APPENDIX A

Record of Decision

Highway 71/72 Refinery Site
Bossier City, Louisiana

September 2000

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
SUPERFUND DIVISION

The web version only includes the decision summary and does not include all tables and appendices. The complete version can be viewed at the Site repository which is located at the Bossier City Library at 2206 Beckett.

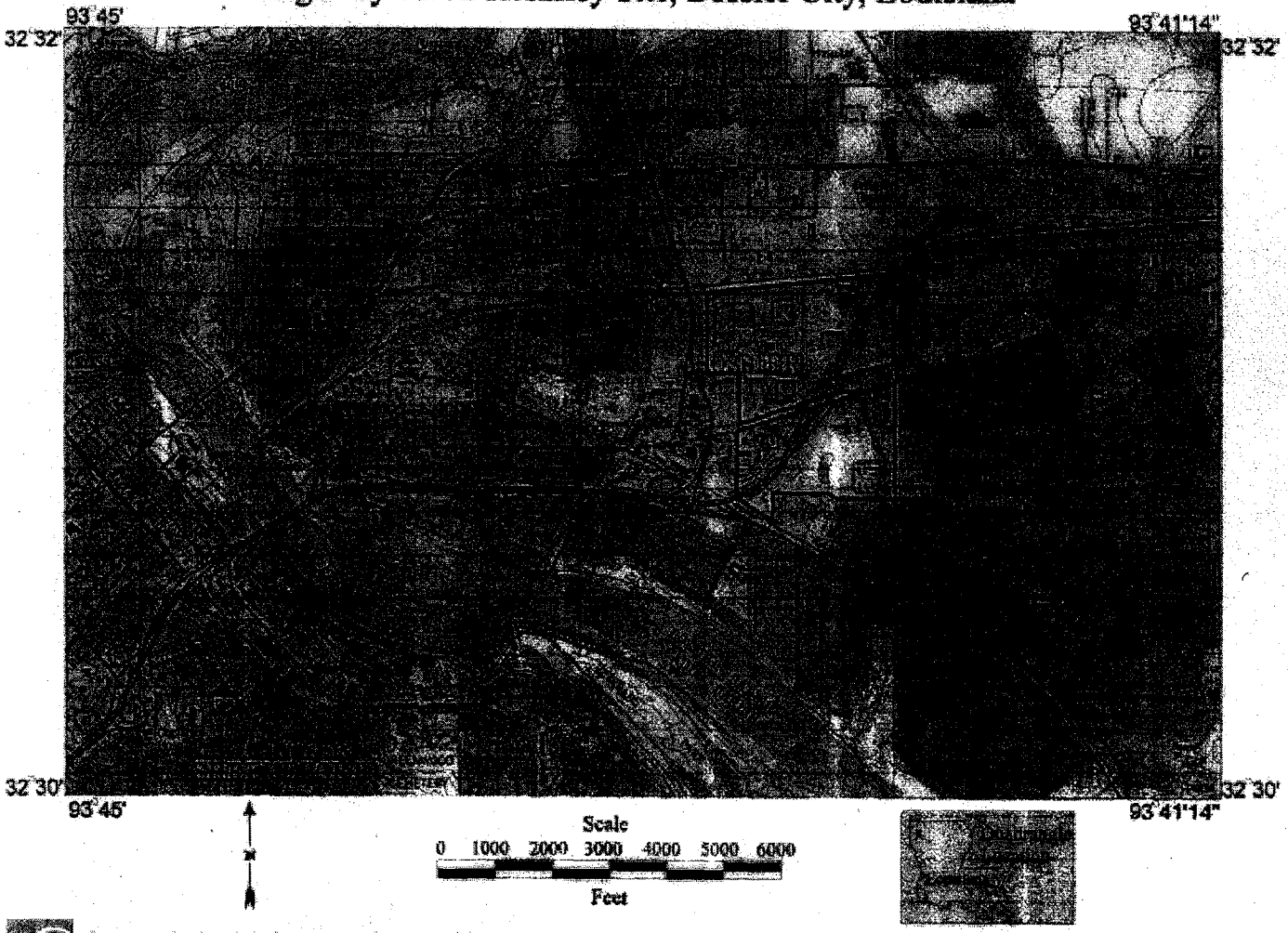
SECTION 1
Site Name, Location, and Description

The Highway 71/72 refinery Site (the "Site"; also called the Old Citgo Refinery, or the Arkansas Fuel Oil Refinery) is located near the intersections of Louisiana State Highways 71 and 72 in Bossier City, Bossier Parish, Louisiana (Figure 1). The Site is approximately 2 miles east of downtown Shreveport and 1,500 feet north of the Red River. The geodetic coordinates of the Site are 32 degrees 31 minutes north latitude and 93 degrees 42.7 minutes west longitude. The Site consists of approximately 215 acres of land where an industrial facility, a crude oil refinery, was once located. The refinery included processing areas, bulk storage areas, distribution areas, and a railroad tank car repair yard. At the time of operation, the refinery was north of the Kansas City Southern Railroad lines and south of the Illinois Central Gulf Railroad lines.

Today, the Site is fully developed with single-family homes, apartments, and businesses. There are approximately 3,500 people living within the former refinery boundaries, including approximately 370 children who are six years old and under (U.S. Census Bureau, 1998).

The Environmental Protection Agency (EPA) is the lead agency for Site activity, with support from the Louisiana Department of Environmental Quality (LDEQ). The National Superfund Electronic Database Identification Number for the Site is LAD981054075.

Figure 1. Site Location Map
Highway 71/72 Refinery Site, Bossier City, Louisiana



Cartography by: Mission Research Corporation
Date: February 1996

Source: Bossier City Quadrangle, 7.5 Minute Series, 1975, USGS
Projection: Universal Transverse Mercator

SECTION 2

Site History, Investigations, and Enforcement Activities

Site Operational History

This summary of Site operational history is based on an analysis of aerial photographs (EPA, 1985; Lockheed Environmental, 1995), the deposition of a former employee taken in 1995 (U.S. Department of Justice, 1995), information provided by OXY USA, Inc. (OXY) in response to an EPA CERCLA[1] Section 104(e) Information Request Letter (OXY USA, 1995), and on an investigation of the ownership history of the Site (TechLaw, 1998). A detailed review of Site operational history and Site ownership is found in the Site Remedial Investigation (RI) Report (Mission Research Corporation, 1999).

Between 1923 and 1929, the Louisiana Oil Refining Corporation (LORECO) acquired the property now known as the Site (except for a small part) (TechLaw, 1998) and began building a refinery for the production of home heating and fuel oil (C-K Associates, 1988). LORECO continued to operate the Site until about 1938 when Arkansas Fuel Oil Company purchased the property.

In November 1938, the Louisiana Oil Refining Corporation sold all property that it owned within the Site to Arkansas Fuel Oil Company. By September 1940, Arkansas Fuel Oil Company had acquired ownership of all land within the Site boundary. Arkansas Fuel Oil Company continued to operate the refinery until some time between 1944 and 1948 when the refining operations were shut down.

In 1953, Arkansas Fuel Oil Company merged with Arkansas Natural Gas Corporation, and the surviving corporation was named Arkansas Fuel Oil Corporation which became the owner of the Site, except for one tract that Arkansas Fuel Oil company sold in 1951. In October 1957, Arkansas Fuel Oil Corporation conveyed a tract of land to the Bossier Parish School Board.

In December 1960, Arkansas Fuel Oil Corporation conveyed and assigned all but one tract of its property within the former refinery boundaries to Cities Service Reserves, Inc. The property was then conveyed to Cities Service Company (CSC). In 1962 and 1963, CSC conveyed several tracts of Site land. In 1964, the State of Louisiana, through the Department of Highways, expropriated two tracts of Site land for the Interstate 20 right-of-way.

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[1] The Comprehensive Response, Compensation, and Liability Act, as amended, 42 United States Code (U.S.C.) §§ 9601 to 6975

In 1961, Cities Service Oil Company and Orange State Oil Company merged into Arkansas Fuel Oil Corporation, which simultaneously changed its corporate name to Cities Service Oil Company. In 1962, Cities Service Oil Company and Cities Service Refining Corporation merged with Cities Service Petroleum Company and the surviving corporation was named Cities Service Oil Company.

In August 1965, Cities Service Company and Cities Service Oil Company conveyed one tract of Site land to a railroad. By this time Cities Service Oil Company owned one tract of land within the former refinery boundaries while Cities Service Company owned the remainder of the property with the exception of the tracts that had been previously conveyed or expropriated. In September 1967, Cities Service Oil Company conveyed one tract of land to Cities Service Company. The Site continued to operate as a petroleum storage and distribution facility until about 1967 when the Site was cleared for redevelopment.

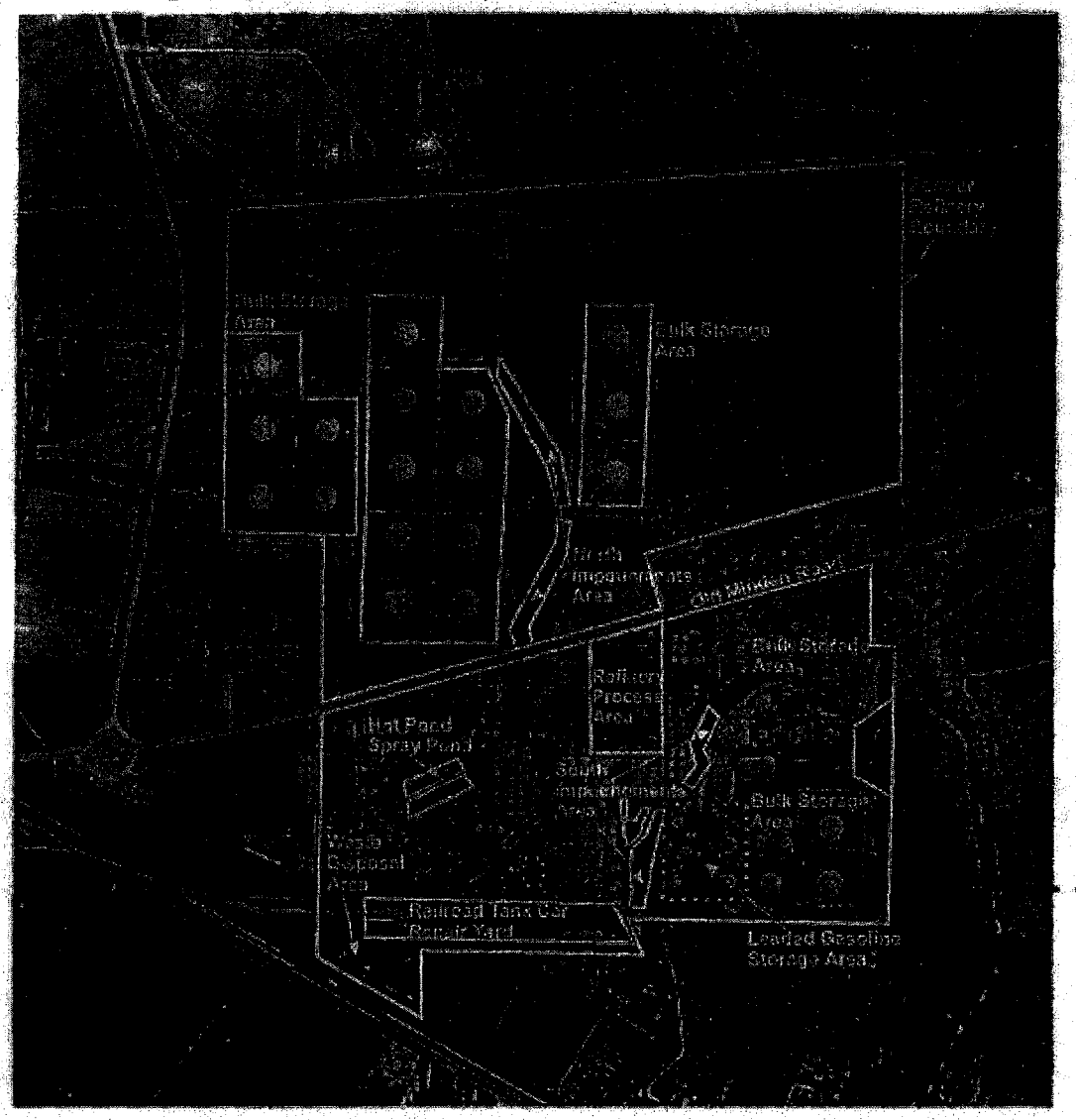
Throughout 1967, 1968, and 1969, Cities Service Company and Cities Service Oil Company conveyed various tracts of land to several parties. By December 1973, Cities Service Oil Company and Cities Service Company owned only two tracts and a portion of a third tract within the former refinery boundaries.

Figures 2 and 3 are aerial photographs depicting Site conditions in 1939 and 1955 respectively. Figure 4 is a map showing past refinery features superimposed on a 1992 aerial photograph. Significant former refinery features indicated on Figure 2 include the former refinery boundary, bulk storage areas, north and south impoundment areas, the refinery process area, leaded gasoline storage areas, hot pond/spray pond, waste disposal area, and the railroad tank car repair yard.

During operations, the Site consisted of a bulk storage area north of Old Minden Road (approximately 120 acres) and refinery process, bulk storage, and distribution areas (approximately 90 acres) located south of Old Minden Road. Crude oil was stored in steel storage tanks on the northern half of the Site. Steel tanks on the southern half of the Site were used to store refined products such as leaded gasoline, no weed oil, and kerosene. Many of the steel storage tanks were surrounded by earthen berms, also called dikes. In addition, tetraethyl lead, a gasoline additive, was stored on the southern half of the Site. The refinery process area consisted of catalytic cracking units, warehouses, and other support buildings (EPA, 1985; Lockheed Environmental, 1995). Railroad tank cars were cleaned and repaired on the southern portion of the Site. A gasoline loading rack, fuel oil loading racks and truck loading racks were also located near the southern boundary of the Site.

The refinery waste disposal and drainage system consisted of a series of open ditches directed to impounded bayous that flowed by gravity to an oil/water/solids separator before wastewater was discharged to another impounded bayou. The impoundments were used for process wastewater, oily cooling wastewater, storm water runoff, water from storage tank draining and cleaning operations, and non-contained spills. The impoundments received dry weather flow of oily cooling wastewater and process wastewater. The impoundments were

Figure 2. 1939 Refinery Features
Highway 71/72 Refinery Site, Bossier City, Louisiana



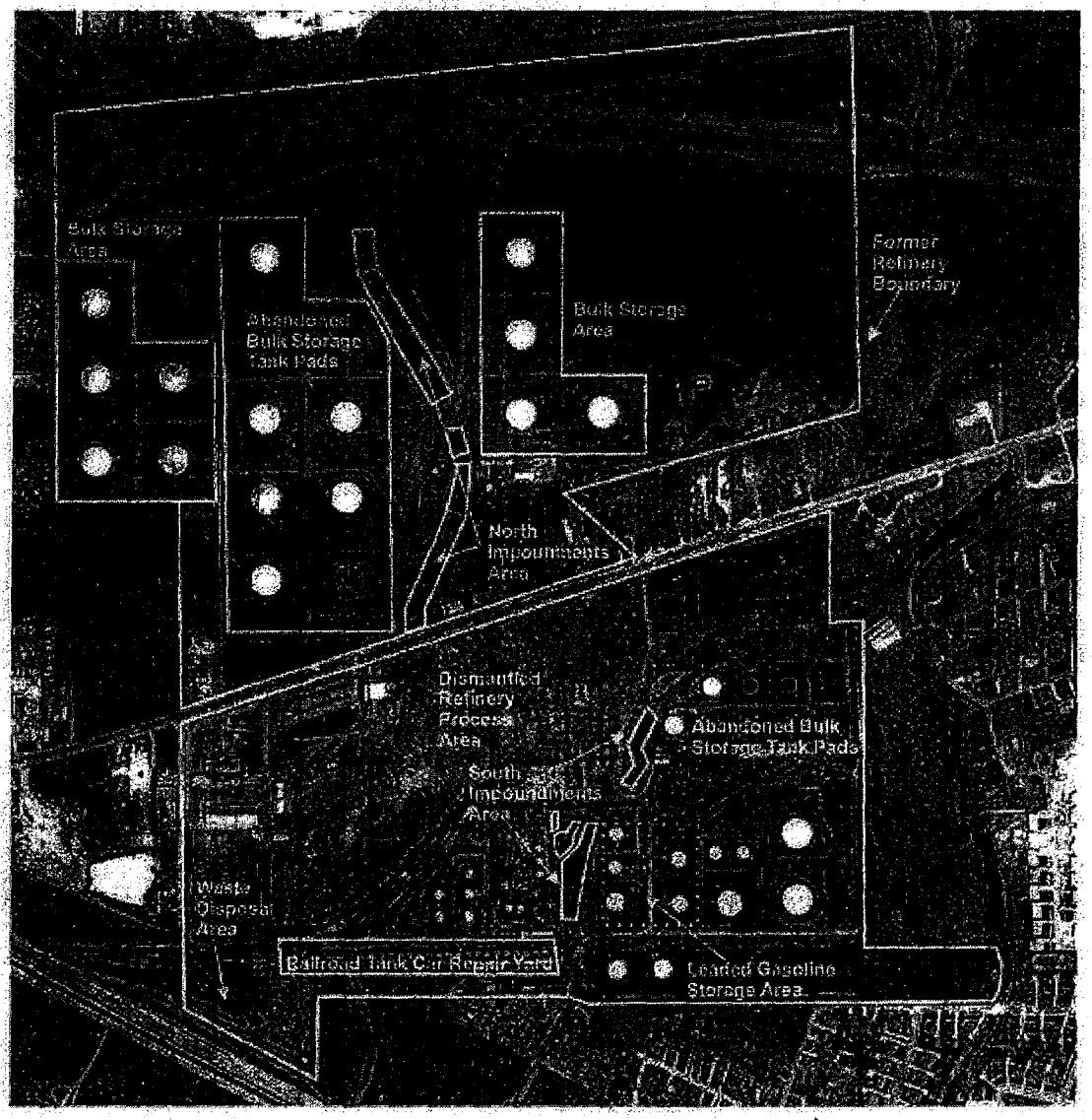
Scale
0 200 400 600 800
Feet

N

Cartography by: Mission Research Corporation
Date: July 1997

Source: EPA, 1995, Aerial Photographic Analysis of the Old Citgo Refinery, Bossier City, Louisiana. Environmental Monitoring Systems Laboratory, Las Vegas, NV.

Figure 3. 1955 Dismantling of the Refinery
Highway 71/72 Refinery Site, Bossier City, Louisiana



Scale
0 200 400 600 800
Feet

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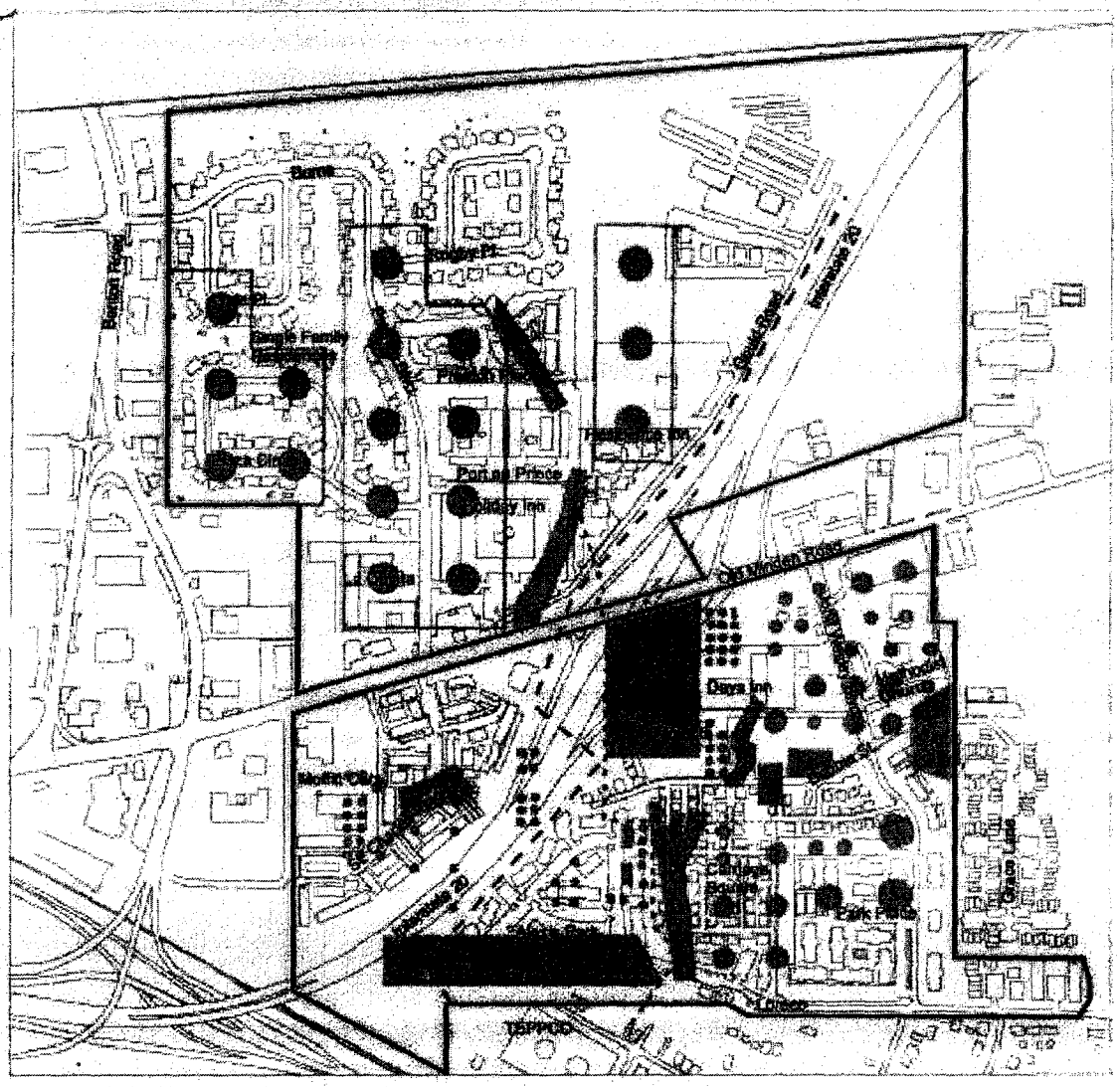
Cartography by: Mission Research Corporation
Date: May 1998

Source: EPA, 1995, Aerial Photographic Analysis of the Old Citgo Refinery, Bossier City, Louisiana. Environmental Monitoring Systems Laboratory, Las Vegas, NV.

Figure 4. Current Land Use and Former Refinery Features of the Highway 71/72 Refinery Site, Bossier City, Louisiana



Legend
- Former Refinery Features
- Former Refinery Boundary
- Former TEPPCO Pipline
- Current TEPPCO Pipeline

N

Scale
0 200 400 600 800
Feet

Source: Basemap was digitized from the 1992 digital ortho-quad. Former refinery features digitized from 1939 aerial photograph.

Cartography by: Mission Research Corporation
Date: July 1997

also used for the disposal of sludge generated during treatment or storage of this wastewater. The north impoundment area included the main oil trap (OXY USA, 1995, Meyer, 1997). Other elements of the waste disposal system included the south impoundment area, the hot pond/spray pond, sumps in the railroad tank car repair yard, and the waste disposal area. In addition to the north and south impoundments, other areas of the Site received dry weather flow of oily cooling wastewater and process wastewater, including the waste disposal area in the southwest corner and the hot pond/spray pond area. These areas were also used for the treatment and storage of oily cooling wastewater and process wastewater.

Process wastewaters disposed of at the Site included condensate from steam-stripping operations, tank emulsions and water draw-offs, and other wastewaters containing emulsions, heavy oils, or tar. Oily cooling wastewaters include uncontrolled oily storm water from refinery processing and tankage areas, and controlled oily storm water released from diked areas or surge ponds. The deposition of a former employee indicates that condensate from steam stripping operations was produced when the railroad tank cars were steam-stripped prior to repair. The deposition also indicates that water was drawn from tank bottoms and spilled onto the Site (U.S. Department of Justice, 1995). These process wastewaters were disposed of on-site in various impoundments, and sludges from these process wastewaters were also disposed of in on-site impoundments. That is, at the point where the process wastewaters were disposed of and contained in an impoundment, lateral particle movement ceased, and a sludge was formed, and this sludge was also disposed of in these impoundments.

The refinery was operational until shortly after the end of World War II. The refinery was shut down some time between 1944 and 1948 (OXY USA, 1995). The former refinery site continued to serve as a petroleum storage and distribution facility even after refinery operations were discontinued. Petroleum stored at the Site included leaded gasoline. By 1955, a significant portion of the refinery process equipment had been dismantled (Lockheed, 1995), and most of the tanks and bulk storage were leased to third parties (OXY USA, 1995). Between 1955 and 1967, various refinery operations were removed and sold. By 1966, an interstate highway corridor (I-20) was under construction through the Site. The interstate highway was completed by the late 1960's (Lockheed Environmental, 1995).

In November 1966, CSC announced plans for the demolition of the remaining refinery structures and cleanup of the property. A land use plan was subsequently approved by the Bossier City Council and the Bossier City-Parish Metropolitan Planning Commission. Newspaper accounts indicate that the announcement by CSC and the local developer were favorably received by Bossier City officials (C-K Associates, 1988). In 1966 and 1967, CSC undertook site clearing, which is reported to have included: filling in all remaining ponds and bayous (with soil) with the exception of the two canals on the north half of the property; leveling all dikes, spoils banks, and mounds; clearing structures, foundations, and piping in planned residential areas to a depth of two feet; removing oil, product, and gas lines regardless of depth, and burning or removing all asphaltic refinery waste from the Site.

Recent investigations and response actions conducted at the Site found evidence that shows the Site was not thoroughly cleaned in the 1960's as had been reported. (See Previous Response Action Section of this Record of Decision (ROD); and see the photos from the October 1999 water main break at the Site, Bossier City Fire Department, 1999.) During the investigations and response actions, it became apparent that, during the 1960's, sludge deposits were buried under thin layers of fill material or simply graded into a level surface without any attempt at removal. High concentrations of lead (greater than 40,000 parts per million [ppm]) found in surface soil and subsequently addressed through a removal action (see Previous Response Action Section of this ROD) indicate lead contamination was present at the time the Site was cleared for development in the 1960's, and also indicate that lead contamination could still be present in the surface soil that has not been addressed by the Soil Removal Action. In this ROD, "shallow surface soil" means soil in the top two inches below ground surface (bgs), "surface soil" means soil from 0 to 2 feet below ground surface (bgs), and "subsurface" or "deeper" soil means soil at depths greater than 2 feet bgs.

Numerous abandoned pipelines, foundation remnants, concrete rubble, railroad tracks and ties, coke material, and tar material (sludge) were also encountered in the surface soil during recent response actions conducted at the Site (Mission Research Corporation, 1999). These response actions are detailed in the Previous Response Action section of this ROD. In addition, when a buried water main ruptured near the Alexis Park Apartments, a layer of black hydrocarbon-stained soil was uncovered during the repair operation (Bossier City Fire Department, 1999). This material may be serving as a source of ground water or indoor air contamination. Information contained in the OXY response to EPA's information request also indicates that lead-contaminated sludge material was burned and buried on-site prior to redevelopment (OXY USA, 1995).

In summary, physical evidence and documentary evidence has shown that significant quantities of refinery wastes are still present at the Site in surface and subsurface soils. Unknown quantities of the hazardous substances benzene, carcinogenic polyaromatic hydrocarbons (PAHs), and lead were disposed on at the Site as a result of these waste disposal practices. The source of the benzene, PAHs, and lead included without limitation the following RCRA[3] wastes which were spilled or disposed of on the Site: petroleum refinery primary oil/water/solids separation sludge (F037); petroleum refinery secondary oil/water/solids separation sludge (F038); slop oil emulsion solids from petroleum refining (K049); heat exchanger bundle cleaning sludge from petroleum refining (K050); API separator sludge (K050); and tank bottoms (leaded) from petroleum refining (K052) (Volume I of the Remedial Investigation Report by Mission Research Corporation, 1999). All of the RCRA wastes are CERCLA hazardous substances. Some of the RCRA wastes may have become mixed with petroleum product (e.g., gasoline, heating oil) spills in the subsurface soil.

In 1978, Cities Service Oil Company merged into Cities Service Company. By July 1983, after several land conveyances, CSC owned only one tract of land within the former refinery

[3] Resource Conservation and Recovery Act, 42 U.S.C §§6901 to 6992k

boundary (TechLaw, 1998). In September 1983, Cities Service Company was renamed Cities Offshore Production Company and in February 1984, Cities Offshore Production Company changed its name to CanadianOxy Offshore Production Co. (COPCO) (U.S. EPA, 1996a). COPCO is the potentially responsible party (PRP) for the Highway 71/72 Refinery Site. Under CERCLA, PRPs are potentially responsible for the remediation of the site of a release of hazardous substances. Glenn Springs Holdings, Inc. (GSHI) has been acting on COPCO's behalf.

Summary of Previous Investigations

Site investigations began in 1985 and were conducted primarily under the direction of CSC and later OXY. The LDEQ provided oversight of Site investigations prior to EPA's proposed listing of the Site on the National Priorities List (NPL) of Superfund Sites in 1995. The EPA has gathered additional site-specific sampling data during planning and implementation of response activities at the Site. This section briefly summarizes the scope of Site investigations.

From 1985 through 1987, five episodes of limited investigations/excavations were conducted on or adjacent to the Site. These investigations/excavations included limited sampling of hydrocarbon residue, coke material, and stained soil in the areas of the Bossier Crossroads Shopping Center, the old refinery process areas, the petroleum waste disposal area located in the southwest corner of the Site (based on aerial photographs), one Carriage Square residence, and the Alexis Park Apartment Complex (C-K Associates, 1988).

In August 1986, the Site was evaluated for EPA by its Field Investigation Team. Approximately 15 soil samples were collected from a maximum depth of 4 feet bgs. These samples were analyzed for both organic (contaminants like benzene commonly found in hydrocarbon-contaminated materials) and inorganic (metal) compounds. In this ROD the terms "hydrocarbon-contaminated" and "organic-contaminated" are used interchangeably to describe some of the Site material. The highest observed lead concentration at that time was 6,980 parts lead per million parts soil (ppm) (later sampling efforts found much higher lead concentrations). Using the Hazardous Ranking System (HRS) model in effect at the time, the Site scored below the 28.5 HRS score necessary to qualify for submittal as an NPL candidate (Ecology and Environment, 1986). Therefore, in February 1988, the Site was referred to LDEQ for action under state authority.

In 1990, a Site Investigation of the Alexis Park Apartment Complex was conducted by the OXY contractor, ERM-Southwest, Inc., to determine the source, and the lateral and vertical extent of the hydrocarbon vapors detected at the Site, and to better define the shallow stratigraphy. This investigation included the installation of 18 soil borings, and the implementation of a shallow soil-gas survey (ERM-Southwest, 1990a). ERM-Southwest, Inc. also conducted indoor air monitoring of apartment buildings in the complex because of odor complaints, and because Louisiana Office of Public Health (LOPH) ordered certain apartments on the Site to be evacuated due to the presence of vapors which could potentially

become explosive (ERM-Southwest, 1990b). ERM-Southwest also conducted vapor sampling and a deep soil-gas survey at the Alexis Park Apartment complex to determine the generating source or sources of methane and other hydrocarbon vapors detected during previous investigations (ERM-Southwest, 1990c).

Under an Investigative Agreement between OXY and LDEQ, signed in August 1991, OXY had ERM-Southwest, Inc., prepare a work plan for a Site investigation intended to determine the nature and extent of contamination (ERM-Southwest, 1992). OXY's objective was to obtain sufficient, quality data to assess potential risks to human health and the environment attributable to previous refinery activities at the Site. The work was conducted from 1991 through 1994 and included investigations of subsurface soil, ground water, surface soil, and surface water. In 1994, ERM-Southwest, Inc., documented the findings of the investigation in a five-volume interim report submitted to LDEQ (ERM-Southwest, 1994).

In 1992, OXY contracted Exploration Technologies Inc., to conduct a soil vapor investigation throughout the former refinery area (Exploration Technologies, 1993). Based on the results of the soil vapor investigation, OXY contracted Law Environmental Inc., to conduct indoor air screening in those areas where elevated soil vapor readings were found (Law Environmental, 1993). In 1994, Law Environmental Inc., followed this investigation with indoor air monitoring in 36 on-site locations where indoor airborne hydrocarbons had been documented (Law Environmental, 1994).

In September 1992, EPA conducted an Expanded Site Investigation (ESI) to re-evaluate the Site using the revised HRS model (PRC Environmental Management, 1993). Under the revised HRS, the Site received a score of 50. A site must score 28.5 or higher to be listed on the NPL. On February 13, 1995, EPA proposed that the Site be placed on the NPL.

In 1994, Texas Eastern Petroleum Products Company (TEPPCO) completed an analysis of Light Nonaqueous Phase Liquids (LNAPL) in six wells located within the former refinery process area (Environmental Excellence Group, 1994).

In 1995, Mission Research Corporation (MRC) collected two surface soil samples consisting predominately of tar and coke material. The sampling objective was to analyze the tarry and coke material for metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and full suite Toxicity Characteristic Leaching Procedure (TCLP) testing. One sample showed a lead concentration above 500 ppm (MRC, 1995). In 1995, OXY collected four surface soil samples from several Site locations. Analytical results indicated lead above 500 ppm in one sample (OXY USA, 1996).

A more complete description of these investigations can be found in the Remedial Investigation Report (Mission Research Corporation, 1999) for the Site and in the Administrative Record.

Results of Public Health Assessment and Additional Studies

On June 4, 1996, LOPH and the Superfund Site Assessment Branch of the Division of Health Assessment and Consultation of the Agency for Toxic Substance and Disease Registry (ATSDR) released a draft Public Health Assessment for the Site (Louisiana Office of Public Health, 1996). The draft Public Health Assessment described the Site at that time as a public health hazard based on three findings: (1) lead concentrations reported in soil would pose a future health risk to young children if they frequently come in contact with the lead-contaminated soil; (2) benzene concentrations reported in indoor air (1990-1994) may pose a health threat if the short-term benzene measurements are representative of daily exposures; and (3) methane concentrations measured indoors and in soil gas may pose a potential explosion hazard.

LOPH and ATSDR stated, in their 1996 draft report, that in certain areas of the Site, shallow surface soil, 0 to 2 inches bgs (where there is the highest probability of exposure for children), was contaminated with lead. The areas of lead contamination with the highest lead concentrations had been covered with grass to reduce the likelihood that the residents would come in contact with the lead-contaminated soil. Young children (six months to six years) are the population most sensitive to lead exposure in soil and to the health effects of that exposure.

In July 1995, LOPH and ATSDR tested the blood of Site children whose parents came forward in response to Site-wide notices. The purpose of the testing was to determine whether children living on-site had elevated blood lead levels. Blood lead values were found to be in the normal range, below the levels requiring medical follow-up. Although the blood lead levels of children tested in the exposure investigation were below levels requiring follow-up, LOPH was only able to get consent from parents to test 55 out of the approximately 370 children ages six months to six years who live on-site. The children tested may not have been representative of the larger population of children living on-site.

In their 1996 draft report, LOPH and ATSDR made several recommendations for the Site based on their 1995 findings:

- Additional indoor air sampling should be conducted to include analysis for refinery related chemicals and sampling should be of more frequent and longer duration
- Contaminants in soil gas should be measured concurrently with indoor air contaminants
- Measures should be taken to limit exposure of small children to areas of lead-contaminated soil (Louisiana Office of Public Health, 1996)

In response to these recommendations, in June 1996, EPA conducted sampling of indoor air at 92 on-site locations, where access was granted, using the EPA Trace Atmospheric Gas Analyzer (TAGA). Additionally, Summa canister samples of indoor air were collected in 31 on-site locations in order to determine time-weighted exposure to contaminants of concern (COCs) (Weston, 1996). Locations of Summa canisters were determined based on TAGA results.

On January 6, 1997, LOPH and ATSDR released a Health Consultation for the Site based on the results of EPA's June 1996 TAGA sampling of indoor air (Louisiana Office of Public Health, 1997). At that time, LOPH and ATSDR drew several conclusions:

- Indoor air concentrations of benzene in some on-site residences may pose an unacceptable cancer risk for long-term residents
- Some residential and motel units on the Site have consistently shown benzene levels above 10 parts per billion by volume (ppbv) during four sampling episodes spanning six years
- The source of benzene in indoor air on the Site in spaces tested could not be attributed solely to household products
- Indoor air concentration levels of contaminants other than benzene were below levels associated with detrimental health effects

LOPH and ATSDR recommended that:

- Site residents and property owners should be made aware of the health risks
- Exposure of Site residents and motel patrons to benzene levels of health concern should be mitigated
- On-site soil gas and indoor air sampling should be expanded (Louisiana Office of Public Health, 1997)

A final Public Health Assessment was issued on June 16, 2000. The LOPH recommendations in the final Public Health Assessment were the same as the recommendations made in the 1996 draft. An addendum to the Public Health Assessment will also be issued. (See September 19, 2000, memorandum in the Administrative Record.) The addendum details the steps the EPA had taken to address LOPH and ATSDR recommendations in the draft Public Health Assessment and Health Consultation.

Previous Response Actions

Both OXY and GSHI have performed, on behalf of the PRP COPCO, removal actions under EPA orders at the Site. "Removal actions" are defined broadly and include a wide range of actions taken to study, clean up, prevent or otherwise address releases and threatened releases at a site. "Remedial actions," which include the actions which will be taken under this ROD, are those actions consistent with permanent remedies, taken instead of, or in addition to, removal actions.

In July 1996, through a Unilateral Administrative Order (UAO), EPA ordered COPCO to conduct a removal action to address certain lead-contaminated surface soils. Under the UAO, lead-contaminated surface soil characterization, excavation, and off-site disposal were conducted initially by OXY and then by GSHI, both on COPCO's behalf (Conestoga-Rovers & Associates, 1998a). COPCO complied fully with the soil lead UAO. The response action taken as a result of the July 31, 1996, UAO is referred to as the "Soil Removal Action" in this ROD.

For removal actions, EPA uses the term "action level" to mean the contaminant concentration level at which the response action in question will be taken. Action levels should not be confused with "cleanup levels." The cleanup level is the contaminant concentration level which the response action is designed to meet. That is, once EPA has identified a contaminated medium (in this case soil) which contains concentrations of a contaminant (in this case lead) which exceed the action level, the removal action calls for continued response (in this case excavation to a maximum depth of two feet bgs) until the concentration of the contaminants in the contaminated medium are below the established cleanup levels. For the Soil Removal Action that EPA ordered in 1996, the action level for lead was 500 parts lead per million parts soil (ppm), and the cleanup level was also 500 ppm.

The Soil Removal Action included an investigation of 13 areas to determine the extent of soil lead contamination in those areas. A 500 ppm action level and cleanup level was selected for the Soil Removal Action based on experience at other Region 6 Superfund Sites including the RSR Corp. Superfund Site (RSR) in Dallas, Texas. In addition to the areas that were to be investigated and addressed if necessary, three Site areas where lead concentrations were known to exceed action and cleanup levels were targeted for response action under the Soil Removal Action. From 1996 to June 1998, approximately 6,630 cubic yards of lead-contaminated soil were removed from the Site and disposed of off-site at an approved landfill (Conestoga-Rovers, 1998a). In June 1998, an additional 1,228 cubic yards of lead-contaminated surface soil were excavated and disposed of off-site. The Soil Removal Action was officially completed on December 30, 1998. Figure 5 shows the approximate boundaries of the surface soil areas addressed during the Soil Removal Action. More detailed descriptions of the Soil Removal Action are included in the RI report.

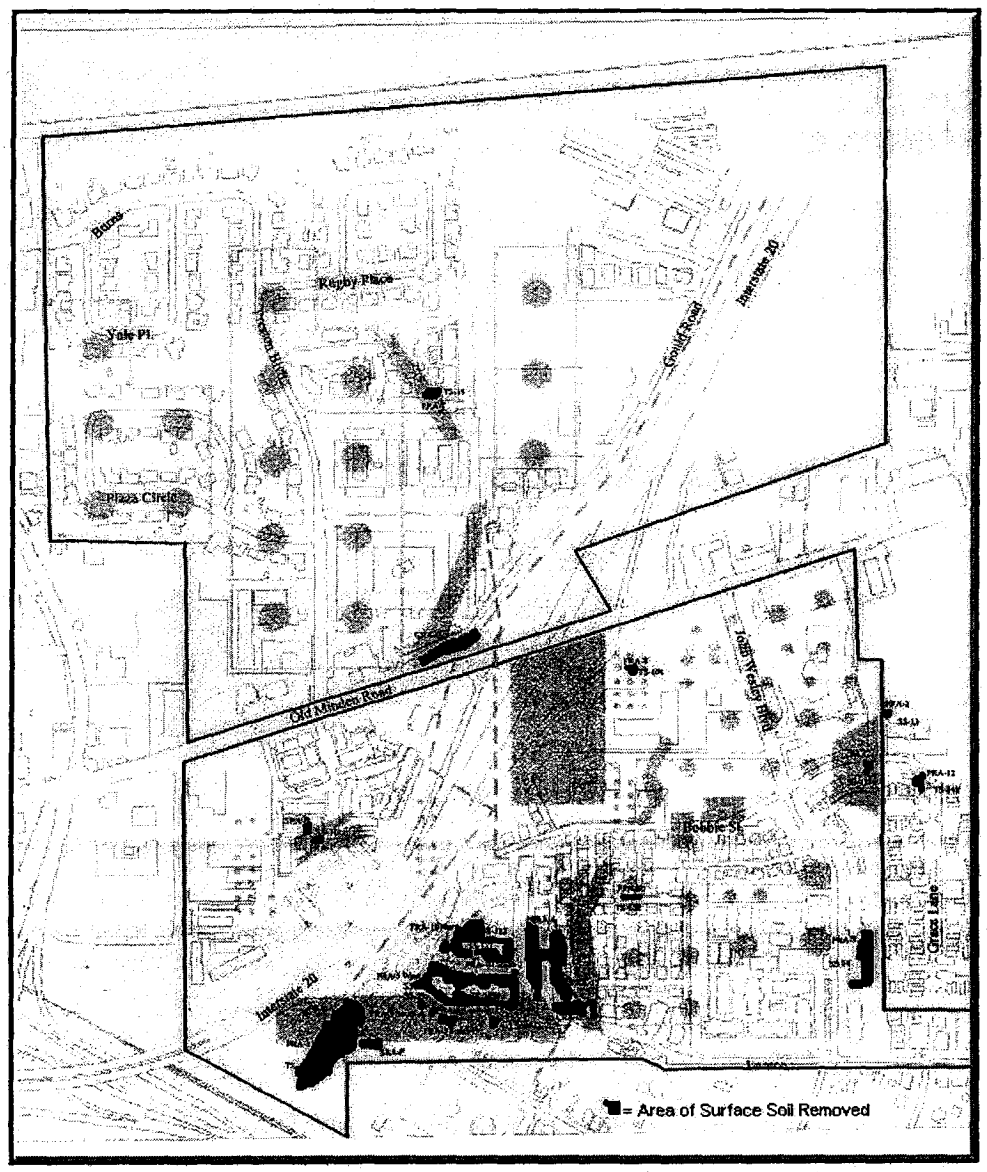


Figure 5 - Approximate Surface Soil Removal Areas

In December 1996, through a second UAO, EPA ordered COPCO to conduct a removal action to address indoor air contamination at the Site. The response action taken as a result of the December 1996 UAO is referred to as the "Indoor Air Removal Action" in this ROD. The Indoor Air Removal Action was conducted by GSHI on COPCO's behalf. The Indoor Air Removal Action addressed indoor air contamination at eight private residences and motel rooms in order to alleviate confirmed indoor air hazards at the Site (Conestoga-Rovers, 1997b). One residence was subsequently removed from the UAO process. (See October 23, 1998, letter in the Administrative Record.) In early 1997, EPA used the TAGA to screen additional on-site residences for indoor air contaminants.

The Indoor Air Removal Action included sampling air in Site buildings that had not been sampled previously. The Indoor Air Removal Action also included response actions in buildings that had been sampled previously and found to be contaminated with benzene at concentration levels that exceeded the action /cleanup level of 10 parts benzene per billion parts air (ppbv). EPA selected 10 ppbv benzene as the action level and cleanup level for the Indoor Air Removal Action based on site-specific data that was available at the time. A total of 32 dwelling units (e.g., homes, apartments or hotel rooms) were sampled, resulting in eight dwelling units which required corrective action because they contained concentrations of benzene in indoor air that exceeded the action level.

Corrective action consisted of engineering controls including: sealing cracks in foundations, where accessible; sealing penetrations in walls and foundations, where accessible; and/or installing or modifying ventilation systems for the dwelling units in question (Conestoga-Rovers, 1997b). These engineering controls were designed to reduce indoor air concentrations of benzene to concentrations that were below the cleanup level. The engineering controls did not address the source of the benzene, but only prevented the benzene from entering the dwelling units or from accumulating in the dwelling units above the action/cleanup level. Based on the results presented in the Post-Corrective Measures Inspection Report, the corrective action successfully reduced benzene concentrations in indoor air in the dwelling units addressed to below 10 ppbv. COPCO is in compliance with the indoor air UAO, which is still in force because continued monitoring is necessary to ensure that the corrective action remains effective.

In addition to the Removal Actions conducted at the Site, an LNAPL recovery program was initiated voluntarily by GSHI on behalf of COPCO in early 1997. LNAPL contains COCs including benzene. LNAPL generally floats on the ground water underlying the Site. The purpose of the LNAPL recovery program is to reduce the volume of LNAPL, which is a primary source of the indoor air contamination documented at the Site. As of June 30, 2000, 4,721 gallons of LNAPL had been recovered from the Site. LNAPL recovery technologies, including skimming and dual phase extraction, were among the remedial alternatives considered for LNAPL recovery at the Site. (Conestoga-Rovers, 1997a, 1998b, 1998c; G&E Engineering, 1998).

SECTION 3

Community Participation

Throughout the Site's history, community concern and involvement has been high. The EPA has kept the community and other interested parties apprized of Site activities through informational meetings, fact sheets, newspaper notices and public meetings. Below is a brief chronology of public outreach efforts:

In March 1995, the EPA released a community relations plan that outlined a program to address community concerns and keep citizens informed about and involved in remedial activities.

In June 1995, August 1995, October 1996, January 1997, July 1997, September 1997, and December 1999, public informational meetings were held. These meetings were to discuss the Remedial Investigation (RI) and Feasibility Study (FS) and the removal actions which took place at that site. Site fact sheets were issued in conjunction with most of these meetings.

In February 2000, a site fact sheet was issued to notify the public of upcoming sampling. Door-to-door public outreach was also performed.

On May 11, 2000, the EPA held an informational meeting at the Holiday Inn in Bossier City to discuss the results of the Remedial Investigation and Feasibility Study, and to describe the Proposed Plan of Action.

On May 12, 2000, the EPA made the Administrative Record available for public review at EPA's offices in Dallas, Texas; at LDEQ's offices in Baton Rouge, Louisiana; and at the Site repository which is located at the Bossier City Library at 2206 Beckett. This Administrative Record included information about reasonable anticipated future land use (See Walker, December 1999) and potential beneficial uses of ground water. The EPA also made the Proposed Plan available to the public on this date. The Proposed Plan included notice that the EPA intended to seek a technical impracticability (TI) waiver of ground water Applicable, Relevant and Appropriate Requirements (ARARs) at the Site (see 40 Code of Federal Regulations (CFR) § 300.430 (f)(1)(ii)(C)(3)). (See Appendix B, for a more detailed description of the TI waiver.)

On May 12, 2000, the EPA published a notice and brief analysis of the Proposed Plan in The Shreveport Times and the Bossier Press-Tribune.

From May 12, 2000 to June 12, 2000, the EPA held a 30-day public comment period to accept public comment on the Remedial Investigation, on the alternatives presented in the Feasibility Study and the Proposed Plan, and on the supporting analysis and information located in the site repository.

On June 6, 2000, the EPA, held a public meeting to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting is included in the Administrative Record for this Site. The oral comments received during this meeting and the written comments sent during the 30-day comment period, along with the EPA responses to these comments are included in the Responsiveness Summary, Appendix A of this ROD.

SECTION 4

Scope and Role of the Response Action

As discussed in the section of this document regarding previous response actions, several removal actions have been conducted to address certain lead-contaminated surface soils at the Site, and to address indoor air contamination at certain private residences and motel rooms at the Site. The remaining Site contamination will be addressed as one operable unit through the remedy selected in this ROD. (An operable unit is a discrete action that comprises an incremental step toward comprehensively addressing Site contamination.) That is, the response action, detailed in this ROD, will address the principal threat wastes (the light non-aqueous phase liquids) and the low-level, but significant, threat wastes (the lead and hydrocarbon-contaminated waste) which is discovered, or becomes uncovered in other areas of the Site.

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SECTION 5

Site Characteristics

Physical Site Characteristics

Bossier Parish lies within the upper portion of the Gulf Coastal Plain Region. Topographic relief ranges from relatively flat to strongly sloping with the entire region sloping to the south. The parish is divided into three major topographic areas: the Alluvial Valley of the Red River, the Tertiary Uplands, and the Broad Stream Terraces.

The approximately 215-acre Site is located within the Alluvial Valley of the Red River. The Alluvial Valley consists of the floodplain on the eastern side of the river and extends the full length of the western side of Bossier Parish. Based on topographic information presented on the 1975 U.S. Geologic Survey (USGS) quadrangle map of Bossier City, on-site contours range from 165 feet National Geodetic Vertical Datum (NGVD) to 170 feet NGVD. The Site is relatively flat with a gentle slope of less than 1 percent toward the Red River which is located approximately 1500 feet from the Site.

As previously stated, the Site is fully developed with single-family homes, apartments, and businesses. No features from the former refinery, such as bulk storage areas, north and south impoundment areas, the refinery process area, leaded gasoline storage areas, hot pond/spray pond, waste disposal area, and the railroad tank car loading area are currently visible as Site surface features.

Site Contamination—Investigatory Approach

Under the National Contingency Plan (NCP), 40 CFR Part 300, EPA must ensure that the public has appropriate opportunities for involvement in a wide variety of site-related decisions, including site analysis and characterization, and alternatives analysis (40 CFR § 300.430(c)(2)(ii)(A)). Since the Site is fully developed with residential and commercial properties, the Bossier City community leaders played a heightened role in decisions regarding Site investigation. From the time the Site was proposed to the NPL, EPA considered the advice of the Mayor of Bossier City and his staff, the members of the City Council, the Bossier City Chamber of Commerce, and the U.S. Congressional delegation which represents the area that includes the Site.

Throughout the Site investigation, community leaders at the Site requested that EPA take a nonintrusive approach to Site investigation and remediation. To that end, EPA, Bossier City, LDEQ, and OXY who acted on behalf of the identified PRP, COPCO, entered into an "Agreement in Principle" (AIP) on September 10, 1995. For more information on the AIP, please consult Volume I, Section 1 of the Remedial Investigation Report by Mission Research

Corporation, 1999, and the AIP itself, both of which are included in the Administrative Record for the Site.

The AIP provided that, based on the information then in EPA's possession, the parties would work toward an agreement with the following elements (subject to NCP requirements and procedures):

1. An Administrative Order on Consent (AOC) under which OXY would conduct a physical removal action to clean up surface soil and other surficial substances with concentrations of lead which exceed 500 ppm in certain parts of the Site (this removal action was conducted under an EPA order that is more fully described in the Previous Response Actions section of this document)

2. A judicial consent decree under which the PRP would: a) pump the LNAPL from under the old refinery process area, and conduct well monitoring to confirm the results of the pumping; b) take corrective action measures regarding Site living units or work places with refinery-related indoor air pollution that posed a risk of 1×10^{-4} (or greater) increased lifetime cancer risk and/or contributes to a hazard index of one (or greater) for occupants, appropriately taking into account background levels and other sources; and c) establish financial assurance mechanisms to assure OXY's payment of corrective action measures to address Highway 71/72 Refinery-related contamination discovered during future Site earthmoving operations

3. Implementation of restrictions on the use of Site ground water

Since the AIP, additional data and information have been generated in the course of planning and conducting removal activities at the Site (for lead in surface soil and benzene in indoor air) and during a water main break on-site in October 1999. This information, along with data which had been gathered at the time of the AIP, is included in the Administrative Record for the Site and is discussed in the following section of this ROD.

Site Contamination - Results of Sampling

The media which were investigated, the sampling approach used, the areas sampled, and when the sampling was performed are included in Section 2 of this ROD.

Surface Soil (0 to 2 feet below ground surface)

The contaminants of concern (COCs) found in the surface soil include hydrocarbons in the form of SVOC (semi-volatile organic compounds), such as polynuclear aromatic hydrocarbons (PAHs). The surface soil COCs also include lead, a metal. Concentrations of organic contaminants ranged from not detected (ND) to 33 ppm, with most organic contaminants measured at concentrations below one ppm (ERM-Southwest, 1994). No surface soil sampling for volatile organics such as benzene was conducted during this sampling effort.

Lead was the most prevalent metal contaminant detected at the Site in the surface soils. Lead concentrations found in samples taken prior to the Soil Removal Action ranged from 15.1 to 11,800 ppm (PRC Environmental Management, 1993) (The EPA's action level and cleanup level for the Soil Removal Action was 500 ppm lead). During surface soil sampling performed as a part of the Soil Removal Action, the maximum lead concentration detected was 41,760 ppm. The maximum lead concentration reported at the bottom of the excavations (2 feet bgs, at the top of the subsurface soils) was 155,000 ppm (Mission Research Corporation, 1999.) These excavations were backfilled with clean soil which covered any remaining concentrations of lead. Other metals were much less significant in terms of concentration and distribution (ERM-Southwest, 1994).

The RI Report indicates lead was present in significant quantities in areas of the Site associated with former refinery waste disposal areas such as the railroad tank car loading area, the tank truck loading area, and surface water impoundments of the former refinery (Figure 2). Lead contamination came from lead-contaminated waste materials that were discharged during Site refinery and storage operations (Meyer Environmental Consultants, 1996, 1998).

In February and March 2000, the EPA took samples of shallow surface soil (i.e., soil less than 2 inches bgs) at 118 on-site residential yards. (See the discussion of lead in soil on page 9-3 of this ROD.) The EPA took at least two samples per yard. The EPA found that none of the yards sampled had a soil lead concentration that exceeded 510 ppm. Site residents should be aware, however, that lead contamination could still exist in residential yard soil at depths greater than 2 inches bgs. In fact, historical documents suggest that a thin layer of clean soil may have been placed over areas of contaminated soil on the Site. Although all known areas of surface soil with concentrations of lead that exceeded 500 ppm were removed during the 1996-1997 Soil Removal Action, EPA believes that concentrations of lead contamination in residential yard surface soils at depths greater than 2 inches bgs may still present a threat to human health (especially children's health) should these soils be uncovered during excavation (e.g., during gardening or underground utility repair).

Subsurface Soil (greater than 2 feet below ground surface)

Soil at depths greater than 2 feet bgs is referred to in this ROD as "subsurface" or "deeper" soil. Subsurface soil was sampled by ERM-Southwest, Inc., as part of a Site investigation for GSHI (ERM-Southwest, 1994). These deeper soil samples were collected during the drilling of deep boreholes. Monitoring wells were later installed into some of these deep boreholes for the purposes of ground water monitoring and sampling. Lead was found in several areas within the subsurface soil. Hydrocarbon-contaminated subsurface soil was detected primarily on the southern half of the Site in areas associated with former refinery features.

Contaminants detected in the deeper soil included the following: hydrocarbons in the form of VOCs (volatile organic compounds), such as benzene, toluene, ethylbenzene, and xylenes (BTEX); SVOCs, including several PAHs; and several metals, including lead. Concentrations of the hydrocarbon contaminants in the subsurface soils ranged from not-detected (ND) to 110 ppm, though most of these contaminants were detected at concentrations ranging from ND to 10 ppm (ERM-Southwest, 1994). Lead, the most prevalent inorganic contaminant in the subsurface soils, was detected at concentrations ranging from ND to 3,980 ppm; though most of the lead concentrations ranged from 1 to 40 ppm (ERM-Southwest, 1994).

High levels of hydrocarbon contamination occur primarily on the southern half of the Site in the areas formerly used for gasoline blending, gasoline storage, railroad tank car repair yard, tank truck loading, and surface water impoundments (Figure 2).

The volume of soil (surface and subsurface) potentially contaminated with refinery-related wastes has been estimated by EPA at approximately 645,000 cubic yards. This approximation is based on an estimate that about 30 acres of the Site were contaminated with wastes during Site operations, that an additional 10 acres of the Site were contaminated during Site redevelopment (i.e., grading of the Site, moving contaminated soil into uncontaminated areas, etc.), and that soils are contaminated to a depth of 10 feet bgs (average depth to the water table). Since approximately 52 percent of the Site is covered by pavement and/or buildings, the volume of affected soil in uncovered areas is estimated to be 310,000 cubic yards.

The EPA believes that subsurface soil contamination does not present a significant human health or environmental threat through direct contact or ingestion unless these contaminants are brought to the surface (e.g., during earthmoving). However, subsurface soil contamination could be acting as a source of contamination of the indoor air and ground water.

Surface Water

Surface water was sampled by ERM-Southwest, Inc., to determine whether surface water quality had been contaminated by past Site activities. Surface water samples were collected from eight locations. Most of the surface water sample locations contained trash and debris

(including concrete pieces, scrap metal, oil filters, plastic, paper, and organic matter) that were not related to use of the Site as a refinery.

No VOCs were detected in any of the samples collected from locations impacted by runoff from the Site. Four VOCs were detected in the background samples located upstream of the Site. One SVOC, bis(2-ethylhexyl)phthalate, was detected in both on-site and background samples. The concentrations of bis(2-ethylhexyl)phthalate detected in surface water samples representing Site conditions (SW-1, SW-2, and SW-4) were similar to the concentration detected in a background sample (SW-3). Twelve inorganic compounds were detected in surface water samples. The concentration ranges of inorganic constituents detected in surface water samples were similar to the ranges detected in samples collected from background/upstream locations (ERM-Southwest, 1994).

Based on these results, the surface water channels on and near the Site do not appear to be contaminated with constituents related to past refinery activities.

Ground Water

The EPA Ground Water Protection Strategy classification guidelines were used to classify the aquifer beneath the Site to assist in determining the appropriate remediation method for shallow ground water underlying the Site (U.S. EPA, 1988b). Based on these guidelines, EPA determined that the aquifer is a Class IIB aquifer. A Class IIB aquifer is an aquifer which could be used as a source of drinking water in the future. The LDEQ supported this determination.

Ground water samples were collected from two Site ground water monitoring wells and analyzed for total dissolved solids (TDS). Ground water from monitoring well MW-63 was found to contain 798 milligrams per liter (mg/L) TDS and ground water from monitoring well PZ-4-97 showed 1810 mg/L TDS (G&E Engineering, 1997c). The secondary drinking water standard (for taste and aesthetics) for TDS is 500 mg/L.

Shallow ground water (less than 10 feet bgs) underlying the Site has been sampled on several occasions for site-related contaminants since the installation of monitoring wells in 1993. Samples were collected from monitoring wells installed into the uppermost water bearing unit located at the Site. Ground water within this upper unit has been found to be contaminated by refinery wastes both in the dissolved phase and as LNAPL floating on the surface of the ground water.

The occurrence of LNAPL is a likely result of refinery waste moving downward from disposal areas under the influence of gravity through the alluvial sediment underlying the Site. LNAPL is present in some Site monitoring wells at thicknesses ranging from a thin sheen to more than 15 feet (G&E Engineering, 1998). The ground water contamination at the Site is likely related to the presence of LNAPL and other underground hydrocarbon waste sources including waste in soil. Concentrations of VOCs in the ground water ranged from ND to 49.0 ppm. Most

ground water samples had concentrations of VOCs that were below one ppm. Concentrations for SVOCs ranged from ND to 4.20 ppm. Most SVOC concentrations were below one ppm. Concentrations of lead ranged from ND to 0.154 ppm and chromium ranged from ND to 0.24 ppm.

The lateral and vertical extent of the ground water plume was estimated based on available information. Three LNAPL plumes (identified as plumes A, B, and C) were identified at the Site based on soil and ground water sampling (Figure 7). The estimated volume of LNAPL in Plumes A, B, and C is approximately 325,000 gallons. The estimated volume of ground water contamination (in addition to the LNAPL contamination) is approximately 160,000,000 gallons. These estimates are based on an estimate that 32 acres of the Site are impacted by LNAPL, as detected in borings, and on an average saturated thickness of 15 feet. An additional LNAPL plume is present in the southern part of the Site, labeled "Zone 1" in Figure 7 and all previous site documents. Zone 1 has been renamed "Plume D" in this ROD to more accurately reflect its similarities to Plumes A, B, and C. The volume of potential contamination in Plume D has not been calculated because data is limited; however, the LNAPL in Plume D appears to be a thin layer. The EPA has also found that there is hydrocarbon contamination underlying Zone 2, a very small zone in the north central portion of the Site (see Figure 7) in the vicinity of monitoring well MW-2. (The size of this zone precludes it from being shown on the map.) Data on Zone 2 is limited, but at this time the thickness of the LNAPL in this zone (a sheen) does not appear to be such that the LNAPL in this zone should be addressed as part of the remedial action.

The EPA believes that LNAPL presents a significant threat to human health because it volatilizes, migrates to the surface as soil gas, enters buildings through foundation openings, and impacts indoor air. The EPA also believes that LNAPL presents a significant threat to human health because it contaminates ground water which may be ingested.

Soil Gas/Vapor Phase

A soil gas survey was conducted in September 1992 by OXY contractor Exploration Technologies, Inc. (1993) to investigate the nature and extent of previously detected Soil gases and their potential sources. The Soil gas survey was used as a screening tool to identify areas of concern. The results of the Soil gas survey were utilized to specify some of the borehole and monitoring well locations and to identify indoor air screening locations.

Soil gas samples from 898 locations were collected from depths of approximately 2.5 to 7.0 feet bgs at locations throughout the Site. Each sample was analyzed for light hydrocarbon gases including methane, ethane, propane, butanes, and the C5 plus (gasoline range) compounds. Two deep reservoir gas samples were also collected from commercially producing gas wells in the area and analyzed to determine if there were any similarities to the shallow soil gases. The reservoir gas samples were also analyzed for the compounds listed above in this paragraph, as well as for stable isotopes of carbon in order to help determine the

origin of the shallow soil gases. Some samples were also analyzed for BTEX compounds, and for nitrogen, oxygen, and carbon dioxide.

The results of the soil gas survey indicate that the highest hydrocarbon gas concentrations are generally found in the southern half of the Site. The composition of the deep reservoir gas samples was different from the typical shallow soil gas samples, thus suggesting that a portion of the soil gas is not originating from deep reservoir gas. Low oxygen and high methane content in shallow soil gas indicate potential biological decomposition of underground hydrocarbon compounds. The highest soil gas readings tend to be concentrated in the area where ground water monitoring results indicate the presence of a large plume of LNAPL (Plume A). However, the soil gas readings were also high along the old impounded bayous, which indicates the potential presence of organic material remaining from past refinery waste activities. High soil gas concentrations also occurred in the former railroad tank car repair yard where hydrocarbon- saturated soil was detected in boreholes, and LNAPL was detected in measurable quantities in these same boreholes during earlier sampling episodes.

The EPA believes that contaminated soil gas migration to indoor air presents the potential for a significant public health threat at this Site.

Indoor Air

Resident complaints of indoor odors were common from 1990 to 1996 on the Site. In 1990, at the direction of LOPH, 47 families were evacuated from an on-site apartment complex because elevated levels of methane and other hydrocarbon gases were detected in some on-site apartments. Two on-site hotels frequently closed several first floor rooms because of hydrocarbon odor complaints by customers.

In September 1993, OXY completed an indoor air screening and monitoring event through its contractor, Law Environmental (Law Environmental, 1994). Indoor air screening measurements were conducted three times per month over a three-month period in 419 ground floor locations on the Site. Selected locations were surveyed on a more frequent basis. For screening purposes, total hydrocarbons in the air were measured with an organic vapor analyzer (OVA). Additionally, 49 single event air samples were collected at 36 selected homes, apartments, and commercial buildings on the Site. The contractor took 36 breathing-space samples and 13 wall-space samples. In homes where chemical-specific analysis was performed, hydrocarbon gases (benzene, toluene, m,o,p-xylene, o-xylene, methane, ethane, propane, n-butane, n-pentane, n-hexane, n-heptane, and n-octane) were detected in certain ground floor locations.

In June 1996, EPA conducted an indoor air sampling study on the Site using EPA's Trace Atmospheric Gas Analyzer (TAGA). The TAGA is an air sampling instrument which detects very low concentrations of organic chemicals simultaneously in both indoor and outdoor air. TAGA sampling probes can be easily placed in crevices to help determine the source of air

contamination. The TAGA gathers data in "real time" which means that it gives a continuous reading of contaminant concentration during the sampling period.

The results of the TAGA indoor air screening showed contaminant concentration levels above the ambient (or background) outdoor concentration level. The TAGA found that concentrations of contaminants in indoor air were three times outdoor background concentrations for benzene, toluene, and/or xylenes in 48 of the 92 dwelling units tested (Weston, 1996). Additional monitoring and analysis was conducted at 32 dwelling units based on the results of the TAGA screening. Five of these units showed benzene levels above 10 ppbv. The results of a second TAGA indoor air screening conducted in January through March 1997, indicated elevated levels of benzene, toluene, and/or xylenes in nine of the 72 dwelling units tested.

Additional testing of indoor air in 37 Site dwelling units during the Indoor Air Removal Action found benzene levels above 10 ppbv in three indoor locations. Corrective measures (e.g., crack sealing, HVAC modification) were required in eight dwelling units. Based on TAGA data, EPA found that in certain dwelling units, benzene concentrations in indoor air are caused by the migration of soil gas into the structures in question. Although elevated benzene levels in indoor air can come from domestic sources, (e.g., cigarette smoke, vapors from an attached garage), this was not the case in the units where EPA determined that soil gas was the problem.

Weather patterns, including rainfall events and rising and falling ground water levels, influence the migration of soil gas through the subsurface. Cracks in foundations and penetrations in walls and foundations serve as conduits for soil gas migration into indoor air on the Site. An increase in structural integrity (i.e., sealing foundation cracks), and certain ventilation methods may prevent both the migration of soil gas into structures and the potential build-up of contaminants within structures.

Although the Indoor Air Removal Action mitigated known indoor air quality problems in the dwelling units which were tested, EPA believes that the potential still exists for Site-related contaminants to impact indoor air quality in the future, since the sources of indoor air contamination (e.g., the LNAPL) still exist and the integrity of on-site structures may deteriorate with age.

Conceptual Site Model

Prior to starting the Site investigation, the EPA made a model of the Site to represent the migration routes of contaminants. This model is called the conceptual site model, and is shown in Figure 6. The primary source of the contamination shown in Figure 6 is from past refinery operations which are detailed in the Site Operational History section of this ROD. The secondary source of the contamination, through which all other pathways became

contaminated, is soil. The general pathways of the contaminants, and the typical exposure routes for the Site receptors orignally considered are as follows:

Site Soils

- Exposure of current/future on-site residents, commercial workers, and utility workers to soils through incidental ingestion and dermal contact

Ground Water

- Exposure of future on-site residents to ground water through ingestion, and through dermal contact and ingestion when showering

Surface Water

- Exposure of current/future on-site child trespassers to surface water through dermal contact

Air

- Exposure of current/future on-site residents, transient hotel residents, and commercial workers through inhalation of indoor air in on-site buildings
- Exposure of current/future utility workers through inhalation of volatiles in trenches dug on-site

- figure 6

Not included in Web version

SECTION 6

Current and Potential Future Land and Resource Use

Current Land and Ground Water Use

Since 1968, the Site has been developed, and, currently, private residences, commercial buildings, and light industrial establishments cover a large portion of both the northern and southern parts of the Site. (See Figure 4 and Walker, December 1999, in the Administrative Record) The northwest corner of the Site contains a single-family residential development, apartment complexes, and commercial establishments. The northeastern portion of the Site contains commercial establishments and a plot of undeveloped land. The southern part of the Site is covered by several large apartment complexes, other residential areas (mainly townhouses and garden homes), and several commercial establishments including two hotels. The population of the Site is estimated at 3,500 people including approximately 370 children six years of age and younger. Based on digital photogrammetric data, approximately 52 percent of the area within the former refinery boundary is covered by pavement or buildings. Another approximately ten percent of the Site has limited accessibility due to easements for Interstate 20. Most of the rest of the Site is landscaped. Land use in the area surrounding the Site is similar to on-site use--residential, commercial, and light industrial.

As stated previously, the EPA Ground Water Protection Strategy classification guidelines were used to classify the aquifer beneath the Site. The ground water beneath the Site is classified as a Class IIB aquifer. A Class IIB aquifer is one that is not currently used, but could potentially be used in the future for drinking water, agriculture, or other beneficial uses. Currently, the ground water from this aquifer is not used for any of these purposes. Drinking water for on-site residents comes from treated water from the Red River which provides an abundant source of water. A well survey conducted in 1995 (Volume I, Site Characterization Report, ERM-Southwest, Inc., June 7, 1995) showed that only one private ground water well was located on-site. This well is not being used. The Site aquifer is not expected to be used for drinking water or irrigation in the future because of the availability of an abundant water supply, because of the high total dissolved solids in the aquifer (which makes the water unpalatable for drinking without some type of treatment), and because of a City ordinance which requires connection to the City water supply for all property owners.

Potential Future Land and Ground Water Use

The reasonably anticipated future land use at the Site, projected for the purposes of the Baseline Risk Assessment, is the same as the current use-- residential and commercial. This future land use projection is based on current conditions at the Site which is fully developed with single-family residences, apartments, hotels, and businesses. Land use adjacent to the Site consists of residential development to the east and south, and commercial developments to the west and north. This future land use projection is also based on zoning maps provided by the City. (See Walker, December 2000, in the Administrative Record.)

The reasonable anticipated future ground water use at the Site, projected for the purposes of the Baseline Risk Assessment, is residential use including drinking and showering. This projected future scenario must be used in the risk assessment because the ground water beneath the Site is classified as a Class IIB aquifer, which is one that is not currently used, but could potentially be used in the future for drinking water, agriculture, or other beneficial uses. (See 55 Federal Register (Fed. Reg.) 8666, 8732 (March 8, 1990)) However, as stated in the previous section, there are currently no plans to use the Site ground water for any beneficial use. Institutional controls that are included as a part of the remedy selected in this document will ensure that the ground water is not used in the future.

Due to the nature of this fully-developed Site, surface water is only present on-site in drainage ditches, many of which do not contain water year-round. This surface water is not used, nor is it expected to be used in the future.

SECTION 7

Principal and Low-Level Threat Wastes

Definitions

Principal threat wastes are wastes that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvents), and high concentrations of toxic compounds (e.g., concentrations that are several orders of magnitude[4] above levels that allow for unrestricted use and unlimited exposure). The EPA expects that treatment will be the preferred means to address the principal threats posed by a site, wherever practicable. Low-level threat wastes are those source materials that generally can be reliably contained and that contain contaminant concentrations not greatly above the acceptable levels. Examples of low-level threat wastes include non-mobile contaminated source material of low toxicity and low concentrations of low toxicity source material. Principal threat and low-level threat wastes associated with the Site are as follows:

Light Non-Aqueous Phase Liquids

LNAPL found floating on the ground water which underlies the Site is a principal threat waste because concentrations of constituents of concern in this LNAPL are very high. The LNAPL is mobile and it may volatilize into soils, migrate to the surface, and accumulate in the air inside buildings located on the Site, and the resulting concentrations of COCs in indoor air may be substantially above concentration levels which pose an unacceptable risk to human health. LNAPL may be found floating on the ground water or as residual materials sorbed to soils; however, only the LNAPL found floating on the ground water is of a high enough concentration to be considered a principal threat waste at the Site.

Ground Water

The EPA considers BTEX in ground water at the Site to be a principal threat waste because contaminant concentrations are substantially above concentration levels that pose an unacceptable risk to human health, if humans were exposed to the ground water. The contaminated ground water is not currently used by the citizens of Bossier City.

Based on the presence of an extensive source area that will remain at the Site (i.e., contaminated subsurface soil) and, based on the nature and extent of the contaminated ground water plume as described in the previous paragraph, EPA believes that it is technically impracticable to remediate the ground water contamination at the Site. Consequently, EPA includes a technical impracticability (TI) waiver of ground water Applicable, Relevant and

[4]An order of magnitude is a tenfold difference.

Appropriate Requirements (ARARs) at the Site (see 40 CFR § 300.430 (f)(1)(ii)(C)) as Appendix B of this ROD. Under EPA's Selected Remedy, the threat to human health posed by contaminated ground water at the Site will be addressed by preventing human exposure through institutional controls (i.e., banning the use of ground water from the contaminated aquifer in the vicinity of the Site) implemented by Bossier City. In addition, under the Selected Remedy, LNAPL will be aggressively recovered. Removing the LNAPL associated with ground water will reduce, but not eliminate, ground water contamination. These LNAPL sources are also the primary source of Site-related indoor air contamination.

Lead-Contaminated Surface Soil

Lead-contaminated surface soil at the Site is not classified by EPA as principal threat waste under EPA standards; however, should soil lead concentrations at the Site residential areas be found to be above health-based cleanup standards, these soils would pose a significant low-level threat to human health (young children are especially affected by small amounts of lead). The PRP has undertaken removal actions to address known areas of lead contaminated soil, mainly in residential areas on the southern part of the Site. Based on limited data and information gathered during the RI, including historical accounts, analysis of aerial photographs, professional opinions, and the testimony of a former Site refinery worker, the EPA believes that other areas on the Site may also be contaminated with lead in subsurface and surface soil deeper than two inches bgs; however, recent EPA sampling events have found no residential yards on the Site that contain concentrations of lead that exceed 510 ppm in the shallow surface soil (i.e., the top two inches). Based on EPA's experience with lead-contaminated soil on the Site so far, it is not likely that soil lead concentrations on the rest of the Site will be of the magnitude of a principal threat waste. That is, soil lead concentration levels are not likely to be several orders of magnitude above levels that allow for unrestricted use and unlimited exposure. Moreover, lead generally adheres to soil and is not highly mobile in the environment.

Organic-Contaminated Waste in Soils

Based on the information that EPA has, organic-contaminated waste in soils at the Site is not a principal threat because concentrations of organic contaminants in the soil are not likely to be several orders of magnitude above levels that allow for unrestricted soil use and unlimited exposure. However, this material is a low-level, but significant threat because of the possibility of human exposure, through dermal contact or through breathing fumes, to unacceptable levels of contaminants in the hydrocarbon-contaminated waste, should it be uncovered during earthmoving activities. In addition, organic-contaminated material at the Site appears to be somewhat mobile in that it is generally found in an oily layer in which there are visual indications of seeps through preferential pathways in the soil.

SECTION 8

Summary of Site Risks

Under the NCP, 40 CFR § 300.430, the role of the baseline risk assessment is to address the risk associated with a site in the absence of any remedial action or control, including institutional controls. The baseline assessment is essentially an evaluation of the no-action alterative. (See 55 Fed. Reg. 8666, 8710-8711 (March 8, 1990)) The baseline risk assessment also provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the March 1999 Baseline Risk Assessment for the Site.

Contaminants of Concern (COCs)

Overall, the Site COCs identified by the March 1999 Baseline Risk Assessment represent constituents typical of the materials present at petroleum refineries. There were also sporadic detections of chlorinated hydrocarbons in soil and ground water, and the metals arsenic, barium, manganese, chromium, aluminum, and vanadium in ground water; however these contaminants are not considered COCs due to infrequency of detection or low concentration.

For soil, the COCs include lead, benzene, and polyaromatic hydrocarbons (PAHs). For indoor air, the COCs include benzene, toluene, ethylbenzene and xylene (BTEX). For hydrocarbon-contaminated soil, the COC selection at the Site is based on site-specific data, and upon knowledge of other sites with similar wastes since Site analytical data is limited. The COCs were retained for risk evaluation based upon toxicity, frequency of detection, and concentration. They also represent the contaminants that contribute most significantly to human health risks at the Site.

In a baseline risk assessment, the EPA uses a concentration for each COC to calculate the risk. This concentration, called the exposure point concentration, is a statistically-derived number based on all the sampling data for a Site. Generally, the 95 upper confidence limit (UCL) on the arithmetic mean concentration for a chemical is used as the exposure point concentration. The 95 percent upper confidence limit on the arithmetic mean is defined as a value that, when calculated repeatedly for randomly drawn subsets of site data, equals or exceeds the true mean 95 percent of the time.

The summary of the COCs and the medium-specific exposure point concentrations is included in Table 1.

Exposure Assessment

In the exposure assessment part of the Baseline Risk Assessment, a detailed evaluation was completed for each potential exposure scenario at the Site. This evaluation included identification and characterization of contaminant sources and release mechanisms, transport media, exposure points, exposure routes, and human receptors. Human receptors identified and assessed as part of the potential exposure scenarios included on-site residents, commercial and utility workers, and transient hotel residents. Both current and future land use scenarios were considered in the exposure assessment.

The Baseline Risk Assessment identified primary contaminant sources, contaminant release mechanisms, exposure pathways, and receptors for the COCs. For future and current land use scenarios (which are the same at the Site), human chemical intakes were calculated for inhalation of contaminated air (indoor air and air in trenches dug for utilities), for ingestion of ground water, for ingestion of soil including dust and volatiles, and for dermal contact with soil, surface water, and ground water.

The exposure pathways and the conceptual site model for the Site are further discussed at the end of the Site Contamination - Investigatory Approach Section of this ROD. Major assumptions about exposure frequency, duration, and other exposure factors can be found in the March 1999 Baseline Risk Assessment (Volume III of the Remedial Investigation) which is included in the Administrative Record for this Site.

Toxicity Assessment

Site contaminants were assessed for carcinogenicity and for non-carcinogenic systemic toxicity. The incremental upper bound lifetime cancer risk, presented in this ROD as the "carcinogenic risk," represents the additional site-related probability that an individual will develop cancer over a lifetime because of exposure to a certain chemical (i.e., greater than the general nationwide lifetime risk of cancer).

To protect human health, EPA has set the acceptable risk range for carcinogens at Superfund Sites from 1 in 10,000 to 1 in 1,000,000 (expressed as 1×10^{-4} to 1×10^{-6}). A risk of 1 in 1,000,000 (1×10^{-6}) means that one person out of one million people could be expected to develop cancer as a result of a lifetime exposure to the site contaminants. Where the aggregate risk from COCs based on existing ARARs exceeds $1x10^{-4}$, or where remediation goals are not determined by ARARs, EPA uses the $1x10^{-6}$ as a point of departure for establishing preliminary remediation goals. This means that a cumulative risk level of $1x10^{-6}$ is used as the starting point (or initial "protectiveness" goal) for determining the most appropriate risk level that alternatives should be designed to attain. Factors related to exposure, uncertainty and

technical limitations may justify modification of initial cleanup levels that are based on the $1x10^{-6}$ risk level.

For non-carcinogenic toxic chemicals, the toxicity assessment is based on the use of reference doses (RfDs) whenever available. A reference dose is the concentration of a chemical known to cause health problems. The estimated potential site-related intake of a compound is compared to the RfDs in the form of a ratio, referred to as the hazard quotient (HQ). If the HQ is less than one, no adverse health effects are expected from potential exposure. When environmental contamination involves exposure to a variety or mixture of compounds, a hazard index (HI) is used to assess the potential adverse effects for this mixture of compounds. The HI represents a sum of the hazard quotients calculated for each individual compound. HI values that approach or exceed one generally represent an unacceptable health risk that requires remediation.

There are no available RfDs with which to assess exposure to lead in an environmental medium. Although EPA considered several methods for selecting a soil lead remediation goal, including slope studies, direct blood-lead measurements, and Integrated Exposure Uptake Biokinetic (IEUBK) modeling, EPA decided to use the IEUBK Model in the Baseline Risk Assessment to assess potential chronic exposures of children receptors to lead in drinking water and soil at the Site. The IEUBK Model is a computer model that estimates human health risk based on data gathered at a lead-contaminated site. Model input includes measurements of lead in indoor dust, measurements of lead in tap water, and measurements of lead in soil. Default parameters are utilized for any medium for which site-specific data does not exist. The EPA recommends that, for soil lead, a remediation goal be selected such that a typical child or group of children exposed to the soil in question would have an estimated risk of no more than five percent of exceeding a blood lead concentration of 10 micrograms per deciliter (μg/dL) (EPA July 1994). In this ROD, this five percent is referred to as the five percent benchmark. The Centers for Disease Control (CDC) says that blood lead levels at least as low as 10 μg/dL are associated with adverse health effects in children (CDC, 1991).

The toxicity data and sources of the information used in calculations of carcinogenic risk are included in Table 2. The toxicity data (including the target organ for each COC) used in calculations of non-carcinogenic risk are included in Table 3.

Human Health Risk Characterization

Risk estimates were calculated for current and future land use scenarios for hypothetical human receptors at the Site. Appendix D of the Baseline Risk Assessment shows the detailed calculation of risk. Cancer risks were estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to carcinogenic contaminants. Toxicity risk estimates for noncarcinogenic toxic chemicals are presented for COCs where toxicity values were available. The potential for noncarcinogenic hazards due to potential exposures to

chemicals was evaluated by calculating an HI for the COCs at the Site. As explained above, risk from lead was evaluated separately using the IEUBK model.

The Baseline Risk Assessment organized the types of risk at the Site according to various exposure scenarios. Each exposure scenario specifies the type of human receptor (e.g., child resident, adult utility worker), the exposure pathway (e.g., inhalation, ingestion) and the COC. If a contaminant or exposure scenario is found to produce a risk which will require a remedial action (based on either the carcinogenic risk or the HI) that contaminant or exposure scenario is said to "drive the risk" or "drive" the need for action. A remediation goal is set for site-related contaminants that drive risk. The following exposure scenarios are driving the need for action at the Site (all carcinogenic risks are based on the Reasonable Maximum Exposure or RME):

Indoor Air

Carcinogenic Risks: For the exposure scenario based on the potential inhalation of indoor air, benzene is driving the risk for the carcinogenic compounds for adult and child residents. Cancer risk from this indoor air contaminant for adult residents is 5×10^{-5} and 1×10^{-5} for child residents. Benzene in indoor air also drives the risk for adult commercial workers at 2×10^{-4}.

Non-Carcinogenic Risks: For the exposure scenario based on potential inhalation of contaminated indoor air, benzene is also the contaminant driving the risk based on its toxic but non-carcinogenic health effects. The HI for adult and child residents and adult transient hotel residents is about 3. The HI for an adult commercial worker is 1.

Ground Water

Carcinogenic Risks: For the exposure scenario based on the potential ingestion of contaminants in ground water, benzene is driving the risk for the carcinogenic compounds for adult and child residents. Cancer risk from these ground water contaminants for adult residents is 1×10^{-2} and 8×10^{-3} for child residents.

For the exposure scenario based on the potential inhalation of contaminants in ground water while showering, benzene is driving the carcinogenic risk for both adults and children at 3×10^{-2}. For the exposure scenario based on potential dermal exposure while showering, benzene is driving the risk for adult residents at 3×10^{-4} and 2×10^{-4} for child residents.

Non-Carcinogenic Risks: For the exposure scenario based on the potential ingestion of contaminants in ground water, several contaminants are driving the non-carcinogenic risk; however, these contaminants (mainly arsenic and manganese) were not found to be Site-related.

For the exposure scenario based on inhalation of contaminants in ground water while showering, benzene is driving the non-carcinogenic risk for adult residents with an HI of 324.

The potential risks regarding the ground water are described in Baseline Risk Assessment (Volume III of the Remedial Investigation). The ground water does not pose a health problem at the site because it is not being used at this time.

Surface Soils

This discussion of surface soils does not include a discussion of the adverse health risks due to potential exposure to lead which are discussed separately in a later section.

Carcinogenic Risks: For the exposure scenario based on the incidental ingestion of chemical contaminants in surface soil, the additive carcinogenic risk from all contaminants is 5×10^{-6} for adult residents, 1×10^{-5} for child residents, and 2×10^{-6} for commercial workers. The risks due to carcinogenic compounds in the surface soil drive the risk in this medium. Specifically, the contaminants driving the risk in the surface soil are carcinogenic polyaromatic hydrocarbons (PAHs) a group of compounds which include benzo(a)anthrocene, benzo(b)fluoranthene, benzo(a)pyrene, carbazole, chrysene, dibenz(a,h)anthracene, bis(2-ethylhexyl)phthalate, hexachlorobenzene, and indeno(1,2,3-cd)pyrene.

Based on limited data and information gathered during the RI, including historical accounts, analysis of aerial photographs, professional opinions, and the testimony of a former Site refinery worker; based on EPA knowledge of other similar refinery sites; and based on photographic evidence from the removal actions and the October 1, 1999, water main break, EPA believes that there is likely hydrocarbon-contaminated waste in residential area surface soils on the Site. This hydrocarbon-contaminated waste likely includes benzene as a contaminant at high enough concentrations to cause an unacceptable risk. Therefore, remediation goals for benzene in surface soils have also been set.

Subsurface Soils

This discussion of the subsurface soils does not include a discussion of the adverse health risks due to potential exposure to lead which are discussed separately in a later section.

Carcinogenic Risks: Three exposure scenarios were used to calculate risk to utility workers from subsurface soil at that Site. For the exposure scenario based on the potential inhalation of volatilized contaminants in subsurface trenches by utility workers, the total carcinogenic risk is 5×10^{-8}. For the exposure scenario based on the potential incidental ingestion of

subsurface soil by utility workers, the total carcinogenic risk is 1×10^{-7}. For the exposure scenario based on potential dermal contact with subsurface soil by utility workers, the total carcinogenic risk is 1×10^{-8}. These risks are within the acceptable risk range for carcinogens at Superfund Sites.

Non-Carcinogenic Risks: For the three exposure scenarios for utility workers noted in the previous paragraph, the HIs for all three exposure pathways were in the range of 0.001 - 0.00001. These HI values do not represent an unacceptable health risk that requires remediation.

Based on limited data and information gathered during the RI, including historical accounts, analyses of aerial photographs, professional opinions, and the testimony of a former site refinery worker; based on EPA knowledge of other similar refinery sites; and based on photographic evidence from the removal actions and the October 1, 1999, water main break, EPA believes that there is likely to be hydrocarbon-contaminated waste in subsurface soils on portions of the Site.

Although new analytical data has not been gathered, the presence of the black-stained soil layer up to six feet deep in the trench excavated in order to repair the water main (Bossier City Fire Department, 1999) suggests that there are several other possible exposure scenarios. These exposure scenarios include a child trespasser who could be exposed to the material during utility repairs or other construction activities. These exposure scenarios also include both adult and child residents who could potentially be exposed to the material while digging in their yards.

Until more data is gathered about the constituents in the black-stained soil, EPA considers incidental ingestion of subsurface soil, dermal contact with subsurface soil, and inhalation of vapors from subsurface soil potential COC exposure pathways which may pose unacceptable risks to human health. This hydrocarbon-contaminated waste likely includes benzene and carcinogenic PAHs as contaminants at high enough concentrations to cause an unacceptable risk. Therefore, remediation goals for benzene and PAHs in subsurface soils have been set.

Surface Water

Risk from dermal contact with surface water during wading for a child trespasser was calculated and was not found to be in an unacceptable range. The dermal contact carcinogenic risks were in the range of 1×10^{-8} and the HIs were in the range of 0.001.

Sediment

Sediment samples were not taken and, thus, a risk from sediment was not calculated. Under this ROD, should any contaminated sediment be excavated, it will be treated the same as soil. (See Section 12, The Selected Remedy.)

Risks from Lead

Since there are no EPA-approved RfD values for lead, it is not possible to evaluate the noncancer toxic risks of lead by calculation of a Hazard Index. An alternative approach is to estimate the likely effect of lead exposure on the concentration of lead in the blood of the children living on-site using the Integrated Exposure Uptake Biokinetic (IEUBK) model. The IEUBK model was used in the Site Baseline Risk Assessment to assess potential chronic exposures of children receptors to lead in ground water and soil. In the Site Baseline Risk Assessment, model default parameters were used for all exposure pathways except the soil ingestion pathway because the soil ingestion pathway was the only pathway for which data had been gathered at that time. Additional data from several media were gathered later in the RI so that a Site-specific lead remediation goal for surface soil could be developed using the IEUBK model. This is further discussed in Basis for the Selection of Remediation Goals Section of this document.

The modeling performed for the Site Baseline Risk Assessment produced a probability function that predicted the likelihood of elevated blood lead concentrations in child residents. In the case of potential exposure to lead-contaminated surface soil, using available data and certain assumptions, the estimate of the percentage of child residents expected to have blood lead concentration levels in excess of the 10 μg/dL criterion established by CDC was greater than five percent. Since the risk from lead was determined to be greater than the five percent benchmark, lead was retained as a COC which drives the risk in the soil medium and a remediation goal was set.

Risk Assessment Uncertainty

Within the Superfund process, baseline quantitative risk assessments are performed in order to provide risk managers with a numerical representation of the severity of contamination present at a Site, as well as to provide an indication of the potential for adverse public health effects. There are many inherent and imposed uncertainties in the risk assessment methodologies. Uncertainties in the human health risk assessment include sampling data that may not fully characterize the contaminants at the Site, exposure factors that are extrapolated from animal or laboratory studies, and inhalation concentrations derived from a soil exposure model. These uncertainties could cause both overestimation and underestimation of risk. These

uncertainties are further described in the Section 9 of the March 1999 Baseline Risk Assessment for the Site. General uncertainties are also discussed in the RI.

Ecological Risk Characterization

One of the first steps in performing an ecological risk assessment is evaluating whether or not there is a pathway of exposure for ecological receptors. At the Highway 71/72 Site, EPA considered several factors in this evaluation: the urban setting of the Site, the developed nature of the Site (i.e., much of the Site is paved or covered with commercial establishments and residential buildings), and the fact that a major interstate highway and several multi-lane state highways transect the Site. In addition, EPA considered the input of the U.S. Department of the Interior (DOI, April 22, 1998, and January 5, 2000.) The EPA concluded that continuing with an ecological risk assessment was not appropriate for the Site because there was an incomplete exposure pathway to ecological receptors.

Basis for Action

It is EPA's judgment that the remedial alternative selected in this ROD is necessary to protect the public health or welfare or the environment from actual releases of hazardous substances into the environment, or from the substantial threat of such release.

SECTION 9

Remedial Action Objectives and Goals

Remedial Action Objectives

The following are the Remedial Action Objectives (RAOs) for this Site:

Soil Media Remedial Action Objectives

1. Prevent human (especially child) ingestion of lead-contaminated surface and subsurface soil with lead concentrations that exceed 510 ppm.

2. Prevent human ingestion of, and prevent human dermal contact with, and prevent human inhalation of surface and subsurface soils containing carcinogenic PAHs at concentrations greater than 1 ppm benzo(a)pyrene (BAP) equivalents, or benzene at concentrations greater than 1 ppm.

3. Prevent human ingestion of, and prevent human dermal contact with, soils containing other site-related compounds that present a carcinogenic risk greater than 1×10^{-6} or a HI greater than 1.

4. Reduce and/or eliminate the potential for soils to be impacted by COCs present in refinery waste materials located in the subsurface by removing LNAPL from ground water until the performance standard (a threshold thickness of 0.1 foot of LNAPL, measured using an interface probe in monitoring or extraction wells) is attained.

Indoor Air Remedial Action Objectives

1. Prevent human inhalation of concentrations of benzene in indoor air that exceed 10 ppbv benzene.

2. Reduce and/or eliminate the potential for indoor air to be impacted by COCs present in refinery waste materials located in the subsurface by removing LNAPL from ground water until the performance standard (a threshold thickness of 0.1 foot of LNAPL, measured using an interface probe in monitoring or extraction wells) is attained.

Ground Water Remedial Action Objectives

1. Prevent human ingestion or inhalation of ground water containing site-related COCs at concentrations which exceed the corresponding Maximum Contaminant Level Goals (MCLGs) established under the Clean Water Act (CWA) that are set above zero for these COCs. Alternatively, prevent human ingestion or inhalation of ground water containing CWA Maximum Contaminant Levels (MCLs) of these COCs when the corresponding MCLGs are set at zero.

2. Reduce and/or eliminate the potential for ground water to be impacted by COCs present in refinery waste materials located in the subsurface by removing LNAPL from ground water until the performance standard (a threshold thickness of 0.1 foot of LNAPL, measured using an interface probe in monitoring or extraction wells) is attained, and by removing hydrocarbon-contaminated surface and subsurface soils, containing carcinogenic PAHs at concentrations greater than 1 ppm benzo(a) pyrene(BAP) equivalents, or benzene at concentrations greater than 1 ppm, should they become uncovered.

3. Prevent human ingestion or inhalation of ground water containing Site-related COCs at concentrations which exceed the corresponding non-zero MCLGs (or MCLs where the corresponding MCLGs equal zero) by monitoring to ensure that concentrations of site-related COCs do not exceed remediation goals in Site ground water that may migrate to an area that is not within the area under the jurisdiction of the City's ban on ground water use.

Basis for Selection of Remediation Goals

A Remediation Goal is the allowable concentration of a contaminant which may remain in a specific medium (such as soil or indoor air) at a site after implementation of the ROD through the Remedial Action. Remediation goals are concentrations of contaminants for each exposure route that are protective of human health and the environment. Generally remediation goals are based on ARARs. Where no ARARs exist or where ARARs are not sufficiently protective, the NCP prescribes methods for selection of remediation goals. There are no ARARs for Site soil or indoor air; consequently, according to NCP procedure, remediation goals were selected based on risk to human health. That is, soil and indoor air remediation goals were selected that correspond to risk levels that are acceptable under the NCP. For ground water remediation goals, in keeping with the NCP, EPA identified non-zero MCLGs (or MCLs where MCLGs equal zero) as ARARs; however, as explained in this ROD, EPA is waiving ARARs for ground water because compliance with ground water ARARs is technically impracticable from an engineering perspective.

As mentioned above, air in trenches dug for utility conduits may be a COC exposure route; however, EPA has determined that, if PAHs and benzene found in situ in soil are cleaned up to a concentration of 1 ppm in soil, the inhalation threat will be eliminated. Therefore, no separate remediation goal for trench air has been established. In addition, the Selected Remedy includes provisions through which a utility worker may contact a remediation contractor should the worker encounter any stained or malodorous soil. (See Section 10 of this ROD, entitled Description of Alternatives.)

The basis for the selection of remediation goals for soil and indoor air is detailed in three memoranda prepared by EPA toxicologist Dr. Jon Rauscher which are a part of the Administrative Record for the Site (Rauscher, January 2000, March 2000, and August 2000). A discussion of Site conditions which are a part of the basis for the technical impracticability waiver for ground water ARARs is included in a memorandum prepared by EPA hydrologist, Mr. Vincent Malott which also is a part of the Administrative Record for the Site (Malott, January 2000). (The full TI Waiver is Appendix B of this ROD.) The same memorandum by Mr. Malott explains the basis for the performance standard selected for LNAPL extraction. The remediation goals and the performance standard selected for the Site are consistent with the NCP, with EPA policy and with remediation goals at other EPA Region 6 Sites. The basis for each remediation goal is summarized below.

Lead in Soil

Remediation goals for lead were calculated on a Site-specific basis using the IEUBK model. Input parameters for this model include lead concentration data from Site soils, indoor dust in homes, and tap water, among other data. For this Site, except for limited data on lead in Site soils, these types of data were not collected prior to the release of the RI Report. Therefore, EPA Region 6 undertook a limited sampling effort in February and March 2000 in order to acquire the data necessary to run the IEUBK model and to calculate a Site-specific remediation goal. The concentration of 510 ppm is the soil lead concentration that corresponds with an estimated risk of no more than five percent that a typical child or group of children living on the Site would have a blood lead concentration greater than or equal to 10 μg/dL. (See Rauscher, March 2000.)

This remediation goal is different than the action level set for lead during the Site removal actions because that action level was based on knowledge gained from another EPA Region 6 Site, the RSR Corp. Superfund Site, and on data collected at that site. At the time that EPA selected the Soil Removal Action for the Site, EPA could have run the IEUBK model using the Site soil lead data along with default values for indoor dust and tap water. However, EPA decided that it was more appropriate to base its cleanup level on knowledge gained from EPA's experience at the RSR Corp. Superfund Site because using data and experience from an actual site would be more likely to produce an appropriate action level and cleanup level than would reliance on the IEUBK model's default values. At the RSR Corp. Superfund Site, any area where contamination was found was excavated to a depth of 6 inches, then retested, and excavated and retested in 6 inch increments, until the cleanup level was reached or until the

excavated area reached 2 feet bgs. Since soil lead concentrations decreased with depth at RSR, most of the soil in the final 6-inch lift in any given area generally contained clean soil which was under the contaminated soil; consequently, the target cleanup level of 500 ppm actually attained a lower cleanup level.

Based on results at RSR, EPA assumed the Soil Removal Action would attain similar results. However, data acquired during the Highway 71/72 Site Soil Removal Action showed that lead concentrations actually increased with depth in many cases. Evidently, the difference between the Site and RSR is the manner in which the lead was deposited. At RSR, lead concentrations almost invariably decreased with soil depth. During the Soil Removal Action, EPA found that there was no consistent pattern to changes in soil lead concentrations as excavations went deeper, but, generally, lead concentrations increased at depth. In fact, the highest soil lead concentration ever found at the Site was found at 2 feet bgs in one excavated area. EPA's finding that there are random concentrations of soil lead on the Site is consistent with EPA's belief, based on analysis of aerial photographs taken during the clearing of the Site, that contaminated soil was bulldozed and spread throughout the Site. Since the method used to select the action level and cleanup level for the Soil Removal Action was found to be inappropriate for conditions at the Site, EPA used a different method for selecting the remediation goal for the Remedial Action. EPA considered several methods for selecting a soil lead remediation goal including slope studies, direct blood-lead measurements, and IEUBK modeling. EPA decided to run the IEUBK computer model using data that was actually gathered at the Site. Since the IEUBK model considers all sources of lead that may affect children, samples of indoor dust, yard soil, and tap water were gathered from on-site residences. This data was put into the IEUBK computer model, and a site-specific soil lead remediation goal of 510 ppm was calculated. This concentration of 510 ppm is the soil lead remediation goal presented in this ROD.

Organic-Contaminants in Soil

The two organic contaminants driving the risk in the soil at the Site are carcinogenic Polynuclear Aromatic Hydrocarbons (PAH's) and benzene.

Carcinogenic PAH's: Eight compounds, related in both their chemical structure and the health effects they may cause in humans, are considered carcinogenic PAHs. For simplicity in laboratory reporting, the concentrations of these carcinogenic PAH's are generally reported as one of the more common PAHs, benzo(a)pyrene (BAP). This comparative measurement is referred to as a BAP equivalent. The conversion to BAP equivalents is done using mathematical conversion factors which compare the toxicity of each compound to that of BAP.

The EPA has determined that PAH concentration levels (measured in BAP equivalents) in soil that correspond to a $1x10^{-6}$ risk level, the NCP point of departure (point of departure is explained further in the Toxicity Assessment section of this ROD), would be below the practical quantitation limit. The practical quantitation limit is the lowest concentration of a contaminant that can be accurately measured. Accordingly, due to this technical limitation, EPA selected the lowest BAP equivalent level that could be accurately measured, 1 ppm BAP equivalent, as the remediation goal for PAHs in soil. This PAH remediation goal corresponds to a $1x10^{-5}$ excess lifetime cancer risk.

Benzene: A remediation goal of 1 ppm benzene was selected for benzene in soil, and this remediation goal corresponds to a $1x10^{-6}$ excess lifetime cancer risk--the NCP point of departure.

Additional Organic Contaminants: Due to the limited sampling undertaken for organic contaminants at the Site and due to the oily nature of the matrix of the soil contamination (this matrix could mask contaminants when a standard laboratory analysis is performed), a remediation goal has also been set for certain site-related contaminants even though the Baseline Risk Assessment did not identify these certain contaminants as posing an unacceptable human health risk in soil. For all Site-related compounds discovered during the excavation or sampling performed as part of the Remedial Action, maximum concentrations left unexcavated will be those which correspond to an excess lifetime cancer risk of $1x10^{-6}$ or less, calculated assuming the type of residential exposure that is consistent with the Site Baseline Risk Assessment using the risk assessment procedures described in the various volumes of EPA's Risk Assessment Guidance for Superfund and supplementary guidance. (See Section 11, References, in Volume III of the Remedial Investigation.) For non-carcinogenic compounds, maximum concentrations left unexcavated will be those that correspond to an HI less than or equal to 1.

Benzene in Indoor Air

The EPA found that the indoor air concentration of benzene that corresponds to an excess lifetime cancer risk of $1x10^{-6}$ is actually below the non-site-related background concentration of benzene in ambient outdoor air. Accordingly, EPA adjusted the remediation goal upward to take into account the background benzene concentration in indoor air under the range of Site conditions encountered during the Indoor Air Removal Action. A goal of 10 ppbv was selected, which is near the high end value of the background concentration range. This remediation goal corresponds to an excess lifetime cancer risk in the range of 1×10^{-4} to 3×10^{-5}. A memorandum describing the selection of the indoor air remediation goal for benzene is found in Appendix C of this ROD.

LNAPL Removal

The purpose of the extraction of LNAPL is to keep it from continuing to act as a source of contamination for indoor air, soil, and ground water. Due to the nature of the extraction methods for LNAPL plumes, it is more appropriate to establish a performance standard for LNAPL extraction than it is to select a remediation goal based on concentrations of COCs. Therefore, this ROD requires LNAPL to be extracted until a maximum of one-tenth of a foot (0.1 foot) of LNAPL remains in the monitoring wells (s) or extraction well(s) completed in the LNAPL plume. The LNAPL thickness will be measured using an interface probe. That is, once the LNAPL thickness in the monitoring or extraction wells for each plume has stabilized at 0.1 foot or less the LNAPL removal may stop. Whether or not the plume has stabilized will be determined by statistically analyzing data from four equally-spaced sampling events, conducted over a minimum of a one-year period. This standard is based on EPA guidance and common engineering practice during hydrocarbon recovery operations at underground storage tank locations (EPA, September 1996).

SECTION 10

Description of Alternatives

This section summarizes the five non-intrusive remedial alternatives developed during the Feasibility Study (FS). These alternatives are analyzed in more detail in the FS, which is part of the Administrative Record.

- **Alternative 1**: *No Action*

- **Alternative 2**: *Implementation of the Common Elements:* Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at the Request of On-site Community Members; Cleanup of Lead-Contaminated Surface Soil and Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air

- **Alternative 3:** *Implementation of the Common Elements Plus LNAPL Removal Through Skimming (Plume A, B, C)*

- **Alternative 4**: *Implementation of the Common Elements Plus LNAPL Removal Through Dual Phase Extraction (Plume A, B, C)*

- **Alternative 5: The Selected Remedy;** *Implementation of the Common Elements Plus LNAPL Removal Through Dual Phase Extraction (Plume A, B, C and D)*

Common Elements of Remedial Alternatives 2, 3, 4, and 5

Common Elements—Feasibility Study Assumptions

Each of the remedial alternatives (other than Alternative 1) evaluated as part of the detailed analysis have certain assumptions and aspects in common. These are called the common elements. Common elements which concern assumptions used in the FS for Alternatives 2, 3, 4, and 5 follow:

- All costs were based on a 30-year project lifetime.

- All costs have a degree of accuracy of +50% to -30% pursuant to the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA - Interim Final" OSWER Directive 9355.301 (October 1988). This guidance was followed to the extent that it is consistent with the NCP.

- All costs and implementation times are estimates which should be used as a basis for a comparative analysis of the alternatives only, and not as a determination of absolute costs and time which will be expended during the project. Costs will be recalculated in the Remedial Design Work Plan.

- Any changes to the common elements, since publication of the cost estimates in the FS, that could result in a change in cost for one alternative, will result in a proportional change in cost to all alternatives; consequently, the comparisons between the alternatives remain valid.

- Present worth costs are presented in this ROD so that the remedial action alternatives which may have costs incurred in different time periods can be compared on the basis of a single cost figure for each alternative. Also, although some alternatives may take over 30 years to implement, a maximum cost period of 30 years is used for comparison purposes. For example, Alternative 3, which would implement skimming of LNAPL, has its cost estimated over a 30-year period, although it would probably take much longer to implement. Present worth or present value cost is the amount of money that would have to be set aside at the inception of the response action in order to assure that funds will be available in the future to complete a given response action, assuming certain economic factors such as an interest rate and an inflation rate.

- Under the NCP, if a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the Site at concentrations that are above concentrations that allow for unlimited use and unrestricted exposure, EPA must review the remedial action every five years. Although the performance of five-year reviews is not itself part of a remedial alternative, upon implementation of any of the proposed remedial alternatives, EPA would perform five-year reviews. The five-year reviews are necessary because each remedial alternative evaluated allows hazardous substances to remain on-site in concentrations that restrict use after the Remedial Action. EPA must conduct the reviews no less often than every five years after initiation of the Remedial Action in order to ensure that human health and the environment are being protected. (See 42 U.S.C. Section 9621(c).)

- All alternatives will meet ARARs except for ground water ARARs which have been waived. The TI Waiver for the ground water ARARs is included as Appendix B of this ROD.

- All alternatives will support the current and future anticipated land use at the Site -- residential, commercial, and light industrial.

Common Elements—Technical Features

In addition to their common assumptions, each of the remedial alternatives (other than Alternative 1) evaluated as part of the detailed analysis also share certain technical common elements regarding the manner in which they address lead-contaminated soils, hydrocarbon-contaminated soils, indoor air contaminated with COCs, ground water, and environmental monitoring. These technical common elements are detailed in Section 12 of this ROD.

Many of these common elements employ the services of a contractor to perform excavation, sampling, and notification activities. This local contractor is referred to as "LDEQ's agent," because, under each evaluated alternative, LDEQ would be performing direct oversight of the contractor. The LDEQ would also handle local coordination of the cleanup and communication with EPA regarding Site activities. This is an arrangement commonly used during site cleanups so that the cleanups may proceed quickly. The EPA would retain overall project management responsibility at the Site, and the EPA would ensure that the PRP funds the cleanup.

The LDEQ has agreed in principle to undertake the tasks which the ROD calls for it to take. The LDEQ, however, is an agency of a sovereign State, and, notwithstanding any other part of the ROD, LDEQ may at some future time decide not to continue these actions. At that time, EPA will evaluate its options, and take actions consistent with CERCLA and the NCP.

The technical elements common to Alternatives 2, 3, 4, and 5 are:

- Sampling for lead in surface soil and sampling for hydrocarbons in surface and subsurface soils at the request of on-site community members;
- Cleanup of lead-contaminated surface soil discovered during requested sampling or uncovered during earthmoving activities;
- Cleanup of hydrocarbon-contaminated surface and subsurface soil discovered during requested sampling or uncovered during earthmoving activities;
- Sampling for benzene in indoor air at the request of on-site community members;
- Mitigation of indoor air contamination discovered through requested sampling;

- Periodic notification of the on-site community of potential contamination, of available services, and of ground water use restrictions;
- Implementation of ground water use restrictions; and
- Environmental monitoring of LNAPL, ground water, and indoor air.

Alternative 1 - No Further Action Alternative

No Further Action, Operation and Maintenance

Alternative 1 is the baseline condition against which other remedial alternatives are compared, as required by the NCP and CERCLA. Alternative 1 would provide no further remedial action at the Site. Alternative 1 would not address the human health risks identified in Section 4 of this document and, therefore, does not protect human health. Alternative 1 does not reduce contaminant toxicity, mobility, or volume and it is not an effective or permanent remedy. Since, under all alternatives including the no further action alternative, hazardous substances would remain on the Site, CERCLA requires EPA to conduct a review of the Remedial Action every five years in order to assess whether human health and the environment are being protected. Alternative 1 is mentioned throughout the evaluation process for the purposes of comparison.

- Capital cost: $0 million
- Annual operation and maintenance (O&M): $3,700
- Present worth: $46,100
- Implementation Time: Not applicable
- Total cost: $111,400

Alternative 2 - Implementation of Common Elements

Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at Request of On-site Community Members; Cleanup of Lead or Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air

- Capital cost: $9.9 million
- Annual O&M: $146,000
- Present worth: $11.7 million

- Construction time: 1 year (indoor air mitigation completed in this time period)
- Total cost: $14.1 million

Alternative 2 calls for implementation of all of the common elements described in the Common Elements section. Alternative 2 does not offer any unique elements for LNAPL recovery, but does provide for the following: mitigation of COC contamination in indoor air; surface soil remediation in areas impacted by lead contamination; and surface and subsurface soil remediation in areas impacted by hydrocarbon-contamination where hydrocarbon-contaminated soils are found during on-site earthmoving activities or sampling; a ban on ground water use to prevent human exposure; and environmental monitoring. Although the sampling, excavation, and mitigation methods were cost-estimated over a 30-year period, the actual time the common elements would remain in effect could be longer.

Alternative 3 - Implementation of Common Elements plus LNAPL Recovery by Skimming (Plumes A, B, C)

Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at the Request of On-site Community Members; Cleanup of Lead or Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air; LNAPL Recovery by Skimming (Plumes A, B, C) and LNAPL Recycling/Reuse or Disposal

- Capital Cost: $10.7 million
- Annual O&M: $326,000
- Present Worth: $14.7 million
- Construction Time: 1 year (indoor air mitigation completed and LNAPL skimming system installed)
- Additional Time Assumption: recovery by skimming will take more than 30 years (in the range of 100 years)
- Total Cost: $20.2 million

Alternative 3 calls for the following: source removal through LNAPL recovery using skimming in Plumes A, B, and C; LNAPL management through recycling/reuse or disposal; and management of other media as described in Alternative 2 and in the Section of this ROD entitled Common Elements of Remedial Alternatives 2, 3, 4, and 5. Alternative 3 and all of

the alternatives which include LNAPL removal will remove at least 325,000 gallons of LNAPL.

Skimming is a process which involves the slow removal of LNAPL through the use of extraction wells. Two types of skimming equipment are available: mechanical skimming equipment which actively extracts LNAPL; and passive skimming equipment which accumulates the LNAPL over time. Skimming operations would be constructed in a safe manner that prevents trespassers from coming into contact with the LNAPL or the equipment. LNAPL would be removed until a threshold thickness of 0.1 foot of LNAPL, measured using an interface probe in monitoring or extraction wells was achieved. This performance standard would be met when the threshold thickness had stabilized at 0.1 foot over four equally-spaced sampling events, conducted over a minimum of a one-year period.

Alternative 3 provides protection to human health through source reduction accomplished by LNAPL recovery. That is, removal of the LNAPL will eliminate the principal source of benzene and other hazardous hydrocarbons which pollute indoor air on the Site. CERCLA favors the reuse of recovered waste materials, which may be accomplished by LNAPL recycling. Due to the slow rate of LNAPL source removal through skimming, Alternative 3 will reduce the threat to indoor air very slowly.

In areas contaminated with low thicknesses of LNAPL (such as Plume D), skimming would be extremely slow. Skimming would not address the residual LNAPL held in soil because it is relatively passive, and does nothing to draw the LNAPL out of the interstitial area between soil particles. Alternative 3 does not address the thin layer of LNAPL in Plume D because of the extensive length of time that it would take for any LNAPL to accumulate in a skimming well in this zone.

Alternative 4 - Implementation of Common Elements plus Enhanced LNAPL Recovery By Dual Phase Extraction (Plumes A, B, C)

Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at the Request of On-site Community Members; Cleanup of Lead or Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air; Enhanced LNAPL Recovery by Dual Phase Extraction (Plumes A, B, C); LNAPL Recycling/Reuse or Disposal; and Treatment or Disposal of Co-extracted Ground Water and Vapors

- Capital cost: $11.1 million
- Annual O&M: $380,000
- Present worth: $14.4 million
- Construction time: 1 year (indoor air mitigation completed)
  - 1.5 years (LNAPL dual phase extraction system installed)
- Additional time assumption: recovery by dual phase extraction will take 8 years
- Total cost: $17.3 million

Alternative 4, calls for the following: source removal through LNAPL recovery using dual phase extraction on Plumes A, B and C; LNAPL management through recycling/reuse or disposal; treatment of co-extracted ground water and vapor using granular activated carbon (GAC), if co-extracted ground water and vapor do not meet treatment and performance standards; discharge of treated co-extracted ground water to the publicly-owned treatment works (POTW); and management of other media as described in the section of the ROD entitled Common Elements of Alternatives 2, 3, 4, and 5.

Dual phase extraction is a technology which applies a strong vacuum to extraction wells in order to simultaneously remove LNAPL floating on the water table and residual LNAPL trapped in the soil above the water table. Dual phase extraction can also remove ground water and vapor. Once above ground, this co-extracted ground water and vapor are separated from the LNAPL and treated. LNAPL would be sent off-site for recycling/reuse. Ground water incidentally extracted during LNAPL removal as part of any of the remedial alternatives that address LNAPL, would be treated and discharged to a POTW. Co-extracted ground water would be treated, under each of the alternatives that address LNAPL, to meet the POTW treatment standards. Co-extracted vapor would be treated using the Best Demonstrated Available Technology (BDAT) which is the performance standard.

Dual phase extraction is an enhanced LNAPL recovery technique, and, thus, would recover more LNAPL in a shorter time frame than Alternative 3 which employs skimming. Dual phase extraction operations would be constructed in a safe manner that prevents trespassers from coming into contact with the LNAPL or the equipment.

Alternative 4 provides protection to human health by removing source material in the form of LNAPL which is the principal source of indoor air contamination; moreover, Alternative 4 removes the LNAPL more quickly than Alternative 3. The duration of LNAPL impact on indoor air and ground water under Alternative 4 will be shorter than it would be under Alternative 3 because Alterative 4 uses a more aggressive LNAPL recovery technique. CERCLA favors the reuse of recovered waste materials, which may be accomplished through LNAPL recycling under Alternative 4.

Alternative 5 - The Selected Remedy: Implementation of Common Elements plus Enhanced LNAPL Recovery By Dual Phase Extraction (Plumes A, B, C, and D)

Sampling for Lead in Surface Soil and Sampling for Hydrocarbons in Surface and Subsurface Soils at the Request of On-site Community Members; Cleanup of Lead or Hydrocarbon-Contaminated Surface and Subsurface Soil Discovered during Requested Sampling or Uncovered during Earthmoving Activities; Sampling for Benzene in Indoor Air at the Request of On-site Community Members; Mitigation of Indoor Air Contamination Discovered through Requested Sampling; Periodic Notification of the On-site Community of Potential Contamination and of Available Services; Ground Water Use Restrictions; and Environmental Monitoring of LNAPL, Ground Water, and Indoor Air, Enhanced LNAPL Recovery by Dual Phase Extraction (Plumes A, B, C, and D); LNAPL Recycling/Reuse or Disposal; and Treatment or Disposal of Co-Extracted Ground Water and Vapors

- Capital Cost: $11.3 million
- Annual O&M: $428,000
- Present Worth: $14.8 million
- Construction Time: 1 year (indoor air mitigation completed)
  - 2 years (dual phase extraction system installed)
- Additional Time Assumption: recovery by dual phase extraction will take 8 years
- Total Cost: $17.8 million

Alternative 5, the remedy selected in this ROD, calls for the following: source removal through LNAPL recovery using dual phase extraction on Plumes A, B and C and D; LNAPL management through recycling/reuse or disposal; treatment of co-extracted ground water and vapor using granular activated carbon (GAC), if co-extracted ground water and vapor do not meet treatment and performance standards; discharge of treated co-extracted ground water to the publicly-owned treatment works (POTW); and management of other media as described in the Section of the ROD entitled Common Elements of Remedial Alternatives 2, 3, 4, and 5. (See description of dual phase extraction in Alternative 4.) Dual phase extraction operations will be constructed in a safe manner that prevents trespassers from coming into contact with the LNAPL or the equipment.

Dual phase extraction is a technology which applies a strong vacuum to extraction wells in order to simultaneously remove LNAPL floating on the water table and residual LNAPL trapped in the soil above the water table. Dual phase extraction can also remove ground water and vapor. Once above ground, this co-extracted ground water and vapor are separated from

the LNAPL and treated. LNAPL will be sent off-site for recycling/reuse. Ground water that is incidentally extracted during LNAPL removal as part of any of the remedial alternatives that address LNAPL, will be treated and discharged to a POTW. Co-extracted ground water will be treated, under each of the alternatives that address LNAPL, to meet the POTW treatment standards. Co-extracted vapor will be treated using the Best Demonstrated Available Technology (BDAT) which is the performance standard.

Alternative 5 was selected because it provides the most protection to human health of all of the five non-invasive remedies presented in this ROD, by removing LNAPL and residual LNAPL, which is the principal source of indoor air contamination, in the fastest manner over the broadest Site area. Alternative 5 removes source material (LNAPL) from all identified LNAPL plumes in addition to removing source material (LNAPL) from Plume D (Zone 1 in Figure 7.) Removing the LNAPL from plumes which underlie areas of indoor air contamination will remove the principal source of indoor air contamination. Indoor air contamination may be caused by COCs volatilizing from LNAPL or by COCs volatilizing from buried hydrocarbon-contaminated wastes. Since soil gas can travel either vertically or horizontally, depending on the subsurface material which it encounters, it is not necessary for LNAPL or buried hydrocarbon waste to directly underlie an indoor area for that area to be contaminated by soil gas from the LNAPL or hydrocarbon waste. Based on the community's request for a non-invasive remedy, this ROD does not address hydrocarbon waste that lies beneath Site structures.

Alternative 5 shortens the duration of indoor air and ground water impact by using the most aggressive LNAPL recovery program over the largest area of the Site. Contaminant migration and LNAPL volume in the aquifer will be reduced most effectively and most rapidly using dual phase extraction. CERCLA favors the reuse of recovered waste materials, which may be accomplished through LNAPL recycling under Alternative 5.

Figure 7

Not included in Web version.

SECTION 11

Summary of Comparative Analysis of Alternatives

The EPA uses nine NCP criteria to evaluate remedial alternatives for the cleanup of a release. These nine criteria are categorized into three groups: threshold, balancing, and modifying. The threshold criteria must be met in order for an alternative to be eligible for selection. The threshold criteria are overall protection of human health and the environment and compliance with ARARs. The balancing criteria are used to weigh major tradeoffs among alternatives. The five balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost. The modifying criteria are state acceptance and community acceptance. The following briefly describes the evaluation criteria:

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
Overall Protectiveness of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other promulgated requirements that pertain to the site, or whether a waiver is justified.
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

In the following analysis, the five remedial alternatives are evaluated in relation to each other with regard to the nine criteria in order to identify the relative advantages and disadvantages of each alternative.

Overall Protectiveness of Human Health and the Environment

Alternative 1 (the No Action Alternative) fails to protect human health because it does not address the risks to human health that were identified in the Baseline Risk Assessment. If considerations are made to take into account the reductions in risk that were the result of the removal actions, Alternative 1 still fails to address all the risks remaining at the Site after the removal actions. Alternative 1 does nothing to protect the environment at the Site. Since Alternative 1 fails to protect human health, it is not eligible for selection under the NCP.

Alternative 2 (Implementation of the Common Elements) does not directly address the LNAPL that is the primary source of indoor air contamination on the Site; however it does address the other media (e.g., soil, indoor air, ground water) through which contamination at the Site presents a risk. Alternative 2 relies on the natural degradation of the LNAPL. Accordingly, it is not as protective of human health as the other alternatives.

Alternatives 2, 3, 4, and 5 all address risks posed by contact with soil that is contaminated with lead or hydrocarbons. Alternatives 2, 3, 4, and 5 each call for excavation of the contaminated soil and offsite disposal. In areas where hydrocarbon materials are excavated, Alternatives 2, 3, 4, and 5 provide additional protectiveness because the hydrocarbon material is a potential source of indoor air contamination. Excavation of buried hydrocarbon waste eliminates the potential for the COCs in the waste to volatilize on the Site. The excavation portion of Alternatives 2, 3, 4, and 5 is protective of human health.

Alternative 3 addresses the LNAPL through skimming and, therefore, it is protective of human health with respect to LNAPL. Alternative 3, however, takes so long to address the LNAPL, the primary source of indoor air contamination, that, of all the alternatives evaluated, it cannot be considered the most protective of human health. Moreover, Alternative 3 cannot recover residual LNAPL trapped in soil, another source of indoor air pollution. Since the LNAPL trapped in soil by capillary tension can become a source of indoor air contamination, Alternative 3 is not the most protective of human health of the alternatives; therefore, Alternative 3 was not selected.

Alternative 4, which uses dual phase extraction, a relatively fast form of LNAPL recovery, is protective of human health in the parts of the Site that it addresses, but it does not address all parts of the Site. Specifically, Alternative 4 does not address the LNAPL in Plume D; consequently, any LNAPL in Plume D may remain a source of indoor air contamination in Plume D if Alternative 4 is selected.

Alternative 5, which also uses dual phase extraction, is the most protective of human health throughout the Site because it addresses the LNAPL contamination over the largest Site area, including Plume D. Moreover, Alternative 5 (and Alternative 4) will remove LNAPL trapped in soil by capillary tension.

Compliance with ARAR's

All of the Remedial Alternatives analyzed in this report would meet ARARs except for ground water ARARs. The EPA has waived these ground water ARARs pursuant to 40 CFR § 300.430 (f)(l)(ii)(C)(3) based on technical impracticability. (See Appendix B, the TI Waiver.) Compliance with ARARs includes a review of chemical-specific, action-specific, and location-specific ARARs as discussed in the FS. A list of the ARARs for the Selected Remedy is included in the Statutory Determinations section of this ROD.

Long-Term Effectiveness and Permanence

Alternative 1 (the No Action Alternative) will not be effective or permanent. Alternative 2 (Implementation of the Common Elements) does not address LNAPL source removal and is, therefore, not an effective or permanent long-term remedy. Alternatives 3, 4 and 5 offer the highest degree of long-term effectiveness and permanence because these alternatives offer the best source removal through a combination of soil excavation actions and LNAPL recovery. Of these alternatives, Alternative 5 offers the greatest potential for long-term effectiveness due to its use of aggressive dual phase LNAPL recovery over the largest contaminated area (i.e., LNAPL Plumes A, B and C, and D). Under Alternative 4, LNAPL recovery is less complete; consequently, indoor air contamination problems may arise due to Plume D if Alternative 4 is selected. Under Alternative 3, the less aggressive LNAPL recovery program (i.e., skimming) will take up to 100 years to become effective compared to 5 to 8 years for Alternatives 4 and 5 which each use dual phase extraction; therefore, Alternative 3 is the least acceptable of the three alternatives that offer the greatest degree of long-term effectiveness and permanence.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternative 2 (Implementation of the Common Elements) would not call for the on-site treatment of any hazardous substance, so Alternative 2 does not meet the NCP criterion regarding reduction of toxicity, mobility, or volume through treatment for any on-site remedial operation. Under Alternative 2, benzene- and PAH-contaminated soil that is excavated would be shipped to an off-site Treatment, Storage, and Disposal facility (TSD) where it may be incinerated. If it is incinerated, the mobility and toxicity of the benzene and PAH would be

eliminated and the volume would be significantly reduced through treatment. No other treatment is contemplated under Alternative 2.

All the LNAPL cleanup alternatives (i.e., Alternatives 3, 4 and 5) will have the same treatment components of the common elements that are a part of Alternative 2. In addition, under the LNAPL cleanup alternatives, the LNAPL which underlies the Site will be recovered either by dual phase extraction or by skimming, both of which are a form of treatment. Ultimately, under each of the LNAPL cleanup alternatives, the LNAPL will be shipped off-site to a recycling/reuse operation or to a RCRA-compliant TSD. If the LNAPL goes to a TSD, it may be incinerated which will significantly reduce toxicity, mobility and volume. In addition, co-extracted ground water produced under Alternatives 4 and 5, the dual phase extraction alternatives, will be treated, if necessary to meet POTW standards using GAC. Co-extracted vapor produced under Alternatives 4 and 5, the dual phase extraction alternatives, will be treated using BDAT. Since Alternative 5 addresses what is potentially the largest volume of LNAPL, Alternative 5 will use treatment to do the most to reduce the toxicity, mobility and volume of the LNAPL and the co-extracted ground water and vapor.

Short-Term Effectiveness

The LNAPL cleanup alternatives (i.e., alternatives 3, 4, and 5) share the common elements which make up Alternative 2, Implementation of the Common Elements. With respect to the NCP criterion "Short Term Effectiveness," except for problems associated with the failure of Alternative 2 to address LNAPL, the LNAPL cleanup alternatives and Alternative 2 will face similar short-term problems such as potential risks to the Site residents during implementation of soil excavation activities in residential areas. These potential risks are all manageable through use of engineering controls (e.g., water sprayed to control dust). Alternative 2 would not achieve protection until the LNAPL decomposed naturally (an unacceptably long period of time); accordingly, it is not protective in the short term. Moreover, since Alternative 2 would take so long to achieve protectiveness with respect to the LNAPL, it cannot be considered to provide long-term effectiveness.

Alternative 3 will also take a long time to become protective in areas above LNAPL plumes that it addresses, and Alternative 4 will take a long time to become protective in Plume D. Only Alternative 5 attains Site-wide protectiveness in an acceptable period of time. Risks to human health and the environment that may be posed by the LNAPL cleanup alternatives are manageable as evidenced by the fact that GSHI has performed the skimming well operations at the Site without incident.

Implementability

Technical Feasibility

All of the common elements which would be used under Alternatives 2, 3, 4, and 5 are technically feasible. Specifically, within the common elements, the excavation components are time-proven techniques, the indoor air mitigation measures have been used at the Site with success, and institutional controls such as ground water restrictions have been thoroughly discussed with the City and LDEQ so no problems are anticipated. Environmental monitoring methods that would be used under Alternatives 2, 3, 4, and 5 are standard practice in the environmental industry.

Skimming, as proposed in Alternative 3, has been used at the Site for over one year. Dual phase extraction proposed in Alternatives 4 and 5 is a newer technology, and it has been proven in the field to recover greater amounts of LNAPL, including residual LNAPL, making it more successful than skimming.

Administrative Feasibility

The EPA and the PRP have been coordinating with the City and the State for many years regarding the elements of these various remedial alternatives, and no administrative difficulties are anticipated.

Availability of Equipment and Services

Alternative 1 (the No Action Alternative) has no implementability concerns since it represents the baseline condition. Equipment and workers necessary to implement Alternatives 2, 3, 4, and 5 are readily available. Recyclers and disposal firms are available in the area.

Cost

Cost estimates provided for all alternatives are limited to a 30-year time period in accordance with EPA guidance, even though actual implementation time frames may extend beyond the 30-year cost estimating period for the Common Element portions of all the alternatives and for the LNAPL recovery through skimming provided under Alternative 3. The discount rate used was 7%.

Cost details, assumptions, and uncertainties related to each alternative are included as Appendix A of the FS. The FS uses the terminology Long Term Remedial Action (LTRA) costs in place of Operation and Maintenance (O&M) costs. For the purpose of this ROD, the terms are interchangeable.

Total Cost and O&M Cost

Alternative 1 (the No Action Alternative) is the lowest cost alternative, incurring costs only for the five-year reviews required under the CERCLA. Alternative 2 (Implementation of the Common Elements) is the next lowest in total cost, but it does not meet all of the RAOs related to LNAPL because it does not involve any engineered source control measures to address LNAPL. Alternative 3 has the highest total cost and the highest O&M cost of all of the remaining three engineered alternatives (mainly because of the long implementation time of skimming compared to dual phase extraction), but it is less protective in the long-term and in the short-term than Alternatives 4 and 5. Alternative 4 is the least expensive of the engineered alternatives in total cost and in O&M cost, but it does not provide for comprehensive LNAPL removal in all known source areas. Based on analysis of total life-cycle costs, Alternative 5 offers the best overall protection of human health and the environment, and the shortest time to achieve compliance with RAOs and ARARs. Alternative 5 offers the most comprehensive LNAPL recovery in source areas of all alternatives evaluated in the FS. In short, Alternative 5 is cost effective because its costs are proportional to its overall effectiveness.

Present Worth Costs

The present worth cost of Alternative 5 at $14.8 million is only slightly greater than the present worth cost of Alternative 4 at $14.4 million and the present worth cost of Alternative 3 at $14.7 million, and it is only moderately more than the present worth cost of Alternative 2 at $11.7 million. Alternative 5 offers by far the highest degree of protectiveness compared to all the other alternatives, much higher than its incremental cost. The reason that the present worth costs of Alternatives 4 and 5 are so close to the present worth cost of Alternative 3, which involves a much more simple technology, is that, under Alternatives 4 and 5 after eight years, the O&M costs are greatly reduced compared to the O&M costs of Alternative 3 which were cost-estimated over a 30-year period. Under Alternatives 4 and 5, O&M costs related to dual phase extraction of LNAPL are relatively high for the first eight years of the 30-year costing period, but the costs of alternatives 4 and 5 are much less than the cost of Alternative 3 after the first eight years.

State Acceptance

The State of Louisiana, represented by LDEQ, has worked with the EPA in the investigation of the Site and in developing the Proposed Plan and ROD. The LDEQ documented its support for the Selected Remedy in an April 12, 2000, letter to the EPA. This letter is included as Appendix D of this ROD. As previously stated, the LDEQ has agreed in principle to undertake the tasks which the ROD calls for it to take. The LDEQ, however, is an agency of a sovereign State, and LDEQ may at some future time decide not to continue these actions. If LDEQ should discontinue its actions, EPA will then evaluate its options under the NCP and CERCLA.

Community Acceptance

As described in the ROD, the Bossier City community leaders played a heightened role in decisions regarding Site investigation. In addition, because of high citizen interest in the Site, EPA has held extra open house meetings at the Site. In general, the public comment on the Proposed Plan was favorable and EPA did not receive specific adverse comments on the proposed alternative. Most of the public comments were questions about implementation of the proposed alternative, or risk from the Site prior to completion of the removal actions. The responses to these comments are included in Appendix A, the Responsiveness Summary.

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SECTION 12

The Selected Remedy

Summary of the Rationale for the Selected Remedy

The Selected Remedy is a comprehensive remedy which utilizes source control and management of migration components to address the principal Site risks. Alternative 5, Implementation of Common Elements coupled with Enhanced LNAPL Recovery By Dual Phase Extraction (Plumes A, B, C, and D), is EPA's Selected Remedy. EPA selected Alternative 5 because it will achieve substantial reduction of the risk posed by the principal threat wastes at the Site (i.e., the LNAPL) through treatment over the largest area of the Site, and because it provides a process for excavation and disposal of the other significant wastes at the Site.

In addition, Alternative 5, the Selected Remedy, offers, relative to its costs, the best overall protection of human health and the environment and the shortest time to achieve compliance with RAOs. That is, the slight increase in the present worth cost of the Alternative 5, compared to the present worth cost of Alternative 4 (or any other alternative) offers a large increase in effectiveness. Alternative 5 offers the most comprehensive LNAPL recovery in source areas of all the alternatives evaluated.

Description of the Selected Remedy

Alternative 5, the Selected Remedy, Implementation of Common Elements plus Enhanced LNAPL Recovery By Dual Phase Extraction (Plumes A, B, C, and D), consists of:

- Sampling for lead in surface soil and sampling for hydrocarbons in surface and subsurface soils at the request of on-site community members;
- Cleanup of lead-contaminated surface soil discovered during requested sampling or uncovered during earthmoving activities;
- Cleanup of hydrocarbon-contaminated surface and subsurface soil discovered during requested sampling or uncovered during earthmoving activities;
- Sampling for benzene in indoor air at the request of on-site community members;
- Mitigation of indoor air contamination discovered through requested sampling;

- Periodic notification of the on-site community of potential contamination, of available services, and of ground water use restrictions;
- Implementation of ground water use restrictions;
- Environmental monitoring of LNAPL, ground water, and indoor air; and
- Enhanced LNAPL recovery by dual phase extraction (Plumes A, B, C, and D), including LNAPL recycling/reuse or disposal and treatment or disposal of co-extracted ground water and vapors.

Many of the tasks in the Selected Remedy employ the services of a contractor to perform excavation, sampling, and notification activities. This local contractor is referred to as "LDEQ's agent," because, under the proposed alternative, LDEQ will be performing direct oversight of the contractor. The LDEQ will also handle local coordination of the cleanup and communication with EPA regarding Site activities. This is an arrangement commonly used during site cleanups so that the cleanups may proceed quickly. The EPA will retain overall project management responsibility at the Site, and the EPA will ensure that the PRP funds the cleanup.

The technical requirements of the Selected Remedy are detailed below:

Sampling and Cleanup of Lead-Contaminated Surface Soil

Any parties conducting earthmoving activity (e.g, tree planting, vegetable gardening, irrigation, underground utility installation and/or repair) on-site will be able to contact LDEQ's agent to obtain soil sampling and analysis. Whenever concentrations of lead are found to exceed 510 ppm in surface soil, the LDEQ, or its agent, will oversee the excavation and off-site disposal of the lead-contaminated soil, the backfilling of the area in question with clean soil of a type similar to the excavated soil, and revegatation or re-landscaping, if necessary. (Mature trees of two inch caliper of greater will be replaced with trees of at least two-inch caliper.) Soil excavation will continue until lead concentrations meet the remediation goal, or until 2 feet bgs is reached (whichever is sooner). If the excavation in question reaches that lead remediation goal before 2 feet bgs, then the final confirmatory sampling for lead in each excavation will also include sampling for organic contaminants. If organic contaminants are discovered at concentrations which exceed the remediation goals, the excavation will continue as described in the following section concerning cleanup of hydrocarbon-contaminated soil.

Sampling and Cleanup of Organic-Contaminated Surface and Subsurface Soil

Any parties conducting earthmoving activity (e.g, tree planting, vegetable gardening, irrigation, underground utility installation and/or repair) on-site will be able to contact LDEQ's agent to obtain soil sampling and analysis whenever the earthmoving activity unearths stained

or malodorous surface or subsurface soil. In addition, any parties that suspect hydrocarbon-contamination on their property due to staining, malodorous soil, or indoor air contamination may contact LDEQ's agent to obtain soil sampling and analysis.

Whenever concentrations of benzo(a) pyrene equivalents (BAPEQ) or of benzene exceed 1 ppm in surface or subsurface soil, LDEQ, or its agent, will oversee the excavation and off-site disposal of the hydrocarbon-contaminated soil, the backfilling of the area in question with clean soil of a type similar to the excavated soil, and revegatation or re-landscaping if necessary. (Mature trees of two inch caliper of greater will be replaced with trees of at least two-inch caliper.) Excavation will continue until hydrocarbon concentrations meet remediation goals at the bottom of the excavated area.

LDEQ's agent will sample soil for lead contamination in excavations intended to address hydrocarbon-contaminated material whenever those excavations meet organic remediation goals before they reach 2 feet bgs. Whenever concentrations of lead are found to exceed 510 ppm in these surface soil excavations, the LDEQ, or its agent, will oversee the excavation and off-site disposal of the lead-contaminated soil and the backfilling of the area in question with clean soil. Soil excavation will continue until lead concentrations meet the remediation goal, or until 2 feet bgs is reached (whichever is sooner).

Indoor Air Sampling and Mitigation of Indoor Air Contamination

The indoor air remedial action (e.g., sampling, venting, sealing) will be administered by LDEQ or its agent. A system will be established to facilitate communication between the Site community members (e.g., residents, workers, and business and property owners) and LDEQ. The LDEQ will be notified whenever a Site community member desires indoor air testing for an on-site residence or workplace. When LDEQ, or its agent, is contacted, it will obtain access, sample the indoor air, take remedial action (e.g., venting, sealing, etc.) as appropriate, and substantiate the effectiveness of the remedial action by follow-up sampling.

Ground Water Use Restrictions

The EPA and the LDEQ will work with Bossier City officials to implement institutional controls (through a city ordinance) to ban the use of Site ground water, and to thereby eliminate the potential for human exposure to COCs in ground water. The city's intent to implement this institutional control is documented in a September 1, 2000, letter in the Administrative Record. Institutional controls implemented by the City will include prohibition of new water supply wells in the general area of the Site and prohibition of the use of ground water taken from the vicinity of the Site.

Notification of the On-Site Community

In order to communicate information about the availability of soil and indoor air sampling, and soil excavation services to the property owners, lessees, property managers, business owners, public agencies, and utility companies, LDEQ's agent will send quarterly notices to those parties through utility bills or direct mailings.

In order to communicate information about the ground water restrictions to property owners, lessees, property managers, business owners, and public agencies, the LDEQ agent will also send periodic notices to those parties through utility bills or direct mailings.

These notifications will continue until a five-year review of the remedy is performed at which time the frequency of notification will be evaluated and changed if warranted. Notification will not be completely discontinued until an EPA five-year review of the remedy reveals that no hazardous substances, pollutants, or contaminants remain in soil, ground water, or indoor air at the Site at concentrations that allow for unlimited use and unrestricted exposure.

Environmental Monitoring

Because hazardous substances will remain on the Site, environmental monitoring of LNAPL, ground water, and indoor air will be performed to evaluate remedy impacts and effectiveness. Environmental monitoring will include:

- Quarterly LNAPL monitoring to evaluate changes in LNAPL volume over time, and to estimate the effectiveness of the LNAPL removal remedy in order to ensure that LNAPL is being removed in a manner that will meet the performance standard. Quarterly LNAPL monitoring will use as many monitoring wells as may be necessary to adequately characterize and monitor the LNAPL plumes and their migration.

- Ground water monitoring to track the location of the dissolved-phase contaminants of concern. Ground water monitoring will include ground water sampling and water level measurements in order to track the direction and rate of contaminant plume migration. Ground water monitoring will be performed semiannually (twice per year) using as many monitoring wells as may be necessary to adequately characterize and monitor the plumes and their migration.

- Indoor air sampling will be performed to ensure the effectiveness of corrective measures applied to dwellings. The LDEQ or its agent will perform semiannual (twice per year) air sampling for indoor air COCs at locations where indoor air mitigation measures have been implemented in order to ensure long-term effectiveness of indoor air corrective measures.

Enhanced LNAPL Recovery by Dual Phase Extraction

LNAPL will be recovered using dual phase extraction on Plumes A, B and C and D. As part of the remedial design phase of the Selected Remedy, pilot testing will be implemented in order to optimize the design of the dual-phase recovery systems. Pilot tests will be conducted in the LNAPL plumes and may require the installation of additional wells. Parameters that will be evaluated during the pilot tests include:

- Aquifer pumping tests of 24-hour to 72-hour duration to quantify aquifer characteristics such as hydraulic conductivity, storativity, transmissivity, pumping rates, and radius of influence of extraction wells
- Tests to determine the optimum well spacing to achieve measurable pressure drops (e.g., 0.1 psi) at one-half the distance between adjacent wells
- Tests to determine design parameters such as vapor flow rate, well head system vacuum, vapor discharge temperature, and vapor concentration
- Tests to determine proper vacuum and pumping rates such that the recovery of LNAPL is maximized while minimizing the total fluids requiring treatment.

Recovered LNAPL will be sent off-site for recycling/reuse.

Dual phase extraction may also remove ground water and vapor. Once above ground, this co-extracted ground water and vapor will be separated from the LNAPL. If co-extracted ground water and vapor do not meet treatment and performance standards, they will be treated using BDAT. The treated liquid will be discharged to a POTW once it meets the POTW treatment standards.

Dual phase extraction operations will be constructed in a safe manner that prevents trespassers from coming into contact with the LNAPL or the equipment. This could involve placing the operations in small enclosures, or fencing the structure on four sides and on top.

Summary of the Estimated Remedy Costs

Table 4 shows a detailed cost estimate summary table for the Selected Remedy. The cost summary is based on the construction and annual O&M activities anticipated to implement the major components of the Selected Remedy. A 7% discount factor was used to derive this table. The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the Selected Remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Changes in cost for the Selected Remedy may be documented in the form of a memorandum in the Site file, an Explanation of Significant

Differences (ESD), or a ROD amendment depending upon NCP requirements for the change in question. The cost estimate in this ROD is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Expected Outcomes of the Selected Remedy

The Selected Remedy, Alternative 5, meets the remedial action objectives in all of the affected media:

Soil: The Selected Remedy will address significant low-level threat wastes in the soil medium through the establishment of a local capability to respond to future contaminated soil concerns. The Selected Remedy will also remove and dispose of lead-contaminated surface soil and hydrocarbon-contaminated surface and subsurface soil that is discovered during requested sampling, or earth-moving activities. Disposal will occur in an appropriate offsite landfill, excavated areas will be backfilled with clean soil and revegetated.

The primary expected outcome of implementation of the soil portion of the Selected Remedy is that the Site soils will no longer present an unacceptable risk to on-site residents, commercial workers, and utility workers via incidental ingestion, inhalation, and dermal contact, and that the Site will continue to be suitable for residential and commercial development.

Indoor Air: The Selected Remedy will address the threat to human health from indoor air contamination through the establishment of a local capability to respond to future indoor air concerns. The Selected Remedy will implement mitigation measures for indoor air contamination through actions such as foundation sealing and HVAC system modification if necessary. Also, the Selected Remedy will use dual phase (liquid and vapor) extraction (a form of treatment) to remove the LNAPL, the primary source of the indoor air contamination. The Selected Remedy requires periodic environmental monitoring of indoor air to ensure the protectiveness of the remedy.

The primary expected outcome of implementation of the indoor air portion of the Selected Remedy is that the indoor air will no longer present an unacceptable risk to on-site residents, transient hotel residents, commercial workers, and utility workers via inhalation of vapors, and that the Site will continue to be suitable for residential and commercial development.

Ground Water: The Selected Remedy will address the principal threat waste at the Site, LNAPL, which is a major source of the Site ground water contamination, through removal of the LNAPL from the subsurface using dual phase (liquid and vapor) extraction. The Selected Remedy requires periodic environmental monitoring of the ground water to ensure that it is not migrating to non-contaminated areas and

periodic environmental monitoring of the LNAPL to evaluate whether the dual phase extraction system is recovering LNAPL as planned. Under EPA's the Selected Remedy, the expected outcome is that the threat to human health posed by contaminated ground water at the Site will be addressed by preventing human exposure through institutional controls in the form of a city ordinance banning all uses of Site ground water.

The primary expected outcome of implementation of the ground water portion of the Selected Remedy is that the LNAPL will no longer act as a source of contamination of indoor air and soil, and that the Site will continue to be suitable for residential and commercial development. Another expected outcome of the Selected Remedy is that future on-site residents will not be exposed to COCs through ingestion, dermal contact, or inhalation of vapors when showering because residents and businesses will be precluded from drilling or using wells on Site by a City ordinance. Through implementation of the ordinance, the exposure pathway will be interrupted.

The remediation goals and performance standards for the Selected Remedy and the justification for their selection are included in the Remedial Action Objectives and Goals section of this ROD.

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SECTION 13

Statutory Determinations

The Selected Remedy for the Highway 71/72 Refinery Site is consistent with CERCLA and, to the extent practicable, the NCP. The Selected Remedy is protective of human health and the environment, will comply with ARARs (or invoke an appropriate waiver), and is cost effective. In addition, the Selected Remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfies the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

Protection of Human Health and the Environment

The Selected Remedy will protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through excavation and offsite disposal of contaminated soils, mitigation of indoor air contamination, extraction and treatment of LNAPL, and institutional controls. More specifically, excavation and offsite disposal of contaminated soils will eliminate the risk from these soils to human heath in these areas and remove a potential source of ground water contamination. Extraction and treatment of LNAPL will remove a primary source of indoor air contamination, reducing or eliminating potential risks to human health in this media. Institutional controls, in the form of ground water use restrictions imposed through a city ordinance, will control the risk to human health from possible ingestion or dermal exposure to Site ground water.

The Selected Remedy will reduce potential human health risk levels from exposure to Site soils and indoor air such that they do not exceed EPA's acceptable risk range of 10^{-4} to 10^{-6} for carcinogenic risk for the soil and indoor air. It will also reduce the non-carcinogenic hazards to below a level of concern, i.e., to a level at which the HI will not exceed 1. It will reduce potential human health risk levels to protective ARARs levels, i.e., the remedy will comply with ARARs (except for ground water ARARs which have been waived). Implementation of the Selected Remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

Compliance With ARARs

The Selected Remedy will meet ARARs except for ground water ARARs. The EPA has waived these ground water ARARs pursuant to 40 CFR § 300.430 (f)(l)(ii)(C)(3) based on technical impracticability. (See Appendix B, the TI Waiver.) A brief description of the ARARs the Selected Remedy must meet follows:

All of the RCRA process wastes described in the FS (i.e. F037, F038, K049, K050, K051, and K052) are found in soil on the Site. In addition, some soil excavated from the Site during the Soil Removal Action was identified as RCRA-hazardous-waste when subjected to the Toxicity Characteristic Leaching Procedure (TCLP). Consequently, during the remedial actions taken to address lead-contaminated soil and to address soil that is contaminated with carcinogenic hydrocarbon constituents including benzene and PAHs, whenever RCRA hazardous waste is encountered, it will be shipped off-Site to a RCRA-compliant TSD. No hazardous substances from soil will be stored, treated, or disposed of at the Site under the Selected Remedy, so RCRA hazardous waste treatment, storage, and disposal regulations are not ARARs for the on-Site remedial actions taken to address soil.

RCRA manifesting requirements are applicable to the off-Site shipment of RCRA hazardous waste-contaminated soil so the substantive parts of the RCRA manifesting requirements and pre-transport requirements as described at Louisiana Administrative Code (LAC) 33:V.1107 and LAC 33:V.1109 will be met as an ARAR whenever RCRA hazardous waste-contaminated soil is shipped off-Site.

On-Site LNAPL remediation activities may require RCRA-hazardous-waste-contaminated LNAPL accumulation in containers for periods of more than 90 days. Consequently, the RCRA container-labeling and storage requirements will be met as ARARs. Otherwise, RCRA requirements will be met by sending LNAPL to a RCRA-compliant TSD or to an appropriate recycling operation. In order to efficiently ship LNAPL, including RCRA hazardous waste-contaminated LNAPL, it will be accumulated on-Site in containers until large amounts are collected - usually at least 5,000 gallons. Once amounts that are sufficient to make efficient loads are collected, the LNAPL will be shipped off-Site to a TSD that is RCRA compliant, or to an appropriate recycling operation. Therefore, the substantive portions of the RCRA-authorized hazardous waste storage regulations as described at LAC 33:V.2301-2315 will be met as ARARs whenever LNAPL is accumulated on Site.

RCRA manifesting requirements are applicable to the off-Site shipment of RCRA hazardous waste-contaminated LNAPL so the substantive parts of the RCRA manifesting requirements and pre-transport requirements as described in LAC 33:V.1107 and LAC33:V.1109 will be met as an ARAR whenever RCRA hazardous waste-contaminated soil is shipped off-Site.

Cost-Effectiveness

In the EPA's judgment, the Selected Remedy is cost effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through

treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost effectiveness. The relationship of the overall effectiveness of the Selected Remedy was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

The present worth cost of Alternative 5, the Selected Remedy, at $14.8 million is only slightly greater than the present worth cost of Alternative 4 at $14.4 million and the present worth cost of Alternative 3 at $14.7 million, and it is only moderately more than the present worth cost of Alternative 2 at $11.7 million. The Selected Remedy offers by far the highest degree of protectiveness and overall effectiveness because it aggressively recovers LNAPL over the largest area of the Site in the shortest time period. The benefits of The Selected Remedy compared to all the other alternatives are much higher than the incremental increase in cost over the other alternatives.

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

The EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Site. The Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, considering State and community acceptance, while also considering the statutory preference for treatment as a principal element and the bias against off-site treatment and disposal.

The Selected Remedy utilizes treatment and resource recovery to address the principal threat waste at the Site, the LNAPL. The LNAPL will be treated through dual phase extraction. Once extracted, the LNAPL will be sent off-site for resource recovery. In addition, the co-extracted ground water and vapor will be treated using BDAT, most likely GAC. The EPA expects that removal of the LNAPL will achieve significant reduction in the concentration of benzene in dwellings with indoor air contamination.

For the low level threats at the Site posed by soil contaminated with either lead, or with lead and hydrocarbons, the preference for treatment will not be satisfied because soil contaminated with lead, in general, is not amenable to treatment. For the low level threats at the Site posed by soil contaminated with hydrocarbons, the preference for treatment will not be satisfied.

Preference for Treatment as a Principal Element

By extracting the LNAPL through dual phase extraction and treating the co-extracted ground water and vapor through BDAT, the Selected Remedy addresses principal threats posed by the Site through the use of treatment technologies. By utilizing treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

SECTION 14

Documentation of Significant Changes

The Proposed Plan for the Highway 71/72 Refinery Site was released for public comment on May 12, 2000. The Proposed Plan identified Alternative 5, Implementation of Common Elements plus Enhanced LNAPL Recovery By Dual Phase Extraction (Plumes A, B, C, and Zone 1) as the preferred alternative for Site remediation. (As noted previously in the ROD, Zone 1 has been renamed Plume D to more accurately reflect its similarity to Plumes A, B, and C.) The EPA reviewed all written and oral comments submitted during the public comment period and determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

One change from the Proposed Plan is that the remediation goal for benzene in indoor air has been raised from 3 ppbv to the 10 ppbv utilized during the Indoor Air Removal Action. (See the memorandum written by EPA's toxicologist, Dr. Jon Rauscher, PhD, which is included as Appendix C of this ROD.) This standard was raised based on concerns and documentation submitted during the public comment period that cleanup to 3 ppmv benzene in indoor air may be impracticable because, under some conditions, 3 ppmv is lower than some of the Site-specific background values encountered during the Indoor Air Removal Action.

The average upper end background concentrations of benzene observed during the Indoor Air Removal Action appeared to have a double series of ranges, both from 1-2 ppbv and from approximately 7-8 ppbv. (Note that a reasonable upper end benzene background concentration would then be approximately one and one half times the average background concentration, which could be as high as 12 ppbv for this Site.) The revised remediation goal for indoor air established in the ROD takes into account the fact that spikes in background concentrations of benzene may occur due to random unpredictable events such as occasional cigarette smoke, open gasoline cans in attached garages, and the use of household products that contain benzene. The revised remediation goal is, however, also based on our experience with mitigation during the Indoor Air Removal Action. During the Indoor Air Removal Action, EPA found that cleanup levels of 10 ppbv benzene were attainable in indoor units located on the Site. Therefore, instead of selecting a concentration above 10 ppbv, the revised remediation goal was set at the more protective, and achievable 10 ppbv. A remediation goal of 10 ppbv equates to a risk of 3×10^{-5} to 1×10^{-4} that is within EPA's acceptable risk range.

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