RECORD OF DECISION
OPERABLE UNIT 2
GROUNDWATER REMEDIATION

AMERICAN CREOSOTE WORKS, INC.

Pensacola, Escambia County, Florida

Prepared By

Environmental Protection Agency

Region IV

Atlanta, Georgia

RECORD OF DECISION
OPERABLE UNIT 2
AMERICAN CREOSOTE WORKS, INC. SITE

I. DECLARATION

SITE NAME AND LOCATION

American Creosote Works, Inc.
Pensacola, Escambia County, Florida

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operable Unit 2 at the American Creosote Works, Inc. (ACW) site in Pensacola, Florida, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (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 Florida Department of Environmental Protection (FDEP) has provided input as the support agency throughout the remedy selection process. Based on FDEP's comments to date, EPA expects that concurrence on this remedy will be forthcoming, although a formal concurrence letter has not yet been received.

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 REMEDY

The remedy selected by EPA for the American Creosote Works site will be conducted in two operable units. Operable Unit 1 addresses contaminated soils and sludges which represent the source of contamination at the site. Operable Unit 2, presented in this ROD, will address groundwater contamination at the site.

The selected remedy for Operable Unit 2 consists of two phases. The first phase, involving recovery and disposal of dense non-aqueous phase liquids (DNAPLs), includes the following components:

- o Enhanced DNAPL recovery using a combination of water, alkaline, surfactant, and polymer flooding
- o DNAPL/water separation and groundwater treatment
- o Off-site transport and recycling of recovered DNAPL and reinjection of treated groundwater

- o Periodic groundwater monitoring to evaluate DNAPL recovery efficiency
- o Sampling, plugging, and abandoning private wells for which owner consent is granted
- o Implementation of State-imposed well permit restrictions

Based on the results of periodic monitoring data compiled during the five year review, EPA will determine whether to continue enhanced recovery of DNAPLs or to implement the second phase of the Operable Unit 2 remedy to address residual groundwater contamination in the aquifer. The components of this second phase of the remedy are listed below:

- o Groundwater removal via extraction wells
- o On-site treatment of contaminated groundwater
- o Nutrient and hydrogen peroxide addition to treated water
- o Reinjection of treated groundwater (including nutrients) into the contaminated portion of the aquifer to stimulate in-situ biological treatment activity
- o Dewatering of waste sludge from the treatment process and disposal at an off-site RCRA landfill
- o Periodic groundwater and surface water monitoring to evaluate treatment system performance

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy may result in hazardous substances remaining in the groundwater above health-based levels, a review will be conducted every five years after commencement of remedial action to evaluate system performance and ensure that the remedy continues to provide adequate protection of human health and the environment.

February 3, 1994
Date

Patrick M Tobin
for John H. Hankinson
Regional Administrator
U.S. EPA Region IV

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II. DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

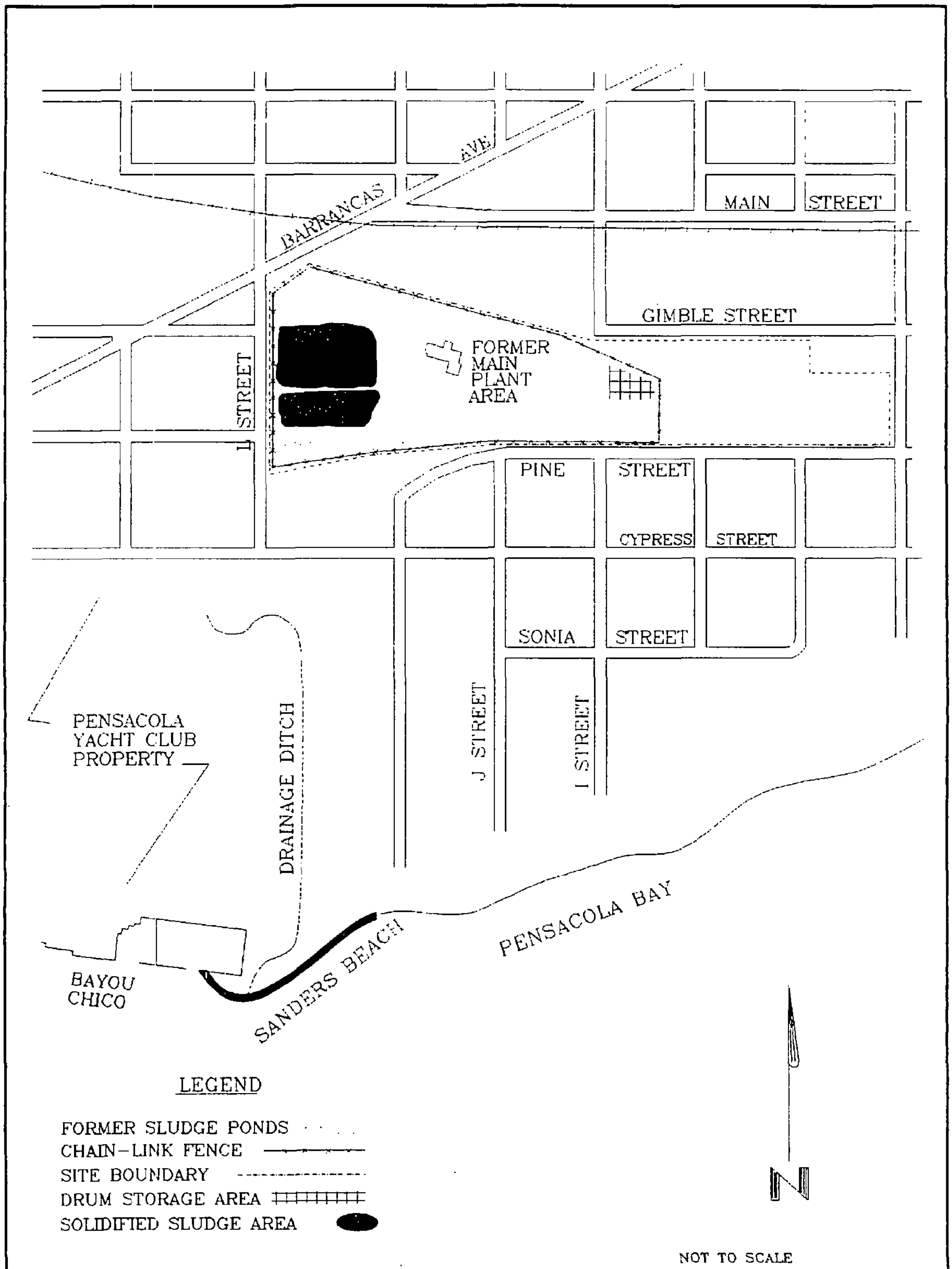
The American Creosote Works, Inc. (ACW) site occupies 18 acres in a moderately dense commercial and residential district in Pensacola, Florida. The site is located about one mile southwest of the intersection of Garden and Palafox Streets in downtown Pensacola and is approximately 600 yards north of Pensacola Bay and Bayou Chico. Immediately north of the site is a lumber company, an auto body shop, an appliance sales and repair shop, and a wire storage area. The Pensacola Yacht Club is southwest of the site. Residential neighborhoods are immediately adjacent to the site on the east and south, with the nearest residence located approximately 50 feet from the site boundary. A general site location map is provided as Figure 1.

The ACW site is nearly flat, with elevations ranging between 12 and 14 feet above sea level. The land slopes gently southward at about 25 feet per mile toward Pensacola Bay. The site is about 2,100 feet long, east to west, and an average of 390 feet wide, north to south. Primary access to the plant is from Barrancas Avenue. Originally, a railroad spur line of Burlington Northern Railroad traversed the plant from west to east. The majority of site buildings, process tanks, and equipment were situated near the center of the site in an area designated as the main plant area. A few small work sheds, miscellaneous equipment, and debris were situated around the remainder of the site. The railroad spur and all of the process equipment and buildings have been removed. At present, only the main building foundation and approximately 200 drums containing investigation-derived wastes remain on-site.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Wood-preserving operations were carried out at the ACW site from 1902 until December 1981. Prior to 1950, creosote was used exclusively to treat poles. Use of pentachlorophenol (PCP) started in 1950 and increased in the later years of the ACW operations.

Four former surface impoundments were located in the western portion of the ACW site. The Main and Overflow ponds, located adjacent to "L" Street, were used for disposal of process wastes. During its years of operation, ACW discharged liquid process wastes into the two unlined surface impoundments. Prior to about 1970, wastewaters in these ponds were allowed to overflow through a spillway and follow a drainage course into Bayou Chico and Pensacola Bay. In subsequent years, liquid wastes were periodically drawn off the larger impoundments and allowed to accumulate in the smaller Railroad Impoundment and Holding Pond, or were spread out on the designated "Spillage Area" on-site. Additional discharges occurred during periods of heavy rainfall and flooding, when the ponds overflowed the containment dikes.



EPA	GENERAL SITE LAYOUT	AMERICAN CREOSOTE WORKS, INC. PENSACOLA, FL	FIGURE 1

In March 1980, the City of Pensacola found considerable quantities of an oily creosote-like material in the groundwater near the intersection of "L" and Cypress Streets. In July 1981, the U.S. Geological Survey (USGS) installed nine groundwater monitor wells in the vicinity of the ACW site. Samples taken from those wells revealed that a contaminant plume was moving in a southerly direction toward Pensacola Bay. In October 1981, EPA proposed the site for inclusion on the National Priority List (NPL), a list of abandoned or unregulated hazardous waste sites eligible for attention under the CERCLA long-term cleanup program. The site's listing was finalized on September 8, 1983.

In February 1983, EPA conducted an investigation which included sampling and analysis of on-site soils, wastewater sludges, sediment in area drainage ditches, and existing groundwater from on-site and off-site monitoring wells. Analytical results indicated that the major contaminants in the groundwater and on-site soils were polynuclear aromatic hydrocarbons (PAHs), which are common to creosote. Among the various surface water and sediment locations that were sampled, only the drainage ditch on the Pensacola Yacht Club (PYC) property showed contaminants associated with the ACW site. Analytical results indicated that inorganic contaminants were not present in significant concentrations.

Because of the threat posed to human health and the environment by frequent overflows from the waste ponds, the EPA Region IV Emergency Response and Control Section performed an immediate cleanup during September to October 1983. The immediate cleanup work included dewatering the two large lagoons (main and overflow ponds), treatment of the wastewater, and discharge to the City of Pensacola sewer system. The sludge in the lagoon was then stabilized with lime and fly ash, and a temporary clay cap was placed over the stabilized material. The Florida Department of Environmental Regulation (FDER), the predecessor agency to FDEP, also assisted during the cleanup.

In 1985, EPA completed a remedial investigation and feasibility study (RI/FS) under CERCLA. Samples were collected from local surface water, sediment, existing USGS monitor wells, residential wells, newly installed monitor wells, and on-site and off-site surface soils. Analytical results indicated that on-site and off-site surface soils, the drainage ditch on the Pensacola Yacht Club property, and groundwater were contaminated with PAHs, phenols, and volatile organic compounds.

Based on this study, EPA signed a ROD in September 1985 which selected a remedy for all on-site and off-site contaminated surface soils, sludges, and sediments to be placed in an on-site hazardous waste landfill. Groundwater remediation was not included. However, the State of Florida did not agree with this decision, citing the need for additional information. Consequently, EPA initiated another study in 1988 (known as the Post-RI) to provide further information on the extent of contamination in surface soils. Over 125 organic compounds were detected on and around the ACW site during this investigation. Indicator groups of contaminants were selected to simplify the data discussion. These included carcinogenic PAHs, noncarcinogenic PAHs, phenols, pentachlorophenol, dioxins/dibenzofurans, and phthalates.

Following the Post-RI, EPA prepared a revised risk assessment and a supplemental alternatives evaluation (the Post-FS) and selected a new cleanup remedy in September 1989 which called for bioremediation of surface soils. The ROD specified that treatability studies would be conducted during the design phase to determine the most effective type of biological treatment. These studies demonstrated that bioremediation would not be effective for addressing all contaminants in site soils, so EPA anticipates selecting another remedy in a ROD amendment in 1994.

In March 1990, EPA completed Phase II of the Post-RI which addressed contamination in groundwater, solidified sludge, and subsurface soils. A total of 63 samples were collected including 23 groundwater samples, 17 sediment samples, 15 subsurface soil samples, and 8 surface soil samples. The groundwater, sediment, subsurface soil, and one surface soil sample were analyzed for purgeable and extractable organic compounds. Seven on-site surface soil samples were analyzed for total dioxins. Results of the analyses indicated the presence of elevated concentrations of numerous organic compounds and dioxins in one or more environmental media (soil, surface water, groundwater, or sediments).

EPA completed Phase III of the Post-RI in January 1991 to further characterize and verify the extent of organic contamination in the groundwater and dioxin contamination in the on-site and off-site soil (down to a depth of 18 inches). During this investigation, a total of 16 samples were collected including 4 groundwater samples, 8 on-site soil samples, and 4 off-site surface soil samples. A variety of organic compounds and dioxins were detected.

Finally, EPA conducted a focused groundwater investigation (Phase IV) in May 1993 to evaluate the presence of dioxin in groundwater. Samples were collected from 10 wells screened in the shallow, intermediate, and deep zones of the aquifer along the axis of the known contaminant plume. Dioxins were detected at very low levels (0.0092 ng/l TEQ) in only one well completed in the deep zone directly beneath the site.

EPA completed a Baseline Risk Assessment in August 1993 to evaluate potential risks associated with groundwater, solidified sludge, and subsurface soils. A summary of the risks associated with contaminated groundwater at the site is presented in Section 6.0.

Enforcement Summary

The earliest documented incident of a release of any type from the ACW plant occurred in the summer of 1978, when a spill of liquids flowed onto a nearby street and then onto the property of a yacht sales company. A flood in March 1979 resulted in a similar spill. These incidents resulted in increased regulatory attention to ACW by FDER.

In 1980, ACW filed an incomplete application with FDER for construction of an industrial wastewater treatment system. FDER issued a Notice of Violation (NOV) for corrective action in 1981, alleging contamination of soils and groundwater. This enforcement action called for ACW to cease operations until a permit was issued, submit a restoration plan, install a groundwater monitoring system, and remove contaminated soils. In January 1981, FDER completed a responsible party search, a title search, and a financial assessment for the site, and in March 1981, FDER and ACW entered into an administrative consent order which incorporated the previous NOV requirements and allowed ACW to continue operations. The Order included schedules for completing construction of the wastewater treatment system and meeting the other NOV requirements.

Throughout 1981 and 1982, FDER encountered difficulty with ACW's compliance efforts, and in March 1982, ACW announced that environmental regulations were forcing the company to go out of business. As a result, FDER filed a Petition for Enforcement and Agency Action and a Complaint for Permanent Injunction and Civil Penalties in April 1982 because of ACW's failure to make progress toward compliance. One month later, in May 1982, ACW, Inc. of Florida filed for reorganization in bankruptcy court. In 1984, the court presented a final court stipulation for the approval of the litigants. The stipulation provided that half of the proceeds of any sale or lease of the ACW property would go to EPA and FDER. The remaining 50 percent would go to Savings Life Insurance Company which holds a mortgage on the property in the principal sum of $675,000. The stipulation was finalized and entered by the court in 1988.

In 1985, EPA sent a notice letter to Burlington Northern Railroad requesting removal of a railroad spur line along their right of way on the site. The railroad company completed this work in 1986.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

In accordance with Sections 113 and 117 of CERCLA, as amended, EPA has conducted community relations activities at the ACW site to solicit community input and ensure that the public remains informed about site activities. EPA has relied on a number of methods for keeping the public informed, including press releases, fact sheets, public meetings, establishment of an information repository, and public comment periods.

EPA's earliest community outreach effort was a press release related to the emergency removal activities in 1983. Periodic fact sheets were issued during 1984 and 1985 to update the community concerning studies being conducted at the site. In September 1985, EPA issued fact sheets and press releases announcing a public meeting and comment period related to the proposed plan for addressing source contamination at the site. Similarly, in 1989, EPA issued a fact sheet and held a public meeting to discuss the revised source control remedy. In 1990, EPA prepared an Explanation of Significant Differences (ESD) notifying the public of additional tasks that would be necessary to implement the 1989 ROD. Later, in March 1991, a fact sheet was published to advise the public of the initiation of these site preparation activities which included cap repair, drum characterization, fence repairs, well closure, and building demolition.

More recently, EPA conducted a door-to-door survey in September 1993 in the neighborhood surrounding the site to update its mailing list. EPA's Proposed Plan for Operable Unit 2 was sent to the public in November 1993, and the administrative record for the site was made available in the public repository at the West Florida Regional Library. A notice was published in the Pensacola News Journal on November 28 and 30, 1993 advising the public of the availability of the administrative record and the date of the upcoming public meeting. On December 2, 1993, EPA held a public meeting to answer questions and receive comments on EPA's preferred alternative for addressing groundwater contamination at the site. A public comment period was held from November 12, 1993 to January 11, 1994, and a response to any significant oral or written comments received during this period is included in the Responsiveness Summary in Section III of this ROD.

This decision document presents the selected remedial action for contaminated groundwater at the ACW site in Pensacola, Florida, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP. This decision is based on the Administrative Record for the site.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

As with many Superfund sites, the problems at the ACW site are complex. As a result, EPA has organized the remedial work into two smaller units, referred to as operable units. Operable Unit 1 addresses contaminated soils and sludges which represent the source of contamination at the site. Operable Unit 2, presented in this ROD, will address groundwater contamination at the site. The selected remedy for Operable Unit 2 will be conducted in two phases. The first phase will involve recovery and disposal of DNAPLs, and the second phase will involve remediation of dissolved contamination in the groundwater. The selected remedy is consistent with plans for future work to be conducted at the site.

In 1989, EPA selected bioremediation for cleaning up on-site surface soil contamination. However, following further testing of this technology, EPA determined this remedy might not be fully effective for all contamination in site surface soils. Therefore, EPA plans to issue an amended ROD for Operable Unit 1 in 1994 which selects a more suitable remediation strategy. This amended ROD will also address subsurface soil contamination and solidified sludges.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 General Site Characteristics

Pensacola lies within the Coastal Lowlands, or subdivision of a major physiographic division of the United States known as the Coastal Plain Province. The Coastal Lowlands are relatively undissected, nearly level, and lie about 100 feet or less above sea level. The only distinctive topographic features of the Lowlands are the step-like Pleistocene marine terraces, which descend from the north, southward to the coastline. The area is situated on a somewhat hilly, sandy slope which borders Bayou Chico and Pensacola Bay. The bay is separated from the Gulf of Mexico by a long narrow island that forms a natural breakwater for the harbor. Most surface water drainage in the area is by overland sheet flow through the streets and storm drains south of the site to Pensacola Bay, and by way of the drainage ditch on the Yacht Club property.

The Gulf of Mexico, situated about 6 miles south of Pensacola Bay, moderates the climate of Pensacola by tempering the cold northern winds of winter and causing cool sea breezes during the daytime in summer. The average temperature for the summer months is around 80 degrees with an average daily range of 12.5 degrees. Temperatures of 90 degrees or higher occur on an average of 39 times yearly. A temperature of 100 degrees or higher occurs occasionally. The average winter temperature is in the low to mid 50s with an average daily range of 15.7 degrees. Severe cold waves are infrequent.

Rainfall is usually well distributed through the year with the greatest frequency normally being in July and August. The greatest average monthly rainfall occurs in July, and the lowest occurs in October. Seriously destructive hurricanes are occasionally experienced in the vicinity. Hurricanes historically occur from early July to mid-October.

The groundwater in the vicinity of the ACW site contains three major aquifers: a shallow aquifer which is both confined and unconfined (the Sand-and-Gravel Aquifer), and two deep confined aquifers (the upper and lower limestones of the Floridan Aquifer). The Sand-and-Gravel Aquifer and upper limestone of the Floridan Aquifer are separated by a thick section of relatively impermeable clay called the Pensacola Clay.

The Sand-and-Gravel Aquifer is the only freshwater aquifer in central and southern Escambia County and is the source of public water supply for the area, including the City of Pensacola. The aquifer is exposed at the surface throughout Escambia County and deepens to as much as 1,100 feet thick. It extends north and west from Pensacola into Alabama and is recognized as far eastward as the Chactawhatchee River (about 78 miles).

The water bearing zone underlying the ACW site area is composed primarily of sand with many interbedded layers and lenses of clay and sandy clay. These clay layers and lenses range from less than an inch to approximately 38 feet in thickness. Based on characteristics of the sands in these areas, the water-bearing zone can be divided into two distinct strata. The sand in the upper 25 feet below land surface (b.l.s.) of sediment varies in grain size from fine to coarse and in density from loose to dense. These variations in grain size and density are important, since these are a factor in the seepage rate of water through the sediment.

The sand at depths greater than 25 feet b.l.s. to a depth of about 200 feet is predominantly a very dense sand, usually fine to medium grained, with variable amounts of silt. Discontinuous clay and sandy clay nodules and lenses occur throughout the deep sand. No stratigraphic correlations can be determined between the clay lenses found in the various borings.

Two massive clay formations exist in the water-bearing zone in the site area. One clay layer is directly under the ACW ponds at a depth of about 100 feet b.l.s. This clay appears to be continuous under the ACW pond area, although it does pinch out south of the site. South of the site, a second massive clay layer approximately 38 feet thick underlies the Pensacola Yacht Club property at a depth of about 20 feet b.l.s., and extends south to the Pensacola Bay. This second clay pinches out before reaching the ACW site.

There are three recognizable geologic subunits within the Sand-and-Gravel aquifer in the site area. The uppermost subunit includes the terrace sands, with shallow wells to approximately 25 feet b.l.s., which provide relatively small yields of less than 50 gallons per minute (gpm). The middle subunit includes the Citronelle Formation, where water supply wells extend 50 to 150 feet b.l.s. in depth, and have yields ranging from 50 to several hundred gpm. The lowest subunit includes the Miocene Coarse Clastics and the lower portion of the Citronelle Formation, where wells are over 200 feet b.l.s. in depth and have yields ranging from 1,000 to 2,000 gpm.

Water-level measurements from wells installed north of the 20-foot deep clay layer to depths of less than 100 feet indicate that the groundwater within the upper 100 feet is unconfined. Water-levels from 20-foot deep and 60-foot deep wells indicate similar groundwater elevations. South of the site where the 20-foot deep clay layer is present, water levels below the clay layer show groundwater elevations 0.5 to 3 feet higher than groundwater elevations in the sand overlying this clay layer. This difference in hydraulic head indicates that groundwater below the 20-foot clay layer is confined. This water-level difference also suggests that an upward gradient exists. The ultimate fate of groundwater below the 20-foot clay is upward migration to the overlying sand and discharge to Pensacola Bay and Bayou Chico. The groundwater below the 100-foot clay is also under water-table conditions, with little difference between wells above and below this clay layer. This deeper clay contains profuse layers and lenses of clayey sand which allow hydrologic communication between the two sand units.

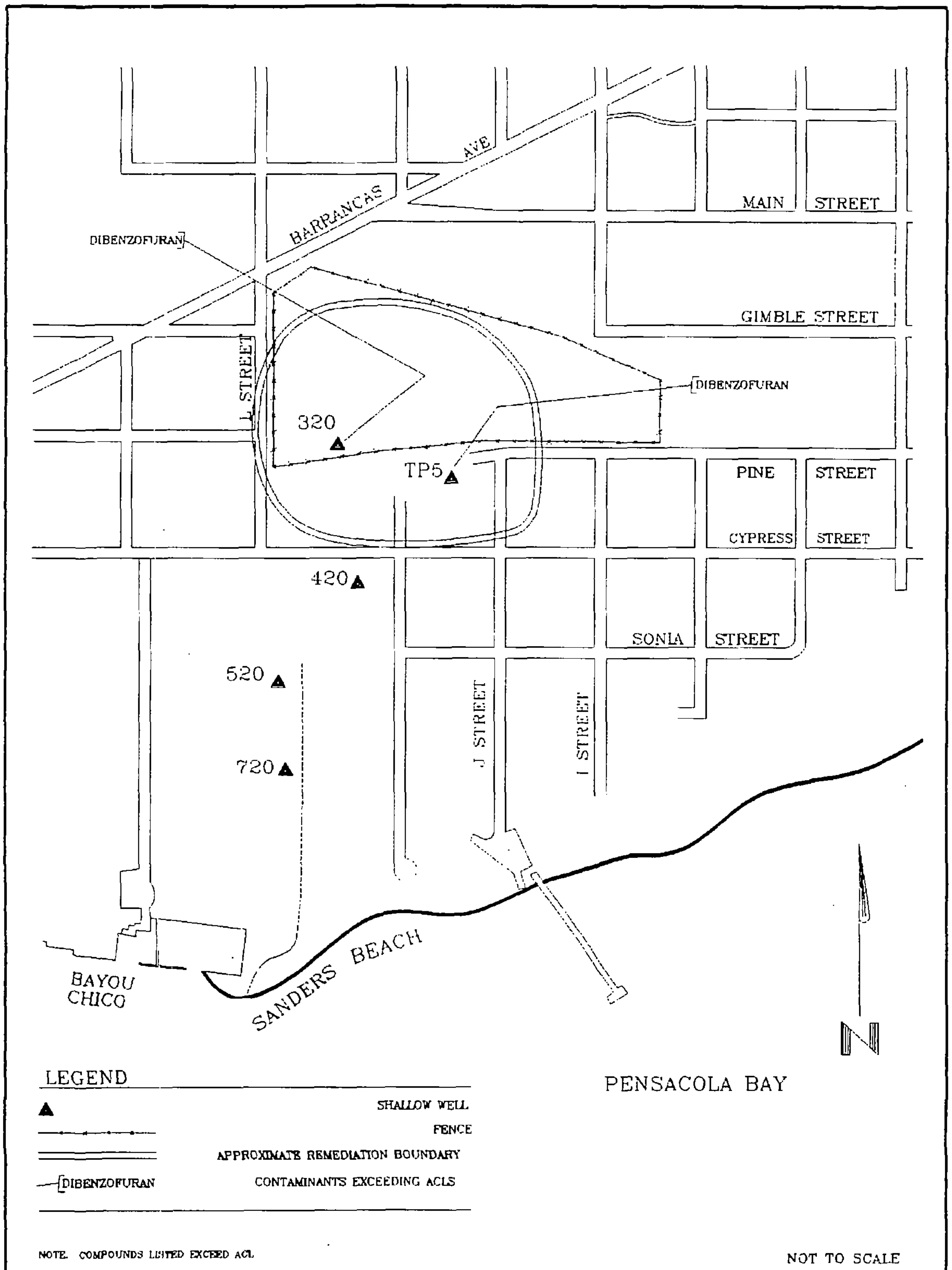
The direction of groundwater flow is to the south with discharge to Pensacola Bay. Portions of the shallow groundwater appear to discharge to a drainage ditch on the Pensacola Yacht Club property, which subsequently drains into Pensacola Bay at the mouth of Bayou Chico. The aquifer is recharged by local rainfall, with relatively high infiltration rates because of the sandy nature of the aquifer and overlying soils. Annual recharge is 0 to 10 inches per year.

There are no public water supply wells in the immediate vicinity of the ACW site, making this portion of the Sand-and-Gravel aquifer a Class G-II groundwater under Florida Administrative Code (FAC) 17-520.410. The nearest well field belongs to the City of Pensacola, located approximately a mile north of the site. The cones of influence of these wells do not reach the ACW site, and these wells are not affected by site contamination. The People's Crystal Ice Company, located upgradient of the site at 1511 W. Government Street, does operate a well for ice production. Samples were collected from a nest of wells near the ice company well, and results indicated the presence of very low levels of phenol to a depth of 100 ft. However, the well is 190 ft. deep, and it is sampled annually to comply with permit requirements.

5.2 Results of Groundwater Investigations

In order to facilitate discussions of groundwater contamination at the ACW site, EPA refers to three zones within the Sand-and-Gravel aquifer known as the shallow zone, intermediate zone, and deep zone. The shallow zone represents groundwater at depths of up to 30 feet b.l.s. The intermediate zone extends from 30 feet to 70 feet b.l.s., and the deep zone includes groundwater at depths greater than 70 feet. These zone descriptions have no geologic significance, but they provide a convenient way of referencing data from specific depths within the aquifer.

Contamination in the shallow zone appears to be limited to the area below and immediately downgradient of the ACW site. The primary sources of this contamination were the four former wastewater lagoons on the ACW property. Although EPA drained these lagoons, stabilized the sludges, and placed a clay cap over the stabilized material in 1983, these concentrated wastes may continue to serve as a contaminant source for the shallow groundwater. Volatile organic compounds (VOCs), phenols, and (PAHs) were detected in wells installed in this zone. EPA also observed a separate DNAPL layer of oil and creosote in this zone. The limits of contamination in the shallow zone above remedial goals is illustrated in Figure 2.



SHALLOW ZONE CONTAMINATION ABOVE REMEDIAL GOALS

AMERICAN CREOSOTE WORKS, INC
PENSACOLA, FL

FIGURE 2

The intermediate zone appears to have the highest level of contamination. The highest contaminant concentrations were detected on-site immediately downgradient of the former sludge ponds. VOCs, phenols, and PAHs were detected at levels above standards protective of human health. VOCs, phenols, and PAHs were also found in significant concentrations off-site in the direction of groundwater flow. The contaminant plume containing these compounds has extended past Sonia Street, and it is approaching Pensacola Bay. A DNAPL layer was also observed in this zone. The extent of contamination above remedial goals in the intermediate zone is illustrated in Figure 3.

PAHs, VOCs, and phenols have also been detected in significant concentrations in the deep zone. However, VOC/phenol contamination has migrated further downgradient than PAH contamination. The majority of the PAH contamination was found on-site and immediately downgradient from the site. In contrast, VOC and phenol contamination was detected in a well just north of Pensacola Bay and Bayou Chico. The extent of contamination above remedial goals in the deep zone is illustrated in Figure 4.

Based on the data available to date, EPA estimates that 152 million gallons of groundwater will require treatment. While 7.25 million gallons of DNAPL are estimated to be present in the saturated zone, EPA expects that only 2 million gallons (approximately 30 percent) of this material can be recovered. However, further investigations will be necessary during the design to refine these volume estimates.

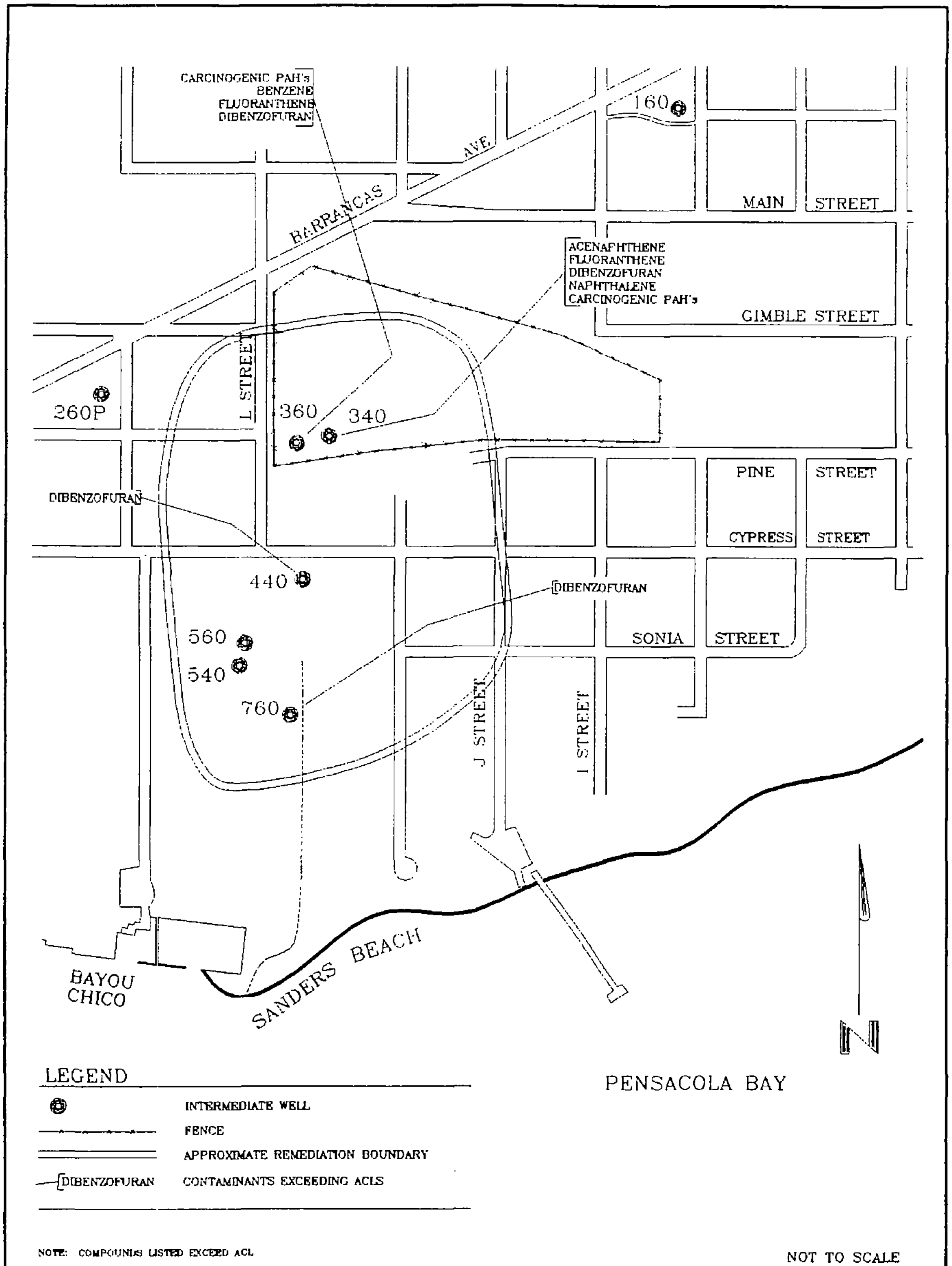
6.0 SUMMARY OF SITE RISKS

6.1 Human Health Risks

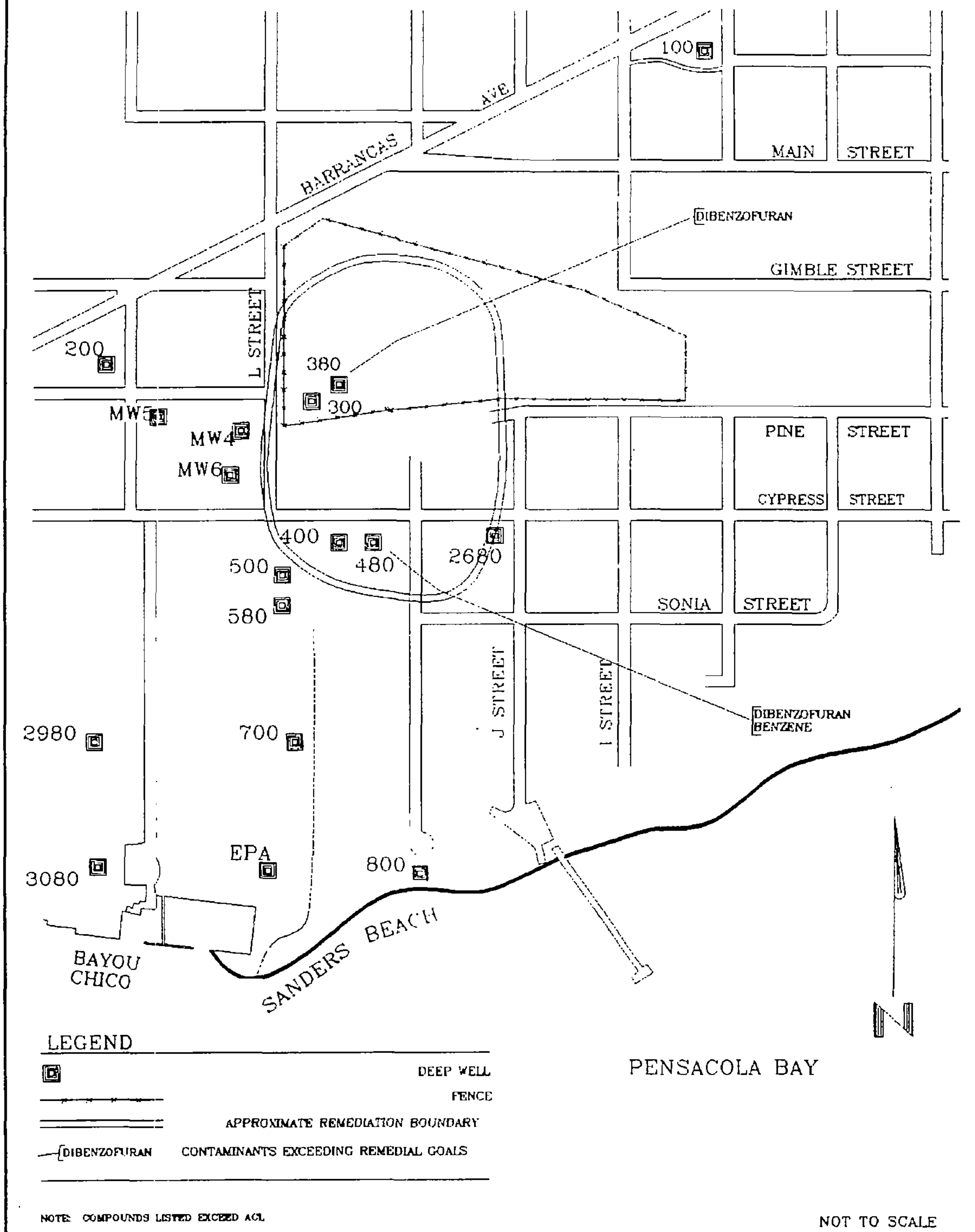
In order to evaluate whether existing or future exposure to contaminated groundwater could pose a risk to people or the environment, EPA completed a Baseline Risk Assessment (BRA) in August 1993. In estimating potential site risks, EPA assumed no further action would be taken to address contamination at the site. This evaluation then served as a baseline for determining whether cleanup of each site media was necessary. In the BRA, EPA evaluated site risks for several environmental media. However, this ROD addresses only the risks attributable to chemicals in the groundwater at the ACW site. The risk assessment included the following major components: contaminants of concern, exposure assessment, toxicity assessment, and risk characterization.

6.1.1 Contaminants of Concern

Chemicals are included in the Summary of Site Risks section as contaminants of concern if the results of the risk assessment indicate that the contaminant might pose a significant current or future risk. Contaminants of concern are those compounds that contribute to a pathway that exceeds a 1×10^{-4} risk or a Hazard Index



EPA	INTERMEDIATE ZONE CONTAMINATION ABOVE REMEDIAL GOALS	AMERICAN CREOSOTE WORKS, INC. PENSACOLA, FLORIDA	FIGURE 3



EPA

DEEP ZONE CONTAMINATION ABOVE REMEDIAL GOALS

AMERICAN CREOSOTE WORKS, INC
PENSACOLA, FL

FIGURE 4

(HI) of 1. Chemicals contributing risk to these pathways were not included if their individual carcinogenic risk contribution was less than $1x10^{-6}$ or their noncarcinogenic Hazard Quotient (HQ) was less than 0.1. In addition, chemicals were included if they exceeded either State or Federal ARARs. A list of contaminants of concern for groundwater and their associated exposure point concentrations is shown in Table 1. The exposure point concentration for each contaminant was derived using the 95 percent upper confidence limit (UCL) on the arithmetic mean as defined by the following formula:

$$95\%\ UCL = \bar{X} + \sigma_n \times 1.96$$

where: $\bar{X}$ = arithmetic mean of the data
σ_n = standard deviation of the data

If the 95% UCL resulted in a concentration higher than the maximum concentration detected, the maximum concentration detected was used as the exposure point concentration. In order to provide an accurate assessment of risk from the site, EPA calculated exposure point concentrations using sampling results from the Phase II Post-RI, which provided the most current and complete set of groundwater data available.

The site is currently abandoned. However, it was assumed for the purposes of the BRA that future development could result in the site itself becoming residential, since it is currently surrounded on the south and east by residential properties. The groundwater is not currently used for drinking water since the area is serviced by the City of Pensacola potable water supply system. However, EPA assumed in the BRA that the groundwater could be used for drinking water and other potable uses in the future in the event existing institutional controls designed to prevent or limit groundwater use were not enforced. Additionally, private wells which have been documented to exist in the area are currently used for irrigation purposes.

6.1.2 Exposure Assessment

In the exposure assessment, EPA considered ways in which people could come into contact with contaminated groundwater under both current and future conditions. EPA determined that there is no exposure to contaminated groundwater under current conditions. However, under potential future scenarios, both existing off-site residents and hypothetical on-site residents could be exposed if groundwater were used as a potable water source. It was assumed that people could potentially drink and bathe with this water, resulting in exposure through the ingestion, dermal contact, and inhalation pathways. In addition to evaluating future adult resident exposure, EPA considered potential exposure for a child resident, since children generally represent a more sensitive population. Final lifetime risk estimates were then calculated by summing the risks derived from both adult and child exposures.

Table 1
Contaminants of Concern and
Exposure Point Concentrations

Contaminant of Concern	Exposure Point Concentration (mg/1)[a]	
	Future Off-site Residents	Future On-site Residents
Carcinogenic PAHs (total)	81	330
Benzo(b and/or k)Fluoranthene	24	96
Benzo(a)Anthracene	30	120
Chrysene	27	110
Naphthalene	580	1,400
Acenaphthene	320	760
Dibenzofuran	240	560
Fluorene	300	710
Phenanthrene	830	2,000
Anthracene	37	150
Fluoranthene	270	1,100
Pyrene	170	690
Bis(2-ethylhexyl)Phthalate	0.02[b]	.015
2-Methylphenol	4.3	7.7[b]
(3-and/or 4-)Methylphenol	20	38[b]
Phenol	6.4	25
2,4-Dimethylphenol	7.3	11[b]
Pentachlorophenol	1.9	3.9[b]
1,2,4-Trichlorobenzene	1.0	--
Carbazole	0.9	1.0[b]
Quinoline	7.6	20[b]
Benzene	0.09	.10[b]
Cis-1,2-Dichloroethene	0.87	--
Methyl Ethyl Ketone	0.10	.14[b]
Styrene	0.03	.04[b]

Contaminant of Concern	**Exposure Point Concentration (mg/l)**[a]	
	Future Off-site Residents	**Future On-site Residents**
Trans-1,2-Dichloroethene	0.34	--
Vinyl Chloride	0.26	--

[a] Results rounded to two significant figures
[b] Maximum concentration detected was used as exposure point concentration
-- Compound was not detected in on-site groundwater

The exposure assumptions for each pathway are provided in Table 2. The same exposure assumptions were used for both off-site and on-site adult residents. Similarly, the same assumptions were used for both off-site and on-site child residents. Based on the exposure point concentrations derived from site data for the compounds shown in Table 1 and using the exposure assumptions identified in Table 2, EPA estimated the average daily intake (DI) associated with each exposure pathway and population combination. The formulas used to calculate the DI for each pathway are provided in Table 3.

6.1.3 Toxicity Assessment

The toxicity assessment evaluated possible harmful effects of exposure to each contaminant of concern. A number of compounds found at the site, including benzene, PAHs, pentachlorophenol (PCP), and dioxins, have the potential to cause cancer (carcinogenic). Slope factors (SFs) have been developed by EPA's Carcinogenic Assessment Group for estimating lifetime cancer risks associated with exposure to potentially carcinogenic compounds. These SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Slope factors are derived from results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied. The SFs for the carcinogenic contaminants of concern are contained in Table 4.

Other contaminants of concern, such as dibenzofuran, may cause other problems not related to cancer. Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to contaminants of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of contaminants of concern from contaminated groundwater can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (to account for the use of animal data to predict effects on humans). The RfDs for the noncarcinogenic contaminants of concern are also provided in Table 4.

As an interim procedure until more definitive Agency guidance is established, Region IV has adopted a toxicity equivalency factor (TEF) methodology for evaluating chlorinated dioxins and furans. This methodology relates the relative potency of each dioxin or furan congener to the potency of 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD), the most toxic dioxin compound. The TEFs for the dioxins/furans are presented in Appendix A.

Table 2
Exposure Assumptions for
Future On-site and Off-site Residents
Exposed to Contaminated Groundwater

Parameter	**Assumed Value**	
	Adult Residents	**Child Residents**
Standard Assumptions		
Exposure Frequency (EF)	350 days/yr[a]	350 days/yr[a]
Exposure Duration (ED)	chronic: 12 years lifetime: 24 years	chronic: 6 years
Body Weight (BW)	70 kg	16 kg
Averaging Time (AT)	chronic: 4,380 days lifetime: 25,550 days	chronic: 2,190 days lifetime: 25,550 days
Ingestion Pathway		
Ingestion Rate (IR)	2.0 L/day	1.4 L/day
Dermal Contact Pathway		
Skin Surface Area (SA)	18,150 cm^2	7,195 cm^2
Exposure Time (ET)	0.2 hr/day	0.2 hr/day
Conversion Factor for Water (CF)	1L/1000 cm^3	1L/1000 cm^3
Inhalation Pathway		
Inhalation Rate (IR)	0.6 m^3/hr	0.6 m^3/hr
Exposure Time (ET)	0.2 hr/day	0.2 hr/day

[a] Assumes people are not home during 2 weeks of vacation per year

Table 3
Daily Intake (DI) Formulas

Ingestion Pathway

$$DI=\frac{CS\times IR\times EF\times ED}{BW\times AT}$$

where:	***DI***	=	average daily intake (mg/kg/day)
	CS	=	exposure point concentration (mg/L)
	IR	=	ingestion rate (L/day)
	EF	=	exposure frequency (days/yr)
	ED	=	exposure duration (years)
	BW	=	body weight (kg)
	AT	=	averaging time (days)

Dermal Contact Pathway

$$DI=\frac{CS\times SA\times PC\times ET\times EF\times ED\times CF}{BW\times AT}$$

where:	***DI***	=	average daily absorbed dose (mg/kg/day)
	CS	=	exposure point concentration (mg/L)
	SA	=	skin surface area available for contact (cm^2)
	PC	=	permeability constant (cm/hr)
	ET	=	exposure time (hours/day)
	EF	=	exposure frequency (days/yr)
	ED	=	exposure duration (years)
	CF	=	volumetric conversion factor for water (1L/1000 cm^3)
	BW	=	body weight (kg)
	AT	=	averaging time (days)

Inhalation Pathway

$$DI=\frac{CS\times IR\times ET\times EF\times ED}{BW\times AT}$$

where:	***DI***	=	average daily intake (mg/kg/day)
	CS	=	exposure point concentration (mg/L)
	IR	=	inhalation rate (m^3/hour)
	ET	=	exposure time (hours/day)
	EF	=	exposure frequency (days/yr)
	ED	=	exposure duration (years)
	BW	=	body weight (kg)
	AT	=	averaging time (days)

Table 4
Toxicity Values for
Contaminants of Concern

Weight of Evidence for Cancer	Contaminant of Concern	ORAL			INHALATION		
		Cancer SF	Chronic RfD	Reference	Cancer SF	Chronic RfD	Reference
	Naphthalene		4.0E-03	HEAST			
	Acenaphthene		6.0E-02	IRIS			
D	Dibenzofuran		1.0E-02	HEAST			
D	Fluorene		4.0E-02	IRIS			
	Phenanthrene						
D	Anthracene		3.0E-01	IRIS			
D	Fluoranthene		4.0E-02	IRIS			
D	Pyrene		3.0E-02	IRIS			
B2	Benzo(a)pyrene[1]	7.3E+00		IRIS			
B2	Benzo(b and/or k)fluoranthene	7.3E+00		*			
B2	Benzo(a)anthracene	7.3E+00		*	6.1E+00		HEAST
B2	Chrysene	7.3E+00		*			
B2	Bis(2-ethylhexyl)phthalate	1.4E-02	2.0E-02	IRIS			
	2-Methylphenol		5.0E-02	IRIS			
	(3-and/or 4-)Methylphenol		5.0E-02	IRIS			
D	Phenol		6.0E-01	IRIS			
	2,4-Dimethylphenol		2.0E-02	IRIS			
B2	Pentachlorophenol	1.2E-01	3.0E-02	IRIS			
	1,2,4-Trichlorobenzene		1.3E-03	HEAST		9.0E-03	HEAST
B2	Carbazole	2.0E-02		HEAST			

Table 4
(continued)

Weight of Evidence for Cancer	Contaminant of Concern	ORAL			INHALATION		
		Cancer SF	Chronic RfD	Reference	Cancer SF	Chronic RfD	Reference
C	Quinoline	1.2E+01		HEAST			
A	Benzene	2.9E-02		IRIS	2.9E-02		HEAST
	Cis-2,3-Dichloroethene		1.0E-02	IRIS			
D	Methyl Ethyl Ketone		5.0E-02	IRIS		1.0E+00	IRIS
B2	Styrene	3.0E-02	2.0E-01	IRIS		1.0E+00	IRIS
	Trans-1,2-Dichloroethene		2.0E-02	IRIS			
A	Vinyl Chloride	1.9E+00		HEAST	3.0E-01		HEAST
B	2,3,7,8-TCDD (equivalents)	1.5E+05		IRIS	1.5E+05		IRIS

IRIS Integrated Risk Information System
HEAST Health Effects Assessment Summary Tables

1 Although Benzo(a)pyrene (BaP) was not detected in groundwater, EPA customarily relates the potency of other carcinogenic PAHs to the toxicity of BaP. For the ACW site, it was assumed that each carcinogenic PAH was as potent as BaP.

* Since no slope factor exists for this compound, the slope factor for BaP was used. This is a conservative assumption, since the other PAHs are considered less toxic than BaP.

6.1.4 **Risk Characterization**

The centerpiece of the BRA is the risk characterization, which combines the other components of the evaluation to estimate the overall risk from exposure to site contamination. For cancer-causing compounds, risk is a probability that is expressed in scientific notation. For example, an excess lifetime cancer risk of 1×10^{-6} means that an individual has an additional 1 in 1,000,000 chance of developing cancer as a result of site-related exposure over an estimated 70 year lifetime. EPA has established a target risk range for Superfund cleanups of between 1×10^{-4} (1 in 10,000) and 1×10^{-6}. The formula used for calculating cancer risks is shown below:

$$\text{Risk} = \text{DI} \times \text{SF}$$

where:

risk	=	a unitless probability of an individual developing cancer
DI	=	chronic daily intake averaged over 70 years (mg/kg-day)
SF	=	slope-factor, expressed as $(\text{mg/kg-day})^{-1}$.

Estimated cancer risks associated with potential future potable use of groundwater at the ACW site are extremely high, approaching 1.0 for the ingestion and dermal contact exposure pathways for both on-site and off-site residents. These "upper bound" probability estimates predict that an individual exposed to the concentrations and exposure rates assumed in the BRA will contract cancer. These risks are primarily associated with PAHs in the groundwater. Inhalation risks for both on-site and off-site residents were associated with VOC contamination. A summary of the cancer risks for each contaminant of concern is presented in Table 5. Total cancer risks for each population group evaluated are provided in Table 6.

For compounds which cause toxic effects other than cancer, EPA compared the average concentration of a contaminant found at the site with a reference dose representing the maximum amount of a chemical a person could be exposed to without experiencing harmful effects. The ratio of the average daily intake to the reference dose is called a hazard quotient (HQ). The formula for calculating the HQ is shown below:

$$\text{Noncancer HQ} = \text{DI}/\text{RfD}$$

where:

DI	=	chronic daily intake
RfD	=	reference dose

DI and RfD are expressed in the same units (mg/kg-day) and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Table 5
Individual Risks Associated with Contaminants of Concern[1]

Contaminants of Concern	Hazard Quotients						Cancer Risks					
	On-site Groundwater			Off-site Groundwater			On-site Groundwater			Off-site Groundwater		
	Ingest. (Child)	Dermal (Child)	Inhal. (Child)	Ingest. (Child)	Dermal (Child)	Inhal. (Child)	Ingest. (Adult)	Dermal (Adult)	Inhal. (Child)	Ingest. (Adult)	Dermal (Adult)	Inhal. (Child)
Naphthalene	30,000	4,000	--	10,000	2,000	--	--	--	--	--	--	--
Acenaphthene	1,000	300	--	400	100	--	--	--	--	--	--	--
Dibenzofuran	5,000	1,000	--	2,000	600	--	--	--	--	--	--	--
Fluorene	1,000	500	--	600	200	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	40	20	--	10	5	--	--	--	--	--	--	--
Fluoranthene	2,000	2,000	--	600	400	--	--	--	--	--	--	--
Pyrene	2,000	1,000	--	500	300	--	--	--	--	--	--	--
Benzo(b and/or k)fluoranthene	--	--	--	--	--	--	1.0E+00	1.0E+00	--	1.0E+00	1.0E+00	--
Benzo(a)anthracene	--	--	--	--	--	--	1.0E+00	1.0E+00	--	1.0E+00	1.0E+00	--
Chrysene	--	--	--	--	--	--	1.0E+00	1.0E+00	--	1.0E+00	1.0E+00	--
Bis(2-ethylhexyl)phthalate	0.06	0.003	--	0.08	0.004	--	2.0E-06	1.7E-07	--	2.6E-06	2.3E-07	--
2-Methylphenol	10	0.04	--	7	0.02	--	--	--	--	--	--	--
(3-and/or 4-)Methylphenol	60	0.4	--	30	0.2	--	--	--	--	--	--	--
Phenol	4	0.04	--	0.9	0.01	--	--	--	--	--	--	--
2,4-Dimethylphenol	50	1	--	30	0.9	--	--	--	--	--	--	--
Pentachlorophenol	10	10	--	5	7	--	4.4E-03	1.0E-02	--	2.1E-03	5.0E-03	--
1,2,4-Trichlorobenzene	0	0	0	60	10	10	--	--	--	--	--	--

Table 5
(continued)

Contaminants of Concern	Hazard Quotients						Cancer Risks					
	On-site Groundwater			Off-site Groundwater			On-site Groundwater			Off-site Groundwater		
	Ingest. (Child)	Dermal (Child)	Inhal. (Child)	Ingest. (Child)	Dermal (Child)	Inhal. (Child)	Ingest. (Adult)	Dermal (Adult)	Inhal. (Child)	Ingest. (Adult)	Dermal (Adult)	Inhal. (Child)
Carbazole	--	--	--	--	--	--	1.9E-04	1.0E-06	--	1.7E-04	9.2E-07	--
Quinoline	--	--	--	--	--	--	9.0E-01	1.2E-02	--	5.8E-01	4.7E-03	--
Benzene	--	--	--	--	--	--	2.7E-05	2.1E-06	2.9E-05	2.5E-05	1.9E-06	2.6E-05
Cis-2,3-Dichloroethene	0	0	--	7	0.1	--	--	--	0.0E+00	--	--	7.0E-04
Methyl Ethyl Ketone	0.2	0.0005	0.02	0.2	0.0004	0.02	--	--	--	--	--	--
Styrene	0.02	0.002	0.005	0.01	0.001	0.004	1.1E-05	2.2E-06	--	8.5E-06	1.7E-06	--
Trans-1,2-Dichloroethene	0	0	--	1	0.03	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	0.0E+00	0.0E+00	0.0E+00	4.6E-03	1.2E-04	7.8E-04
Total Pathway	41,000	8,800	0.03	14,000	3,600	10	1.0E+00	1.0E+00	2.9E-05	1.0E+00	1.0E+00	1.5E-03

1 The risk for the more sensitive population (adult or child) is shown.

-- No RfD or Slope Factor is available for the compound under this pathway.

Table 6
Summary of Future Cancer Risks
Associated with Groundwater Contamination

Groundwater Exposure Pathway	**Excess Lifetime Cancer Risk**			
	Adult On-site Resident	**Child On-site Resident**	**Adult Off-site Resident**	**Child Off-site Resident**
Ingestion	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Dermal Contact	1.0E+00	1.0E+00	1.0E+00	1.0E+00
Inhalation	2.7E-05	2.9E-05	1.4E-03	1.5E-03
Total Cancer Risk[1]	1.0E+00	1.0E+00	1.0E+00	1.0E+00

1 Cancer risks cannot theoretically exceed 1.0, since risk is presented as a probability. A risk level of 1.0 predicts that an individual exposed to the concentrations and exposure rates assumed in the BRA will contract cancer.

Table 7
Summary of Future Hazard Quotients

Groundwater Exposure Pathway	**Hazard Quotient**			
	Adult On-site Resident	**Child On-site Resident**	**Adult Off-site Resident**	**Child Off-site Resident**
Ingestion	13,000	41,000	5,300	14,000
Dermal Contact	5,100	8,800	2,000	3,600
Inhalation	.006	.03	3	10
Total Hazard Index[1]	20,000	50,000	7,000	20,000

1 The hazard index was rounded to one significant figure.

The hazard index (HI) can be generated by adding the HQs for all contaminants of concern that affect the same target organ (such as the liver) within a medium or across all media to which a given population may reasonably be exposed. In general, EPA considers an HI of 1.0 to be the maximum acceptable hazard. However, the ACW risk assessment estimated an HI of 50,000 for a future child on-site resident. For both on-site and off-site residents, non-cancer risks for ingestion of and dermal contact with site groundwater were primarily associated with PAHs. Non-cancer risks for the inhalation pathway stemmed from VOC contamination in the groundwater. A summary of the potential future HQs for each contaminant of concern is presented in Table 5. Hazard indices (HIs) for each population group are in Table 7.

It should be stressed that current human health risks associated with direct exposure to contaminated groundwater are minimal since residents near the site are connected to the City of Pensacola potable water supply. Therefore, no one is currently using the groundwater near the ACW site for drinking or bathing. However, as indicated in Section 6.1.1, EPA has evidence to suggest that some private wells located in the vicinity of the site are being used for residential irrigation purposes. Based on samples collected from two of these wells in June 1988, EPA plugged an irrigation well on the condominium property south of the site in 1991. A survey of residents near the site will be necessary to locate as many additional wells as possible.

In summary, the results of the BRA indicate that human health risks associated with potential future scenarios at the ACW site exceed EPA's target risk range for protection of human health. Therefore, actual or threatened releases of hazardous substances in the groundwater in the area of the ACW site, if not addressed by EPA's preferred alternative or one of the other alternatives considered, may present a current or potential threat to public health and the environment.

6.1.5 Uncertainties in the Risk Assessment

The factors that contribute uncertainty to the estimates of exposure concentrations, daily intakes, and toxicity information also contribute uncertainty to the estimates of risk. These factors include:

- Chemicals not included in the risk assessment
- Exposure pathways not considered
- Derivation of exposure point concentrations
- Intake uncertainty
- Toxicological dose-response and toxicity values

If a compound does not have an assigned slope factor and it had data qualifiers indicating the presumptive evidence of its presence, it was eliminated from the quantitative risk assessment. Compounds identified using presumptive evidence cannot be given the same weight as a compound which was positively identified. If a compound had data qualifiers indicating that the data were not useable, it was also eliminated from the risk assessment. Also, compounds that do not have an assigned reference dose or slope factor were eliminated from the risk assessment. Elimination of these compounds will result in an underestimation of risk.

There are uncertainties associated with summing cancer risks or hazard indices for different chemicals. The cumulative dose ignores possible synergism or antagonism among chemicals and differences in mechanisms of action and metabolism. However, for the ACW site, the risks for most of the individual contaminants of concern fell outside the acceptable risk range prior to being summed.

Another uncertainty surrounds the fact that risk calculations for dermal exposure to all compounds are evaluated using dermal toxicity values. The dermal toxicity values represent an adjustment to the oral toxicity value to reflect an absorbed dose rather than an administered dose. The accuracy of this adjustment depends on the suitability of the absorption rate which was used to make the adjustment. This and other uncertainties need to be considered when evaluating the results of the risk assessment and when making risk management decisions for the site.

6.2 **Environmental Risks**

To evaluate the potential ecological impacts from the site, EPA initiated a phased approach to ecological studies. The initial phase of the ecological assessment, known as the Dye Dispersion and Sediment Sampling Study, was completed by EPA in 1991. The objective of this study was to determine the presence and concentration of site-related contaminants within the area of Pensacola Bay influenced by surface water drainage from the PYC drainage ditch. This ditch has historically received surface runoff from the ACW site, and contaminated groundwater may also be discharging into the ditch.

Significant conclusions from the study are presented below:

- Continuous communication between the PYC ditch and the bay was afforded by the presence of an 18-inch concrete culvert even when the mouth of the ditch was occluded by a sandbar.
- The presence of a 15 ft. deep navigation channel entering Bayou Chico suggests a potential additional source for contamination in the nearshore bay area.
- No organic compounds were detected within the upper stratum of the bay sediments.
- Toxic levels of organic compounds, principally anthracene, fluoranthene, and pyrene, were detected within the drainage

ditch and lower stratum of the bay sediments at the mouth of the ditch.

- Levels of organics and metals in the surface waters were within normal ranges found throughout southeastern estuarine systems.

Following evaluation of the results of this investigation, EPA, FDEP, and the Natural Resource Trustees will determine whether a subsequent study is necessary. This second study would involve the collection of water and sediment samples for toxicity tests, testing of biota for contaminant levels, and bioaccumulation studies.

7.0 DESCRIPTION OF ALTERNATIVES

EPA conducted an FS to identify and evaluate appropriate remedial alternatives for minimizing current and future risks to people and the environment posed by contaminated groundwater. In the FS, remedial alternatives were assembled from applicable remedial activities known as process options. These alternatives were initially evaluated for effectiveness, implementability, and cost. In order to fully address this contamination, EPA considered four alternatives for removing and treating the separate DNAPL layer and five alternatives for treating dissolved groundwater contamination. Included among the remedial alternatives is the no action alternative, which is required by the NCP to serve as a basis for comparison to the other alternatives.

Alternatives considered for addressing DNAPL contamination at the ACW site include the following:

Alternative DN1	-	No Action
Alternative DN2	-	DNAPL Extraction and On-site Thermal Treatment
Alternative DN3A	-	DNAPL Extraction and Off-site Treatment
Alternative DN3B	-	DNAPL Extraction and Recycling

The alternatives considered for addressing dissolved groundwater contamination include the following:

Alternative GW1	-	No Action
Alternative GW2	-	Groundwater Use Restrictions and Monitoring
Alternative GW3A	-	Extraction, Treatment, and Surface Water Discharge
Alternative GW3B	-	Extraction, Treatment, and Reinjection
Alternative GW4	-	In-Situ/Ex-Situ Bioremediation

7.1 Alternative DN1 - No Action

Under the No Action alternative for DNAPLs, no remedial action would be taken at the ACW site to address the separate DNAPL layer in the groundwater. No measures would be taken to reduce the potential for exposure through the use of institutional controls, containment, treatment, or removal of DNAPLs. As required by the NCP, the no action alternative provides a baseline for comparison with the other alternatives which offer a greater level of response.

EPA estimates that approximately 7.25 million gallons of DNAPL are present in the aquifer beneath and immediately down-gradient of the site. Since Alternative DN1 does nothing to remove or contain any of this material, the risks posed by the site would likely increase as the DNAPL migrates both horizontally and vertically, contaminating currently uncontaminated portions of the aquifer and potentially impacting surface water. There are no costs associated with implementation of Alternative DN1.

7.2 Alternative DN2 - DNAPL Extraction; On-site Thermal Treatment

Alternative DN2 involves extraction of a combination of groundwater and DNAPL contamination, separation of the aqueous and non-aqueous phases, treatment and reinjection of groundwater, and on-site incineration of recovered DNAPL.

Enhanced removal technologies would be used to increase the DNAPL removal efficiency. Enhanced removal can include the use of one or more of the following process options: water flooding, alkaline water flooding, surfactant water flooding, and polymer water flooding. Water flooding utilizes the injection of water into wells to hydraulically sweep DNAPL toward production or recovery wells. Alkaline water flooding relies on the addition of alkaline agents into the water flood which raise the pH of the water and react with organic acids in the DNAPL to generate surfactants at the oil-water interface. This reaction leads to improved recovery due to reduced interfacial tension, emulsification effects, and wettability reversals. Surfactant water flooding involves the injection of a surfactant solution as a slug in a flooding sequence to decrease the interfacial tension between DNAPL and water by several orders of magnitude. This has the effect of improving the displacement efficiency of the flood, increasing DNAPL recovery, and reducing residual DNAPL saturation. Polymer water flooding uses polymers in the flood to reduce the mobility ratio (mobility of the displacing fluid divided by the mobility of the displaced fluid). The result is improved sweep efficiency. A typical flooding sequence might consist of water, alkaline, surfactant, and polymer flooding conducted in series, followed by water flooding to displace the viscous polymer and DNAPL combination.

Alternative DN2 conceptually involves the use of two extraction wells pumping at a combined rate of up to 100 gpm. The enhancing agents are introduced into the aquifer via two injection wells located just upgradient of the DNAPL zone. Employing a flooding sequence similar to the one described above, it is expected that a maximum of 30 percent of the DNAPL can be extracted in 50 pore volumes. This means that based on an estimated 7.25 million gallons of DNAPL present in the subsurface, only 2 million gallons are recoverable using enhanced recovery methods. It would take approximately 30 years to remove 50 pore volumes. Further characterization of the extent of DNAPL contamination, aquifer pumping tests, and detailed computer modelling will be necessary during design to determine well locations, depths, and pumping rates.

Following extraction, water and DNAPL would be separated using centrifugation or another appropriate separation technology. The DNAPL would be thermally destroyed on-site in accordance with RCRA requirements in 40 CFR 264.601 and 265.400, and the recovered water would be treated to meet Federal and State primary drinking water maximum contaminant levels (MCLs) using the selected groundwater treatment alternative.

The estimated capital cost for this alternative is $3,441,000, with an annual operation and maintenance (O&M) cost of $546,000. This results in a net present worth cost of $11,825,000 for Alternative DN2.

7.3 Alternative DN3A - DNAPL Extraction; Off-site Treatment

This alternative is similar to Alternative DN2, except the recovered DNAPL would be transported off-site to an approved RCRA facility for treatment. Currently, the only off-site treatment technology widely available is incineration, so cost estimates are based on this technology. RCRA requirements under 40 CFR 263 and 264 would apply to the transportation of the DNAPLs, and the off-site treatment facility would have to meet requirements in 40 CFR 264.601 and 265.400 and the Superfund Off-site Policy (OSWER Directive 9834.11).

The estimated capital cost for this alternative is $2,506,000, with an annual O&M cost of $867,000. This results in a net present worth cost of $15,832,000 for Alternative DN3A.

7.4 Alternative DN3B - DNAPL Extraction; Recycling

This alternative is similar to Alternative DN3A, except the recovered DNAPL would be transported to a recycler for reuse as product. The significant volume of DNAPL which is expected to be recovered at the ACW site makes recycling a viable alternative.

This alternative would utilize a temporary unit (TU) as defined by RCRA Subtitle C for the storage of DNAPLs at the site until sufficient quantities accumulate for off-site transport and recyling. The alternative would comply with all substantive portions of the corrective action management unit (CAMU) rule pertaining to TUs. This TU would therefore not be subject to the requirements of the RCRA Land Disposal Restrictions or Minimum Technology Requirements. Off-site recycling activities would comply with the provisions of the Superfund Off-site Policy.

The estimated capital cost for this alternative is $2,586,000, with an annual O&M cost of $351,000. This results in a net present worth cost of $7,978,000 for Alternative DN3B.

All alternatives for the extraction of DNAPL are expected to leave behind a significant amount of residual DNAPL in the saturated zone (an estimated 70%). The residual DNAPL will be a source of groundwater contamination by dissolution over time. In order to control the migration of contaminated groundwater, a containment system consisting of extraction and/or injection wells may also be necessary.

7.5 Alternative GW1 - No Action

Under the No Action alternative for groundwater, no remedial action would be taken at the ACW site to address dissolved contamination in the groundwater. No measures would be taken to reduce the potential for exposure through the use of institutional controls, containment, treatment, or removal of contaminated water. As required by the NCP, the no action alternative provides a baseline for comparison with the other alternatives which offer a greater level of response.

EPA estimates that approximately 152 million gallons of groundwater are contaminated above the site-specific alternate concentration limits (ACLs) established under CERCLA Section 121(d)(2)(B)(ii) for the site. These ACLs, shown in Table 8, were developed to ensure compliance with surface water standards at the point where groundwater discharges to surface water. Since area residents and businesses are on the city water supply, and the groundwater in the vicinity of the site is presently proposed as a delineated area under Chapter 17-524.420, F.A.C. to restrict the potable use of the aquifer, EPA believes that adequate institutional controls exist to support the use of ACLs. Therefore, ACLs are more appropriate than primary drinking water standards (MCLs) or risk-based levels as remedial goals for groundwater.

Since Alternative GW1 does nothing to remove or contain any of this contamination, the risks posed by the site would likely increase as groundwater contaminants migrate both horizontally and vertically, degrading currently uncontaminated portions of the aquifer and potentially impacting surface water. There are no costs associated with implementation of Alternative GW1.

TABLE 8
Groundwater Remedial Goals

Compound	Remedial Goal (ug/l)
<u>**Volatile Organics**</u>	
Benzene	91
<u>**Semi-Volatile Organics**</u>	
Acenaphthene	9,000
Fluoranthene	1,500
Naphthalene	21,900
Total Carcinogenic PAHs	1,100
Benzo(a)Anthracene	
Benzo(b&k)Fluoranthene	
Benzo(a)Pyrene	
Chrysene	
Anthracene[a]	
Fluorene[a]	
Phenanthrene[a]	
Pyrene[a]	
Dibenzofuran	44
Pentachlorophenol	296,000

[a]These compounds, while not currently considered to be carcinogenic, were originally incorporated into the ACL calculation for carcinogenic PAHs.

7.6 Alternative GW2 - Groundwater Use Restrictions and Monitoring

Under this alternative, institutional controls would be implemented, restricting the use of the groundwater from the contaminated plume within the Sand-and-Gravel Aquifer. These State-imposed restrictions include deed restrictions preventing current and future use of the aquifer for such purposes as potable and industrial water supplies, irrigation, washing, etc. Permit restrictions would require the State of Florida to restrict all well drilling permits issued for new wells on the properties which may impact the contaminated groundwater plume. These restrictions would be written into the property deeds to inform future property owners of the possibility of contaminated groundwater beneath their property.

In addition to these restrictions, quarterly groundwater monitoring of all existing monitor wells would be implemented. Analytical parameters to be evaluated would include at a minimum PAHs, PCP, VOCs, phenols, and dioxin. Surface water monitoring would also be conducted at the Pensacola Yacht Club drainage ditch to evaluate the potential impacts of contaminated groundwater discharges on surface water quality. For cost estimating purposes, it was assumed that monitoring would continue for a minimum of 30 years.

The primary ARARs which apply to this alternative are the ACLs developed by EPA as remedial goals for groundwater. Since no extraction or treatment of groundwater would take place under this alternative, exceedances of these levels would continue to occur, and the risks posed by contaminated groundwater would continue to increase.

The estimated capital cost for this alternative is $197,000, with an annual operation and maintenance (O&M) cost of $83,000. This results in a net present worth cost of $1,474,000 for Alternative GW2.

7.7 Alternative GW3A - Extraction and Treatment; Surface Water Discharge

Under this alternative, three extraction wells would pump contaminated groundwater at a combined rate of 105 gpm to an on-site treatment facility. Primary treatment steps are UV-oxidation, activated sludge, and granular activated carbon (GAC) adsorption. Auxiliary processes include dissolved air floatation (pretreatment), sludge dewatering via a filter press, and filtration prior to GAC adsorption. Treated groundwater would be discharged to Pensacola Bay. The goal of this alternative would be to treat groundwater to the remedial goals outlined in Table 8. However, the ability to achieve these goals throughout the plume cannot be determined until the extraction and treatment system has been implemented and modified as necessary and the plume's response has been monitored over time.

In general, the extraction well layout is conceptual based on an analytical groundwater model. It is assumed that the extraction wells will be placed to the depth of the lower most zone of contamination. Upon completion of aquifer testing to be conducted during design, detailed groundwater flow modelling would be performed to more precisely estimate locations and depths of wells along with pumping rates that will be required to extract groundwater from the various zones within the aquifer. The assumed duration of the extraction and treatment process is 30 years, which will provide for treatment of approximately 11 pore volumes of contaminated groundwater from the plume.

Inclusion of a dissolved air flotation (DAF) system is required since the selected DNAPL recovery system is expected to leave a substantial amount of residual DNAPL contamination within the aquifer. The DAF system includes a circular basin equipped with a skimming arm to handle floating product, and a scraper arm and sludge trap for sinking product. The DAF system will also benefit the UV-oxidation system, which is color sensitive, by providing a clearer influent. The DNAPL will be periodically collected and treated using the selected DNAPL treatment alternative. Preliminary sizing indicates that a 20 foot diameter basin is appropriate.

The UV-oxidation process involves use of ultraviolet light to catalyze the chemical oxidation of organic contaminants in water by its combined effect upon the organic contaminant and its reaction with hydrogen peroxide. The UV-hydrogen peroxide reaction would result in formation of hydroxyl radicals, second only to fluorine in oxidative power, which then react with organic contaminants in water. The UV-oxidation process is capable of quickly destroying VOCs such as trichloroethane, vinyl chloride, tetrachloroethane, 1,1-dichloroethene, and others depending on oxidation time. The system can also treat phenolic compounds and PAHs, such as naphthalene and acenaphthalene. UV radiation has been used to generate mutated microorganisms capable of biodegrading complex chlorinated organics. Pilot testing would be necessary to determine the applicability of UV-oxidation in treating dioxins and PAHs. The UV-oxidation unit selected would be a function of the flow rate and the required oxidation time, both of which would be determined through pilot testing.

The activated sludge treatment process would be based on a system where aeration, clarification, and sludge recycling would be provided in a single package unit. Several package plant designs are available. Some systems consist of a single basin structure with an outer tank used for aeration and an inner tank for clarification. Other package designs feature separate basins that are operated in series for aeration and clarification. Multi-media tertiary filtration would be dewatered via a filter press with filtrate recirculated to the activated sludge plant. Dewatered sludges would be sampled to determine if they exhibit hazardous characteristics. If the sludge is hazardous, it would be disposed in an off-site RCRA Subtitle C landfill. Otherwise, the sludge could go to a RCRA Subtitle D sanitary landfill.

The GAC adsorption system would consist of two sets of three down-flow carbon beds each connected in series. For discussion and illustration purposes, each bed would be approximately 5 feet in diameter by 6 feet high. The GAC system is expected to provide polishing treatment to remove any organics not removed by UV-oxidation or activated sludge treatment. Effluent from the GAC system would be discharged to a clear well and monitored prior to surface water discharge.

The treatment system would be designed to treat groundwater to the surface water discharge standards outlined in the National Pollutant Discharge and Elimination System (NPDES) under the Clean Water Act (40 CFR 122, Subpart C). Since the treated groundwater would be discharged off-site, a permit would be required.

The estimated capital cost for this alternative is $3,553,000, with an annual O&M cost of $349,000. This results in a net present worth cost of $8,910,000 for Alternative GW3A.

7.8 Alternative GW3B - Extraction and Treatment; Reinjection

Alternative GW3B is similar to Alternative GW3A, except that treated groundwater would be reinjected into the aquifer instead of being discharged to surface water. Reinjection would provide a degree of containment of the contaminant plume and minimize salt water intrusion associated with operation of the extraction system. The goal of this alternative would be to treat groundwater to the remedial goals outlined in Table 8. However, the ability to achieve these goals throughout the plume cannot be determined until the extraction and treatment system has been implemented and modified as necessary and the plume's response has been monitored over time.

Groundwater would be treated to meet Federal and State primary drinking water maximum contaminant levels (MCLs) prior to being reinjected into the aquifer. The estimated capital cost for this alternative is $3,662,000, with an annual O&M cost of $349,000. This results in a net present worth cost of $9,019,000 for Alternative GW3B.

7.9 Alternative GW4 - In-Situ/Ex-Situ Bioremediation

Alternative GW4 combines in-situ and above-ground biological treatment. The process would involve pumping contaminated groundwater at a combined rate of 105 gpm to an on-site treatment facility, consisting of a DAF system, continuous flow bioreactor, clarifier, media filter, and a GAC column. The treated effluent would then flow to a holding tank where hydrogen peroxide and nutrients would be added prior to injection into the aquifer. The injection system was developed solely to illustrate the general concept of oxidant/nutrient injection into the aquifer. It is anticipated that the total bioremediation operation would require 5 years to achieve aquifer restoration consistent with the remedial goals shown in Table 8. This scenario will treat a total of approximately 1.8 pore volumes of contaminated groundwater. However, the ability to achieve these goals throughout the plume cannot be determined until the extraction and treatment system has been implemented and modified as necessary and the plume's response has been monitored over time.

Use of the in-situ bioremediation techniques has potential advantages compared to conventional "pump and treat" remedial actions for contaminated groundwater plumes. Using pump and treat techniques, a residual fraction of organic contaminants will remain adsorbed to organic and mineral components of the aquifer matrix after efforts to remove concentrated forms of the contaminant, such as creosote oils, have ceased to be productive. This contaminant fraction may be unrecoverable using standard pumping methods and will continue to slowly solubilize into the groundwater system. Remediation of the aquifer using a standard pump and treat scheme typically requires several "flushes" of the aquifer system within the affected area.

Bioremediation schemes attempt to either stimulate naturally occurring aerobic microorganisms to degrade contaminants in situ, or introduce microorganisms capable of degrading the contaminants. Indigenous microorganisms would be used if capable of degrading site contaminants. Treatability testing would be used to determine the need for specialized microbes. Typically, biodegradable contaminants can be degraded at rates which are orders of magnitude greater than the leaching rate of the contaminant in a soil/water system, provided environmentally limited nutrients and oxygen are added as growth enhancing agents. In particular, phenolics, PAH's and ketones are all readily biodegradable by many indigenous microorganisms.

The in-situ/ex-situ remediation process would first involve pumping of contaminated water from extraction wells through the DAF system to remove any oil and free product prior to treatment in the bioreactor, where the bulk of the contaminants would be removed. Oil and free product would be addressed under one of the DNAPL remedial alternatives. The effluent from the bioreactor would then flow to a clarifier where suspended solids would be settled out to avoid clogging problems in the injection wells. Sludge from the clarifier would be dewatered via a filter press, with filtrate recirculated to the bioreactor. Dewatered sludge would be transported to an off-site landfill for disposal.

Effluent from the clarifier would then pass through a granular activated carbon column to remove any remaining contaminants before flowing to a holding tank where it would be amended with inorganic nutrients and hydrogen peroxide. The nutrient-enriched water would then be pumped to reinjection wells. Hydrogen peroxide is used as an oxygen source because it readily breaks down into oxygen and water. This oxygen- and nutrient-rich water would enter the aquifer, providing the oxygen and nutrients necessary for in-situ treatment.

This water also acts as a carrier for contaminants that have been released by the soils due to the natural surfactants produced by the microbial activity. The contaminants would then be available to in-situ degradation or they would be destroyed in the above-ground bioreactor after extraction. This combination of in-situ and above-ground treatment would expedite the overall aquifer restoration. An estimated 20 gpm of treated groundwater would be purged from the system and discharged to the Escambia County Utilities Authority (ECUA) publicly owned treatment works (POTW). Effluent monitoring would be performed prior to discharge to assure compliance with the POTW discharge limitations. In addition, periodic monitoring of influent groundwater would be necessary to assess the effectiveness of the treatment process.

Groundwater would be treated to meet Federal and State MCLs prior to being reinjected into the aquifer. The estimated capital cost for this alternative is $3,906,000, with an annual O&M cost of $452,000. This results in a net present worth cost of $5,865,000 for Alternative GW4.

8.0 COMPARATIVE ANALYSIS OF GROUNDWATER AND DNAPL ALTERNATIVES

In this section, the performance of each alternative relative to the other alternatives will be evaluated for each of the nine criteria identified in the NCP (40 CFR Part 300.430). The criteria are listed in the NCP and discussed further in EPA's guidance for conducting Remedial Investigations and Feasibility Studies. The nine criteria are segregated into three categories. Threshold Criteria are those which dictate the minimum standards with which a remedial alternative must comply. Primary Balancing Criteria include those which are used to evaluate the effectiveness of the remedial alternatives. Finally, Modifying Criteria are those which may be used in distinguishing between equally protective alternatives. The nine criteria are shown below:

Threshold Criteria

- Overall Protection of Human Health and the Environment
- Compliance with ARARs

Primary Balancing Criteria

- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume through Treatment
- Short-term Effectiveness
- Implementability
- Costs

Modifying Criteria

- o State Acceptance
- o Community Acceptance

A comparison of the remedial alternatives with respect to each of these criteria and each other is presented in the following sections. The discussion has been arranged to provide a comparison among the DNAPL alternatives followed by a separate evaluation of groundwater alternatives. Those alternatives which fail to meet the threshold criteria of overall protection of human health and the environment and compliance with ARARs will be eliminated from further analysis.

8.1 Overall Protection of Human Health and the Environment

This criterion assesses whether alternatives adequately protect human health and the environment and to what degree an alternative would eliminate, reduce, or control the risks to human health and the environment associated with the site through treatment, engineering, or institutional controls. It is an overall assessment of protection that encompasses other criteria such as long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

DNAPL:

Alternatives DN2, DN3A, and DN3B each provide equal protection of human health and the environment. These alternatives reduce contamination in the aquifer through active recovery, and they result in ultimate destruction or reuse of DNAPLs. However, each alternative will leave a significant amount of contamination within the aquifer which must be addressed by an appropriate groundwater alternative. Alternative DN1 is not protective of human health or the environment, since DNAPL contamination would continue to migrate and further degrade groundwater and surface water.

Groundwater:

Alternatives GW3A, GW3B, and GW4 would provide equal protection of human health and the environment and would reduce the concentration of chemical constituents in the groundwater through a combination of treatment and institutional controls. Alternative GW2 would provide some protection of public health by preventing the widespread use of the contaminated water. However, this alternative would do nothing to prevent contaminated groundwater discharges to area surface water, putting both public health and the environment at risk. Alternative GW1 is not protective of human health or the environment.

8.2 Compliance with ARARs

This criterion considers whether a remedial alternative meets all Federal and State ARARs. Unless a waiver is justified, the selected remedy must comply with all chemical-specific, location-specific, or action-specific ARARs.

DNAPL:

Alternatives DN2, DN3A, and DN3B would be designed to comply with all Federal and State ARARs. Alternative DN3B is not required to comply with RCRA Land Disposal Restrictions or Minimum Technology Requirements under 40 CFR Part 268 because this alternative utilizes a TU for storage of DNAPL. Alternative DN1 would not comply with ARARs, since contamination in the aquifer currently exceeds ACLs and discharges of DNAPL into local surface water could result in violations of surface water standards.

Groundwater:

Alternatives GW3A, GW3B, and GW4 would comply with all ARARs. Neither Alternative GW1 nor GW2 would comply with ARARs since groundwater contamination above remedial goals would remain in the aquifer.

Because Alternatives GW1, GW2, and DN1 do not comply with the two threshold criteria, they will not be considered further in this analysis.

8.3 Long-Term Effectiveness and Permanence

This criterion assesses whether a remedial alternative would carry a potential, continual risk to human health and the environment after the remedial action is completed. An evaluation is made as to the magnitude of the residual risk present after the completion of the remedial actions as well as the adequacy and reliability of controls that could be implemented to monitor and manage the residual risk remaining.

DNAPL:

Alternatives DN2, DN3A, and DN3B would all leave behind a significant amount of residual DNAPL in the saturated zone which will need to be addressed by a groundwater alternative. However, each of the alternatives provides for maximum DNAPL removal to the extent practicable and either treatment or reuse of the recovered creosote.

Groundwater:

In combination with a DNAPL recovery alternative, all three remaining groundwater alternatives represent permanent solutions to the groundwater contamination at the ACW site. However, Alternative GW4 provides an additional degree of effectiveness, since treatment occurs both above ground and within the aquifer, shortening the overall treatment duration. The long-term effectiveness of Alternatives GW3A and GW3B would depend on the ability of the extraction system to remove all of the contamination from the aquifer, since treatment only occurs above ground.

8.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion assesses the degree to which a remedial alternative, by utilizing treatment technologies, would permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances at the site. The assessment focuses on the degree and irreversibility of treatment.

DNAPL:

Alternatives DN2, and DN3A provide equal reduction in mobility, toxicity, and volume through treatment. Alternative DN3B does not require treatment, but provides for recovery and reuse of the DNAPL as a product or BTU source rather than disposal as a waste. All alternatives have the potential to mobilize contaminants through the injection of surfactants and other agents. However, the extraction well network can be designed to capture the mobilized contamination.

Groundwater:

Alternatives GW3A, GW3B, and GW4 all provide a substantial reduction of toxicity, mobility, and volume of contamination through treatment. Because Alternative GW4 provides for treatment of contamination both above ground and within the aquifer, EPA expects this alternative to provide a greater reduction in the contaminant volume.

8.5 Short-Term Effectiveness

This criterion assesses the degree to which human health and the environment would be impacted during the construction and implementation of the remedial alternative. The protection of workers, the community, and the surrounding environment as well as the time to achieve the remedial response objectives are considered in making this assessment.

DNAPL:

The short-term effectiveness of each of the three remaining DNAPL alternatives is equivalent. Each will involve temporary storage of recovered DNAPL until sufficient volume has been collected for cost-effective disposal. Normal short-term hazards associated with well installation and other construction activities will be addressed through a site-specific health and safety program.

Groundwater:

During the construction phase, all three groundwater alternatives would involve typical construction hazards and potential contact with contaminated soils and groundwater during well installation. However, these short-term threats to construction workers would be addressed through a health and safety program and the use of personal protective clothing and equipment. Alternative GW4 would provide better short-term effectiveness because of the shorter remediation time required to implement this alternative (5 years).

8.6 Implementability

This criterion assesses the technical and administrative feasibility of implementing a remedial alternative and the availability of services and materials required during implementation.

DNAPL:

The recovery technologies for all three DNAPL alternatives are identical. All alternatives are expected to leave behind a significant amount of residual DNAPL in the saturated zone, which will be addressed by a groundwater alternative. Alternative DN2 will involve extensive effort, including a test burn, to meet regulatory requirements for siting an on-site incinerator. Implementation of Alternatives DN3A and DN3B will depend on the availability of off-site incineration or recycling facilities, respectively.

Groundwater:

Each of the groundwater alternatives would involve one or more innovative technologies (UV-oxidation, biological treatment) which would require treatability tests to verify their ability to meet cleanup levels. Alternative GW3A would require the contractor to obtain an NPDES permit for discharge to Pensacola Bay. Finally, all three alternatives would involve extensive negotiations with landowners to obtain access and easements for installation of extraction wells and distribution system piping.

8.7 Cost

This criterion assesses the capital costs, operation and maintenance costs, and total present worth analysis associated with implementing a remedial alternative. The capital costs are divided into direct costs and indirect costs. Direct capital costs include construction costs, equipment costs, and site development costs. Indirect capital costs include engineering expenses and contingency allowances. Operation and maintenance (O&M) costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action.

DNAPL:

Alternative DN3B is the most cost effective DNAPL alternative because is provides equal protection as the other alternatives at a lower cost. Alternative DN2 is the next most cost effective alternative, followed by Alternative DN3A.

Groundwater:

Alternative GW4 is the most cost effective groundwater alternative because it provides a greater degree of effectiveness and shorter treatment duration at a lower cost than the other alternatives. Alternatives GW3A and GW3B provide similar protectiveness at similar costs.

8.8 State Acceptance

This criterion assesses the technical and administrative issues and concerns the state may have regarding each of the remedial alternatives. FDEP and its predecessor, FDER, have been the support agency during the RI/FS process at the ACW site, providing input into all activities conducted by EPA. Based on discussions with FDEP staff, EPA anticipates that the State's concurrence is forthcoming. However, a formal letter of concurrence has not yet been received.

8.9 Community Acceptance

EPA has conducted community relations activities throughout the history of this site to advise interested persons of EPA's activities and solicit community input. A summary of EPA's responses to significant oral and written comments received during the public comment period is provided in the Responsiveness Summary in Section III of this ROD.

9.0 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of alternatives using the nine criteria, public comments, and the Administrative Record for the site, EPA has determined that a combination of Alternatives GW4 and DN3B is the most appropriate remedy for addressing groundwater contamination at the ACW site. EPA anticipates using a phased approach for implementing the groundwater cleanup. The initial phase would involve recovery of DNAPL contamination to the maximum extent practicable (Alternative DN3B) to control a significant source of contamination. The subsequent phase (Alternative GW4) will address the remaining residual contamination in the aquifer, as necessary, to prevent the migration of contamination to surface water.

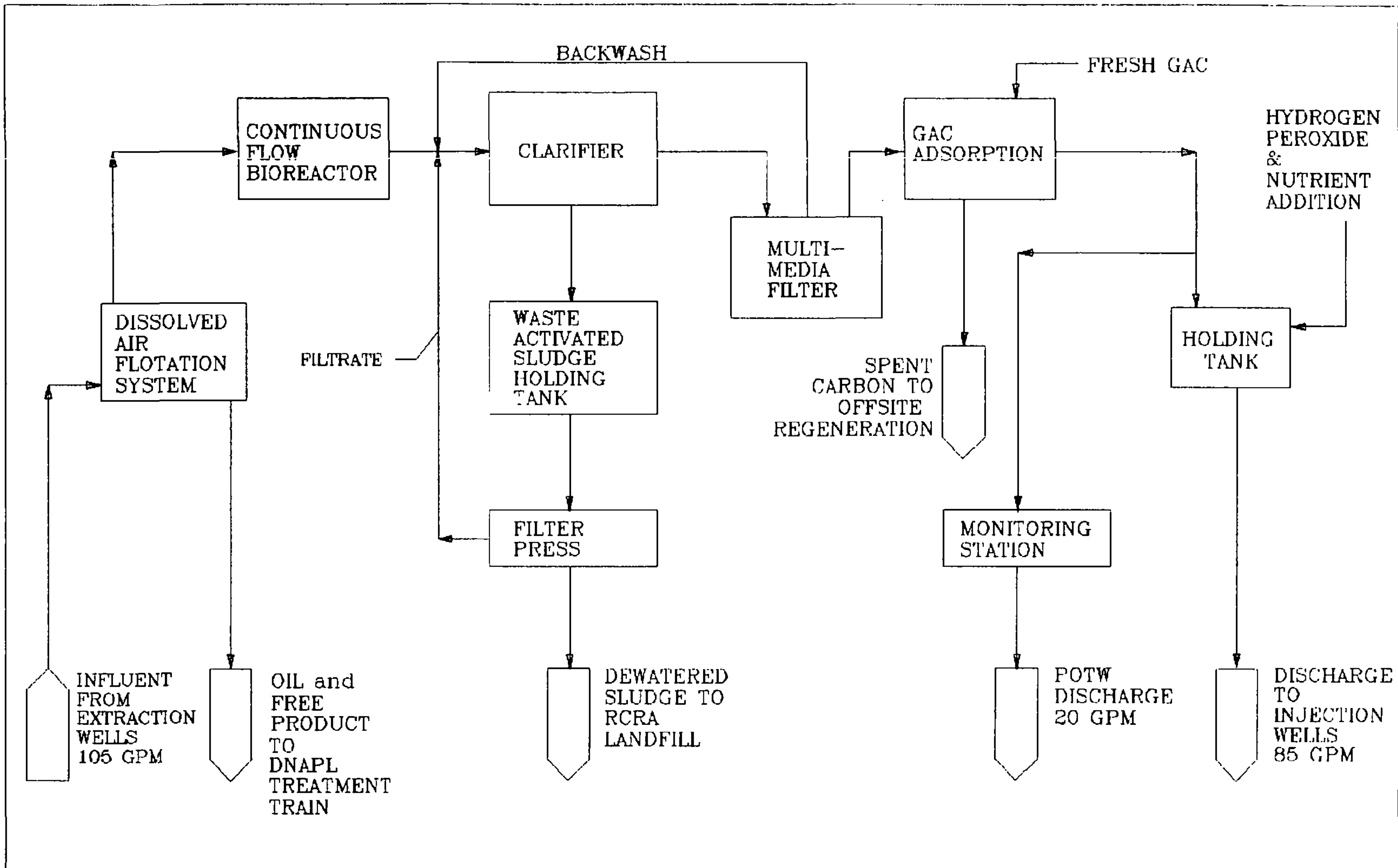
An estimated 2 million gallons of DNAPL will be pumped from extraction wells at a combined rate of about 100 gpm using enhanced removal methods. The enhancing agents (alkalines, surfactants, and polymers) will be introduced into the aquifer via injection wells located just upgradient of the DNAPL zone. Additional aquifer sampling, testing, and modelling will be required during remedial design to further characterize the extent of DNAPL contamination and to determine the appropriate location and number of extraction and injection wells.

Recovered DNAPL will be dewatered and stored on-site in a temporary unit (TU) until sufficient quantities have been collected to cost-effectively transport the material for off-site recycling. Testing of the recovered DNAPL will be done to characterize the chemical composition of the material to be recycled to ensure that the recovered DNAPLs will meet the acceptance criteria of the recycling facility.

The goal of the DNAPL recovery system is to remove the maximum contaminant mass from the aquifer in the most cost-effective manner. Since additional characterization of the extent of DNAPL contamination is necessary and significant uncertainty surrounds the ability of any extraction system in recovering contaminant mass, EPA cannot currently predict the duration of DNAPL recovery system operation. Instead, EPA will collect system performance data to evaluate whether enhanced DNAPL recovery should continue at any or all of the following milestones: the 5-year review; upon recovery of 2 million gallons of DNAPL; and/or at such time as EPA determines that DNAPL recovery is no longer technically feasible or cost-effective.

Following termination of the DNAPL recovery system operation, EPA will initiate the second phase of the groundwater remediation plan which addresses the residual DNAPL and dissolved groundwater contamination remaining in the aquifer. Using an estimated porosity of 0.35, one pore volume of contaminated groundwater is estimated to be 152 million gallons. Alternative GW4 involves recovery and treatment of about 1.8 pore volumes of groundwater using a combination of in-situ and above-ground biological treatment.

Groundwater will be pumped from extraction wells at a combined rate of approximately 105 gpm to an on-site treatment facility consisting of a dissolved air flotation (DAF) system, continuous flow bioreactor, clarifier, media filter, and granular activated carbon (GAC) columns (see Figure 5). Groundwater will be treated to the more stringent of the Federal or State MCLs shown in Table 9. Experience suggests that not all of the groundwater recovered from the aquifer can be reinjected, so an estimated 20 gpm of treated groundwater will be discharged to a POTW. The remaining treated effluent (85 gpm) will then flow to a holding tank where hydrogen peroxide and nutrients will be added prior to reinjection into the aquifer in order to stimulate in-situ biological activity. Any sludges generated in the treatment train will be disposed off-site, and the residual DNAPLs recovered by the system will be sent off-site for recycling.



EPA	INSITU/EXSITU BIOREMEDIATION SCHEMATIC	AMERICAN CREOSOTE WORKS PENSACOLA, FL	**FIGURE 5**

Table 9
MCLs and Surface Water Quality Standards for Contaminants of Concern

Contaminant of Concern	Maximum Contaminant Levels (ug/l)		Surface Water Quality Standard (ug/l)	
	State Primary Drinking Water Standards	Federal Primary Drinking Water Standards	State Criteria Class III Surface Water[a]	Federal Criteria[b]
Carcinogenic PAHs (total)	--	--	--	--
Benzo(b and/or k)Fluoranthene	--	--	0.031	0.0311
Benzo(a)Anthracene	--	--	0.031	0.0311
Chrysene	--	--	0.031	0.0311
Benzo(a)Pyrene	0.2	0.2	0.031	0.0311
2-Methylnaphthalene	--	--	--	--
Naphthalene	--	--	26[c]	--
Acenaphthene	--	--	3[c]	2,700
Dibenzofuran	--	--	67[c]	17
Fluorene	--	--	30[c]	0.031
Phenanthrene	--	--	0.031	0.0311
Anthracene	--	--	0.3[c]	0.0311
Fluoranthene	--	--	0.2[c]	16[d]
Pyrene	--	--	0.3[c]	0.0311
Bis(2-ethylhexyl)Phthalate	4.0	6.0	--	3.4[d]
2-Methylphenol	--	--	--	--
(3-and/or 4-)Methylphenol	--	--	--	--
Phenol	--	--	4,600,000	4,600
2,4-Dimethylphenol	--	--	6.5[c]	--
Pentachlorophenol	1.0	1.0	7.9	7.9[d]
1,2,4-Trichlorobenzene	70	70	--	--
Carbazole	--	--	--	--
Quinoline	--	--	371[c]	--

Contaminant of Concern	Maximum Contaminant Levels (ug/l)		Surface Water Quality Standard (ug/l)	
	State Primary Drinking Water Standards	Federal Primary Drinking Water Standards	State Criteria Class III Surface Water[a]	Federal Criteria[b]
Benzene	1.0	5.0	71.3	71
Cis-1,2-Dichloroethene	70	70	--	--
Methyl Ethyl Ketone	--	--	--	--
Styrene	100	100	1,150[c]	--
Trans-1,2-Dichloroethene	100	100	--	140,000
Vinyl Chloride	1.0	2.0	--	525
2,3,7,8-TCDD (Dioxin)	0.000000014[e]	0.00000003	0.000000014[f]	0.000000014

[a] State of Florida surface water quality standards from FAC 17-302.560, January 5, 1993, unless otherwise noted.

[b] Unless otherwise noted, the Federal water quality criteria for human health based on a 10^{-6} risk level for carcinogens and assuming consumption of organisms (e.g. fish) only are presented. Source of criteria was OSWER Publication 9234.2-09/FS, June 1990.

[c] State of Florida chronic toxicity values developed under Chapter 17-302.530(21) and 17-302.530(62).

[d] Federal water quality criteria for protection of aquatic saltwater species.

[e] FDEP identified the dioxin drinking water standard in a letter to EPA dated June 4, 1993.

[f] FDEP has adopted the dioxin surface water standard contained in 40 CFR 131.36(d)(6)(ii).

-- No quantitative standard available for this compound

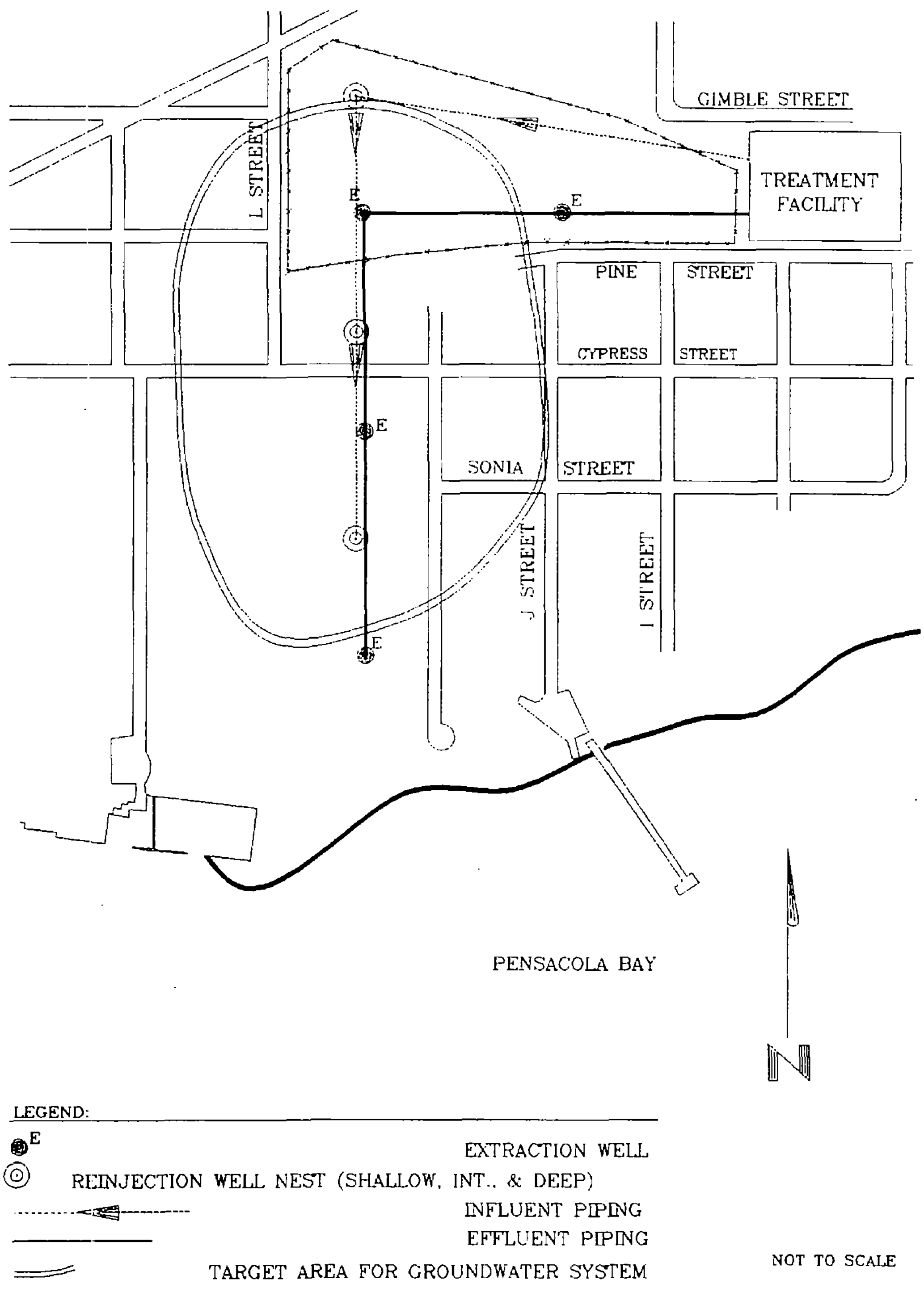
A conceptual extraction and injection well configuration is provided in Figure 6. Additional aquifer testing and modelling will be conducted during remedial design to further refine the number and location of extraction and injection wells. EPA anticipates utilizing some or all of the DNAPL recovery and injection wells as part of the final groundwater remediation system.

Since some of the elements of Alternatives GW4 and DN3B overlap, the combined cost of the alternatives is less than the sum of their individual costs. The net present worth cost of the preferred alternative is $10,344,000 based on the assumption that the DNAPL recovery system will operate for 5 years prior to implementing Alternative GW4. The cost includes $4,498,000 in capital costs and $789,000 in annual operation and maintenance costs for years 1-5 and $660,000 for years 6-10.

The goal of this remedial action is to manage the migration of contaminated groundwater, to prevent statistically significant increases in contaminants in surface water resulting from groundwater discharges, and to prevent the use of the groundwater through institutional controls. Based on information obtained during the remedial investigations and the analysis of all remedial alternatives, EPA believes that the selected remedy may be able to achieve this goal. However, groundwater contamination may be especially persistent in the immediate vicinity of the former wastewater lagoons, where concentrations are relatively high. The ability to achieve remedial goals (ACLs) at all points throughout the plume cannot be determined until the extraction system has been implemented, modified as necessary, and plume response monitored over time. If the selected remedy cannot meet the specified remedial goals at any or all of the monitoring points during implementation, the contingency measures described below may replace the selected remedy for these portions of the plume. Such contingency measures will, at a minimum, prevent further migration of the plume and include a combination of treatment and containment technologies. These measures are considered to be protective of human health and the environment and are technically practicable under the corresponding circumstances.

The selected remedy will include groundwater extraction for an estimated period of 10 years, during which time the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

- o at individual wells where remedial goals have been attained, pumping may be discontinued;
- o alternating pumping at wells to eliminate stagnation points;
- o pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater; and



EPA	CONCEPTUAL GROUNDWATER EXTRACTION AND REINJECTION SCENARIO	AMERICAN CREOSOTE WORKS, INC. PENSACOLA, FLORIDA	FIGURE 6

- installation of additional extraction or injection wells to facilitate or accelerate cleanup of the contaminant plume.

To ensure that remedial goals continue to be maintained, the aquifer will be monitored at least annually at those wells where pumping has ceased.

If EPA determines on the basis of performance data generated during system operation that certain portions of the aquifer cannot be restored to meet remedial goals, all of the following measures involving long-term management may occur, for an indefinite period of time, as a modification of the existing system:

- engineering controls such as physical barriers or long-term gradient control provided by low level pumping as containment measures;

- chemical-specific ARARs will be waived for the cleanup of those portions of the aquifer based on the technical impracticability of achieving further contaminant reduction;

- institutional controls will be provided/maintained to restrict access to those portions of the aquifer (or affected surface water) which remain above remedial goals;

- continued monitoring of specified wells; and

- periodic reevaluation of remedial technologies for groundwater restoration.

The decision to invoke any or all of these measures may be made during a periodic review of the remedial action, which will occur at five year intervals in accordance with CERCLA Section 121(c).

9.1 Remedial Action Objectives

As part of the FS process, EPA identified remedial action objectives (RAOs) for groundwater at the site to serve as a basis for determining cleanup levels and appropriate response actions. The specific RAOs for groundwater are as follows:

- Prevent ingestion of groundwater that contains concentrations of compounds representing a total excess cancer risk greater than 10^{-6}, a noncarcinogenic Hazard Index greater than 1, or concentrations which exceed Federal and State ARARs.

- Management of migration of the pollutants beyond the existing limits of the known contaminant plume.

Based on these RAOs, EPA developed remedial goal options for meeting these objectives in groundwater. Remedial goal options considered included Federal and State MCLs, health-based cancer risk levels (10^{-6}), health-based noncarcinogenic risk levels (HI=1), and CERCLA ACLs. The rationale for selection of the final remedial goals for groundwater and other performance standards for the selected remedy are provided in Section 9.2.

9.2 Performance Standards

Based on the RAOs discussed in Section 9.1 and the risks identified in the BRA, EPA determined that remedial action to treat groundwater contamination was warranted. However, EPA further concluded that since residents and businesses in the area of the ACW site are connected to city water supplies which draw groundwater from upgradient of the site, remediation to health-based levels (e.g. MCLs and risk-based remedial goals) was not necessary. For this reason, EPA developed ACLs under CERCLA Section 121(d)(2)(B)(ii) which provide protection of surface water potentially impacted by discharges of contaminated groundwater.

CERCLA Section 121(d)(2)(B)(ii) sets out the following criteria for the use of ACLs at a Superfund site:

- there are known and projected points of entry of the groundwater into surface water;

- on the basis of measurements or projections, there is or will be no statistically significant increase of site-related constituents from the groundwater to the surface water at the point of entry or at any point where there is reason to believe accumulation of constituents may occur downstream; and

- the remedial action includes enforceable measures that will preclude human exposure to the contaminated groundwater at any point between the facility boundary and all known or projected points of entry of the groundwater into surface water.

EPA believes that these criteria can be met by implementation of the selected remedy. Based on geological and hydrogeological data collected in the vicinity of the ACW site, EPA has determined that there is a hydraulic connection between shallow groundwater (above 20 ft. b.l.s.) and the drainage ditch on the Pensacola Yacht Club property. Regional geological studies further suggest that deeper groundwater (greater than 30 ft. b.l.s.) discharges into Pensacola Bay some distance from the shoreline. Therefore, the first statutory criteria for ACLs is met.

Next, the results of groundwater and sediment sampling near the site suggest that, in the past, the discharge of contaminated groundwater to the PYC drainage ditch has occurred, and contaminants have accumulated in the ditch and in Pensacola Bay sediments near the mouth of the ditch. However, surface water samples collected from the drainage ditch have shown little or no organic contamination. If left untreated, contaminated groundwater discharges would result in the continued accumulation of contaminants in the ditch sediments and potential impacts to surface water quality. For this reason, EPA calculated ACLs (see Table 8) using a computer model which, when achieved at the site boundary, would ensure compliance with surface water standards at the point of groundwater discharge to the drainage ditch. Application of these ACLs as groundwater remedial goals will prevent statistically significant increases in surface water contaminant concentrations once the ACLs are achieved at the point of compliance for the aquifer, which is the southern site boundary. Therefore, remediation of groundwater to the levels in Table 8 will meet the second statutory criteria for ACLs.

EPA will conduct monitoring of surface water in the PYC drainage ditch and Pensacola Bay to confirm that no statistically significant increases of site-related contaminants are occurring. Additionally, EPA will install shallow monitor wells immediately upgradient of the PYC drainage ditch and intermediate and deep wells at the Pensacola Bay shoreline to evaluate whether groundwater exceeds the surface water standards prior to discharge into the surface water body. The State and Federal surface water criteria which will serve as performance standards in these monitor wells are shown in Table 9. These standards, while not considered ARARs for groundwater, were used in the development of groundwater ACLs and will serve as a measure of the performance of the remedial action.

The final CERCLA criteria for application of ACLs at a site requires that adequately enforceable institutional controls are in place to prevent human exposure to groundwater contaminants between the site boundary and the point of discharge to surface water. The area in the vicinity of the ACW site is presently proposed as a delineated area under Chapter 17-524.420, Florida Administrative Code (FAC), to restrict the potable use of the aquifer. At this time, requests for new potable wells are handled by the Northwest Florida Water Management District (NWFWMD) on a case by case basis. In November 1993, NWFWMD advised EPA and area water well contractors that pursuant to Sections 40A-3.301 and 40A-3.504 of the FAC "the District intends to seek denial of any potable or irrigation well permit proposed in [the site] area." EPA believes that this is a sufficiently restrictive institutional control to ensure that inappropriate potable uses of the groundwater will not occur. To address the possibility of a proliferation of bootleg wells in the site area, EPA will conduct a survey during each five year review to determine if any illegal wells have been installed.

Nine private non-potable wells exist in the immediate vicinity of the site. The majority of these wells are used for irrigation and other non-potable uses. However, EPA believes that some or all of these wells may represent a potential source of exposure to current or future residents if they are allowed to remain in service, since groundwater will not be remediated to health-based levels. For this reason, EPA will plug and abandon each well for which consent is granted by the well owner. During remedial design, EPA will conduct a well survey in the area east of Barrancas Avenue and Pace

Boulevard, south of Main Street, and west of South C Street to determine if wells other than the ones shown below exist:

Location	Uses
705 South I St.	Heat pump
1608 W. Cypress St.	Not used
1509 W. Cypress St.	Irrigation
708 South G St.	Irrigation
1407 W. Sonia St.	Not used
809 South F St.	Not used
810 South J St.	Irrigation
1710 W. Cypress St.	Irrigation
916 South I St.	Irrigation

In addition to the statutory criteria outlined above, it is EPA policy to apply ACLs at a site only when active restoration of the groundwater to MCLs is deemed not to be practicable. Based on EPA's experience with groundwater remediation at sites contaminated with DNAPLs, and considering the pervasiveness of DNAPL contamination at the ACW site, EPA believes that remediation to MCLs at the ACW site would not be practicable. However, EPA anticipates that the active remediation measures outlined in this ROD, as modified during implementation based on performance data, may be able to achieve the ACLs developed for the site.

10.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 Protection of Human Health and the Environment

The selected remedy protects human health and the environment through extraction and recycling of DNAPLs, extraction and treatment of contaminated groundwater, and implementation of institutional controls to restrict future groundwater use. This remedy will protect human health and the environment by restoring groundwater to levels which, when discharged to surface water, will not result in degradation of surface water quality above surface water standards protective of both human health and aquatic organisms. Further protection of public health will be provided through the implementation of State-imposed permit restrictions on construction of potable wells in the delineated area identified under Chapter 17-524 FAC. Finally, the plugging and abandonment of existing non-potable private wells in the vicinity down-gradient of the site will prevent inadvertent exposure through incidental dermal contact and ingestion of groundwater contaminants.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedy for groundwater will comply with all ARARs. The major ARARs which apply to the selected remedy and other non-enforceable guidance and criteria which are to be considered (TBC) are presented below:

Federal ARARs

Safe Drinking Water Act (SDWA)

- 40 CFR 141. SDWA Maximum Contaminant Levels (MCLs) for contaminants of concern are **relevant and appropriate** for treatment of water being reinjected into the aquifer.

- 40 CFR 144. SDWA underground injection control (UIC) regulations are **relevant and appropriate** to the construction and operation of injection wells for reinjection of treated groundwater.

Clean Water Act (CWA)

- 40 CFR 403. CWA pretreatment regulations are **applicable** to the off-site discharge of treated groundwater to a publicly owned treatment works (POTW).

- 40 CFR 131. CWA Federal water quality criteria are **to be considered** for evaluation of "statistically significant" increases of groundwater constituents in surface water. These standards, while not considered ARARs for groundwater, were used in the development of groundwater ACLs and will serve as a measure of the performance of the remedial action.

Resource Conservation and Recovery Act (RCRA)

- 40 CFR 262 & 263. RCRA generator and transporter requirements are **applicable** to the off-site transport and recycling of recovered DNAPL.

- 40 CFR 264.553. RCRA requirements for temporary units (TUs) are **applicable** to any tank used for DNAPL storage while sufficient volumes accumulate for off-site recycling.

Other Federal Regulations

- Alternate Concentration Limits (ACLs), derived pursuant to CERCLA Section 121(d)(2)(B)(ii). ACLs are **applicable** as remedial goals for groundwater restoration in place of MCLs.

State ARARs

- Florida Surface Water Quality Standards, FAC 17-302. State surface water standards are **to be considered** for evaluation of "statistically significant" increases of groundwater constituents in surface water. These standards, while not considered ARARs for groundwater, were used in the development of groundwater ACLs and will serve as a measure of the performance of the remedial action.

- Florida Primary Drinking Water Standards, FAC 17-550.310. Maximum contaminant levels are **relevant and appropriate** for treatment of water being reinjected into the aquifer.

- Florida Rules on Hazardous Waste Warning Signs, FAC 17-736. Identifies requirements **applicable** to signs around perimeter and at entrances of site.

- Florida UIC Regulations, FAC 17-28. State UIC regulations are **relevant and appropriate** to the construction and operation of injection wells for reinjection of treated groundwater.

10.3 Cost Effectiveness

The combination of alternatives DN3B and GW4 provides the maximum reduction in risks to human health and the environment at an estimated cost of $10,344,000. The selected remedy combines the least expensive yet most effective DNAPL and groundwater treatment alternatives which provide treatment in the shortest period of time.

10.4 Utilization of Permanent Solutions to the Maximum Extent Practicable

The selected remedy relies on the removal and treatment of a significant amount of contamination in the aquifer to provide for a permanent, long-term solution for groundwater restoration. While contamination will remain in the aquifer above health-based levels, the institutional controls called for in this remedy are currently in place and enforced by the Northwest Florida Water Management District. Additional permanence will be afforded when the proposed delineated area surrounding the ACW site is finalized by a rule-making by FDEP. Finally, EPA's closure of existing privately-owned non-potable wells will prevent future uses of contaminated groundwater.

10.5 Preference for Treatment as a Principal Element

The selected remedy provides for maximum contaminant mass removal from the aquifer by utilizing enhanced DNAPL recovery to remove the separate creosote phase which is serving as a source for groundwater contamination. Recycling of the recovered DNAPL uses the recovered material as a product, thereby preventing the need for disposal. Above-ground biological treatment of groundwater will further reduce contaminant volume. Finally, the in-situ biological treatment will provide continuing reduction of contamination within the aquifer.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for groundwater remediation at the ACW site which was released for public comment in November 1993 identified a combination of Alternatives DN3B and GW4 as the preferred alternative for groundwater remediation. While no changes to the overall remediation approach have been made, EPA has documented a few significant changes below:

Plugging of private wells: Following issuance of the Proposed Plan, EPA determined that plugging and abandonment of existing private irrigation wells in the ACW site area was necessary to foreclose any future incidental exposure to contaminated groundwater. EPA representatives explained this addition to the proposed remedy at the public meeting on December 2, 1993, requesting comments on this and other elements of EPA's preferred alternative. EPA will seek written consent from each individual well owner before plugging any wells.

Change in dioxin ACL: Based on comments received from FDEP and other reviewers, EPA has reevaluated the use of the dibenzofuran ACL for 2,3,7,8-tetrachlorodibenzodioxin (TCDD) because of the notable difference in dibenzofuran and TCDD toxicity characteristics. ACL calculations demonstrated that chlorinated dioxin compounds would not migrate more than about 300 feet downgradient of the site even if dioxin was present at extremely high concentrations. This is due to the low mobility and solubility of dioxin in water. Since dioxin concentrations detected in groundwater were very low (0.0092 ng/l TEQ), EPA has determined that an ACL for dioxin is not needed. However, applicable dioxin surface water standards will apply as performance standards in the PYC ditch.

Appendix A
Dioxin Toxicity Equivalence Factors

DIOXIN TOXICITY EQUIVALENCY FACTORS

Compound	TEFs
Mono-, Di- and TriCCDs	-
2,3,7,8--TCDD	1
Other TCCDs	-
2,3,7,8-PeCDD	0.5
Other PeCDDs	-
2,3,7,8-HxCDDs	0.1
Other HxCDDs	-
2,3,7,8-HpCDDs	0.01
Other HpCDDs	-
OCDD	0.001
2,3,7,8-TCDF	0.1
Other TCDFs	-
1,2,3,7,8-PeCDF	0.05
2,3,4,7,8-PeCDF	0.5
Other PeCDFs	-
2,3,7,8-HxCDFs	0.1
Other HxCDFs	-
2,3,7,8-HpCDFs	0.01
Other HpCDFs	-
OCDF	0.001

III. RESPONSIVENESS SUMMARY

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In accordance with Sections 113 and 117 of CERCLA, as amended, EPA has conducted community relations activities at the American Creosote Works (ACW) site to solicit community input and ensure that the public remains informed about site activities. EPA has relied on a number of methods for keeping the public informed, including press releases, fact sheets, public meetings, establishment of an information repository, and public comment periods.

The U.S. Environmental Protection Agency (EPA) held a public comment period from November 12, 1993 to January 11, 1994 for interested parties to comment on EPA's Proposed Plan for addressing groundwater contamination (Operable Unit 2) at the American Creosote Works (ACW) site. During the comment period, EPA conducted a public meeting at the Sanders Beach Community Center in Pensacola, Florida on December 2, 1993. During this meeting, representatives of EPA presented the results of the studies undertaken at the site and EPA's preferred alternative for addressing groundwater and dense non-aqueous phase liquid (DNAPL) contamination.

A summary of EPA's responses to comments received during the public comment period, known as the responsiveness summary, is required under Section 117 of CERCLA. The responsiveness summary also provides a brief background of EPA's community outreach efforts and the concerns of the community about the site. EPA has considered all of the comments summarized in this responsiveness summary in determining the final selected remedy presented in the Record of Decision (ROD) for Operable Unit 2.

A. Background of Community Involvement and Concerns

EPA's earliest community outreach effort was a press release related to the emergency removal activities in 1983. Periodic fact sheets were issued during 1984 and 1985 to update the community concerning studies being conducted at the site. In September 1985, EPA issued fact sheets and press releases announcing a public meeting and comment period related to the proposed plan for addressing source contamination at the site. Similarly, in 1989, EPA issued a fact sheet and held a public meeting to discuss the revised source control remedy. In 1990, EPA prepared an Explanation of Significant Differences (ESD) notifying the public of additional tasks that would be necessary to implement the 1989 ROD. Later, in March 1991, a fact sheet was published to advise the public of the initiation of these site preparation activities which included cap repair, drum characterization, fence repairs, well closure, and building demolition.

More recently, EPA conducted a door-to-door survey in September 1993 in the neighborhood surrounding the site to update its mailing list. EPA's Proposed Plan for Operable Unit 2 was sent to the public in November 1993, and the administrative record for the site was made available in the public repository at the West Florida Regional Library. A notice was published in the Pensacola News Journal on November 28 and 30, 1993 advising the public of the availability of the administrative record, announcing the opening of the public comment period, and advertising the date of the upcoming public meeting. A public comment period was held from November 12, 1993 to January 11, 1994 to solicit input on EPA's preferred alternative for addressing groundwater contamination at the site. In addition, EPA held a public meeting at the Sanders Beach Community Center on December 2, 1993 to discuss EPA findings and answer residents' questions.

Approximately 50 people attended the public meeting during which several residents expressed concern about their health, citing numerous cases of cancer and other conditions in the community. At least three people requested that a health study of area residents be conducted. Residents also registered complaints about the site being overgrown, thereby providing potential hiding places for criminals. One resident attributed drainage problems and flooding to the site, furnishing EPA with photographs of flooding along Pine and Gimble Streets. At least two citizens suggested that EPA was wasting money in cleaning up this site, but many of the residents expressed support of EPA's Proposed Plan for groundwater remediation.

EPA's responses to these concerns and those provided by mail are summarized in Section B below. Additionally, a transcript of the public meeting was prepared by a certified notary public, and this document is a part of the Administrative Record upon which the remedy selected in the Operable Unit 2 ROD is based.

Following the issuance of the final ROD for Operable Unit 2, EPA will continue to keep the community informed about progress at the site through fact sheets and informal information meetings. Additionally, design and construction documents pertaining to the implementation of Operable Unit 2 will be placed in the information repository at the West Florida Regional Library.

B. Summary of Major Comments and EPA's Responses

Comments on Health and Risk Issues

1. Previous health assessments conducted for the ACW site are inadequate. A new toxicological and epidemiological study should be performed to include air pollution modeling and a survey of existing and former residents.

   EPA has forwarded this request to the Agency for Toxic Substances and Disease Registry (ATSDR) and the Florida Department of Health and Rehabilitative Services (HRS).

2. Numerous people in the community have died of cancers and tumors, and birth defects, thyroid, heart, and other health problems have been identified that may be long term effects of pollution from the ACW site.

This comment has been relayed to ATSDR and HRS, since the evaluation of health concerns associated with past exposure would be the responsibility of health agencies. EPA believes that any immediate health threats have been addressed through the removal actions at the site. The remaining long-term threats posed by the site will be addressed by the proposed groundwater remedy and the source control to be proposed later this year.

3. Are the vegetables from residents' gardens safe? Previous vegetable sampling did not include all the fruits and vegetables consumed from local gardens over the years.

In November 1985, EPA collected samples of pecans, mustard greens, collard greens, and green peppers from six residents' gardens west and south of the ACW site. The results indicated that the produce was not contaminated in spite of the fact that surrounding garden soils were contaminated. Although every type of vegetable grown in the area was not sampled, EPA believes the sampling provided a representative evaluation for the vegetable exposure pathway.

4. Fish having tumors were routinely caught from the local waters. No fish were tested, and many residents ate mullet and other fish caught from the Sanders Beach pier.

EPA has not sampled fish or other marine animals from the bay to date. However, EPA has collected numerous surface water and sediment samples from Pensacola Bay. The surface water was not contaminated, but some bay sediments contained concentrations of contaminants which could be toxic to aquatic organisms. Studies to evaluate contaminant effects on aquatic animals in the bay may be conducted in the future.

5. Is it safe for residents to breathe the air around the site while mowing is done? Is the dust from Pine Street safe to walk on, breathe, or dissolve in rainwater?

While workers may need to wear respiratory protection while mowing the site, the quantity of dust generated as the mower passes each individual house will not be sufficient to result in health problems. Mowing will be conducted in such a way as to direct clippings into the center of the site. Very little dust generation is anticipated during implementation of the groundwater remedy. However, air monitoring and dust suppression would be components of any source control action which involves movement of significant amounts of contaminated soils. EPA's off-site soil sampling along Pine Street

indicates that, although some contamination exists, the levels are low enough not to represent a threat from any short-term exposure.

6. The current overgrown condition of the site provides hiding places for criminals. The site should be secured and mowed.

   EPA agrees and has initiated a contract for mowing the site. Additionally, new locks will be placed on the existing gates, and new signs will be posted to warn of site contamination. This work is expected to be done in February 1994.

7. North winds blew air emissions from the ACW plant over the neighborhood for 30 years. The incidence of lung cancer in the neighborhood should be reevaluated to determine the true risk.

   This request has been forwarded to ATSDR and HRS. EPA collected air samples in 1984 to evaluate the potential for current exposure to air emissions from the site. The results, reported in the NUS RI report dated January 1985, identified the presence of 12 volatile organic compounds at very low levels. However, the concentrations detected were 100 to 1,000 times lower than the Threshold Limit Value for each compound, suggesting that current air emissions from the site do not represent a threat to human health.

8. What is the main pathway for future exposure to contamination at the ACW site? Is it children eating soil from the site? Are my children safe, and is it safe to rent my home to families with young children?

   The highest risks documented by EPA for any potential future exposure were associated with the regular ingestion of contaminated groundwater. EPA's 1989 risk assessment indicated that risks for both adults and children exposed to off-site soil contamination fell within EPA's acceptable cancer risk range of 1x10^{-6} to 1x10^{-4}. However, EPA's most recent off-site soil sampling data indicates that dioxins are present at levels above 1 ppb, which represents an excess cancer risk of greater than 1x10^{-4} (1 in 10,000). EPA forwarded this soil data to ATSDR for review, and ATSDR advised that no immediate action was necessary, but that the contamination should be addressed by EPA's long-term remedial action. Parents should take the following precautions: prohibit children from trespassing on the ACW site itself; encourage them not to play in or eat either on-site or off-site dirt; and wash their hands and face immediately if they do play in the dirt. However, occasional contact with contaminated soils is not expected to present a significant risk.

9. No serious impact on either human or plant life has been documented to date.

The Superfund legislation does not charge EPA with documenting specific health effects in individual humans or other plant or animal species. Rather, EPA must determine whether actual or threatened releases of hazardous substances from the site may present an imminent and substantial endangerment to public health, welfare, or the environment. EPA's environmental sampling and risk assessments have demonstrated that, if left unaddressed, contamination from the site could pose a threat to future residents and the environment.

10. The benzene people breathe each time they fill their gas tanks is more of a human health hazard than exposure to the ACW site conditions. Likewise for the smoking, drinking, and eating habits of all of us.

The risks associated with the everyday activities you identified may very well present health hazards which are greater than the risks related to long-term exposure to the ACW site. However, these risks stem from the voluntary activities of individuals whereas the risks from the site result from the actions of others.

11. What data does EPA and/or ATSDR have on the carcinogenic history of former creosote plant workers anywhere in the U.S.?

EPA's primary mission in the Superfund program is to investigate and respond to releases of hazardous substances into the environment. The Agency for Toxic Substances and Disease Registry (ATSDR) maintains a registry of persons exposed to hazardous substances and a registry of serious diseases and illnesses in persons exposed to hazardous substances in the environment. This comment has been forwarded to ATSDR.

12. A commenter cited documentation stating that potential human health and environmental impacts resulting from possible discharge of contaminated groundwater into Pensacola Bay is of relatively minor significance.

A later study of the sediments in the Pensacola Yacht Club drainage ditch and Pensacola Bay (EPA, September 1991) indicated that concentrations of certain PAHs in bay and drainage ditch sediments pose an ecological risk.

13. What is the potential increase in life expectancy and the expected reduction in the incidence of all cancers after implementation of the remedy? If you don't have a past record of the epidemiology in the area, what will be your frame of reference?

EPA remedial action objectives for groundwater at the ACW site are 1)to prevent ingestion of contaminated groundwater and 2)to manage the migration of pollutants beyond the existing limits of the known contaminant plume. Success in meeting these objectives will be measured by the collection and analysis of groundwater and surface water samples and comparison of these data to established performance standards (i.e. ACLs, surface water standards). Since current residents are not exposed to contaminated groundwater except through incidental contact from private wells, EPA anticipates little or no significant reduction in cancer incidence resulting from the groundwater remedial action. EPA does not use life expectancy as an evaluation criteria since so many other factors contribute to an individual's life expectancy.

14. What studies have been made on the health status of rodents, snakes or other mammals living on the ACW site?

    EPA has not conducted a health evaluation of on-site animals. Instead, a substantial database of animal studies which evaluate the effects of the various chemicals found at the ACW site is available to EPA in conducting risk assessments. Since these studies are conducted under carefully controlled conditions, any observed health effects can be linked directly to the chemical being tested. In site specific studies, conditions cannot be controlled as easily, and too many other factors could confound the study results.

Comments on EPA's Proposed Plan

15. Several commenters stated that the No Action alternative should be selected for the site, since residents are on city water. Another suggested extracting the DNAPL plume if possible and allowing nature to take its course.

    EPA disagrees. While no one is currently drinking the contaminated water, groundwater contamination could pose a risk to future residents through incidental ingestion of water from private wells. In addition to public health, EPA is concerned with protection of the environment. If not addressed, contaminated groundwater could continue to migrate into surface water (Pensacola Bay) and potentially impact both humans and aquatic organisms. EPA's selected remedy does call for initial DNAPL removal. However, experience suggests that even enhanced recovery technologies have limitations in the percentage of DNAPL that can be removed. Since a significant fraction of contamination is expected to remain in the aquifer following enhanced recovery operations, EPA believes that the in-situ/ex-situ groundwater treatment system will be needed to achieve remedial goals.

16. EPA should evaluate whether the surrounding residents should be relocated during the cleanup. Were residents at the Escambia Treating Company (ETC) site relocated?

EPA believes that relocation of residents is unnecessary during implementation of the groundwater remedy. The groundwater treatment system can be designed to capture and treat fugitive emissions. EPA will also conduct perimeter air monitoring to ensure that airborne contamination above levels of concern does not leave the site. Two residents were temporarily relocated during EPA's removal activities at the ETC site, and they are now back in their homes. EPA will evaluate relocation at ACW more closely in relation to the Operable Unit 1 remedy.

17. Remediation of groundwater pollution practiced by the EPA has proven to be ineffective. Your studies of 19 sites involving pumping and treating for up to 10 years show that there has been little success in reducing concentrations to target levels on a permanent basis.

Based on the study referenced, EPA has adjusted its expectations concerning the ability to completely restore contaminated aquifers and revised its approach to groundwater remediation. The proposed groundwater remedy for the ACW site incorporates this new thinking. Specifically, the plan proposes a phased approach to groundwater remediation, calling for DNAPL recovery first, followed by a combination of pump-and-treat and in situ technologies to address residual contamination. Additionally, the selected remedy will be designed to include careful monitoring and provisions for modifying the remedy over time to improve its effectiveness. Finally, EPA may make the determination that modification of remedial action objectives is warranted or that restoration of the aquifer to remedial goals is technically impracticable based on the data collected during remedial action implementation.

18. Is there data to support that bioremediation works on heavier petroleum products known to be present at the site?

EPA's preferred alternative for addressing dissolved groundwater contamination calls for the stimulation of native bacteria by the addition of nutrients and an oxygen source. Treatability studies performed by EPA determined that bacteria native to site soil were available and capable of degrading site contaminants. Specifically, the percent degradation of 43 compounds after 30 days of slurry phase soil treatment ranged from 15 percent for heavier PAHs such as benzo(a)anthracene to 100 percent for lighter fractions such as 2-methylnaphthalene. EPA anticipates achieving higher degradation rates in an aqueous treatment system. Additionally, research by the USGS indicates that in-situ

biodegradation has been occurring naturally in the aquifer for some time.

19. The option of recycling entails soil removal and transport from the site. This would create problems of a magnitude greater than the existing conditions.

    EPA is not proposing to transport <u>soils</u> off-site for recycling. Rather, dense non-aqueous phase <u>liquids</u> (DNAPLs) will be recovered and sent to an off-site recycler. Most recyclers either burn the DNAPL for its BTU value or reuse the material as creosote for treating lumber.

20. Can benzene be recovered and sold?

    EPA's plan basically entails recovering DNAPL, which contains benzene, and allowing it to be used for fuel or wood treatment. The material cannot be sold, but the costs of recycling are much lower than the costs of treatment.

21. Alternative DN3B involves the use of surfactants, alkaline agents, and polymers. Are these proven technologies? What will prevent these chemicals from uncontrolled migration? Will thermal methods reduce the viscosity of the DNAPL and promote an increase in the pollutant level of the aquifer?

    Enhanced recovery technologies have been used for many years in the oil industry, although their application in full-scale DNAPL recovery systems is limited. However, the extraction well network will be designed to prevent uncontrolled migration of mobilized DNAPL. EPA's selected remedy does not call for the use of thermal recovery methods, which can result in uncontrolled vertical migration of DNAPLs.

22. The location of reinjection wells associated with alternative GW4 is not specified as it was for alternative GW3. Will the treated ground water be reinjected at the down gradient margin of the contaminant plume?

    Reinjection wells for the in-situ bioremediation system will likely be placed within the contaminant plume to ensure distribution of nutrients and oxygen to bacteria where the contamination is located. A conceptual well layout is shown in the ROD. However, EPA will conduct additional field studies and modeling to determine the exact location of these wells.

23. Won't the bacteria be pumped back up by the extraction wells?

    The extraction system will be designed to minimize the amount of bacteria pumped out of the aquifer so as to avoid short-circuiting of the in-situ biological treatment.

24. What facilities have been identified to accept recovered DNAPL? What assumptions were used in calculating the cost of this alternative? What provisions will be established to insure that adopting this alternative will not result in a repeat of the American Creosote problem at another location.

EPA has identified at least five facilities which were potentially capable of recycling the ACW DNAPL. EPA used an average price of $1.15 per gallon for cost estimating purposes based on telephone bids. To ensure proper management of wastes, any off-site facility receiving hazardous substances from a Superfund site must be in compliance with its operating permits.

25. The Northwest Florida Water Management District may not be able to enforce a ban on the installation of "bootleg" wells in a restricted area near the site, especially by out-of-state drillers. In light of this problem, EPA should re-visit the underlying assumptions that went into the calculation of the ACLS?

EPA believes the Northwest Florida Water Management District is capable of enforcing its institutional ban. However, to address this concern, EPA will conduct neighborhood surveys periodically to evaluate whether new "bootleg" wells have been installed. Additionally, EPA will seek to plug any existing wells.

26. How soon will the remedy be implemented?

EPA hopes to award a design contract in 1994 and initiate construction activities by late 1995.

Comments on Sampling Data

27. Based on historical drainage patterns in the area, off-site soil sampling has been insufficient to adequately characterize the extent of contamination. No mention is made of contaminated soils off-site.

EPA has collected off-site soil samples from over 40 locations throughout the neighborhood south and west of the ACW site and on the Pensacola Yacht Club (PYC) property. Most samples were collected to depths of 1 ft., but at least 8 samples from the PYC property were collected to depths of 2 ft. Results from these investigations have indicated that off-site soils are contaminated with PAHs, dioxins, and other site-related compounds. However, the contaminant levels represent a long-term (chronic) threat rather than an immediate (acute) hazard. EPA will present plans for addressing soil contamination in the Proposed Plan for source control (Operable Unit 1), at which time the public will have another opportunity to comment on the adequacy of soil sampling.

28. Groundwater sampling locations reflect current rather than historical drainage patterns. Deep and intermediate wells should have been sampled east and south of the site as well as upgradient to the west and north of the site.

During the numerous investigations conducted at the ACW site, EPA, the U.S. Geological Survey, and EPA's contractors have installed and sampled over 100 wells in the vicinity of the site. Well locations were selected based on both current and former drainage patterns, historical site operations, and regional groundwater flow direction. Samples were collected from as far east as G Street (Ropke well), as far south as Sanders Beach (800 series), as far west as M Street (200 series), and as far north as Zarragosa Street (100 series).

29. What is the degree of contamination in the surface water and sediments in Pensacola Bay? Are these areas going to be addressed in Operable Unit 2?

EPA has sampled surface water and/or sediments in both Pensacola Bay and the PYC drainage ditch during investigations in 1984, 1989, 1991, and 1993. Results have consistently indicated little or no contamination in Pensacola Bay. Data from the upstream reaches of the ditch indicated the presence of a few contaminants, including bis(2-ethylhexyl)phthalate (200 ug/l), benzene (0.76J ug/l), and toluene (1.2J ug/l), but a sample collected from near the mouth of the ditch revealed no organic contamination. Sediments in the PYC drainage ditch are contaminated with a variety of compounds, including PAHs, phenols, and dioxins. Toxic levels of organic compounds, principally anthracene, fluoranthene, and pyrene, were detected within the drainage ditch and lower stratum of the bay sediments at the mouth of the ditch. EPA will address sediment contamination, if necessary, in either the Operable Unit 2 ROD or a separate Operable Unit 3 ROD.

30. Has the EPA ever analyzed and compared the contaminants in run-off water both north and south of the site so as to distinguish the amount of pollution from normal run-off versus the contribution from the ACW site?

EPA collected run-off samples from both north and south of the site in March 1991. The sample from north of the site indicated no contamination above detection limits. The two samples south of the site showed no volatile organic contamination. Semivolatile analyses detected a few compounds below detection limits and Anthracene at a level of 46 ug/l.

31. Both sides of the yacht club drainage ditch is lush with a variety of plant growth. Some of the largest and healthiest looking oak and magnolia trees in Pensacola borders this ditch. Is this lush growth consistent with the EPA portrayal of the pollution in the ditch?

EPA frequently relies on the evaluation of stressed vegetation in areal photographs to identify potential contaminant source areas. However, this technique provides no quantitative information, so environmental sampling and laboratory analysis are used to provide data on the level of contamination in various media.

32. The Proposed Plan lists maximum concentrations detected, but the sampling location is undisclosed. What was the location? How many samples over what time period were analyzed from each location? What was the average contaminant level?

The highest concentrations of polynuclear aromatic hydrocarbons (PAHs) were found in well 340, located on-site just south of the former sludge lagoons. This well was drilled to a depth of 39.8 ft. The highest levels of pentachlorophenol and dioxin were detected in well 380, located next to well 340 and drilled to a depth of 77.3 ft. The maximum concentration of benzene was detected in well 480, located just north of the Pensacola Yacht Club and competed at a depth of 80.4 ft. The Baseline Risk Assessment, located in Volume 5 of the Administrative Record at the Pensacola library, provides a good summary of the groundwater data for the site, including number of samples, locations, and average concentrations.

33. Forty-eight percent of the listed contaminants are not carcinogenic. Is the listing made for the purpose of alarming a lay person?

Cancer is only one of the many health effects which may result from exposure to chemicals. Other effects caused by exposure to non-carcinogenic compounds (eg. naphthalene) may include nausea, headaches, skin rashes, cataracts and other eye disorders, kidney damage, and retarded cranial ossification (scull hardening) and heart development in the offspring of exposed individuals. Much of the toxicity information EPA relies upon to assess health effects comes from animal studies, since data for humans is often not available.

34. The numbers listed for PCP and dioxins/furan are confusing. Please elaborate?

The concentrations of PCP and dioxin detected in site groundwater exceed drinking water Maximum Contaminant Levels (MCLs). However, since no one is currently drinking the water, EPA calculated alternate concentration limits (ACLs) which, when met in the aquifer, would ensure compliance with surface water standards where groundwater discharges to the PYC ditch and Pensacola Bay. The ACLs for PCP and dioxin indicate that existing levels of these compounds in the aquifer probably do not present a threat to surface water.

35. Was the PCP used at the site in the form of the relatively insoluble pentachlorophenol or the water soluble sodium- or potassium-pentachlorophenate? It makes a tremendous difference in the mobility of the compound.

EPA information on actual operations at the ACW site is limited. However, sampling of all media at the site has revealed the widespread presence of PCP, but none of the pentachlorophenate compounds have been detected.

36. Have there been any studies completed by EPA to follow up on the 1984 preliminary USGS work studying contaminant impacts on aquatic life in Pensacola Bay?

EPA completed a Dye Dispersion and Sediment Sampling study in 1991 to evaluate contaminant dispersion patterns from the mouth of the PYC ditch into Pensacola Bay and to collect additional sediment samples. Results indicated that lower stratum bay sediments were contaminated with potentially toxic levels of some organic compounds, so EPA will meet with natural resource trustees in the near future to discuss the need for further studies.

Comments about Real Estate and Legal Issues

37. Property owners should be held harmless and indemnified against any future health-related claims if we sell or rent our properties.

EPA has no authority to indemnify property owners for health-related claims made by third parties. However, based on the results of the risk assessment and feasibility study, EPA believes the groundwater remedy selected in this ROD in conjunction with the source control (Operable Unit 1) remedy to be selected later this year will fully address any health risks to the public.

38. Property owners should be compensated for the depressed market value caused by proximity to the ACW site and planned remedial action activities.

EPA has no authority to compensate owners for losses in property value. Moreover, EPA's remedial action will likely improve the market value of the property by removing existing contamination.

39. Will EPA force people to plug and abandon their private wells.

EPA believes the groundwater in the vicinity of the ACW site cannot be restored to a level that is safe for drinking water. For this reason, the ROD calls for plugging and abandoning existing private wells. EPA plans to encourage well owners to voluntarily allow EPA to plug their wells for their own safety

and for the safety of future residents. However, EPA may investigate other means to effect well closure if necessary.

General Comments

40. I have never been notified of any public meeting regarding the ACW site. EPA should ensure that the mailing list is accurate.

    The EPA project manager conducted a door-to-door survey in September 1993 to speak to residents and update the mailing list for the ACW site. All residences south of Main Street, west of C Street, and east of Barrancas with discernable addresses were added to the mailing list, bringing the current mailing list to over 300 households.

41. Runoff from the site floods Gimble and Pine Streets. Can anything be done to prevent this?

    EPA's final remedy for Operable Unit 1 will include final grading of the site and installation of drainage features to prevent this type of runoff problem.

42. Can the dirt roads and streets be paved?

    EPA has no authority to implement public works improvements such as these unless they relate directly to implementation of the selected remedial action.

43. Why is only part of the ACW site fenced? Site operations (and therefore contamination) extended to F Street. The perimeter fence needs to be extended.

    EPA fenced the most contaminated areas of the site which posed the greatest threat to human health. While other portions of the facility are contaminated, the risks are associated with long-term exposure rather than short-term, incidental exposure by trespassers. When the Operable Unit 1 remedy is implemented, the whole site will probably be fenced.

44. The neighborhood should be declared a disaster area, making it eligible for disaster aid.

    EPA has no authority to declare "disaster areas." However, EPA believes the best way to rectify the situation caused by past operations at the ACW site is to conduct remedial actions to address the short-term and long-term risks associated with soil and groundwater contamination.

45. What is the total population and age distribution of all people living within a half-mile radius of the ACW site?

In 1970, the residential population within a 1 mile radius of the site was approximately 5,000. EPA does not maintain information on the age distribution of the community.

46. How many private wells exist within this radius? What is the depth of each of these wells? Has the EPA determined the contaminant level of these wells?

    Based on past data and door-to-door surveys, EPA has identified nine private wells in the site vicinity south of Main St., between Barrancas Ave. and C Street. In addition, a public supply well is located at the People's Crystal Ice Co. north of the site on Government St. This well is reportedly sampled annually. Other wells may exist in the area. Most of the private irrigation wells are fairly shallow (less than 20 ft.), but the ice company well is 190 ft. deep. EPA sampled four wells in 1984, including the ice company well. The results indicated no organic contamination in three of the wells, but two compounds (toluene and bis(2-ethylhexyl)phthalate) were detected below detection limits in the Savannah Condo well upgradient of the site (Mallory St.). Two other wells were sampled in 1988. The Yachtsman's Cove condominium well was contaminated with benzene above the MCL, so this well was plugged in 1991.

47. What is the contaminant level in the air when well water is sprayed during irrigation?

    EPA has not determined what this concentration would be.

48. What percentages of the well owners use their facilities regularly for irrigation? What is the frequency of use via spraying?

    Based on discussions with known well owners, EPA estimates that 5 of the 9 private wells identified south of Main St. are used for irrigation. The frequency of use is unknown.

49. How much money has the EPA spent to date on the ACW site?

    An estimated $2.3 million has been spent by the Atlanta office. This figure does not include expenses incurred by the EPA offices in Athens, GA, Gulf Breeze, FL, and Cincinnati, OH.

50. The last EPA action at the ACW site left many drums, open containers, shallow catch basins filled with stagnant water, treated poles, and a large open dumpster filled with garbage and water. Why wasn't the area cleaned up?

    During 1991, EPA contractors conducted a number of activities at the site including treatability studies, building demolition, drum sampling and segregation, fence and cap

repairs, well plugging, seeding and mowing. The drums containing low-level wastes such as drill cuttings and purged groundwater were placed in a securely fenced area on the eastern portion of the site. The "catch basins" are merely the foundations of demolished buildings which have filled with rainwater. The dumpster remaining at the site contains non-hazardous construction debris. These areas of concern will be addressed during the Operable Unit 1 remedial action.

51. The site contains a sizeable open pool of some liquid. Why hasn't this been covered?

EPA has identified and stabilized the visible source areas and waste impoundments at the site. Any standing liquids are likely to be ponded rainwater which poses no threat to human health.