTS
W-27	HUFFMAN (2)
W-28	AIKMAN
W-29	SHIPLEY
W-30	WRIGHT
W-31	HICKS
W-32	WARE
W-33	FOLEY
W-34	JURINGON
W-37	HUSTON
W-38	DUGGAN

0 1000 2000
scale feet

Figure I-6
Well Locations
Arkwood, Inc. Site

U.S. Environmental Protection Agency

Additionally, a shallow unit (the Sylamore Sandstone) appears to act as an aquiclude, restricting downward migration of the shallow ground water in the vicinity of the site[5]. Almost all of the 54 springs in the area discharge above the Sylamore sandstone. No ground water in the deeper producing zones has been detected to have contamination. This evidence, along with the lack of water in the Powell and Cotter formations indicates that shallow ground water that occurs near the site does not recharge the deeper water bearing units used for drinking water.

F. Location and Distance to Nearby Human Populations

The site is located approximately one-half mile southwest of the small town of Omaha, Arkansas (population estimated at 200). It is estimated that fewer than 200 people live within one mile of the site. There are seven residences that are accessed by Cricket Road, the road on the southwest side of the site. There are two residences within 500 feet of the site.

G. Site Surface and Subsurface Features

1. Former Wood Treating Facility

The site has remnants remaining from its former use as a wood treating site (see Figure I-7, Site Features Map). The existing structures and remnants are as follows.

a. Debarking shed - Parts of the debarking machinery and shed are still on site. The shed covers less than 1,000 square feet and is constructed with what appears to be treated lumber and timbers covered with a tin roof. The machinery is mostly disassembled and all that is left is part of the mechanism that fed the logs into the debarker.

b. Well house - The well house is a small (approximately 10 foot by 10 foot) building housing the well pump and an approximately 5000 gallon water storage tank.

c. Old Foundations - There are numerous foundations on the site. They include those for the pressure vessel, a maintenance building,

---

[5] **Remedial Investigation Report, Arkwood, Inc. Site, Volume I, March 30, 1990, Section 4.2.3**

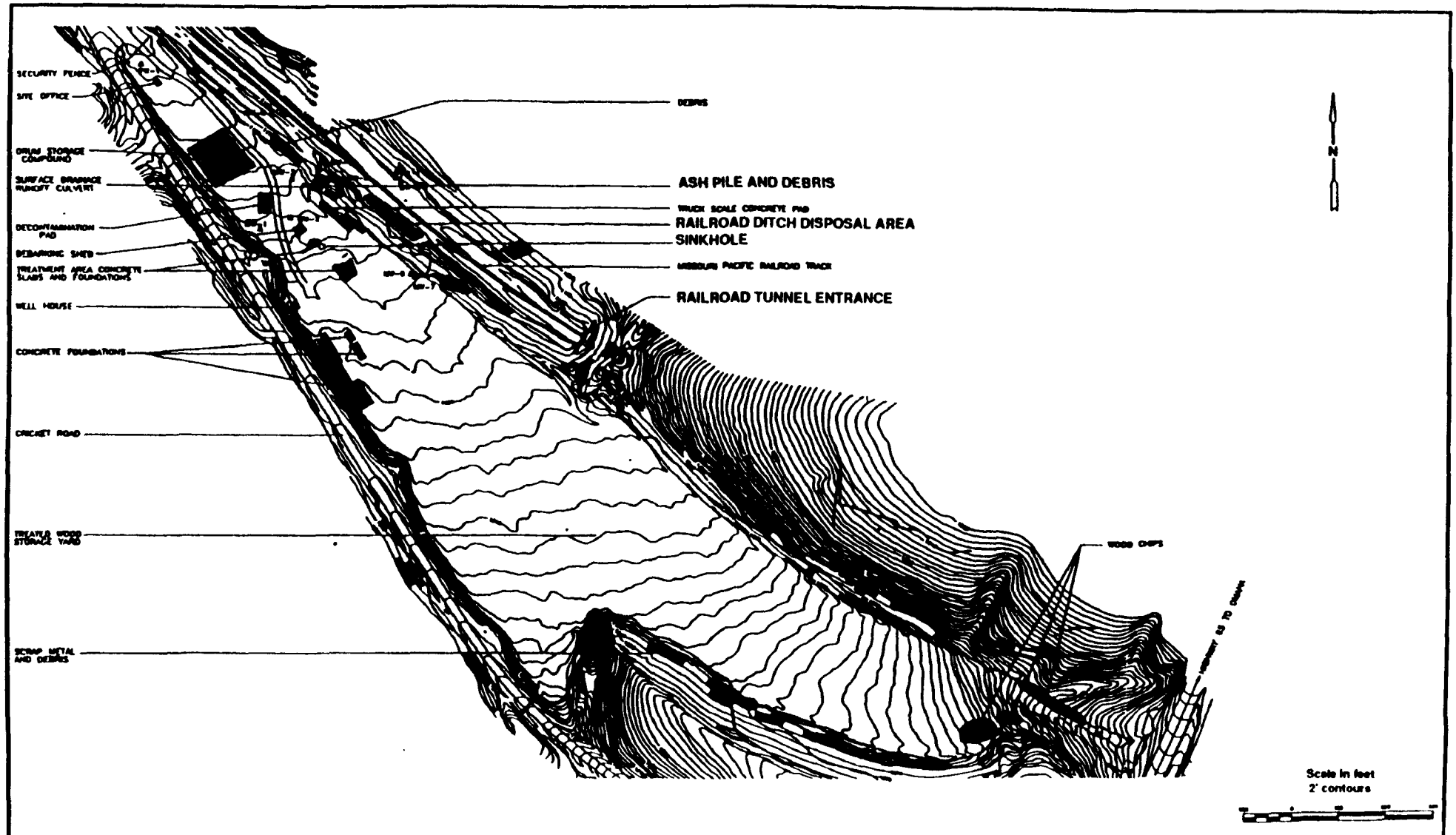


Figure I-7
General Site Features

Arkwood, Inc. Site

U.S. Environmental Protection Agen

office and the concrete ramp and foundations for a truck scale.

2. Sinkhole

There is a feature on site that has been commonly referred to as a sinkhole. This feature does not meet the geologic criteria of a sinkhole (i.e. a funnel shaped feature with subterranean drainage formed by a collapse of soil and rock into a conduit below the throat of the sinkhole leading to bedrock conduits and cavities). This "sinkhole appears to be a depression in the top of the bedrock that is longer in one horizontal direction than the other. It appears to have a limited depth and currently holds water. This is opposed to most sinkholes that readily drain to the ground water system.

During part of the facility operating history, waste water and chemicals were disposed of in this depression. Apparently during part of this time the feature drained into the subsurface, but is has apparently been sealed off with clay and highly viscous material.

3. Railroad Ditch Area

The railroad ditch area is shown on Figure I-7. It is a low area between the main site and the railroad bed. Whether the low area was excavated by personnel from the railroad or Arkwood, Inc. during plant operation is not known. It may have been left low after excavation of the railroad to grade.

According to Mass Merchandisers, Inc., the former operator of the site, spent treatment fluids were disposed of in this depression until 1973 or 1974 when rising oil prices caused a modification of site practices to the recycling of most of the oils from the site. Very localized shallow contaminated ground water appears to occur in a "bath tub" formed by a low area in the top of the rock that surrounds the ditch area. The evidence from monitoring wells and borings in the area is that the top of rock is relatively impervious and the sludges and highly contaminated soils occur in an area of about 6,300 square feet to an average depth of 4.5 feet.

II. Site History and Enforcement Activities

A. History of Site Activities

1. Operations

The Arkwood plant site was originally excavated by the railroad to obtain material for the construction of railroad embankments between 1954 and 1962. In 1962, Arkwood, Inc. opened a single cylinder PCP and creosote wood treatment facility and operated the site until 1973. From 1973 to 1984, Mass Merchandisers, Inc. (MMI) operated the plant under a lease agreement with the owner. MMI ceased operations in 1984, at which time MMI sold or removed its remaining inventory and materials prior to the expiration of its lease in 1985. The owner subsequently dismantled the plant in 1986.

The Arkansas Department of Pollution Control and Ecology (ADPCE) initially received a complaint in 1981 by a railroad worker about potentially affected water in the railroad tunnel. Subsequent preliminary investigations found detectable levels of PCP in the ground water in the immediate area surrounding the facility. The Environmental Protection Agency (EPA) proposed that the site be added to the National Priorities List (NPL) in 1985. On March 31, 1989, the site was added to the NPL.

2. Investigations

In response to the railroad worker's complaint, representatives from the ADPCE and the Arkansas Department of Health conducted an inspection of the Arkwood facility on June 19, 1981. Samples of surface water taken during the inspection showed levels of PCP from 2 to 4 mg/l. On October 6, 1981 the ADPCE conducted a site inspection for the purpose of conducting an interim status standards inspection. The inspector made various recommendations regarding upgrades to the plant to reduce pollution problems.

In March 1985, ADPCE filed a Site Inspection Report for the Arkwood site. The inspection documented PCP and creosote contamination of the site.

In January 1986, EPA sent the Field Investigation Team (FIT) to perform a reconnaissance inspection

to support the listing of the site on the NPL. The FIT catalogued the amounts of waste present on site, and recommended sampling of area wells.

In May of 1985, MMI and EPA entered into an Administrative Order on Consent (AOC) for MMI to perform the Remedial Investigation and Feasibility Study. Due to site access problems, the RI/FS did not begin until 1987, and was completed in May 1990.

B. State and Federal Removal and Remedial Actions

In February of 1987 EPA sent the Technical Assistance Team (TAT) to the site in order to assess the need to perform an immediate removal action. The TAT responded in April, 1987 that the site access was unrestricted, and that local children used the site for recreational activities. The TAT recommended a six foot chain link fence to restrict access[6]. EPA prepared an immediate removal request which was signed by the Regional Administrator. In August of 1987, EPA issued an Administrative Order to the Potentially Responsible Parties to perform the removal which included fencing the site entrance, and the posting of warning signs across the site entrance. The site owner responded on August 12th and 13th by erecting the fence and posting the signs. An "After Action Report" was filed by Greg Fife, EPA On Scene Coordinator on September 8, 1987, closing out the removal action[7]. This removal action made site access more difficult for area children, however it is still relatively easy to get on the site.

C. CERCLA Enforcement Activities

A review of EPA and ADPC&E records revealed PRPs for the site including the owners and former operators of the site. In October, 1985 EPA sent § 104(e) letters to Mr. Bud Grisham and Mr. H.C. Ormond, former owners of the site, and Mass Merchandisers, Inc. (MMI), a former operator of the site, notifying them of their potential liability for the site and requesting information regarding the site. In November 1985, EPA sent notice of an impending RI/FS to the same parties. MMI responded to the notices with a good faith offer to

---

[6] **Ecology and Environment, Inc., April 22, 1987, Transmittal Memorandum to Pat Hammack, OSC**

[7] **Arkwood, Inc. Site/site #A3, After Action Report, August 12, 1987 to August 13, 1987, Greg Fife, 9/8/87**

perform the RI/FS, the owners did not respond to the notice. On May 15, 1986, EPA and MMI entered into an Administrative Order on Consent for MMI to perform the RI/FS. In September 1986, EPA sent an additional § 104(e) letter to Mr. Bud Grisham, agent for Mr. H.C. Ormond in response to reports that Mr. Ormand was removing site buildings and contamination. EPA never received a response to the §104(e) letter. Based on a later review of the site deed, EPA determined that Ms. Mary Burke was the current owner of the site. In June, 1987 EPA sent a Notice Letter to Ms. Burke notifying her of her potential liability for the site.

In about November 1986, Mr. Bud Grisham, acting as legal representative for the site owner, refused to grant access to the site for the RI/FS. EPA referred the case to the Department of Justice (DOJ) in March 1987, for DOJ to file suit to gain access to the site for the RI/FS. On July 12, 1988, DOJ and the attorney for Mr. Grisham signed a Consent Decree allowing EPA and its agents access to the site for the purpose of conducting the RI/FS and any required response action. The RI/FS field work began soon thereafter.

III Highlights of Community Participation

A Community Relations Plan for the Arkwood, Inc. site was finalized in February 1987. This document lists contacts and interested parties throughout government and the local community. It also establishes communication pathways to ensure timely dissemination of pertinent information, and emphasizes the need for community involvement. A Public Workshop was held in February 1987 to explain the overall Superfund process and the specifics of the RI. Fact sheets were released in September 1987, January 1988, June 1989, and September 1989. Another workshop was conducted in February 1990 to explain the results of the RI.

The Proposed Plan was released to the public in July 1990. All of the site related documents are available at the Boone County Courthouse and Library. The Administrative Record is available locally at the Omaha Public School Library. A public comment period was held from July 16 to August 15, 1990 and extended to September 14, 1990. In addition, a public meeting was held on July 25, 1990 in the Omaha Public School cafeteria to present the other alternatives as well as the proposed plan. All comments received by EPA prior to the end of the comment period, including those expressed orally at the public meeting, are addressed in the Responsiveness Summary which is Section XI of this Record of Decision.

IV. Scope and Role of Response Action Within Site Strategy

The selected alternative provides for the removal and destruction via incineration of the dioxin contamination to a level of 20 µg/kg as 2,3,7,8 TCDD equivalents, PNA levels to 6 mg/kg as Benzo-a-pyrene equivalents, and PCP levels to 300 mg/kg. All site materials are to be excavated as shown in Figure IV-1. These materials are to be treated to destroy the site contaminants to the criteria specified above. This will eliminate any direct contact threat from the soils contaminated above the health based treatment goals on the site, and reduce the incremental risk from the overall site to less than 10^{-6}.

The selected remedy also reduces significantly the long term threat to the ground water posed by the geologic uncertainty at the site. The karst geology under the site poses a significant threat of failure for any capping type remedy at the site. In a karst geologic setting, the formation of sinkholes is a potential problem. If a sinkhole were to open beneath consolidated contaminated site soils, contaminated soils would be flushed directly into the upper aquifer, and thence off-site. For this reason, the contaminants must be permanently destroyed at the site.

The ground water emerging at New Cricket Spring will be monitored for a period of time during and following the remediation to determine if natural attenuation is occurring. If natural attenuation does not cause the PCP level in the spring to decrease to State Water Quality Standards, then a water treatment unit will be erected at the spring to treat the water to the appropriate standard. Selected well water users will be provided with a city water line to eliminate any concerns about the ground water quality in the area.

The selected remedy will provide for a permanent solution for the site. No further actions will be required following the selected remedy. As will be discussed in Section VI, Summary of Site Risks, the majority of the site health risk is due to the long term direct contact with site contaminants. Additionally, there also exists a long-term risk to the ground water due to the geology in the area. The Remedial Investigation detected no air-borne contamination and no drinking water well contamination. The Remedial Action described in this Record of Decision will eliminate the threat of direct contact with the site contamination, will eliminate the long-term threat to the ground water, and will provide for the treatment of the affected ground water to the state water quality standards. The contamination in the railroad ditch, and the site soils

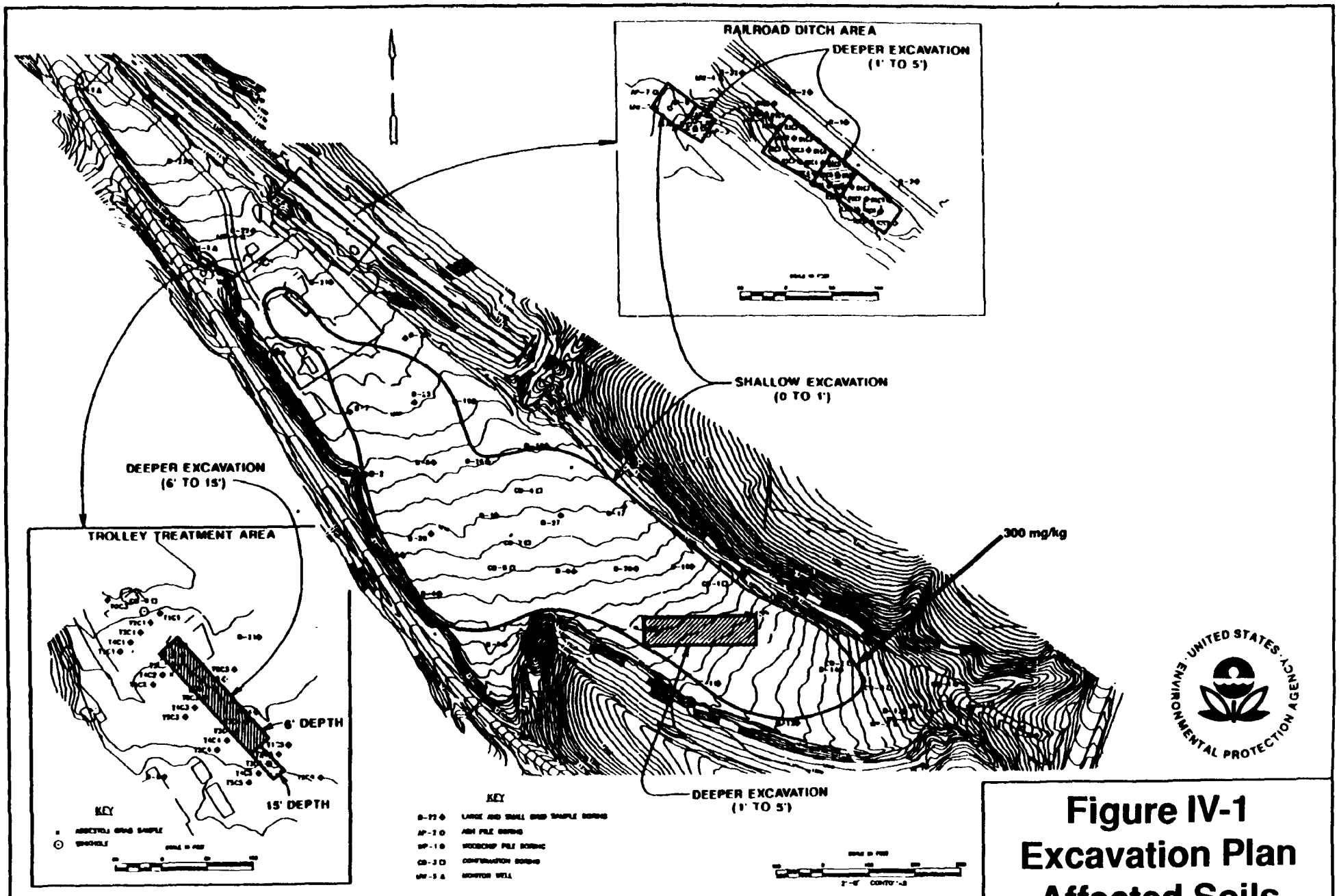


Figure IV-1
Excavation Plan
Affected Soils

Arkwood, Inc. Site
Omaha, Arkansas

contaminated above the action levels for dioxin, PNA and PCP will be excavated, and incinerated. Thus the only direct contact threat is to workers on site during the excavation and incineration of the material. This contact will be minimized with proper personal protective equipment. The topsoil cap and fencing will virtually eliminate the threat of direct contact from the low levels (below health based numbers) of contaminants remaining on the site.

V. Summary of Site Characteristics

A. Types of Contamination

Three major contaminants are found at the Arkwood, Inc. site. Two of the contaminants are actually classes of compounds. One class is chlorinated dibenzo dioxins and furans, referred to in this document as dioxins, while the other class is polynuclear aromatic hydrocarbons (PNAs). The third contaminant is Pentachlorophenol (PCP). Some of the dioxins and PNAs are considered to be cancer causing. The third compound, pentachlorophenol, is not considered carcinogenic, but is toxic at concentrations found on site.

<u>Cancer causing Compounds:</u>

Many of the PNAs are known or suspected carcinogens. The different compounds vary in toxic potency. The exposure and uptake of these compounds vary with the circumstances on the site and with the mixture of PNAs present. In order to relate the complex mixture of PNAs to a standard, the EPA has drafted an equivalency rating for each type of PNA compound. This equivalency system relates each type of the carcinogenic PNAs to the toxicity of benzo-(a)-pyrene, considered the most toxic PNA. This system is described in "Comparative Potency Approach for Estimating the Cancer Risk Associated With Exposure to Mixtures of Polycyclic Aromatic Hydrocarbons", Interim Final Report, April 1, 1988, ICF-Clement Associates. The PNAs found at the Arkwood site include all of the carcinogenic PNAs (PNA-c) at various levels throughout the site.

Some dioxin and furan isomers are probable human and known animal carcinogens, and are present in the soils at the site. The potential threat to human health posed by chlorinated dioxin and furans is based on the established criteria for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). As with PNAs, the different types of dioxins and furans have different toxic potencies. Chlorinated dibenzofurans and other isomers of dioxin

are considered to be less toxic than 2,3,7,8-TCDD and are expressed in toxic equivalents of 2,3,7,8-TCDD. Therefore, although 2,3,7,8-TCDD is not present at the site, the target action level for dioxin and furans is expressed in equivalencies of 2,3,7,8-TCDD. The system used to relate the site's dioxin concentration to 2,3,7,8 TCDD is described in "Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxin and -Dibenzofurans (CDDs and CDFs) and 1989 Update", EPA/625/3-89/016, March 1989. The majority of dioxin and furans found at the site are the hepta and octa isomers of dioxin and furan.

Non Cancer Causing Compounds:

Although some compounds at the site do not cause cancer, they may cause other health effects. The chemicals of concern in this group are pentachlorophenol and the non-carcinogenic PNAs. The non-cancer causing PNAs are related through potency factors to naphthalene, a non-carcinogenic PNA. This system is described in the April 5, 1990 Memorandum from Pei-Fung Hurst to Jon Rauscher regarding "Available Toxicity Information for PAHs" (PAH is another abbreviation for PNA compounds). In the Endangerment Assessment the risks are expressed as a Hazard Index. The Hazard Index is a method of assessing the overall potential for non-carcinogenic effects. A Hazard Index of one or more indicates that the safe threshold for exposure to these non-carcinogenic compounds has been exceeded.

B. Clean Up Levels

Table V-1 summarizes the migration pathways and potential exposure points for the various media on the site.

The clean up levels for the site are as follows;

PCP	300 mg/kg,
Dioxin/Furan	20 µg/kg as 2,3,7,8 TCDD equivalents.
PNA-c	6 mg/kg. as B(a)P equivalents

The clean up level for PCP was set at 300 ppm based on the leachability of PCP from site soils. During the FS, leachability tests were performed on the site soils to provide a correlation between PCP concentrations in the soils to PCP concentrations in the leachate from the soils. According to the correlation, a soil PCP concentration of 300 mg/kg resulted in a leachate

TABLE V-1
EXPOSURE PATHWAYS FOR ARKWOOD SITE[1]
Current Site Conditions

Transport Medium	Source	Release Mechanism	Exposure Point	Exposure Route
Soil	Affected Soil	Diffusion/ Absorption	Site Premises	Dermal Contact Ingestion
Soil	Affected Soil	Diffusion/ Absorption	Railroad Ditch	Dermal Contact Ingestion
Ground Water	Affected Soil	Leaching/ Dissolution	Private Wells Off-Site	Dermal Contact Ingestion Inhalation
Surface Water	Affected Groundwater	Ground Water Discharge to Surface	Off-Site Creeks	Dermal Contact Inhalation
Air	Affected	Volatiliza-tion/Dust Generation	Site Premises	Inhalation
Stream	Affected Soil Run-off	Suspension and Resettling	Off-Site Creek Beds	Dermal Contact

[1] Endangerment Assessment, Arkwood, Inc. Site, August 30, 1989, Page 4-6

containing approximately 1 mg/l PCP. Since 1 mg/l is the MCL for PCP, 300 mg/kg PCP was selected as the soil clean up level based on protection of the ground water.

The clean up goal for PNA-c and dioxin were set assuming an industrial scenario. While the Endangerment Assessment assumed that the most probable future land use would be occasional visits by hunters and other recreational users, an industrial use scenario was assessed because it is possible, and not entirely unlikely that the site may be used for some industry in the future. Since an industrial use would require more stringent clean up goals than the occasional use scenario, industrial based goals were selected. Using the industrial scenario, a clean up goal for PNA-c was calculated. THe scenario assumed a working life of 30 years, at 260 days per year and an adult soil ingestion rate of 100 mg per exposure. These calculations resulted in 10^{-6}, 10^{-5}, and 10^{-4} goals corresponding to 0.6, 6.0, and 60 mg/kg of PNA-c as B(a)P equivalents. Based on these calculations, a PNA-c remediation goal of 6.0 mg/kg corresponding to a 10^{-5} risk was selected. A goal of 0.g mg/kg, corresponding to a 10^{-6} was not selected because, such a goal would require far more excavation than is necessary to meet the 300 mg/kg PCP level, and would result in much higher remediation cost, and would require crushing and grinding of large volumes of rocks and increasing material handling problems.

The dioxin/furan clean up level was selected based upon the Agency for Toxic Substances and Disease Registry (ATSDR) recommendation of 20 μg/kg for industrial use sites.

C. Sources/Extent of Surface Contamination

1. Sinkhole - The sinkhole location is shown on Figure V-1 (Site Features). It is in the northwestern quarter of the site near the debarking shed and the foundation/catch basin for the pressure vessels. It has been covered by boards and a 10x10-foot concrete slab about two inches thick.

During site operations, spent treatment liquids and other contaminated surface water were disposed of in the sink-hole. The practice was stopped based on ADPC&E recommendations due to contaminated ground water in the area. The estimated volume of liquid in the sinkhole is 3,000 gallons. Of this volume, most is water with a surface layer of black oily material. The

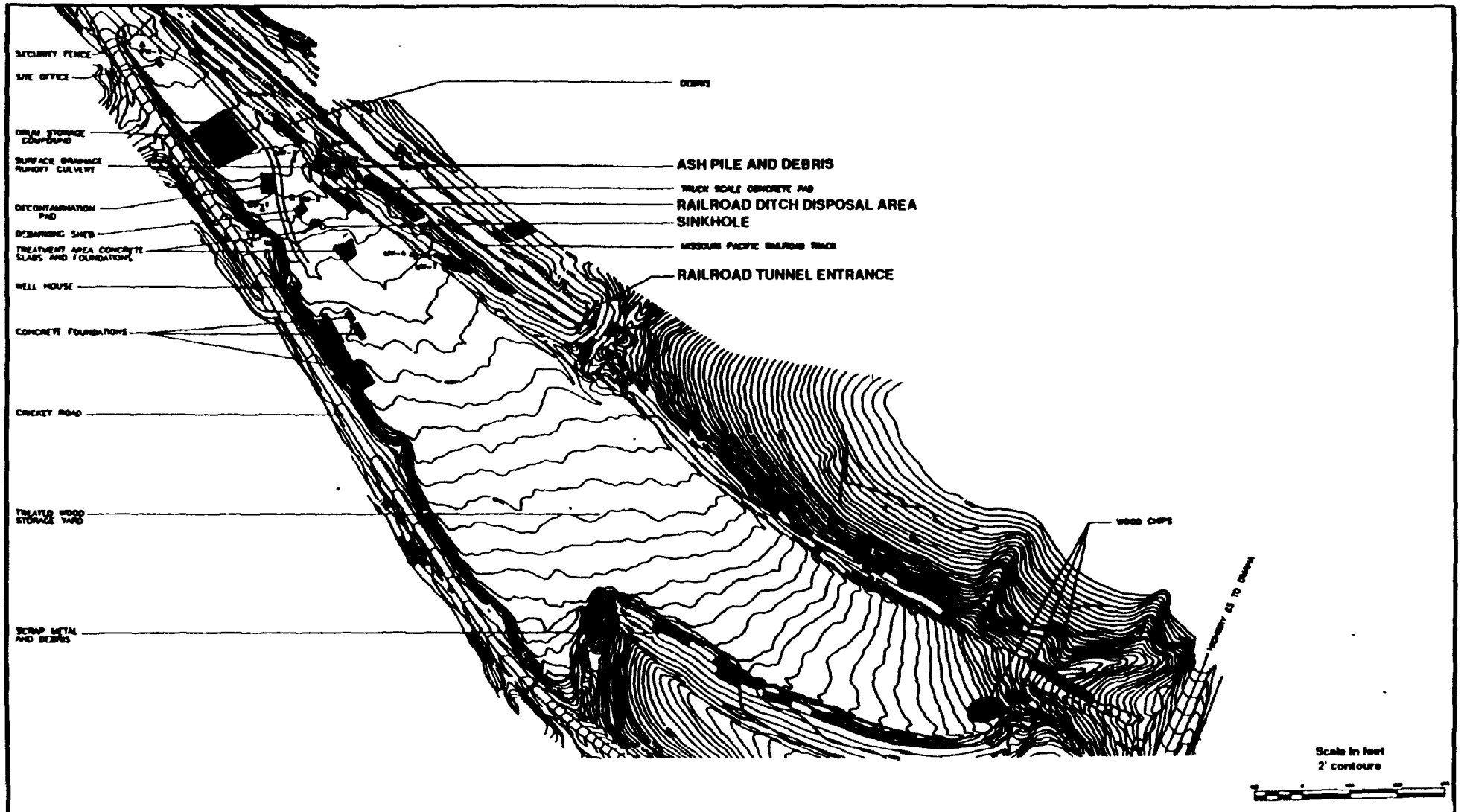


Figure V-1
General Site Features

Arkwood, Inc. Site

U.S. Environmental Protection Agency

bottom appears to be covered with a hydrated layer of bentonite or bentonite-like clay. The liquid level in the sinkhole appears to be persistently higher than the water levels in the nearby monitoring wells. Thus the sinkhole does not appear to be in communication with the epikarst water bearing zone on the site[8].

Examination of material from the sinkhole found non-aqueous phase liquids (NAPL) on the water. These NAPL interfered with the analysis for PNAs, PCP, and dioxin in the water and soils in the sinkhole. Thus, the levels of these contaminants remain unknown for these materials in the sinkhole. Since the levels of contamination in the soils and water is unknown, the volumes of contaminated soil and water are unknown, and will have to be further delineated during the design phase. However, it is expected that the volumes in the sinkhole are not significant compared to the volume requiring treatment over the entire site.

2. Railroad Ditch Area - The railroad ditch area is also shown on Figure V-1. It is a low area between the main site and the railroad bed. Spent treatment fluids were disposed of in this depression until 1973 or 1974[9] when rising oil prices caused a modification of site practices to the recycling of most of the oils from the wood treatment process. Very localized contaminated ground water appears to occur in a low area in the top of the this rock formation that surrounds the ditch area. The evidence from monitoring wells and borings in the area is that the top of rock is relatively impervious and the sludges and highly contaminated soils occur in an area of about 6,300 square feet to an average depth of 1.8 feet[10].

Figure V-2 shows PCP concentration contours at 0-6" depth. Table V-2 shows maximum and average concentrations of PCP as 6200 mg/kg and 2712.5 mg/kg, PNAs-c at 371.2 mg/kg and 117.9 mg/kg as B(a)P equivalents, and dioxin at 120.55 µg/kg and 36.5 µg/kg as 2,3,7,8 TCDD equivalents. It is estimated that approximately 1,350 yds^3 are above the clean up

---

[8] **Remedial Investigation Report, Arkwood, Inc. Site, March 30, 1990, Section 4.2.3**

[9] **Mass Merchandisers, Inc., response to §104(e) letter, January 14, 1986**

[10] **Feasibility Study Report, Arkwood, Inc. Site, March 30, 1990, Figure 6-2, and associated text.**

TABLE V-2

CONCENTRATIONS OF CONTAMINANTS

Area	Contaminant	Concentration Maximum	Concentration Average
Railroad Ditch	PCP mg/kg	6200.0	2712.5
	PNA-c mg/kg	371.2	117.9
	Dioxin µg/kg	120.5	36.5
Treatment/Trolley	PCP mg/kg	6800.0	702.0
	PNA-c mg/kg	49.3	183.0
	Dioxin µg/kg	20.3	6.2
Wood Storage	PCP mg/kg	1700.0	296.0
	PNA-c	89.0	2.05
	Dioxin µg/kg	27.8	11.8
Ash Pile	PCP mg/kg	3700.0	357.6
	PNA-c mg/kg	182.0	42.7
	Dioxin µg/kg	37.7	9.18

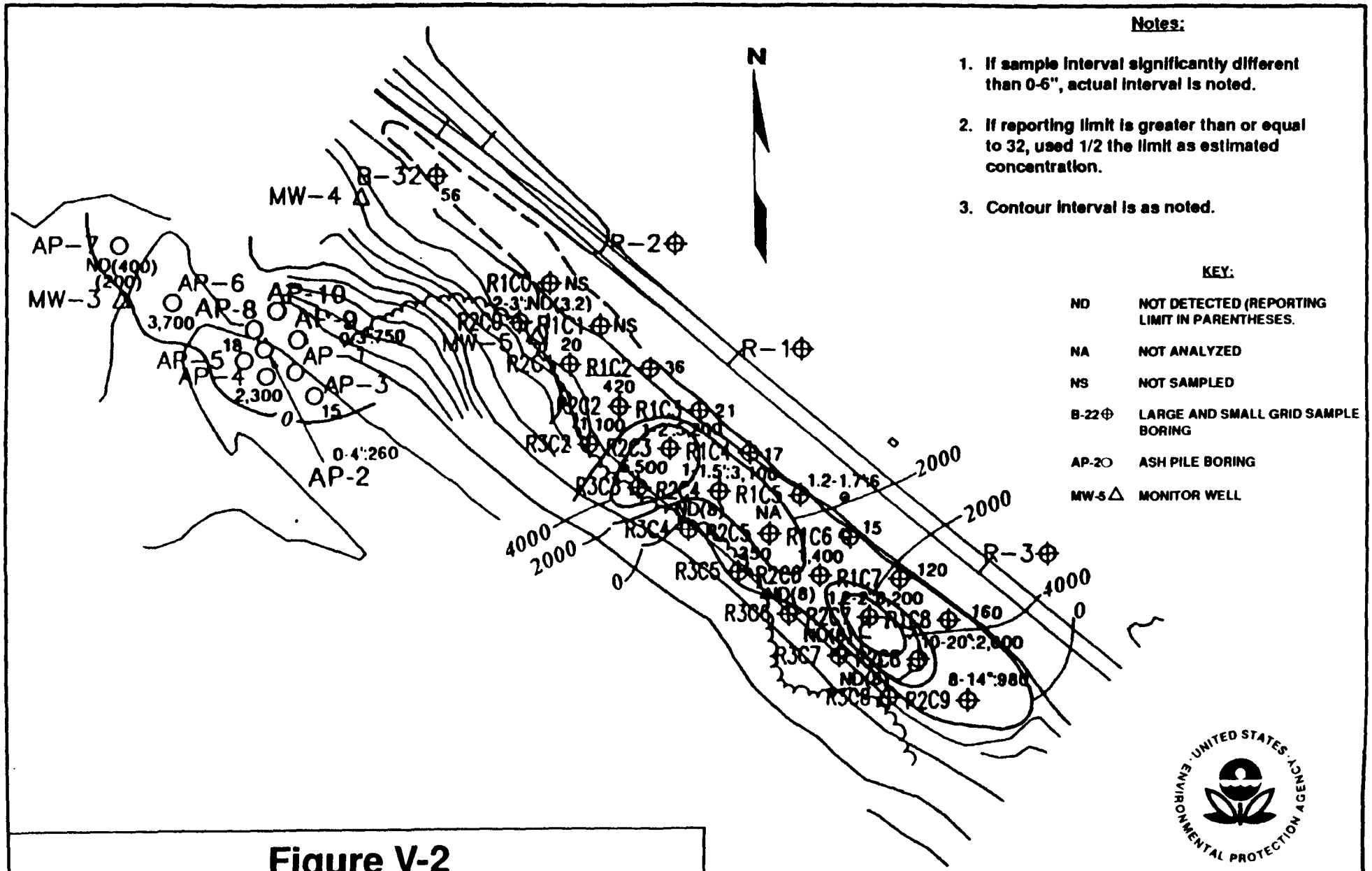


Figure V-2
Railroad Ditch PCP Concentrations
0 - 6" Interval

Arkwood, Inc. Site Omaha, Arkansas

criteria in the railroad ditch, and will require treatment.

3. Trolley/Treatment area - The trolley/treatment area is shown in Figure V-1. It is an area about 60x200 feet at the southeast end of the pressure vessel. The wood was treated in this area and then was placed onto a trolley that ran on rails across this area to a point where it was hauled to other parts of the site for storage. Soils in this area are stained from drippings from the freshly treated materials.

Figure V-3 shows PCP concentration contours at 0-6" depth while Figure V-4 shows the same at 1'-2' depth. Table V-2 shows maximum and average concentrations of PCP as 6800 mg/kg and 702 mg/kg, PNAs as B(a)P equivalents as 49.3 mg/kg and 49.43 mg/kg[11]. Dioxin, as 2,3,7,8 TCDD equivalents, as 20.27 µg/kg and 6.2 µg/kg were found in this area. It is estimated that 1,850 yds^3 are above the clean up criteria in this area and will require treatment.

4. Wood Storage Area - The wood storage area comprises most of the Southeastern two-thirds of the site. This area is where treated wood was stored prior to shipment. The contamination in this area is a result of treatment chemicals dripping off the freshly treated wood during storage.

Figure V-4 shows PCP concentration contours at 0-6" depth while Figure V-5 shows the same at 1'-2' depth. Table V-2 shows maximum and average concentrations of PCP as 1700 mg/kg and 296 mg/kg, PNAs as B(a)P equivalents, as 89 mg/kg and 2.05 mg/kg, and dioxin as 2,3,7,8 equivalents, as 27.8 µg/kg and 11.8 µg/kg. It is estimated that 17,325 yds^3 are above the clean up criteria and will require treatment.

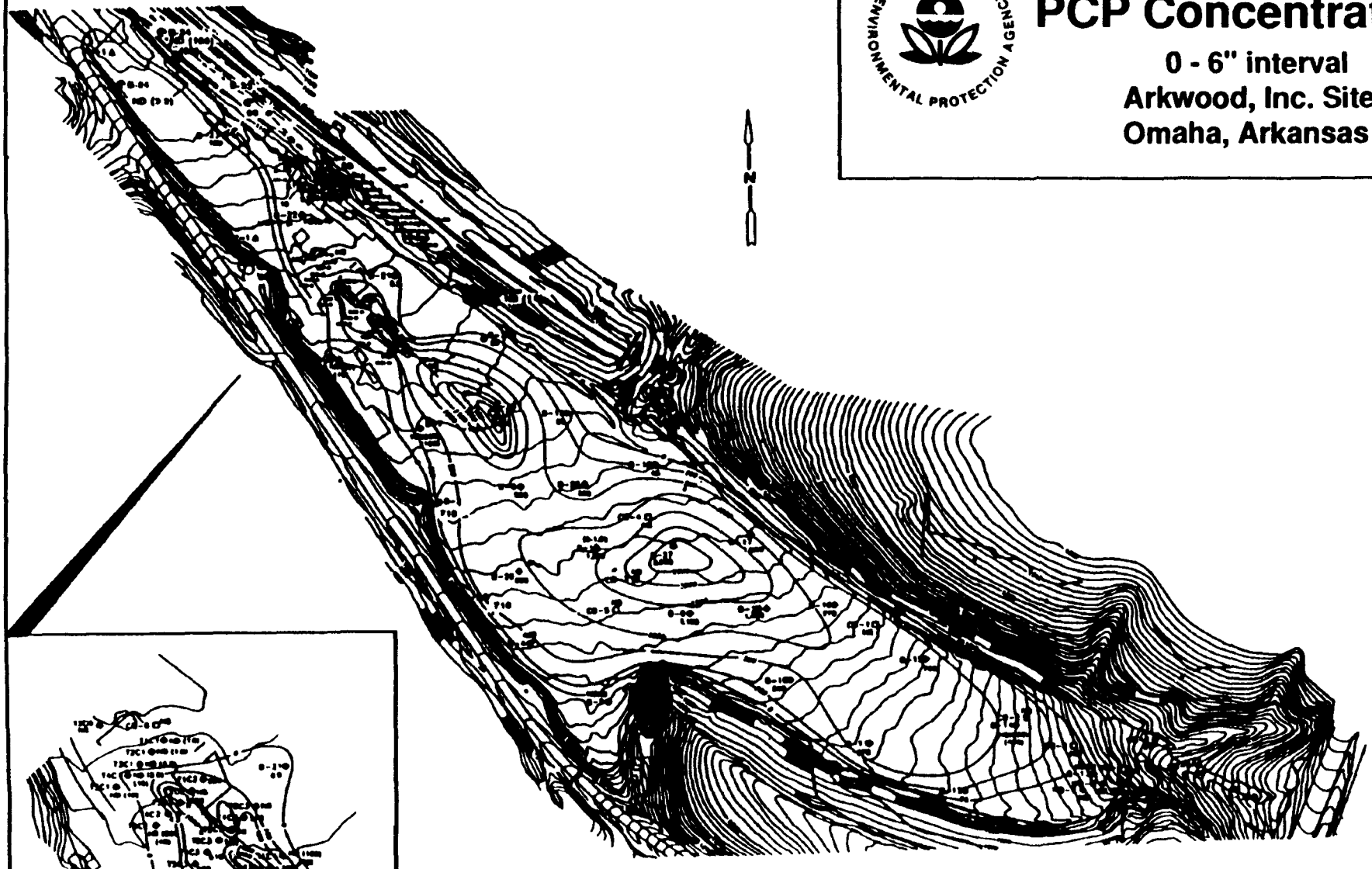
5. Ash Pile - The Ash Pile as shown on Figure V-1. It is a small area of material on the slope to the railroad on the northwest end of the site. This area is where ash from burning spent chemicals and wood chips was disposed of.

---

[11] **The average concentration of PNAs in this area is higher than the maximum detected value. This is due to high detection limits in many samples. The average concentration was calculated using one-half of the detection limit resulting in a higher average concentration.**

Figure V-3
PCP Concentrations

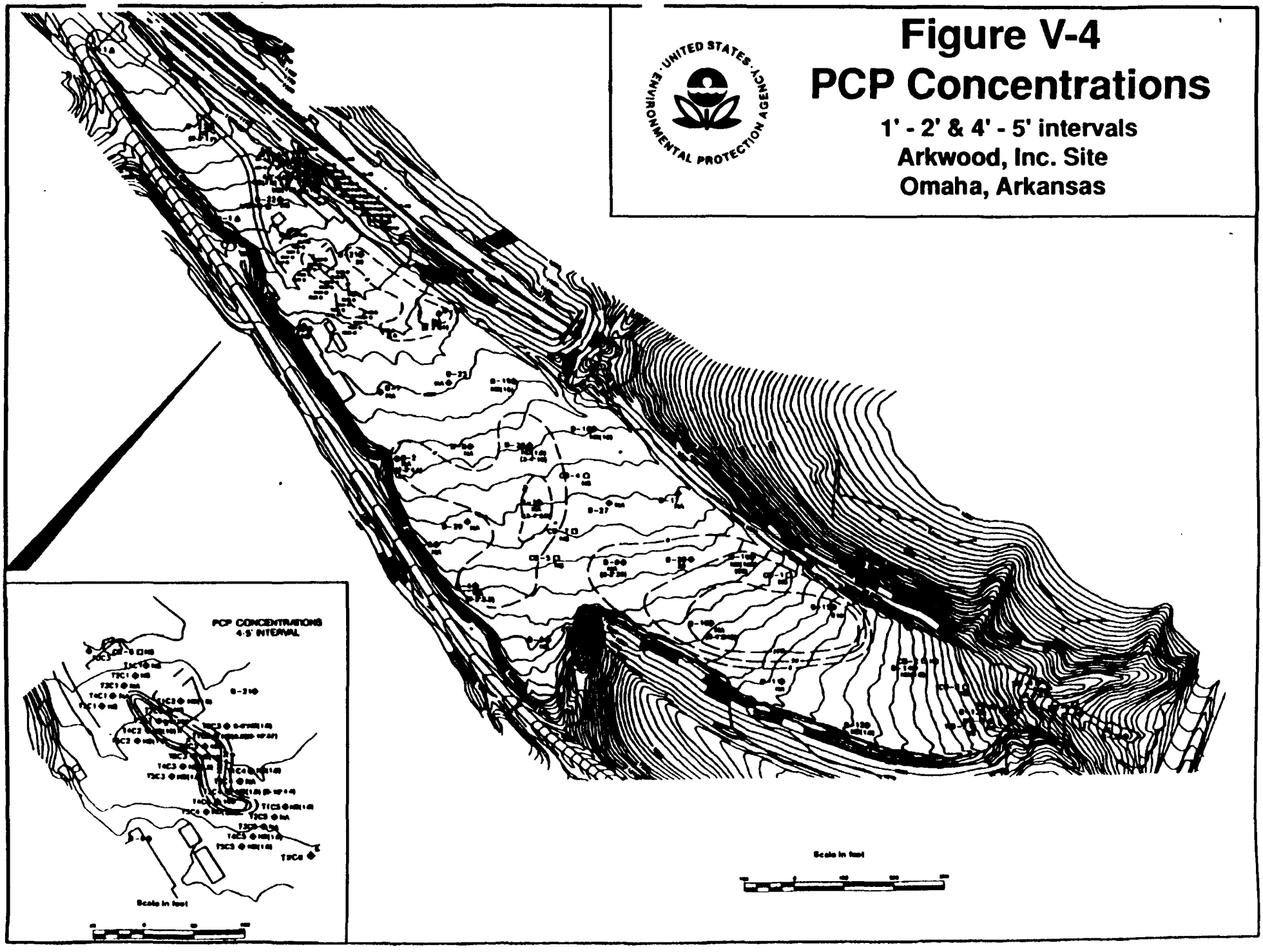
0 - 6" interval
Arkwood, Inc. Site
Omaha, Arkansas



Scale in feet

Figure V-4
PCP Concentrations

1' - 2' & 4' - 5' intervals
Arkwood, Inc. Site
Omaha, Arkansas



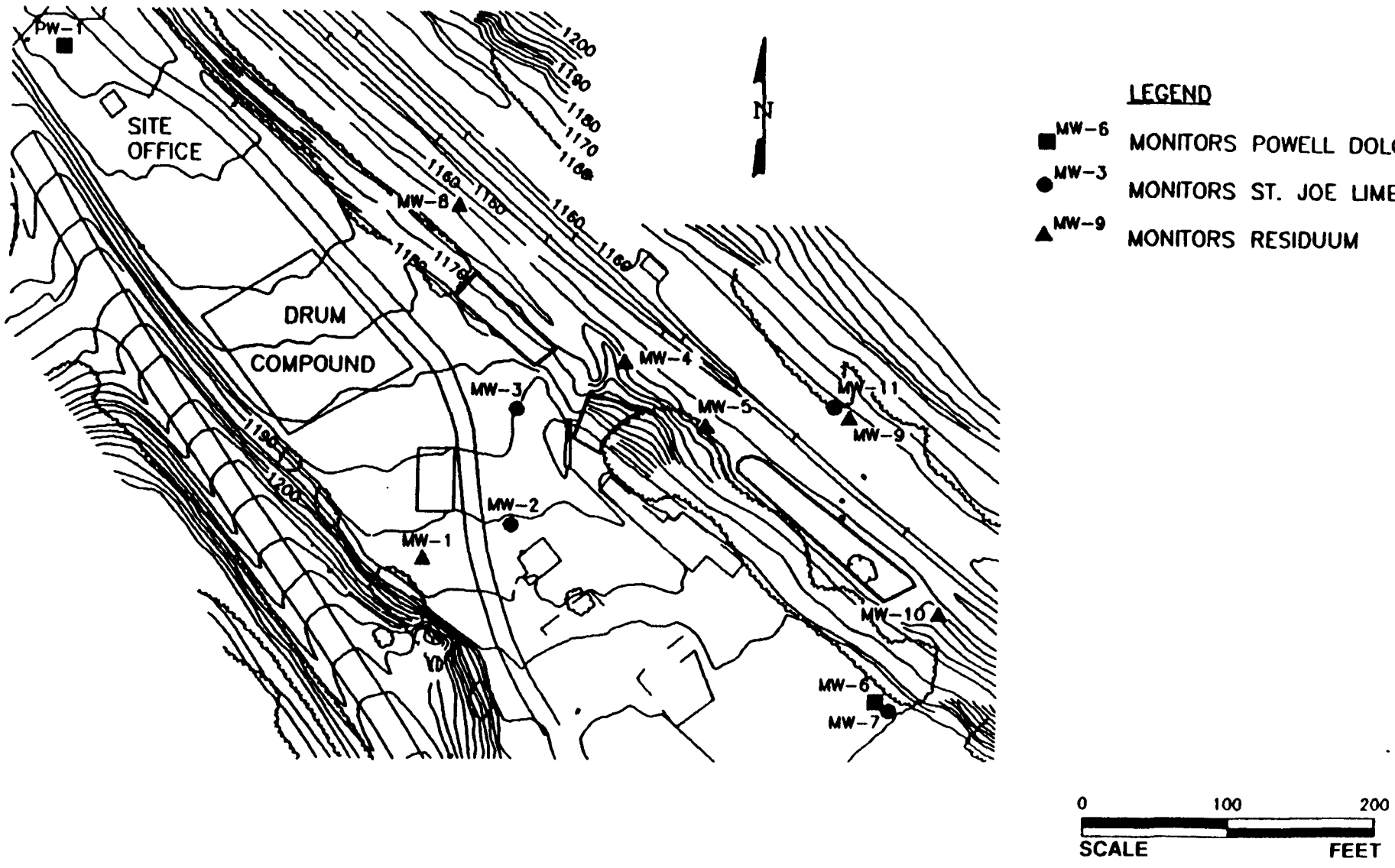


Figure V-5
Monitor Well Location Map

Akwood, Inc. Site - Omaha, Arkansas

U.S. Environmental Protection A

Table V-2 shows maximum and average concentrations of PCP as 3700 mg/kg and 357.6 mg/kg, PNAs as 182 mg/kg and 42.7 mg/kg, and dioxin as 37.74 µg/kg and 9.18 µg/kg as 2,3,7,8 TCDD equivalents. It is estimated that 300 yds^3 are above the clean up criteria and will require treatment.

C. Extent of Ground Water Contamination

A total of 12 wells were installed at the site. Six were installed in the main site area, and six were installed in the railroad ditch area. The locations of these wells are shown on Figure V-5. None of the site wells intercepted conduits with high flow rates. Table V-3 shows the depths, flow rates and PCP concentrations in each well. PCP was the only site contaminant found in the wells. Since the solubility of PCP in water is 25 mg/l, samples which contained higher levels contained waste in an oil phase on the top of the water. As shown on Table V-3, the only wells that contained an oily layer were those around the railroad ditch. It is believed that the ditch is the source of this oily layer and that the remediation of the ditch would eliminate this localized oily contamination.

A total of 54 springs have been identified within a 1.5 mile radius of the site. Of these, 13 were sampled during the RI. As stated earlier, only New Cricket Spring was confirmed to show site related contamination (PCP). The railroad tunnel spring has shown PCP only once during the RI. The other springs have not shown contamination. New Cricket Spring showed PCP levels from 0.3 to 3.9 mg/l with concentrations decreasing as flow increased. Out of the six sampling events, the railroad tunnel spring showed PCP once at 0.061 mg/l after a major rainfall. The MCL for PCP is 1.0 mg/l.

Thirty-five drinking water wells were identified within a 1.5 mile radius of the site. Of these, 15 were sampled during the RI. No site related contamination was found in any well. It is believed that the contaminated upper aquifer and the deeper water supply aquifer are not connected.

TABLE V-3

WELL FLOW RATES AND PCP CONCENTRATION

Well	Area	Depth Feet	Flow Rate	Maximum PCP (mg/l)
PW-1	Main Site	105	Dry	N/A
MW-1	Main Site	45	<1gpm	5.7
MW-2	Main Site	54	<<1gpm	0.79
MW-3	Main Site	50	2-3 gpm	0.58
MW-4	Railroad Ditch	19	<1 gpm	7.9
MW-5	Railroad Ditch	23	2-3 gpm	25
MW-6	Main Site	112	Dry	N/A
MW-7	Main Site	58	<1 gpm	7.8
MW-8	Railroad Ditch	21	<1 gpm	0.68
MW-9	Railroad Ditch	15	2-3 gpm	ND
MW-10	Railroad Ditch	19	1 gpm	55
MW-11	Railroad Ditch	23	Dry	N/A

VI. Summary of Site Risks

A. Human Health Risks

1. Contaminants

The average concentrations and total mass of contaminants in the various areas are shown on Table VI-1.

2. Endangerment Assessment

An "Endangerment Assessment" was performed by MMI as part of the Remedial Investigation. To assess the risk posed by the site, representative concentrations of the various contaminants were calculated. The representative concentrations (mg/kg) used by MMI in the exposure assessment were:

Parameter	Trolley Treatment Area	Wood Storage Area	Railroad Ditch
PCP mg/kg	102	74.8	126
cPNAs mg/kg (total)	46.6	25.4	38
ncPNAs mg/kg	76.8	37.1	59.8
Dibenzodioxins/ Dibenzofurans µg/kg (as 2,3,7,8 TCDD equivalents)	1.0	2.0	8.0

However, since the Endangerment Assessment was completed, EPA policy has changed regarding the toxicity of the various isomers of dioxin in relation to 2,3,7,8 TCDD. This change resulted in an increase in the calculated representative dioxin concentration, as 2,3,7,8 equivalents. Therefore, EPA recalculated risk using the revised representative dioxin concentrations which resulted in dioxin contamination at 6.2 µg/kg in the trolley treatment area, 12.4 µg/kg in the wood treatment area and 36.5 µg/kg in the railroad ditch area (all levels are 2,3,7,8 TCDD equivalents).

The pathways of potential exposure to site constituents were determined to be: · exposure to PCP through both ground and surface water at New Cricket Spring and exposure to PCP, PNAs, and dioxin on the site. Routes of exposures were determined to be through ingestion and dermal contact.

Three exposure scenarios were developed to assess risk from the site in the Endangerment Assessment: Exposure Scenario I, which reflects current site conditions;

TABLE VI-1

ARKWOOD INC. SITE
CONTAMINANT MASS
AFFECTED SOILS
(>300 PPM PCP)

LOCATION	AREA (SQ. FT.)	VOLUME (CU YDS)	PCP MEAN CONCENTRATION (MG/KG)	PCP MASS (LB)	PNA-C MEAN CONCENTRATION (MG/KG)	PNA-C MASS (LB)	DIOXIN MEAN CONCENTRATION (UG/KG)	DIOXIN MASS (LB)
RAILROAD DITCH	6300	1350	2712.5	9887	117.9	430	36.5	133
TREATMENT/TROLLY	4500	1850	702	3506	183	914	6.2	31
WOOD STORAGE	354000	17325	296	13846	2.05	96	11.8	552
ASH PILE	1470	300	357.6	290	42.7	35	9.18	7
TOTAL		20825		27529		1474		723

Exposure Scenario II, which represents the most probable future land use of occasional visitations by hunters and other recreational use; and Exposure Scenario III, which represents a worst-case residential scenario of maximum exposure.
The visitation patterns for each scenario are:

Exposure Scenario I: This scenario represents the current site conditions. The exposure is assumed to be six times a year for railroad personnel and 12 times a year for adults of the general public to the railroad ditch with no access to the main site and no exposure to the site soils;

Exposure Scenario II: This scenario represents the most probable future land use. In this scenario exposure is assumed to be twelve exposures per year for adults and six times a year by 6-12 year-old children to the railroad ditch and the main site, and twelve exposures per year by adults to New Cricket Spring.

Exposure Scenario III: This scenario represents the worst case of people living on the site. Exposure is expected to be daily by adults and children to affected soil on the main site, and drinking water from a well drilled on the main site pumping water from the upper aquifer containing 5.7 mg/l of PCP. Exposure to other contaminated areas of the site are assumed to be twelve exposures per year by adults and 6-12 year-old children to the railroad ditch, and daily exposure by adults to New Cricket Spring.

Table VI-2 presents the results of risk calculations as revised by EPA to reflect the revised dioxin potency factors.

In the Endangerment Assessment the Hazard Index for the site was also calculated. The Hazard Index is calculated to determine what levels of exposure to a non-carcinogenic chemical will result in adverse health effects. A Hazard Index of one or greater represents an unacceptable risk to human health. Results of these calculations are shown in Table VI-3.

Conclusions drawn from these calculations are:

1. There is no significant environmental impact evident at this time due to the off-site migration of contaminants.

TABLE VI-2

Summary of Carcinogenic Risk Estimates

Exposure Scenario Scenerio I - Current Site Conditions

Location	Cancer Risk
Railroad Ditch	1E-04

Exposure Scenario II - Most Probable Future Land Use

Location	Cancer Risk
Railroad Ditch	1E-04
Main Site	8E-05

Exposure Scenario III - Worst-Case Residential Exposure

Location	Cancer Risk
Railroad Ditch	2E-04
Main Site	4E-03

TABLE VI-3

Summary of Non-Carcinogenic Risk Estimates
(Assuming No Remedial Action)

Location	Age Group	Hazard Index [a]
Exposure Scenario I - Current Site Conditions		
Railroad Ditch	Adult	0.044
	Railroad Personnel	0.044
Exposure Scenario II - Most Probable Future Land Use		
Railroad Ditch	6-12	0.18
	Adult	0.044
	Total	0.22
Main Site	6-12	0.097
	Adult	0.025
	Total	0.12
New Cricket Spring	6-12	NA
	Adult	0.076
	Total	0.076
Exposure Scenario III - Worst-Case Residential Exposure		
Railroad Ditch	0-6	NA
	6-12	0.18
	Adult	0.044
	Total	0.22
Main Site	0-6	10
	6-12	5.8
	Adult	1.5
	Total	17
On-Site Ground Water	0-6	12
	6-12	6.7
	Adult	5.3
	Total	24
New Cricket Spring	0-6	NA
	6-12	NA
	Adult	0.25
	Total	0.25

2. The total carcinogenic risk for the site under current site conditions (Scenario I) is associated with the railroad ditch, and is 1×10^{-4} for adults of the general public and 3×10^{-5} for railroad personnel. Risk is higher for the general public than for railroad personnel since the public is assumed to visit the site more frequently and for a longer period of time.

3. Under the most probable future land use conditions (Exposure Scenario II), the total cancer risk for the main site is estimated at 8×10^{-5}. The risks associated with the railroad ditch increase, from those in Scenario I, to 1×10^{-4} due to visitation by children.

4. Carcinogenic risks are highest in the worst-case residential scenario exposure (Scenario III). The carcinogenic risk of the Main Site is 4×10^{-3}, and for the railroad ditch area the carcinogenic risk becomes 2×10^{-4}, because of the increased exposure of adults and children to the contaminants.

5. Noncarcinogenic risks are highest in Exposure Scenario III. In Exposure Scenarios I and II (current conditions and most probable future land use pattern) no hazard index for any of the constituents exceeds unity (1.0) at any exposure point, indicating no expected adverse noncarcinogenic effects. Hazard indices do exceed unity in Exposure Scenario III for the main site (HI=17), and from drinking the water from a well on the main site (HI=24).

6. The risk assessment for New Cricket Spring indicates that no adverse noncarcinogenic effects are expected from PCP exposure to water from New Cricket Spring, under any of the three exposure scenarios (HI less than .25).

B. Environmental Risks

There have been no environmental impacts identified for off-site areas. No endangered species are known to inhabit the area on or near the site[12].

---

[12] **Endangerment Assessment, Arkwood, Inc. Site, August 30, 1989, Section 1.5**

VII. Description of Alternatives

Nine alternatives for soil and sludge remediation were considered in the Feasibility Study. They are:

Alternative	A	-	No Action
Alternative	B	-	Site Monitoring and Restricted Access
Alternative	C	-	Incinerate Sludges
Alternative	C1	-	Incinerate Sludges/Topsoil Cap Over Entire Site
Alternative	D	-	Incinerate Sludges/Consolidate, and Cap-In-Place Affected Soil
Alternative	E	-	Incinerate Sludges/Consolidate, Sieve-and-Wash and Cap-In-Place Affected Soils
Alternative	F	-	Incinerate Sludges/Consolidate, Sieve-and-Wash, Biologically Treat Sand/Fines and Cap-In-Place Affected Soils
Alternative	G	-	Incinerate Sludges/Landfill Affected Soils On-Site
Alternative	H	-	Incinerate Sludges Affected Soils On-Site

A. Common Design Elements

Several of the alternatives include common major elements. These descriptions and design bases are incorporated by reference in sections developing the alternatives.

Fencing

Fencing the site perimeter to control access is included in all alternatives except the No Action Alternative.

Design Basis:

Length	5,000 feet
Height	6 feet
Type	Cyclone with 3 strands barbed wire

Decontaminate and Remove Existing Structures

Several existing structures and other miscellaneous materials will be removed and decontaminated for disposal either on-site or at an off-site municipal landfill. This action will be undertaken under all alternatives except A

(No Action) and B (Site Monitoring and Restricted Access.) These structures and materials include:

- the concrete slab covering the sinkhole
- other visible foundations
- a storage tank
- debarking shed
- miscellaneous trash and debris

Visible concrete slabs and foundations will be removed, decontaminated by steam cleaning until no visible oil or chemicals remain, broken into pieces of manageable size and transported to a municipal landfill. The water collected from steam cleaning will be analyzed for PCP and treated through the waste water treatment unit (described later) if the PCP concentration exceeds State of Arkansas Water Quality Criteria. The storage tank and building will be dismantled, decontaminated and disposed of in the same manner.

Miscellaneous trash and debris will be either disposed of at a municipal landfill or removed and handled with the affected soils. They will be placed under the cap, landfilled or incinerated with the affected soils.

Incinerate Sludges

Sludges have been identified in the railroad ditch area and possibly in the sinkhole. The sludges are defined as highly contaminated soils in which visible contamination is present, and are estimated at 425 yds^3. While the sludges represent the most highly contaminated materials on site, soils surrounding these sludges are also highly contaminated (see section V. Summary of Site Characteristics, for a description of concentrations). In Alternatives C through G, these sludges are excavated, shipped in bulk, and incinerated off-site at a permitted commercial incinerator approved to accept CERCLA site wastes. Under Alternative H, the sludges would be excavated and incinerated on-site along with affected soils.

At the railroad ditch area, the cover soil is removed and handled with other affected soils as indicated under descriptions of the individual alternatives. The limits of sludge excavation are determined by visual observation, as there is a clear demarcation between sludges and underlying soils[13]. The excavation is backfilled as work proceeds to minimize the chances of excavation collapse.

---

[13] **Remedial Investigation Report, Arkwood, Inc. Site Volume I, Table 4-6, Pages 10 through 13**

At the sinkhole, the concrete pad will first be removed and handled as stated under the previous section. All pumpable liquids would be removed, treated on-site, and discharged. If free phase oil is present in the sinkhole liquids, it would be separated and packed in drums for incineration with the sludges. The manner of treatment for the sinkhole fluids water phase would depend on the alternative. In alternatives C, C1, D, G, and H, a waste water treatment unit would be installed and treated water would be discharged on-site. In alternatives E and F, the water would be combined with the wash water for treatment. The sinkhole sludge is then excavated and loaded in trucks for transport to the off-site incinerator (or carried to the on-site incinerator in Alternatives H.)

Excavate Affected Soils

Affected soils are defined as those soils containing levels of contaminants greater than 300 mg/kg PCP, 6 mg/kg PNA-c and 20 µg/kg dioxin as discussed in Section V., Summary of Site Characteristics. The volume of affected soils, excluding the sludges is approximately 20,400 yds^3. Excavation would be performed using common earth-moving equipment. In alternative D, the affected soils would be partially excavated for consolidation in a smaller area for capping (i.e., affected soil beneath the consolidation area would be left in place.) In alternatives E through H, all of the affected soils would be excavated. Some excavation and stockpiling of affected soils will be necessary prior to construction of site facilities, such as a treatment unit, since these units would be located on affected areas. The location of these facilities varies with the alternatives. Stockpile sizes of affected soils will be determined during the design process depending of the flow rates of the incinerator. The stockpiles will be required to meet all RCRA requirements for stockpiles, including berms and storage times.

The actual extent of excavation for alternatives E through H will be based on verification sampling and analyses performed during the excavation.

Composite Cap

In Alternatives D, E, and F, a composite cap is placed over the consolidated soils to minimize the generation of affected leachate by percolation of rain water.

The cap is a composite design of (from top to bottom):

- native grasses
- topsoil
- fill
- geofabric
- drainage layer
- flexible membrane liner
- recompacted clay

It would be constructed by placing and compacting the underlying affected materials, then placing and compacting three feet of clay in lifts. A flexible membrane liner is placed over the clay and covered by six inches of a porous media (sand or gravel) to drain infiltrating rain water from the cap. A geofabric is placed over the porous media to prevent the finer fill from clogging the drainage layer. One foot of fill and six inches topsoil is then placed to provide moisture and nutrient support for a vegetative cover. Finally, native grasses are established to control erosion and to maximize evapotranspiration of percolating rainfall.

In alternatives C1 through H, a topsoil cap will be placed over all site soils (except, in the case of Alternatives D through G, those soils already under a composite cap.) This cap will be seeded with native grasses for protection from wind and erosion. The topsoil cap will prevent direct access with any residual affected soils, thereby reducing the incremental risk from the site to less than 10^{-6}. By minimizing storm water contact with affected soil and enhancing evapotranspiration of percolating water, the potential for generation of affected leachate will be decreased. Maintenance of the topsoil cap will consist of periodic mowing and replacement of any lost topsoil.

Waste Water Treatment

A small waste water treatment unit is included in Alternatives C, C1, D, G, and H. This unit will be used during construction to treat miscellaneous affected liquid streams, such as storm water, decontamination water, and sinkhole fluids. It will be reused during the post-closure care and monitoring period to treat affected ground water or leachate.

Storm water falling on open excavations, stockpiles and process equipment during the construction and operation period will be considered potentially affected by constituents of concern. Storm water falling on unaffected portions of the site will be allowed to run off and will not be collected. After a rainfall, any storm water collected

in open excavations will be sampled and analyzed for the water quality parameters necessary to meet the National Pollutant Discharge Elimination System (NPDES), including PCP. If the NPDES requirements are met without treatment, then the storm water will be considered unaffected and will be discharged. If the NPDES requirements are not met, then the water will be treated in the waste water treatment unit and discharged.

Sinkhole fluids and decontamination water will be pumped from drums into a cone-bottom tank where any free phase organic and solids can be separated from the water. A portable pump will be used to transfer affected storm water from the excavation to the cone-bottom tank. Any settled solids or floating organic will be removed from the cone-bottom tank and placed in drums for disposal. The water from the cone-bottom tank will be pumped through a cartridge filter to remove solids, followed by two disposable granular activated carbon (GAC) canisters piped in series, and then discharged. The spent carbon canisters will be sent off-site for regeneration and reused.

To determine when the GAC units will be regenerated, a flow totalizer installed downstream of the filter will measure the total volume of water treated through the unit. After a preset volume (to be determined during start-up) has been treated, the primary GAC unit effluent will be analyzed for breakthrough of indicator constituents (e.g. PCP, fluoranthene, phenanthrene, and pyrene.) Breakthrough will be considered to have occurred when either the PCP concentration or the indicator PNAs concentrations reach the NPDES requirements. When breakthrough occurs, the primary unit will be shipped off-site for regeneration, the secondary unit will be placed in the primary position, and a new GAC unit will be placed in the secondary position.

B. Description of Alternatives

A. <u>No Action</u>

This alternative would leave the site in its current condition and provide ground water monitoring to detect any impact on ground water for 30 years. This alternative does not change the levels of contaminants left exposed, does not decrease the risk from the site, and does nothing to reduce risk of further ground water contamination.

Implementation Time:	0 year
Capital and Operation Cost:	$0
Maintenance Cost:	$291,000

B. Site Monitoring and Restricted Access

In this alternative, site access is controlled by fencing the site perimeter and by institutional controls as necessary to limit exposure through direct contact with affected soils. Monitoring to detect any impact on ground water would be performed for 30 years. This alternative does not change the levels of contaminants left exposed on site. This alternative decreases the risk only by further restricting site access, and does nothing to reduce the risk of further ground water contamination.

Implementation Time:	0.3 Year
Capital and Operation Cost:	$67,000
Maintenance Cost:	$340,000
Net Present Value:	$410,000

C. Incinerate Sludges

In this alternative, the railroad ditch and sinkhole sludges are excavated, shipped in bulk, and incinerated off-site. The contaminants would be required to be shipped according to all applicable Department of Transportation (DOT) regulations for hazardous substances. The selected off-site incinerator will be in compliance with the CERCLA off-site policy, and will be permitted to accept these types of wastes.Cover soils from the railroad ditch (i.e., clean soils above the sludge) are backfilled into the excavation. Sinkhole fluids are treated on-site along with equipment decontamination water and any affected storm water in a waste water treatment unit to NPDES requirements. The site is then fenced to control access, and existing structures are removed. This alternative would destroy approximately 425 yds^3 of contaminated materials, leaving approximately 20,400 yds^3 of affected soils and the rest of the site in an unchanged condition.

The risk reduction achieved would be the result of the elimination of the risk due to the railroad ditch area, and the further restriction of site access. The risk of further ground water contamination would be reduced by excavating the railroad ditch, but the remaining 20,400 yds^3 of affected soils would still pose a very significant threat to the ground water.

Implementation Time:	0.5 year
Capital and Operation Cost:	$1.8 million
Maintenance Cost:	$.34 million
Net Present Value:	$2.1 million

C1. Incinerate Sludges/Topsoil Cap Over Entire Site

In this alternative, the railroad ditch and sinkhole sludges are excavated (approximately 425 yds^3), shipped in bulk according to DOT regulations for hazardous waste shipments, and incinerated off-site at an incinerator permitted to receive these wastes and in compliance with the CERCLA off-site policy. Cover soils from the railroad ditch are backfilled into the excavation. Sinkhole fluids are treated on-site along with equipment decontamination water and any affected storm water in a waste water treatment unit to meet NPDES requirements. The entire site is covered with a topsoil cap. The site is fenced to control access, and existing structures are removed.

The removal of the sludges eliminates the risk due to the sludges. The topsoil cap reduces the incremental risk from the site due to the direct contact with the soils, and the fence further reduces the risk by further restricting site access. However, approximately 20,400 yds^3 of affected soils would remain on site. The risk of further ground water contamination would be reduced by excavating the railroad ditch sludges, but the remaining 20,400 yds^3 of affected soils would still pose a very significant threat to the ground water.

Implementation Time:	0.5 year
Capitol and Operation Cost:	$2.68 million
Maintenance Cost:	$.39 million
Net Present Value:	$3.1 million

D. Incinerate Sludges/Consolidate and Cap-In-Place Affected Soil

As with Alternative C, existing structures are removed and the railroad ditch and sinkhole sludges are transported according to DOT regulations and incinerated off-site at a permitted facility in compliance with the CERCLA off-site policy. The affected soils shown in Figure VII-1 (approximately 20,400 yds^3) are excavated and consolidated over the remaining affected soils and capped with a composite cap in compliance with RCRA construction requirements. The remainder of the site is then covered with a topsoil cap. The effectiveness of the composite cap at controlling the migration of constituents will be tracked by the monitoring program. Sinkhole fluids, decontamination water and any affected storm water are

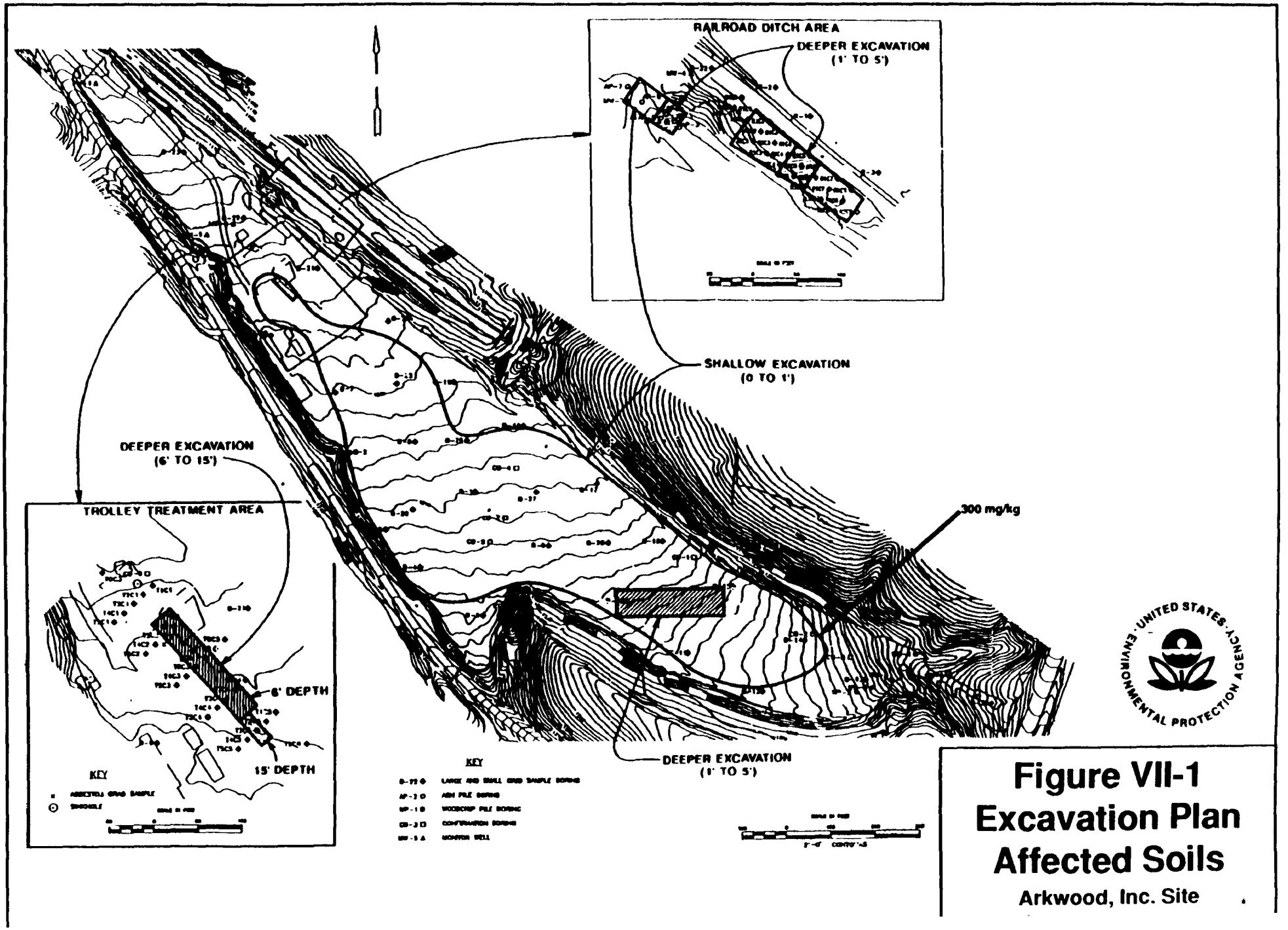


Figure VII-1
Excavation Plan
Affected Soils

Arkwood, Inc. Site

treated to meet NPDES requirements in an on-site waste water treatment unit and discharged.

This alternative treats the same amount of waste as Alternative C (approximately 425 yds^3). The composite cap, combined with the topsoil cap, effectively reduces the direct contact threat from the main site, and the fence further reduces the risk by further restricting site access. The composite cap will also reduce the amount of leachate produced from precipitation. However, under this alternative highly contaminated materials would be left on-site and would still pose a significant long-term threat to the ground water. The uncertainty of the area geology makes this remedy a less than permanent remedy, with a significant threat to the ground water remaining.

Implementation Time:	2.0 years
Capital and Operations Cost:	$3.7 million
Maintenance Cost:	$.39 million
Net Present Value:	$ 4.1 million

E. Incinerate Sludges/Consolidate, Sieve-and-Wash and Cap-n-Place Affected Soils

As with Alternative D, the site is fenced, existing structures are removed and the railroad ditch and sinkhole sludges are transported according to DOT regulations to a permitted incinerator off-site in compliance with the CERCLA off-site policy. Sinkhole fluids, decontamination water and affected storm water are treated along with the spent sieve-and-wash water to meet NPDES requirements and discharged. All of the affected soils (approximately 20,400 yds^3) are excavated as shown on Figure VII-1. The affected soils which are excavated and required to be stockpiled, will be stored in accordance with RCRA requirements for surface storage units. The affected soils are then sieve and washed. The washed soils that are tested and meet the clean up criteria will be backfilled on site. Those washed soils that do not meet the clean up criteria will be consolidated and placed on site under a composite cap that meets RCRA requirements. The site is then covered with a topsoil cap.

The sieve-and-wash process is designed to remove constituents of concern from the affected soils before capping or additional treatment. Constituent removal via soil washing is accomplished by two mechanisms:

- by washing the soil particle surface, dissolving constituents into the water, which can be more easily treated by biological or other means, and

- by abrasion of some of the surface material, leaving a slightly smaller particle with significantly decreased constituent concentration. The material that was abraded from the surface is much higher in constituent concentration than the original coarse soil and becomes affected sand/fines. Affected sand/fines which are generated from the coarser fractions by this mechanism would be handled along with the original affected sand/fines.

The wash water slurry containing affected sand and fines is pumped to a sludge thickener. The thickened sludge is de-watered using a precoated plate-and-frame filter. The filter cake is transported to the consolidation area for capping. The filtrate stream is combined with the thickener supernatant and treated to remove organics. The treated water is recycled to the sieve-and-wash process and then discharged upon project completion.

A wash water treatment unit is provided in this alternative to de-water the sand/fines slurry and treat the wash water for recycle. Treated wash water will ultimately be discharged upon completion of the project.

According to the Treatability Study, there are three streams resulting from the sieve and wash treatment. There is a coarse fraction defined as the +12 mesh material, a sands/fines fraction or -12 mesh material and a water fraction with PCP carried off from the wash process which will be treated in the washwater treatment unit for recycle and re-use.

Some or all of the coarse fraction (+12 mesh, approximately 66% of the site soils) can be washed to residual constituent concentrations of 200 to 300 mg/kg PCP and 10 to 100 mg/kg total indicator PNAs. Data is not available to assess if the course soils would meet the dioxin clean up criteria, however, the dioxin is expected to be similarly distributed as the other contaminants, and therefore it is expected that the coarse fraction will meet the dioxin clean up criteria. Testing also indicated that by washing an even more course fraction, than the +12 mesh fraction, lower residual concentration in the course fraction can be achieved.

The sieve-and-wash process leaves approximately 34% of the site soils in the sand and fines fraction (-12 mesh) with contamination levels likely remaining above the treatment goals. Washing the sand/fines fraction results in residual concentrations in the sand fraction of 250 to 550 mg/kg PCP and approximately 130 mg/kg total indicator PNAs. In the fines fraction, the process results in levels of 1,300 to 1,900 mg/kg PCP and approximately 320 mg/kg total indicator PNAs. As a result of the levels remaining in the soils, these washed soils would be consolidated under a composite cap constructed to RCRA requirements.

This alternative will eliminate the risk from the railroad ditch by incinerating the sludge found there. The sieve-and-wash will effectively reduce the volume of material that remains above the treatment goals. Risk from direct contact is greatly reduced by the composite and topsoil caps. The composite cap will also reduce the amount of leachate from precipitation. However, under this alternative, highly contaminated materials would remain on site and would still pose a significant long term threat to the ground water. The uncertainty of the area geology makes this remedy a less than permanent remedy, with a significant threat to ground water remaining.

Implementation Time:	2 years
Capital & Operating Cost:	$6.4 million
Maintenance Cost:	$.4 million
Net Present Value:	$6.6 million

F. Incinerate Sludges/Sieve-and-Wash, Biologically Treat Sand/Fines and Cap-In-Place Affected Soils

In Alternative F, the site is fenced, existing structures are removed and the railroad ditch and sinkhole sludges, approximately 425 yds^3, are transported according to DOT regulations to a permitted incinerator in compliance with the CERCLA off-site policy and incinerated. The affected soils are excavated and treated by sieving-and-washing, followed by biological treatment of the sand/fines fraction. Any affected soils which are required to be stockpiled, will be stored in compliance with RCRA surface storage requirements. The sand/fines slurry is pumped to a double-lined impoundment with surface aerators for biological treatment in a RCRA compliant impoundment.

Alternative F provides destruction of constituents of concern in the sand/fines fraction by biological treatment. The treated soils which achieve the treatment goal are backfilled on-site; the soils not achieving the treatment goal are placed on-site under a composite cap constructed to RCRA requirements. The biologically treated slurry is discharged to a de-watering system from which the solids are tested for indicator compounds and either backfilled as clean or contaminated soils depending upon the remaining contaminant levels. The sinkhole fluids, equipment decontamination water and affected storm water are also treated in the biological treatment system. The remainder of the site is covered with a topsoil cap. Any water discharge must meet NPDES requirements.

The Treatability Study showed that biological treatment could reduce the PCP in the soils by 85%, or from 2400 mg/kg to 170 mg/kg, and PNA concentrations by 80%, or from 420 mg/kg to 18 mg/kg total indicator PNAs. The treatment did not reduce the concentrations of the dioxin in the soils.

This alternative eliminates the threat from the railroad ditch via incineration of the sludges found there. The sieve and wash and biological treatment further reduce the threats due to the PCP and PNAs. The threat of direct contact to the site soils is minimized due to the topsoil and composite caps, and the risk is further reduced by further restricting site access by fencing the site. However, these treatments will not destroy the dioxin at the site, which is responsible for much of the risk at the site.

Implementation Time:	6 years
Capital & Operation Cost:	$13.2 million
Maintenance Cost:	$.4 million
Net Present Value:	$13.6 million

G. <u>Incinerate Sludges/Landfill Affected Soils On-Site</u>

In this alternative, the railroad ditch and sinkhole sludges are excavated (approximately 425 yds^3), shipped in bulk according to DOT regulations for hazardous waste shipments, and incinerated offsite at an incinerator permitted to receive these wastes and in compliance with the CERCLA off site policy. The affected soils are excavated and consolidated in an on-site landfill constructed to the RCRA minimum technology requirements for a landfill. Closure would require post closure monitoring and care.

Sinkhole fluids are treated on-site along with equipment decontamination water and affected storm water in a wastewater treatment unit to the State of Arkansas Water Treatment Standards. The remainder of the site is covered with a topsoil cap, and the site is fenced.

Monitoring of the leachate collection system is provided in addition to the ground water monitoring program to detect any leaks from the landfill during the post-closure care period. This will be accomplished by measuring liquid levels in the leachate collection system sumps on a quarterly basis.

This alternative treats approximately 425 yds^3 of the most highly contaminated materials but leaves consolidated in a landfill 20,400 yds^3 of affected soils. The direct contact threat is removed in this alternative and the landfill will minimize the amount of leachate produced. However, under this alternative, highly contaminated materials would remain on site and would still pose a significant long term threat to the ground water. The uncertainty of the area geology makes this remedy less than permanent, with a significant threat to the ground water remaining.

Implementation Time:	2 years
Capital & Operation Cost:	$5.1 million
Monitoring cost:	$.4 million
Net Present Value:	$ 5.5 million

H. <u>Incinerate Sludges and Affected Soils On-Site</u>

For Alternative H, an on-site incinerator with afterburner and appropriate air pollution control devices is constructed. While a permit for the incinerator would not be required, the incinerator would be designed the meet the RCRA performance standards for incinerators. All site materials, both sludges and soils, above 300 mg/kg PCP, 6 mg/kg PNA-c and dioxin above 20 μg/kg 2,3,7,8 TCDD equivalents are excavated (20,825 yds^3), and incinerated on site. The incinerator effectively destroys the constituents of concern in both the site sludges from the railroad ditch and sinkhole, and the affected soils. Incinerator ash and neutralization sludge will be backfilled on-site.

Stockpiling of affected soils may be required, and this will be addressed in the design of the incineration system. Any stockpiling of soils will be designed to

meet all RCRA storage requirements. All of the contaminated water from the sinkhole will be treated along with the collected stormwater and incinerator water in an on site water treatment plant to NPDES standards and discharged. The excavated areas will be backfilled with clean soils and a topsoil cap will be placed over the entire site. The site will be fenced to restrict access.

This alternative eliminates the direct contact threat from the railroad ditch and site soils. The long-term threat to the ground water is eliminated since no contamination above health-based levels are left on-site. The topsoil cap will eliminate the threat from contact with any soils remaining with contaminants below the clean-up goals. The fence further reduces the risk by restricting site access.

Implementation Time:	3 years
Capital and Operations Cost:	$18 million
Maintenance Cost:	$0.39 million
Net Present Value:	$18.4 million

VIII. Summary of Comparative Analysis of Soil Alternatives

This section of the Record of Decision subjects the soil alternatives to an evaluation based on the nine criteria. A narrative evaluation of the alternatives is presented for each criterion in the following sections, along with a comparative evaluation of the alternatives. See Table VIII-1, Summary of Comparative Analysis for a comparison of the Threshold and Primary Balancing Criteria.

A. Threshold Criteria

1. Overall Protection of Human Health and the Environment

Alternatives A (No Action) and B (Site Monitoring and Restricted Access) are not protective of human health and the environment relative to the other alternatives, because they do nothing to remove or destroy the site contaminants, or eliminate the direct contact threat to the soils. These alternatives also do not eliminate the long-term threat to the ground water posed by the site geology.

Alternatives C (Incinerate Sludges) and C1 (Incinerate Sludges/Topsoil Cap over Entire Site) are both more protective of human health and the environment than alternatives A and B, based on the destruction of the sludges. Alternative C1 provides additional protection

TABLE VIII-1

Comparison of Threshold and Modifying Criteria
Remedial Alternatives for Sludges and Affected Soils

Arkwood, Inc. Site
Omaha, Arkansas

Alternative	Protection of human health and the environment	Compliance with ARARs	Long-term effectiveness and permanence	Reduction of toxicity, mobility and volume	Short-term effectiveness	Implement-ability	Time to Completion (years)	Cost (millions)
A - No Action	--	-	--	--	--	++	--	$ 0.29
B - Site Monitoring and Restricted Access	-	-	--	--	--	++	0.3	$ 0.4
C - Incinerate Sludges	-	•	•	•	•	++		$ 2.1
C1 - Incinerate Sludges/Topsoil Cap over Entire Site	-	•	+	•	++	++	0.5	$ 3.1
		•					0.5	
D - Incinerate Sludges/Consolidate and Cap-In-Place Affected Soils	+		+	+	++	+	1.0	$ 4.1
E - Incinerate Sludges/Consolidate, Sieve-and-Wash and Cap-In-Place Affected Soils	++	•	+	++	+	-	2.0	$ 6.6
F - Incinerate Sludges/Sieve-and-Wash, Biologically Treat Fines and Cap-In-Place Affected Soils	++	•	+	++	-	--	6.0	$14
G - Incinerate Sludges/Landfill Affected Soils On-Site	+	•	+	+	++	•	2.0	$ 5.5
H - Incinerate Sludges and Affected Soils On-Site	++	•	++	++	-	--	3.0	$18

by providing a topsoil cap that eliminates the excess risk due to direct exposure. However, these alternatives do not afford adequate long term protection of ground water.

Alternatives D (Incinerate Sludges/Consolidate and Cap-in-Place Affected Soils) and G (Incinerate Sludges/Landfill Affected Soils Onsite) each include containment of affected soils as well as incineration of the sludges. The containment of the soils reduces the possibility of contact, which reduces the risk from the site. The reduced risk allows these alternatives to provide better protection of human health and the environment than the preceding alternatives. However,because high levels of contaminants would remain in place, a large degree of uncertainty regarding the protectiveness to the area ground water remains.

Alternatives E (Incinerate Sludges/Consolidate, Sieve-and-Wash and Cap-In-Place Affected Soils), F (Incinerate Sludges/Consolidate, Sieve-and-Wash, Biologically Treat Sand/Fines and Cap-In-Place Affected Soils) and H (Incinerate Sludges and Affected Soils Onsite) provide increased reduction in the excess risk by reducing the levels of PNAs and PCP in the soil. However, neither Alternative E nor F destroy dioxin and thus would leave high levels (up to 45 µg/kg as 2,3,7,8 TCDD) of dioxin on site. Only alternative H destroys the PCP, PNAs and dioxin and thus is the most protective alternative. Alternative E permanently destroys more contaminants than alternative D and is therefore more protective. Alternative F provides even more treatment and is more protective than Alternative E. Alternative H is more protective than Alternative F.

2. Compliance with Applicable or Relevant and Appropriate Requirements

All of the alternatives will comply with ARARs. However, Alternatives A through G do not comply with the dioxin action level for industrial uses, set by the Agency for Toxic Substances and Disease Registry. This action level is a "to be considered" (TBC) requirement, rather than an ARAR, and sets a treatment level for dioxin in an industrial use area as 20 µg/kg. Alternative H will comply with this TBC.

Any on site water discharge resulting from any of these alternatives would not be required to obtain a

discharge permit, but would be required to meet any NPDES discharge requirements.

Any alternative that requires stockpiling of the affected soils would be required to comply with the RCRA requirements for such activities.

An onsite incinerator would not require a permit but would be required to operate within the RCRA requirements found in 40 CFR Section 264 Subpart O.

B. Primary Balancing Criteria

3. Long-term Effectiveness and Permanence

Alternatives A (No Action) and B (Site Monitoring and Restricted Access) are rated low, since neither alternative provides any certainty of long-term protectiveness. The magnitude of the excess risk from the site is unchanged from existing conditions in either alternative.

Alternatives C (Incinerate Sludges) and C1 (Incinerate Sludges/Topsoil Cap Over Entire Site) are more effective due to the incineration of the sludges. Both alternatives effectively remediate the worst contamination at the site, and reduce the risk due to the railroad ditch. These alternatives, however, leave high concentrations of contaminants onsite and thus, do not afford a high degree of permanence, and because of the uncertainty of the geology, do not provide long term protection of the ground water

Alternatives D (Incinerate Sludges/Consolidate and Cap-in-Place Affected Soils) and G (Incinerate Sludges/Landfill Affected Soils Onsite), provide a decrease in excess risk and afford a greater certainty of long-term success than the preceding alternatives, due to the containment of the affected soils. However, the remaining high concentrations of contaminants do not afford a large degree of permanence and still represent a significant long term threat to ground water, due to the uncertainty of the karst geology.

Alternatives E (Incinerate Sludges/Consolidate, Sieve-and-Wash and Cap-in-Place Affected Soils), F (Incinerate Sludges/Consolidate, Sieve-and-Wash, Biologically Treat Sand/Fines and Cap-In-Place Affected Soils) and H (Incinerate Sludges and Affected Soils Onsite) provide increasing treatment of the site contaminants. The magnitude of the remaining risk and the potential for exposure of humans and the

environment to the remaining contaminants is reduced in these alternatives. Alternatives E and F, however, still leave contaminants above health based concentrations consolidated and capped at the site. These alternatives do not destroy the dioxin from the main site which is responsible for much of the risk at the site. Because of the uncertainty of the karst geology, these alternatives do not afford an adequate level of long term protection and permanence. Only Alternative H provides long-term protection by destroying to below the action levels, all the contaminants of concern found in the soils.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives A (No Action) and B (Site Monitoring and Restricted Access) are rated low since neither decreases the toxicity, mobility or volume of contaminants at the site.

Alternatives C (Incinerate Sludges), C1 (Incinerate Sludges/Topsoil Cap Over Entire Site), D (Incinerate Sludges/Consolidate and Cap-in-Place Affected Soils), and G (Incinerate Sludges/Landfill Affected Soils Onsite) all provide increased reduction of toxicity, mobility and volume of contaminants via sludge incineration.

Alternatives E, (Incinerate Sludges/Consolidate, Sieve-and-Wash and Cap-In-Place Affected Soils), F (Incinerate Sludges/Consolidate, Sieve-and-Wash, Biologically Treat Sand/Fines and Cap-In-Place Affected Soils) and H (Incinerate Sludges and Affected Soils Onsite) achieve additional reduction of toxicity, mobility and volume of site contaminants over the previous alternatives. In Alternatives E, the sieve-and-wash process removes a portion of the PCP, but not the PNAs or dioxin. In Alternative F, the additional biological treatment further destroys the PCP and destroys much of the PNAs, but not the dioxin. In Alternative H, all the contaminants of concern are destroyed permanently. Alternative H is, therefore, the most effective at reducing the toxicity, mobility and volume.

5. Short-term Effectiveness

Alternatives A (No Action) and B (Site Monitoring and Restricted Access) are rated low since neither alternative reduces the short-term risk.

Alternatives C (Incinerate Sludges), F (Incinerate Sludges/Consolidate, Sieve-and-Wash, Biologically Treat Sand/Fines and Cap-In-Place Affected Soils) and H (Incinerate Sludges and Affected Soils Onsite) provide treatment of site contaminants via removal and incineration of the sludges. Alternatives F and H include additional treatment, but pose a small potential risk to workers and the environment during construction and operation periods of up to six years. During construction and operations of Alternatives F and H, workers will be exposed to affected soils because increased handling of the soil is required. For this reason, Alternatives F and H are less effective in the short-term than Alternative C.

Alternative E (Incinerate Sludges/Consolidate, Sieve-and-Wash, and Cap-In-Place Affected Soils) effectively remediates affected materials in a shorter time than Alternatives F and H (approximately one to one-and-one-half years). The construction and operation of less complex facilities pose less risk to workers and the environment. Less soil handling is required for Alternative E than for Alternative F. The treatment of affected soils in a relatively short time frame provides an improvement over Alternative C, which does not address the soils. Alternative E is, therefore rated above Alternatives C, F and H.

Alternatives C1 (Incinerate Sludges/Topsoil Cap Over Entire Site), D (Incinerate Sludges/Consolidate and Cap-In-Place Affected Soils) and G (Incinerate Sludges/Landfill Affected Soils Onsite) are most effective in the short-term and are rated the highest. These alternatives effectively remediate the site to remove potential short-term threats to human health and the environment via sludge incineration. However, as stated earlier, these alternatives leave high levels of contaminants in place that pose a long term threat to ground water. Construction activities for these alternatives are expected to be completed within two years, minimizing the short-term risk to workers, the community or the environment due to the handling of affected soil.

6. Implementability

Alternative H (Incinerate Sludges and Affected Soils Onsite) is a complex alternative to implement. Since the system operates at high temperatures, specialists in maintenance and operation are required. A trial burn (demonstration of performance) with associated analytical and reporting requirements is mandatory

prior to operation; analytical and reporting requirements during operation are also more demanding than for other alternatives.

Alternative F (Incinerate Sludges/Consolidate, Sieve-and-Wash, Biologically Treat Sand/Fines and Cap-In-Place Affected Soils) is also more difficult to implement than the remaining alternatives. Although the biological treatment system is not overly difficult to design and construct, it requires more sophistication relative to the remaining alternatives, is difficult to operate and requires a long time period for operation.

Alternative E (Incinerate Sludges/Consolidate, Sieve-and-Wash, and Cap-In-Place Affected Soils) is less complex and requires less effort to implement than Alternatives F and H. The sieve-and-wash system is not well-established and would require pilot testing. However, it consists of only a few pieces of equipment which are all well accepted in other, similar applications and are readily available from several manufacturers. The sieve-and-wash system is designed conceptually to have enough flexibility to be reliable in this application. It is more easily implemented than alternatives F and H

Alternative G (Incinerate Sludges/Landfill Affected Soils Onsite) is less complex and requires less effort to implement than Alternative E. Design, construction and maintenance of landfills is a well-established technology, and experienced construction contractors are readily available.

Alternative D (Incinerate Sludges/Cap-in-Place Affected Soils) is easily implemented. This alternative requires minimal construction, operation and maintenance of facilities. Design and construction of a cap is a well-established technology, and experienced contractors are readily available.

Alternatives A (No Action) and B (Site Monitoring and Restricted Access) do not require much effort. These alternatives are therefore most easily implemented and are rated the highest.

Alternatives C (Incinerate Sludges) and C1 (Incinerate Sludges/Topsoil Cap Over Entire Site) are the most easily implemented of the treatment alternatives, since they require only excavation and transportation of a modest volume of sludges and capping. Minimal construction, operation and maintenance of facilities

is required under Alternatives C and C1. The necessary equipment, specialists, transportation and disposal capacity are readily available.

7. Cost

The net present value costs (construction costs plus operations and maintenance costs) of the alternatives are:

Alternative A	$290,000
Alternative B	$400,000
Alternative C	$2,100,000
Alternative C1	$3,100,000
Alternative D	$4,100,000
Alternative E	$6,600,000
Alternative F	$14,000,000
Alternative G	$5,500,000
Alternative H	$18,000,000

C. Modifying Criteria

8. State Acceptance

The State of Arkansas concurred with the remedy as proposed, but believes that a sieve and wash pre-treatment process should be included before incineration. Since the selected remedy includes the sieve and wash process, this state comment os satisfied. The State also expressed a desire that in-situ vitrification be evaluated as a possible alternative. EPA has evaluated this alternative and this issue is discussed in the responsiveness summary. The State also agreed that they shared EPA's concern that the site's karst geology represents a long term uncertainty, but that the formation of a large sinkhole was unlikely. This issue is also discussed in the Responsiveness Summary.

9. Community Acceptance

The community of Omaha, Arkansas does not want incineration to be done at the Arkwood site. They believe that having an incinerator so close (less than one-half of a mile) to the local public school will create greater health risks to the community than the site now does. EPA has received significant opposition to the incineration from the city, and residents of Omaha. The local school district has expressed a preference for the sieve and wash alternative.

IX. Description of Ground water Alternatives

Common Design Elements

Ground water monitoring will be performed during the remediation and for thirty years following the remediation in all alternatives. Ground water monitoring will be conducted according to the following schedule:

Year	Frequency
During Remediation	Quarterly
1 - 5	Semi-Annually
6 - 30	Annually

Monitoring will consist of sampling and analyzing for PCP. The Remedial Investigation demonstrated that PCP is the only constituent of concern detected in the ground water. The following locations will be monitored;

- New Cricket Spring,
- Cricket Spring,
- Railroad tunnel springs,
- Well W-9,
- Well W-11A,
- Well W-11B.

The monitoring data will be evaluated after each sampling event. If the evaluation indicates that statistically significant increases in constituents of concern have occurred, the sampling event will be immediately repeated to confirm the data. If the data are not confirmed, then scheduled monitoring will continue. If the data are confirmed, then quarterly monitoring will occur for one year (four events.) At the end of that time, data will be re-evaluated. If the evaluation establishes that significant increases in constituents of concern have occurred, then a decision will be made to continue quarterly monitoring, increase the monitoring frequency, or to re-evaluate the remedial alternative for ground water. Otherwise, scheduled monitoring will resume.

Monitoring these locations is expected to detect any off-site migration of constituents of concern after remediation of the Arkwood, Inc. site. In addition, a dye trace study has been initiated for the Arkwood site. The results of the dye study will be used to evaluate the effectiveness of the monitoring system in this remedy. If necessary, the monitoring network will be expanded to include additional monitoring locations identified by the dye trace.

The following alternatives were considered for the ground water at the Arkwood site.

A. Natural Attenuation with Monitoring

Alternative A relies on lowering the levels of constituents of concern through naturally occurring physical, chemical and biological processes. For the karst geologies, such as at the Arkwood site, Natural Attenuation is a suitable alternative according to EPA guidance on remedial actions for ground water[14]. In order to eliminate public concerns regarding offsite ground water, ground water users immediately down Cricket Creek valley from the site will be provided with City water.

B. Ground water Recovery/Treatment/Surface Discharge

Water would be recovered from New Cricket Spring, which is the only source of ground water determined to be affected by site constituents. While on-site wells were determined to contain contamination, pumping of these wells would provide very limited treatment of the ground water because the well pumping rates are very low, and the wells have a small area of influence. Thus, only the small amount of contamination that lies very close to each well would actually be removed. A water treatment plant designed to accommodate the high variability of the spring flow rates would be erected at the spring. The water emerging from the spring would be treated to the State of Arkansas Water Quality Standards, and discharged. In order to eliminate the potential for public concerns regarding offsite ground water, ground water users immediately down Cricket Creek valley from the site will be provided with City water.

X. Summary of Comparative Analysis of Ground water Alternatives

This section of the Record of Decision subjects the ground water alternatives to an evaluation based on the nine criteria. A narrative evaluation of the alternatives is presented for each criterion in the following sections, along with a comparative evaluation of the alternatives. See Table X-1, Summary of Comparative Analysis, for a comparison of the Threshold and Primary Balancing Criteria.

---

[14] **Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, EPA/540/G-88/003, December 1988, Page 5-7.**

TABLE X-1

Comparison of Threshold and Modifying Criteria

Ground Water Remedial Alternatives

Arkwood, Inc. Site

Omaha, Arkansas

Alternative	Protection of human health and the environment	Compliance with ARARs	Long-term effectiveness	Reduction of toxicity, mobility or volume	Short-term effectiveness	Implement-ability	Cost (millions)
A - Natural Attenuation with Monitoring	+	-	+	•	-	+	$0.1
B - Ground Water Recovery/Treatment Surface Discharge	+	•	+	+	+	-	$4.15

A. Threshold Criteria

1. Overall Protection of Human Health and the Environment

Both alternatives, when employed in cooperation with extensive remediation of the source of contaminants, will in the long term, result in equivalent levels of protection of human health and the environment. Drinking water is not currently affected and ground water concentrations protective of human health and the environment will result in the long term with either alternative. As stated earlier, no damage has been observed off site, under current conditions.

2. Compliance with ARARs

Alternative A does not comply with ARARs (i.e. the State of Arkansas Water Quality Standards for PCP) in the short term, but will in the long term. Alternative B does comply with ARARs.

B. Primary Balancing Criteria

3. Long-term Effectiveness and Permanence

Both alternatives will result in concentrations protective of human health and the environment in the long term.

4. Reduction of Toxicity, Mobility or Volume Through Treatment

Alternative A does not decrease the toxicity, mobility or volume of constituents at the site through treatment. Treatment is provided in Alternative B, and toxicity, mobility or volume of the organic constituents in the ground water are actively decreased.

5. Short-term Effectiveness

Alternative A is not effective in the short term, since it may potentially require a number of years of attenuation to achieve state Water Quality Standards. Water treatment in Alternative B will lower PCP concentrations in the spring water in the short term.

6. Implementability

Alternative A does not include capital improvements or require much effort. This alternative is therefore more easily implemented. Alternative B includes construction, operation and maintenance of a fairly complex treatment facility, therefore, B is less implementable.

7. Cost

The net present value costs (construction costs plus operations and maintenance costs) of the alternatives are:

Alternative A $0.15 million
Alternative B $4.15 million

C. Modifying Criteria

8. State Acceptance

The State of Arkansas concurs with the ground water remedy, as presented in the Proposed Plan of Action.

9. Community Acceptance

The community of Omaha has expressed concerns regarding their drinking water supplies, and are uncomfortable with the uncertainties in the karst geology and the difficulties in locating contaminant migration pathways through the ground water. Overall, the community appears to support the proposed remedy.

XI. The Selected Remedy

A. Soil

The selected remedy for soils and sludges is Alterative H described in Section VII.2.1 above, with one significant modification from that in the Proposed Plan of Action. All excavated sludges and soils will be sieve and washed prior to incineration. This "pre-treatment" of the excavated materials will concentrate the contaminants onto a smaller volume, thus reducing the volume requiring incineration. This reduction in volume will likely reduce the time and costs from those originally estimated for alternative H.

Incineration was selected because it was the only technology identified during the FS that would permanently destroy the contaminants of concern. Permanent destruction of the contaminants was deemed especially important at this site because of the long term uncertainty of the area geology.

All sludges and soils containing more than 20 µg/kg dioxin (as 2,3,7,8 equivalents), 6 mg/kg PNA-c as B(a)P equivalents, and 300 mg/kg PCP, will be excavated sieve and washed. The washed materials that are tested and meet the clean up criteria will be backfilled onsite.

Those materials that do not meet the clean up criteria will be incinerated on site

All liquids will be pumped from the sinkhole and treated in an on-site water treatment unit. The sludges will be removed from the sinkhole and handled along with the contaminated site soils. The sinkhole will be backfilled to existing grade.

The incinerator ash will be backfilled into the excavated areas along with the excavated materials that were washed and met the clean up criteria. The remainder of the excavation will be backfilled with clean soil. The backfill will be compacted to preclude settlement and graded to provide drainage and minimize erosion. The entire site will then be covered with 6 to 12 inches of clean topsoil. The site will then be seeded with natural grasses and maintained. Institutional controls such as routine inspection and maintenance of the site, will be continued for at least 30 years following the completion of the remediation. A notice will be negotiated into the deed to the property allowing industrial uses but warning against future excavation on the site.

The revised estimated cost and implementation time for this remedy are:

Net Present Value:	$10,300,000
Time:	2 to 3 years

B. Ground water

The selected remedy for ground water is a combination of Alternative A and Alternative B described in Section VII.3 and in the Proposed Plan.

Ground water users immediately down Cricket Valley will be provided with City water. The ground water monitoring program described in Section IX.A will be implemented. Water from New Cricket Spring will be monitored for two years following the remediation to allow natural attenuation to remediate the aquifer. If, after this two year period, the water at New Cricket Spring does not meet the Arkansas Water Quality Standards, it will be treated to meet them. Depending on the quality of water observed through the monitoring at the other locations, other ground water may require treatment to the same standards. The Dye Tracing Study currently being performed could modify monitoring locations and justify other possible actions such as treatment at additional locations and supplying city

water to additional users or require additional studies.

This remedy was selected because New Cricket Spring is not highly contaminated, ecological damage from the site is not apparent, and natural attenuation may occur quickly following the removal of the source of contamination at the site. Should natural attenuation not occur within two years after site remediation, then the spring will be treated to ensure protection of public health and the environment. Active remediation of the shallow contaminated ground water found on site was not selected because the wells in the area have very low pumping rates and very small areas of influence. Because of this, pumping and treating the ground water would only remove a small amount of contamination within a very small proximity to these wells. In addition, since the majority of shallow ground water contamination was found near the railroad ditch, it is expected that the remediation will help to remediate the ground water contamination.

XII. Statutory Determinations

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that the selected remedial actions must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws, unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

A. Protection of Human Health and the Environment

The selected remedy protects human health and the environment through the permanent destruction of dioxin, PNA, and PCP contaminated soil which presents the principal threat through direct contact, and presents a long-term threat to the ground water due to the site geology.

B. Compliance With Applicable or Relevant and Appropriate Requirements

The selected remedy of excavation, sieve and washing, incineration, and capping will comply with all applicable or relevant and appropriate chemical-, action-, and location-specific requirements (ARARs). Key ARARs are presented below.

1. Action-specific ARARs:

40 CFR 264 Subpart O provides operational standards and monitoring requirements for hazardous waste incinerators. Key components of this regulation include a requirement for a destruction and removal efficiency, and limitations on HCl and particulate emissions. The remedy will be designed such that it will meet these requirements. A test burn will be conducted prior to the full scale operation of the incinerator to determine the operating parameters which will meet these requirements.

40 CFR 264.251 provides requirements for waste piles of non-containerized accumulation of solid hazardous waste that are used for treatment or storage. All stockpiles of waste awaiting treatment will be required to meet these construction requirements.

While a water discharge permit is not required for any on site discharge, the NPDES requirements must be maintained for any discharge from site work.

2. Chemical-specific ARARs:

There are no chemical specific ARARS for the Arkwood site. However, there is a "to be considered" action level for dioxin. The Agency for Toxic Substances and Disease Registry has established an industrial use action level of 20 µg/kg 2,3,7,8 TCDD. This remedy will meet this action level.

3. Location-specific ARARs:

Arkansas State Water Quality Standard Regulation number 2 regarding PCP applies to New Cricket Spring and must be met with natural attenuation after two years or be treated thereafter to meet the standards.

C. Cost-Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its costs. The net present worth value is approximately $10.3 million, with a $4.15 million contingency two years after the completion of the remediation if the New Cricket Spring needs to be treated. While the estimated cost of the selected remedy is significantly greater than the cost associated with onsite capping of highly contaminated soils, the selected remedy destroys the contaminants of concern and this provides significantly more protection to the public health and the environment.

D. Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the Arkwood, Inc. site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA and the State have determined that this selected remedy provides the best balance of considerations. These considerations being; long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, the consideration of the statutory preference for treatment as a principal element, and the consideration of the State and community acceptance.

Thermal treatment offers long-term effectiveness and permanence and will significantly reduce the principal threat and inherent hazards posed by the contaminated soils.

E. Preference For Treatment As a Principal Element

By destroying the dioxin, PNA and PCP contamination in the soils in an incinerator, 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.

XIII. Explanation of Significant Differences

The Proposed Plan which was released for public comment on July 16, 1990, proposed on site incineration of all contaminated site soils, approximately 20,400 yds^3. During the public comment period, information was submitted by Mass

Merchandisers, Inc. (MMI a potentially responsible party), suggesting a change to a component of the remedy for the site. EPA has incorporated this into the selected remedy. The change involves providing a sieve and wash pre-treatment step prior to the incineration of all affected soils on site. The advantage of this pre-treatment step will be to significantly reduce the volume of contaminated materials to be incinerated, thereby reducing the treatment time and cost of the remedy.

According to the comments submitted by MMI and the FS, screening the site soils at the +12" mesh size, results in a reduced volume of contaminated soils of approximately 70%. Sampling of these materials resulted in coarse fraction (greater than 12 mesh) contaminant levels well within the clean up goal for the site soils. While there is no data on the resultant dioxin concentrations for the coarse fraction, the dioxin is expected to be distributed similar to the PNAs. Testing of the coarse materials will be done prior to backfilling to ensure that the clean up goal is achieved. Those coarse soils not meeting the clean up goals will be incinerated along with the sands and fines (less than 12 mesh) from the sieve and wash.

By reducing the amount of soils requiring incineration, the treatment cost and time is significantly reduced. According to MMI's comments, the cost of the remedy is expected to be approximately $10.3 million (capital and operating cost), compared to $18 million for the proposed remedy. By reducing the volume of the material to be treated by 70%, or to approximately 7000 yds^3, the time required for incineration is reduced to approximately 140 days for the selected remedy, from 400 days (assuming 50 yds^3/day incinerator capacity) in the proposed remedy.

This change to the proposed remedy enhances the selected remedies balance in regard to the nine evaluation criteria discussed in Section VII, Summary of Comparative Analysis of Soil Alternatives. The selected remedy provides for a reduction of the volume of soils requiring incineration compared with the proposed remedy. The selected remedy is also more effective in the short term, is less costly, and therefore more cost effective than the proposed remedy. In addition, the State of Arkansas agrees with this modification to the remedy and community acceptance is expected to increase since less material will be incinerated in a shorter period of time. The selected remedy may be considered a logical outgrowth of the FS, therefore no additional public comment will be solicited.

XIV. Responsiveness Summary

The written comments received from Mass Merchandisers, Inc. (MMI), a potentially responsible party at this site were extensive and are presented separately from the comments received from all others. The following are questions and comments received during the public comment period and at the Public Meeting held on July 25, 1990, at the Omaha Public School:

1. Comment: The city of Omaha does not feel it is safe, from an emissions standpoint, to incinerate in the valley, and close to the Omaha Public School.

Response: EPA believes that a well designed and properly operated incinerator will not cause health or environmental problems. Based on the best available information concerning the risks of incineration, EPA has developed strict standards that limit the emissions from hazardous waste incinerators. The incinerator will be required to demonstrate that it can meet these standards during a test burn and must meet these standards at all times during the actual incineration. Air monitors will be placed around the site and at the school to ensure that air quality is maintained safely.

2. Question: How long could the incineration and the possibility of emissions exist?

Response: The time required to incinerate the soils is dependent on the capacity of the incineration unit and the amount of materials requiring incineration following the sieve and wash process. Incinerators with a wide range of capacities are available. The Feasibility Study estimated an incinerator feed capacity of 50 cubic yards per day. Based on this feed rate, incineration of all of the contaminated materials (approximately 20,400 cubic yards) would take 400 days. However, adding the sieve and wash process prior to incineration has been estimated to reduce the volume to be incinerated to 7,000 yds^3 and reduced the time of incineration (used to estimate costs) to approximately 140 days.

3. Question: The residents of Omaha would rather leave the contamination in place than have it burned and expose the school children and area residents to the emissions. If the problem is in the soil now, why put it into the air?

Response: The risk from a well designed and operated incinerator is much less than the current risk from the site. The threats posed by the contaminants that now exist in the site's soils will not be transferred into the air because all (at least 99.99%) of the contamination will be

destroyed or removed from emissions during the incineration process.

4. Comment: The Feasibility Study states that a remedy involving consolidation and capping of soils from the main site is an "acceptable" alternative and thus should be the selected remedy.

Response: The purpose of the Feasibility Study is to present alternatives for site remediation and to compare them to the nine evaluation criteria. This comparison to the evaluation criteria allows EPA to select a remedy that is properly balanced against the criteria. The Feasibility Study does not provide an assessment of the "acceptability" of any alternative. EPA has reviewed the consolidation and capping alternative and has deemed it inappropriate for this site because it does not provide treatment of site contaminants to the maximum extent practicable as required by the Superfund law, is not as permanent a remedy as the alternative selected, and it does not provide for, long term protection of ground water.

5. Comment: The Feasibility Study states that the consolidation and capping alternative is fully protective of human health and the environment. Therefore it should be the selected remedy.

Response: The Feasibility Study does provide that consolidation and capping meets this criteria. However, when EPA selects a remedy, it evaluates the various alternatives against all nine criteria and selects a remedy that has the proper balance between all the criteria. The capping and consolidation remedy was not selected because it does not provide an acceptable level of long term permanence and protection of the ground water compared to the selected remedy.

6. Comment: At the February Open House, EPA representatives stated that there was "very little chance" of onsite incineration.

Response: The purpose of the February Open House was to discuss the findings of the Remedial Investigation, not to discuss the results of the Feasibility Study, which had yet to be completed. At that time, preliminary review of treatability test results indicated that the sieve and wash and biological treatment technologies might meet EPA remedial requirements. However, further review of the alternative technologies indicated that these treatment technologies, alone, would not be sufficient to destroy site contaminants to acceptable levels. Since the incineration alternative is the only alternative identified in the

Feasibility Study capable of destroying the site's contamination to acceptable levels, it was selected as the appropriate remedy.

7. Question: Did EPA consider bioremediation using Flavobacterium and would it be possible to bioremediate during the construction of the incinerator?

Response: Yes, Flavobacterium was added to the indigenous organisms during treatability testing during the Feasibility Study (Feasibility Study Report, Volume II, page 7-1). As mentioned above, the biological treatment alternative did not meet EPA remedial requirements. It would be impractical to design, construct and implement a bioremedial system while constructing the incinerator. The incinerator itself will effectively destroy the contaminants present in the soil and the effort involved with bioremediating the contaminated material first would be counterproductive and unnecessary.

8. Comment: Mass Merchandisers, Inc.(MMI) stated that EPA had, at an earlier meeting between MMI and EPA, agreed that the affected soils should be consolidated and capped.

Response: EPA never made this agreement at an earlier meeting or at any other time. In fact, EPA conveyed to MMI at an earlier meeting that consolidation and capping did not appear to be appropriate and that it would be very unlikely that this alternative would be selected as the site's remedy.

9. Comment: MMI disagrees with EPA's concern that a sinkhole could develop under the capped, contaminated soil, allowing the untreated hazardous materials to migrate into the ground water. They feel that this should not be a reason to reject the consolidation and capping alternative they proposed.

Response: Capping some of the most highly contaminated materials at the site, as preferred by MMI was rejected by EPA because it does not meet the preference for permanent treatment to the maximum extent practicable, as specified by CERCLA. Capping such materials does not provide adequate long term protection. The site investigation indicated that the geology is complex, not well understood, and that sinkholes while not common, could occur below capped materials. This degree of uncertainty stressed the need to comply with the CERCLA preference for permanent treatment.

10. Comment: MMI stated that the levels and types of dioxin at the site do not pose a risk to human health.

Response: EPA disagrees with this assessment. EPA toxicologists have adopted an internationally recognized policy that relates the less toxic forms of dioxin to the most toxic form, using toxicity factors. The dioxin types present on-site are indeed less toxic than the most toxic form, but are present in sufficiently high concentrations to pose a risk to human health.

11. Comment: There is a clear trend in scientific opinion that the risk to human health due to dioxin is overstated.

Response: At present, there is a large amount of discussion in the scientific community, including EPA scientists, regarding the potency of dioxin as a human carcinogen. However, EPA's approach in estimating risks to human health posed by dioxins, and other hazardous substances at the site, is well established and scientifically sound.

12. Comment: MMI believes that every possible alternative should be explored before an incinerator is constructed.

Response: MMI, with EPA oversight, conducted a Feasibility Study to explore a wide range of possible remedial alternatives for this site. MMI also submitted, in writing, a number of additional alternatives they requested EPA evaluate. EPA has evaluated all of the alternatives in both the FS and those submitted by MMI and has selected a remedy it believes will safely and in a cost effective manner, destroy the threats at the site.

13. Question: Since the ground water from New Cricket Spring is showing a decrease in contamination, why is excavation and incineration necessary?

Response: While it is true that New Cricket Spring appears to be showing a slight decrease in contamination, this factor is not a true indication of the threats posed by the site. On-site levels of contamination are sufficiently high to warrant the degree of remedial action selected. The selected remedy will permanently rid the site of contamination above health based levels, and will provide long-term protection to the ground water and surrounding environment.

14. Question: Wouldn't rainfall cause the contamination to spread during the excavation of the soils before incineration?

Response: Runoff from the site during the excavation activities will be collected and treated if necessary to meet NPDES requirements to minimize the possibility of contamination spreading offsite during the remedial action.

15. Question: What are the contaminant levels coming out of New Cricket Spring compared to drinking water standards?

Response: The only contaminant found in New Cricket Spring is pentachlorophenol (PCP). The drinking water standard (expressed as a Maximum Concentration Limit, or MCL) for PCP is 1.01 mg/l. The levels found at New Cricket Spring during the Remedial Investigation were from 1.0 - 2.3 mg/l.

16. Question: After the remediation, what will the site be able to be used for?

Response: The remediation goals were set assuming an industrial use. The site will be able to be used for businesses but not for residential purposes.

17. Question: Because the contamination has been there so long, is it likely that much of the contamination has already degraded or run off the site?

Response: While it is possible that some contamination has run offsite, very little contamination was found offsite during the investigation. Some of the site contamination may have degraded. Regardless, enough contamination remains onsite to warrant the remedial action selected.

18. Question: What type of emission controls are included on the incinerators?

Response: The gasses from combustion in the incinerator are typically treated to remove inorganic acid gasses and particulate matter. Particulate matter can be removed with several devices. One of the oldest methods is baghouse filtration which involves passing the gas through a material that collects the particulate matter. Another method involves electrostatic precipitators. The particulate matter in the gas is electrically charged and collects on plates that are oppositely charged. The particulate matter is then cleaned from the plates. Still another approach is the venturi scrubber. Venturi scrubbers use high pressure water to remove the particulate matter. Hydrogen chloride gasses that result from the incineration of chlorinated compounds (such as PCP and dioxins) are typically removed using other types of scrubber devices, such as packed bed, spray tower, and plate tower scrubbers. These scrubbers bring alkaline water and the combustion gasses together, providing the greatest possible contact between the water and the gasses. This allows the hydrogen chloride gas to dissolve in and be neutralized by the alkaline water.

19. Question: Will the incinerator have an afterburner?

Response: In order to ensure complete combustion of all waste constituents, an afterburner, or any other equivalent devise, is included in all incinerators of hazardous waste.

20. Question: Will my home (the Rose Birmingham residence) be placed on the city water line and who will pay the water bill?

Response: The Birmingham well is included as one of the private wells to be placed on the city water line. Individual homeowners will be responsible for paying the water bills.

21. Question: When will the site be cleaned up?

Response: It will likely be a couple of years before construction of the remedy begins. This time will be used to attempt to negotiate a settlement with the Potentially Responsible Parties (PRPs), and to design the actual remedy. Once the design is complete, remedial construction can begin. Actual site remediation will likely take between two and three years.

22. Question: Will local residents get priority jobs relating to the site's remediation?

Response: If the site work is conducted by the Federal government, then the services required for the work will be procured according to the Federal Acquisition Regulations (FAR). Under the regulation, local businesses are not given a priority over other businesses. Under the regulations, only minority businesses and businesses owned by women are given a priority. However, in the competitive bidding process under FAR, local businesses often have an advantage over others since they are located near the site.

23. Question: Can and/or will hazardous waste from outside the Arkwood site be brought to the site and incinerated? Why not take the contaminated material to the incinerator that has been constructed in Jacksonville, Arkansas?

Response: Because the Jacksonville site is not a permitted commercial disposal facility, waste from the Arkwood site can not be accepted for incineration. In addition federal regulations only allow wastes from one Superfund site to be brought to another if the sites are near one another and the wastes from the sites are similar. Since no other Superfund sites are near the Arkwood site, it is unlikely that wastes from outside the Arkwood site will be incinerated at the

site. Because of the same regulations, the Arkwood wastes can not be taken to the incinerator in Jacksonville.

24. Question: Portions of the school playground were backfilled with soils taken from the site. Has, or will, the playground be tested?

Response: At this time EPA does not plan any soil testing at the playground. Further investigation regarding this issue revealed that all soils that were excavated from the site and used as backfill at the playground were taken from an area on the site that was still in its natural, undisturbed state, located approximately 30 feet above the plant site and treated wood storage areas. Consequently, the fill removed from this area would never have been affected by plant operations or rainwater runoff from the plant site.

25. Question: Were there downstream core samples taken from Cricket Creek?

Response: Sediment samples were collected from Cricket Creek 155 feet above and 165 feet below the confluence of Cricket Creek and Cricket Spring Channel. Sediment samples were also collected in Cricket Spring Channel at approximately 600-foot intervals between New Cricket Spring and the confluence of Cricket Spring channel with Cricket Creek. No contamination was detected during this part of the investigation.

26. Question: Were there any offsite samples taken from the railroad tracks?

Response: No samples were taken <u>on</u> the railroad tracks. However, offsite samples taken <u>near</u> the railroad track did not reveal any site-related contamination.

27. Question: Does contamination in New Cricket Spring increase with flow, such as after a rainfall event?

Response: Sampling of the Spring following rainfall showed the contamination to increase slightly at first and then to quickly decrease as the Spring flow increased.

28. Question: Is there an estimate of how much contamination is in the ground below the surface soils and will there be any future studies to determine this?

Response: Results of the remedial investigation show that approximately 20,800 cubic yards of soils exceed the health based cleanup levels. However, the materials are, for the most part, within a couple feet of the ground surface. Some additional contamination may have migrated to greater depths

but due to the karst geology, it is not possible to define where and if this has occurred. It should be stressed that the selected remedy will destroy the majority of site contaminants and eliminate the source of contamination, thereby providing long term protection.

29. Question: Is the original well for the site contaminated?

Response: No. This well was tested six times, and no site related contaminants were found.

30. Comment: Incineration is an unacceptable solution because if the incinerator allows 1 lb. of hazardous material to release into the atmosphere per 10,000 lbs. of material treated then a total of 3,468 lbs. of hazardous materials will be released.

Response: This assumption is factually incorrect. The incinerator will be required to destroy or remove, before emitting any gasses, at least 99.99% of the hazardous substances fed into the incinerator. The commentor is basing his calculation on the incorrect idea that the material to be incinerated is 100% contaminated. Since the feed to the incinerator will contain contamination in the parts per million range, the emissions will be extremely small.

The following are questions and comments received in writing during the public comment period from Mass Merchandisers, Inc.:

1. Comment: Conditions at the Arkwood Site pose no significant risk to human health and the environment.

Response: Both the Endangerment Assessment (EA) and the remedial investigation (RI) demonstrated that the site does pose a risk to the public health and the environment. The EA indicated that the excess lifetime cancer risk from the Main Site for the worst-case residential scenario is approximately one excess cancer case in a thousand individuals (10^{-3}), using outdated Toxicity Equivalency Factors (TEFs) and four excess cancer cases in a thousand individuals (4×10^{-3}), using the new TEFs. These risk levels exceed the EPA acceptable risk range established in the National Contingency Plan of one excess cancer case in ten thousand individuals (10^{-4}) to one excess cancer case in a million individuals (10^{-6}). The revised calculations using the new TEFs for the most probable future land use

resulted in a calculated risk of approximately one excess cancer case in ten thousand individuals (10^{-4}). This risk level is at the upper end of the EPA acceptable risk range. The calculations, using the new TEFs, for the Railroad Ditch for the most probable land use conditions are the maximum future land use conditions (an increased frequency of exposure to the ditch by children), result in a calculated risk of one excess cancer case in ten thousand individuals (10^{-4}) and two excess cancer cases in ten thousand individuals (2×10^{-4}), respectively. These risk levels are at the upper end, and above the EPA acceptable risk range. Furthermore, the RI demonstrated that the site contained 2,3,7,8 TCDD equivalents above the accepted levels for industrial uses, and far beyond that for any residential use. The RI also demonstrated that the site had contaminated area groundwater above the maximum contaminant levels (MCL).

2. Comment: The new TEF's have not undergone formal adoption through Agency rulemaking or any comparable legal process.

Response: EPA is under no obligation to establish policies through a formal rulemaking process. The concept of using TEFs for chlorinated dibenzo-p-dioxins and -dibenzofurans was peer reviewed and recommended by two Agency wide groups, the Risk Assessment Forum and the Science Advisory Board. The new TEFs (1989 Update) were peer reviewed by the Risk Assessment Forum and were specified for use by a memorandum from F. Henry Habicht II (Deputy Administrator, EPA), Chair, Risk Assessment Council, to the EPA Assistant and Regional Administrators (March 21, 1990).

3. Comment: MMI indicated that the EPA recalculations of the Toxicity Equivalency Factors (TEFs) for dioxins and dibenzofurans were not consistent with the Endangerment Assessment (EA).

Response: The EPA calculations using the new TEFs were done in a manner consistent with both the EA and EPA policy. Both the EA and the EPA "calculations" used the geometric mean of the dioxin and dibenzofuran concentrations.

4. Comment: The EPA made the unilateral decision to recalculate the risk estimate using new TEF values without notifying MMI.

Response: EPA is under no obligation (legally or otherwise) to inform or consult with MMI or any other PRP before making any risk calculations. A memorandum from F. Henry Habicht II to the Assistant and Regional Administrators (March 21, 1990) specified the use of the new TEFs.

5. Comment: The EPA disregarded site specific conditions when proposing the dioxin cleanup levels of 20 ppb.

Response: EPA evaluated the possible future uses of the site in selecting its cleanup goals. This evaluation concluded that while the site is currently unused, it could be used for industrial purposes. Based upon this possible use, EPA selected the 20 ppb cleanup goal, which is the accepted cleanup goal for industrial uses as established by the Agency for Toxic Substances and Disease Registry.

6. Comment: The proposed plan is incorrect in its statement that the majority of the site risk is from dioxins and dibenzofurans.

Response: The Endangerment Assessment indicated that the majority of the excess cancer risk from the railroad ditch and main site is attributed to dioxins and dibenzofurans. EPA calculations using the new TEFs further increased the risk due to the dioxins and dibenzofurans.

7. Comment: MMI contends that classification of dioxin as a probable cancer causing agent is unsubstantiated.

Response: The EPA wide Carcinogenic Risk Assessment Verification Endeavor (CRAVE) Workgroup classifies dioxin as a group B2, probable human carcinogen. Classifications verified by CRAVE Workgroup have undergone extensive peer review and represent an Agency consensus.

8. Comment: In the submission of Appendix A (Evaluation of the 1989 Endangerment Assessment for Arkwood), MMI contends that the dioxin-related risks at the main site and railroad ditch are on the order of 10^{-8} or lower.

Response: MMI contracted with a firm to critique the 1989 Endangerment Assessment which was performed by MMI, with EPA oversight. The critique attacks the Endangerment Assessment for having used calculations and assumptions that are consistent with EPA policies and guidance, and advocates the use of calculations and assumptions that are contrary to EPA policies and guidance. These result in calculated risks many orders of magnitude below those calculated by MMI in the Endangerment Assessment.

EPA Endangerment Assessment policies and guidance that were developed to implement the National Contingency Plan, were subjected to cross-program peer review. The paragraphs below discuss the most important assumptions and calculations advocated in the critique, but that are contrary to EPA policies and guidance.

In Appendix A, Section 3 of the critique (Selection of Indicator Chemicals), octachlorinated dibenzo-p-dioxin (OCDD) and other compounds of concern, such as carcinogenic PNAs are not included as part of the carcinogenic risk at the site. The omission of these compounds in the risk calculations results in a significant understatement site risks. According to EPA policy and guidance, and the Arkwood EA, the compounds should be included in the risk calculations.

A cancer potency factor for 2,3,7,8-tetrachlorinated dibenzo-p-dioxin (2,3,7,8-TCDD) of 9,700 $(mg/kg\text{-}day)^{-1}$ is presented in Appendix A, Section 5 of the critique (Dose Response Assessment). This cancer potency factor or slope factor has not been verified by the CRAVE workgroup and is not in accordance with EPA policy. The EPA slope factor for 2,3,7,8-TCDD is 1.56×10^5 $(mg/kg\text{-}day)^{-1}$.

Several exposure parameters used in Appendix A, Section 6 (Exposure Assessment) are not in accordance with EPA guidance. The MMI submission used soil ingestion rates of 5 mg/day for older children and adults; whereas, EPA guidance (OSWER Directive 9850.4) recommends soil ingestion rates of 100 mg/day for older children and adults. The MMI submission used a soil 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.

In Appendix A, Section 7 (Calculation of Exposure Point Concentrations), the arithmetic mean is used as representative contaminant concentrations. The Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual states that actions at Superfund site should be based on the reasonable maximum exposure (RME). Because of the uncertainty associated with sampling, the 95 percent upper confident limit on the arithmetic average is now being used by EPA as a conservative estimate of the exposure concentration contacted over time. Use of the 95 percent upper confidence limit was not used by MMI at the time the EA was completed, and thus was not used in the EA. However, if the EA were to be conducted today, the 95 percent upper limit would likely be used and the calculated risks at the site would increase.

As a result of the assumptions used in the critique, the MMI submission calculates the potential dioxin risks at the site on the order of one excess cancer case in 100 million individuals (10^{-8}). In contrast, the Endangerment Assessment and the subsequent EPA calculations, which were conducted in accordance with EPA guidance, indicate that MMI

submission underestimates site risks by a factor of approximately 10,000.

9. Comment: MMI contends that there is no scientific basis of the Toxicity Equivalency Factors (TEFs) for octachlorinated dibenzo-p-dioxins (OCDD).

Response: In the new TEF approach, OCDD was assigned TEF value of 0.001. This value was based on a recent study by Couture et al. (1988) in which male rats were exposed to low levels of OCDD for 13 weeks. At the end of the study, the animals exhibited signs of toxicity reminiscent of "dioxin toxicity." Based on these results, a TEF value of 0.001 has been assigned to OCDD in the new TEF approach. The new TEFs were peer reviewed by the Risk Assessment Forum and were specified for use by a memorandum from F. Henry Habicht II to the Assistant and Regional Administrators (March 21, 1990).

10. Comment: In the submission of Appendix E, MMI suggests that 50 ppm of carcinogenic polycyclic aromatic hydrocarbons (PAHs) would be associated with a 10^{-6} excess cancer risk under the most probable future land use conditions at the Arkwood site.

Response: Several exposure parameters used in Appendix E, Section 2 (Exposure Assessment) are not in accordance with EPA guidance. The MMI submission used soil ingestion rates of 25 mg/day for children aged 0 to 6 years, and 5 mg/day for older children and adults; whereas, 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. The MMI submission used a soil 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. These inconsistencies and others suggest that 50 ppm of carcinogenic PAH is not an acceptable remediation goal. In addition, MMI used the draft document "Guidance for Establishing Target Cleanup Levels for Soils at Hazardous Waste Sites" (1988) in calculating their remediation goal. This guidance has not been formally released by EPA and does not represent Agency policy.

11. Comment: The results of the Treatability Study clearly indicate that sieve and wash is a cost-effective means of reducing the volume of contaminants to be dealt with. Sieve and wash should be included as a pre-treatment step before any treatment remedy that might be selected at the Arkwood site.

Response: Sieve and wash has been added to the selected remedy.

12. Comment: MMI opposes the incineration of all affected material at the Arkwood, Inc. site as presented in the Proposed Plan of Action. MMI proposed that any selected alternative include "sieve and wash" as part of the remedy.

Response: The remedy in the ROD includes sieve and wash as part of the remedial action. Therefore, the selected remedy does not include incineration of the entire mass of contaminated material.

13. Comment: The water line that is being installed eliminates any risk due to possible future contamination of nearby domestic wells.

Response: The Superfund law (the Comprehensive Environmental Response, Compensation and Liability Act, CERCLA), and the National Contingency Plan (NCP) specify a strong preference for the permanent treatment of hazardous substances that pose a threat to human health and the environment. Installing water lines, in lieu of treatment, does not satisfy this preference. In addition, Section 300.430 of the NCP states that institutional controls shall not be used as a substitute for treatment. Therefore, MMI's argument is contrary to the goals of the Superfund law and regulations.

14. Comment: MMI submits that further study is warranted in this case due to the unexpected concern about dioxin and catastrophic sinkhole development expressed after completion and approval of the Remedial Investigation and Feasibility Study Reports.

Response: Further study is not warranted. The RI characterized site contamination and the Feasibility Study evaluated a wide range of alternatives that enabled EPA to select a cost-effective, implementable alternative that will meet the CERCLA preference for permanence through treatment. Both the RI and FS reports discuss the uncertainty and complexity of the site geology. Throughout the RI and FS reports, concerns regarding the sinkhole and karst geology are repeated. In addition, the Endangerment Assessment identified dioxin as being responsible for the majority of the site's risk.

15. Comment: MMI contends that EPA has suggested that incineration is the only acceptable remedial alternative for soils containing greater than 20 ppb. However, EPA has selected containment of such soils at

three sites: the Diamond-Alkali, Selma Pressure Treating Co., and Broderick Wood Products sites.

Response: While the RODs for these sites did include containment as part of the selected remedy, at two of these sites, Diamond-Alkali and Broderick Wood Products, containment is considered only an interim measure. At the Diamond-Alkali site the soils are being capped onsite, and the ROD requires that a feasibility study be performed every two years until a final remedy is selected. At the Broderick Wood Products site, the majority of the site contamination is K001 waste (wood-treating waste) and is being incinerated onsite. The remainder of the site contamination is being placed into a temporary storage facility for further evaluation prior to the selection of the final remedy if the volume is more than 2,500 yds^3; if it is less, it will be incinerated onsite along with the other site waste.

The Selma Pressure Treating remedy required solidification and capping of wastes that were contaminated by heavy metals and dioxin. However this remedy is not considered to be appropriate for comparison with the Arkwood site since the Selma remediation was driven by heavy metals contamination which would have required solidification even in the absence of dioxin contamination.

16. Comment: EPA's concerns relative to catastrophic sinkhole failure are not consistent with the accumulated knowledge regarding the geology of the Arkwood site and vicinity.

Response: The potential for sinkhole formation is not the predominant reason why EPA rejected the capping of high concentrations of hazardous substances, as preferred by MMI. Sinkhole formation is, however, a consideration. The CERCLA preference for remedies that permanently treat wastes to the maximum extent practicable is the main reason why EPA rejects capping the majority of the site waste. The knowledge gained during the RI indicates that the area geology is too complex to define, that ground water migration pathways are unknown, and will remain so, and that the possibility of sinkhole formation does exist. This possibility, although low, underscores the need to comply with the CERCLA preference for permanent treatment.

17. Comment: MMI contends that Alternative D (Incinerate Sludges/Cap in Place Affected Soils) is an

appropriate remedy for the Arkwood, Inc. site. Based upon the investigations of the area's geology, the potential for sinkhole development is so low as to not be considered reasonable. Furthermore, consolidate and cap-in-place has been selected as the remedy at a similar site within Region 6, at the Mid-South Wood site.

Response: See response to comment number 16 regarding sinkholes. In addition, the remedy selected in 1986 at the Mid-South site was done so under the requirements of CERCLA, prior to the reauthorization of CERCLA. When CERCLA was reauthorized, it was amended to include a strong preference for permanently treating wastes to the maximum extent practicable. Alternative D does not satisfy this preference. While the Mid-South ROD was signed after the reauthorization of CERCLA, a provision was made to allow those remedies developed just prior to the reauthorization of CERCLA, to be selected according to the requirements of CERCLA.

18. Comment: Alternative D, Incinerate Sludges/Consolidate and Cap Affected Soils, fully satisfies all significant remedial concerns.

Response: Alternative D does not adequately satisfy all of the nine criteria for evaluating remedies. It does not adequately satisfy the criteria of permanence and long-term effectiveness because high concentrations of hazardous substances would remain untreated and pose a long-term threat. In addition, Alternative D does not include treatment to the maximum extent practicable, as preferred by CERCLA.

19. Comment: MMI contends that a refinement of Alternative D, "D+2" (Incinerate Sludges/Consolidate and Stabilize Soils/Cap-In-Place Affected Soil and Provide Stormwater Controls) will address the concerns that exist for Alternative D. This will be done through soil stabilization/solidification to immobilize the dioxins and render the soils into a non-flowable mass and through surface water drainage controls to preclude the formation of sinkholes under the consolidated mass of affected soils.

Response: Alternative "D+2" is unacceptable because it does not meet the CERCLA preference for permanent treatment of hazardous substances to the maximum extent practicable. This alternative would leave high concentrations of waste in place, and thus, would not provide for long-term protection of public health and the environment. In addition, treatability tests

conducted during the feasibility study indicated that stabilizing the Arkwood soils actually increased the mobility of the PCP. Since the site has already contaminated ground water with PCP, this remedy is unacceptable.

20. Comment: EPA rejected a more cost effective remedy for the Arkwood site, i.e., biological treatment followed by solidification, that was recently proposed at another wood treatment site in Region 6. Effective treatment of the dioxin could be achieved by stabilization after biological treatment.

Response: First, the selected remedy for the Arkwood site is sieve and wash followed by incineration. Cost estimates by MMI indicate that this remedy has a cost of approximately $10.3 million. MMI estimated the cost of the biological treatment remedy, without solidification, in the FS at approximately $14 million. However, during a meeting between MMI and EPA, MMI stated that the FS probably overstated the biological reaction time required in this alternative and instead of the 56 days assumed as necessary in the FS, 14 days may be enough reaction time. MMI did not provide EPA with a revised cost estimate for the shorter reaction time, but estimates by EPA and it's oversight contractor indicate the sieve and wash, biological treatment, and solidification remedy would still cost over $9 million. The selected remedy for a relatively modest cost increase provides for more permanent and complete destruction of the site contaminants.

Second, the other Region 6 site referred to is the Texarkana Wood site. At the Texarkana Wood site, EPA proposed two possible remedies: An incineration remedy; and a biological treatment remedy. The remedy selected was the incineration remedy because it provided for more complete destruction of the site hazardous substances.

21. Comment: MMI requests that the agency defer final remedy selection and allow MMI to conduct a focused Feasibility Study of a remedy based upon sieve and wash plus in situ vitrification (ISV).

Response: MMI conducted the RI/FS and could have considered ISV as an alternative. MMI has noted , however, that when it was conducting the RI/FS, ISV was found to not be commercially practicable alternative. Even today, ISV is, compared to incineration, in its infancy as a remedial alternative. EPA has weighed the benefits of delaying remedy selection to conduct a

focused feasibility study, versus the benefits of selecting a remedy now, and has determined that little benefit would be gained by conducting a focused feasibility study. Therefore, EPA has selected a sieve and wash, followed by incineration, remedy. The only benefit to be gained by conducting a focused feasibility study is that the study might show that in-situ vitrification could work and that it could be selected as a remedy. However, this would result in a significant delay in site remediation with nothing gained in the protection of human health and the environment. ISV has yet to be implemented on a large scale for the destruction of organics. Enough treatability testing has not been conducted to eliminate the unknowns and uncertainties that exist regarding its ability to effectively and safely destroy dioxins and other organics similar to the contaminants found at the Arkwood site. Major concerns regarding ISV that would apply at the Arkwood site include the possible lateral migration of vaporized organics into adjacent soils and the effectiveness of off-gas collection and treatment. Because of the unknowns and uncertainties, a focused FS would require extensive treatability testing for this site. Recent EPA experience at the Northwest Transformer site, in Everson, Washington, has shown that such extensive treatability testing could take more than a year and cost hundreds of thousands of dollars. In addition, the results from a similar FS at the Arkwood site may not yield sufficient information on which to base a decision to implement ISV, but instead, only indicate a need to increase the scale of testing.

If ISV was successfully tested and selected as the remedy, nothing would be gained in protecting the public health and the environment by selecting ISV because incineration has been demonstrated numerous times to safely and effectively destroy organics such as those found at the Arkwood site. Past incineration projects have shown that emissions can be safely controlled. Effective ISV emissions control, that would be necessary at the Arkwood site, have not been proven to work on a large scale. Furthermore, cost estimates from MMI indicate that the cost of incineration (approximately $10.3 million) will be comparable or lower than that for ISV (approximately $11.8 million). Since ISV has never been used on a large scale, cost overruns are very likely. In contrast, past experience with incineration enables far more reliable cost estimates to be made. Therefore, incineration may also be more cost-effective than ISV.

22. Comment: MMI contends that Alternative H (Incinerate Sludges and Affected Soils On-site) is critically defective in two of the "primary balancing criteria" used to weigh major trade-offs among feasible alternatives -- implementability, because incineration is complex to implement, and cost-effectiveness. MMI also contends that this alternative lacks community acceptance.

Response: The selected remedy (sieve and wash, followed by incineration) is both implementable and cost effective. It does, however, appear to lack community acceptance. Incineration of contaminated soils is a proven remedial alternative. While it is a technically complex procedure, it has been successfully and safely implemented at numerous other locations. Past experience has shown that materials handling of the feed to incinerators is the most difficult implementation problem. However, the sieve and wash process will greatly reduce materials handling problems by reducing the volume to be incinerated and by creating a very uniform media to be incinerated.

Sieve and wash with incineration was estimated by MMI to cost $10,300,000. Sieve and wash with biological treatment was estimated by MMI, in the FS, to cost approximately $14,000,000 (without including the cost for solidification). However, as discussed earlier in the Responsiveness summary, MMI has indicated that the reaction time required for biological treatment may be shorter than assessed in the FS and therefore, costs may be lower. EPA and it's contractor have estimated that a sieve and wash, biological treatment (with shorter reaction times), and solidification remedy will still cost over $10 million. Since there is a substantial benefit gained with the degree of destruction achieved by incineration, compared to the partial destruction (and no destruction of dioxins) achieved with biological treatment, incineration is cost effective compared to biological treatment. Regarding the inadequacies of capping remedies, see responses to comments #17, 18, and 19. Given the previously discussed inadequacies of capping remedies, the selected remedy is obviously cost effective.

Regarding community acceptance, EPA believes that by adding the sieve and wash process and thereby reducing the volume to be incinerated and the time required for incineration, the selected remedy will gain public acceptance. EPA also believes that as the community learns more about the safety and capabilities of modern

incinerators that it will further accept the incineration remedy.

23. Comment: MMI commented that the Administrative Record was incomplete and should include a number of documents.

Response: The listing of the documents to be included were broken into three separate categories. The response is therefore also broken into these three categories.

Miscellaneous Matters

Documents numbered 1, 3, 6, 8, 9, 12-16, 19-23, 26, 27, 29, and 32-34, have been reviewed and placed into the Administrative Record for the site.

Documents numbered 2, 4, 5, 7, 10, 11, 17, 18, 24, 25, 28, 30, and 31 are not included because they consist of either comments to draft documents, or responses to comments regarding draft documents. EPA policy is not to include draft documents in the Administrative Record, because they do not reflect final agency position with regard to the selection of remedy.

Documents Dealing Specifically With Project Schedule

The documents regarding the schedule are not relevant to EPA's selection of remedy, and are, therefore, not included in the Administrative Record.

Draft or Final Reports and Plans

Draft documents and any redline versions submitted by a PRP or their contractor do not reflect final Agency position with regard to the selection of remedy and, therefore, are not included in the Administrative Record. Documents numbered 1,2,4-8,10-15, and 18 are draft or redline and are not included. Document number 9 is final and will be included in the final Administrative Record. Documents number 3, and 16 are included in the Administrative Record, but were not included in the index. Document number 17 is included on in the Record as index document number 7997-8201, dated 5/23/90.