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EPA Superfund
Record of Decision:

SOUTHERN SHIPBUILDING
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SLIDELL, LA
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RECORD OF DECISION
OPERABLE UNIT TWO

SOUTHERN SHIPBUILDING CORPORATION
SUPERFUND SITE

FINAL DECISION SUMMARY

September 1997

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FINAL DECISION SUMMARY

SOUTHERN SHIPBUILDING CORPORATION SUPERFUND SITE
SLIDELL, LOUISIANA

No Further Federal Response Action is Necessary

SITE NAME AND LOCATION

Southern Shipbuilding Corporation, Slidell, Louisiana

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected final decision for Operable Unit (OU) Two for the Southern Shipbuilding Corporation Superfund (SSC) Site in Slidell, Louisiana. This alternative was selected in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. º 9601 et. seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision takes into consideration all site response actions, including those selected and implemented for OU1, as well as all site removal actions, in reaching a determination that no further Federal response action is required.

DESCRIPTION OF THE SELECTED REMEDY

The U.S. Environmental Protection Agency (EPA) has determined that no further Federal response actions are required at the Site. This determination has been made since the known contaminated area have been addressed through a combination of waste incineration for Operable Unit 1 (OU1) (oily waste pits) and removal actions for contaminated areas in Operable Unit 2 (OU2). Removal actions for contaminated areas in OU2 are described in detail in this Record of Decision (ROD). The site is currently zoned for light industrial use by the city of Slidell. EPA cleanup actions have made the site safe for human health and the environment consistent with such use. Should land use change in the future, the city has demonstrated the ability to implement zoning restrictions to control future development and ensure that any land use is conducted in a manner which is protective of public health and the environment. This ROD documents that no hazardous substance releases from the Site present an imminent and substantial endangerment to public health, welfare, or the environment.

This ROD presents a summary of site investigations, removal actions, and remedial actions; explains EPA's selection of no further Federal action; provides a response to public comments regarding EPA's proposed final plan, and provides a summary of site sampling and investigative reports which are available at the St. Tammany Parish Library, Slidell Branch. This ROD also makes specific recommendations to local authorities for land use controls that will ensure long-term protectiveness of the Southern Ship remedies in the event that future land use changes from it's current zoning as light industrial property.

The Louisiana Department of Environmental Quality concurs with the selected remedy.

DECLARATION STATEMENT

No further response action is necessary to ensure protection of human health and the environment. This decision takes into consideration prior remedial and removal actions undertaken at the Site that utilized permanent solutions and alternative treatment technologies to the maximum extent practicable and that satisfied the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

This selected alternative takes into account the remedy for OU1, which resulted in the capping of low level contaminants, including soil and ash resulting from the incineration treatment process. Because this alternative permits low level contaminated soils to remain in place in certain areas of OU2, as did the remedy selected for OU1, a review of the selected OU1 remedy and response actions for the site as a whole will be conducted annually for five years from the date of this ROD to ensure that the remedy continues to provide adequate protection of human health and the environment, as required by Section 121(c) of CERCLA, 42 U.S.C.º 9621(c) and in accordance with the authority of CERCLA Section 104, 42 U.S.C º 9604.

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SOUTHERN SHIPBUILDING CORPORATION
SUPERFUND SITE

FINAL DECISION SUMMARY
OPERABLE UNIT TWO

1.0 SITE NAME, LOCATION, AND DESCRIPTION

The Southern Shipbuilding Corporation (Southern Shipbuilding or SSC) site is situated on approximately 54 acres of land located in Township 9S, Range 14E, Section 44 (30!16'21" north latitude and 89!48'03") as shown in Figure 1. The site is located at 999 Canulette Road in St. Tammany Parish, Slidell, Louisiana and is immediately downstream of the Louisiana Highway 433 bridge. Approximately 1.5 miles upstream of the SSC site is the Bayou Bonfouca Superfund site which is an abandoned creosote treatment plant that is actively being remediated under the Federal Superfund Program.

As shown in Figure 1, the northern boundary of the SSC property consists of Bayou Bonfouca while the southern portion is defined by Canulette Road. Residential areas surround the site to the west, south, and on portions of the northern shore of Bayou Bonfouca. Directly opposite the active portions of the site on the northern side of Bayou Bonfouca is an active marine service company. The eastern portion of the site is heavily wooded and is bounded by State Highway 433. Approximately half of the western portion of the 54 acre SSC property has been cleared for the plant operations which included operation of two sludge pits that are the focus of this report. The term "sludge" as used in this document refers to the black, oily material in the pits, whether it is liquid or solid, floating or sinking. These pits were used for the disposal of material pumped from vessels from an undetermined time until 1972 and were the source of hazardous substance contamination seeping into Bayou Bonfouca.

In addition to the pits, the site consisted of a wide range of potential environmental and worker threats, many of which have been addressed as removal actions as described in Section 2.3.1 Removal Actions of this document. Solid waste and hazardous substances were disposed of on the ground surface and in dilapidated buildings located on the Site. Abandoned piles of scrap metal drums, paint cans, cranes, other heavy equipment, and discarded solid waste were scattered throughout the facility and in the wooded areas immediately adjacent the operations plant. A paint shed on-site was estimated to have contained over 2,000 cans of paints, solvents and containers that were leaking or in various stages of decay. The majority of these removal actions were completed by the end of June 1996, in conjunction with the investigation and cleanup of contamination on the OU2 property. Figure 2 shows OU1 and OU2.

Extensive sampling and analysis for a broad range of hazardous substances has been completed and compiled in the Remedial Investigation Report, Feasibility Study, and Removal Support Reports 1 and 2. Based on the results of these investigations, EPA determined that several areas within OU2 presented a higher than allowable risk to potential future workers or residents on the Site. As a result, EPA conducted extensive removal actions that addressed contaminated areas and reduced site human health and environmental risks.

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Unlike OU1, which contained primarily organic wastes such as polynuclear aromatic hydrocarbons (PAHs), OU2 contaminants included heavy metals such as lead, cobalt, and arsenic, and organics such as polychlorinated biphenyls (PCBs), and PAHs. Cobalt was removed as a contaminant of concern when subsequent sampling failed to identify elevated levels of this metal. For the purposes of this report, PAH is also expressed as benzo(a)pyrene (B(a)P) equivalents. Figures

3,4,5, and 6 depict soil concentrations in the 0 to 2 foot interval for lead, arsenic, B(a)P equivalents, and total PCBs, respectively, prior to removal actions to address this contamination.

Since incineration of OU1 wastes was nearing completion, EPA conducted an expedited removal of the organic compound-contaminated soil areas from OU2 and blended those contaminated soils with the oily wastes from OU1. Blending of the OU1 and OU2 wastes aided in the handling of OU1 wastes by helping to stabilize the liquid oily wastes from the South Impoundment. Table 1 shows the contaminants of concern identified through rigorous surface and subsurface soil sampling and the removal action levels. Removal action levels are the concentrations in soil which EPA established to be protective of potential future site workers. Soil concentrations above these values were remediated; Soil concentrations below these values were considered non hazardous and left in place. For the purposes of this ROD, marginally contaminated soils are those soils which have contaminants of concern less than the removal action levels identified in Table 1. Approximately 1,072 cubic yards of oily waste from OU2 were blended with OU1 wastes and transported to the Bayou Bonfouca incinerator. Figure 7 shows the areas that were excavated for incineration and off-site disposal.

In addition to the incineration of this waste material, EPA disposed of approximately 4,704 cubic yards of soil and debris that were contaminated with metals. Since metals can not be treated by incineration, EPA transported these wastes off-site for disposal. Analysis of the heavy metal-contaminated soils and debris indicated that it contained metals levels below the regulatory threshold for treatment as a hazardous waste. Therefore, because this material was classified as a non-hazardous waste regulated under Subtitle D of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. º 6901 et. seq., it was disposed of at the Woodside Landfill in Walker, Louisiana.

The Site also included large quantities of non-hazardous waste and debris. As part of a continuing cooperative effort with EPA, Signal Capital, the secured creditor of the bankrupt Southern Shipbuilding Corporation, has conducted extensive recycling and salvage efforts that have involved removal of most of the Site's salvageable and unsalvageable materials that are not contaminated with hazardous substances.

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Table 1

CONTAMINANTS OF CONCERN
AND REMOVAL ACTION LEVELS
OPERABLE UNIT 2

CONTAMINANTS	REMOVAL ACTION LEVEL (mg/kg)
B(a)P	10
Total PCBs	10
Lead	2,000
Arsenic	30

mg/kg - milligrams per kilogram

2.0 SITE OPERATIONS HISTORY

The facility was used for the manufacturing and repairing of shipping vessels including the gas freeing (cleaning) of cargo hulls for change of cargo for a period of over 75 years. Chemical compounds such is benzo(a)pyrene (BaP) and other polynuclear aromatic hydrocarbons (PAHs) have been identified at the site that constitute hazardous substances as defined at Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. º 9601(14), and further defined at 40 CFR º 302.4.

The SSC site began operations in 1919 under the direction of Canulette Shipbuilding. In 1954, Canulette Shipbuilding sold the business to J & S Shipbuilding. Records of site operations for the period of ownership by each of these two companies are unavailable. In 1957, the Southern Shipbuilding Corporation (SSC purchased the property from J & S Shipbuilding. SSC ran the facility from 1957 until 1993, during which time it performed gas freeing, ship construction, docking and repairing operations. In 1993, SSC and its operator filed for Chapter 11 bankruptcy protection under the U.S. Bankruptcy Code and ceased all operations. Also in 1993, SSC's secured creditor, Signal Capital Corporation, secured the facility. Since that time, Signal Capital Corporation has cooperated with EPA by removing scrap and solid waste materials that are not contaminated with hazardous substances in a manner that does not constitute participation in management of the facility.

EPA has utilized avai1able aerial photographs to interpret site conditions over the operational history of the facility. Those aerial photographs have provided evidence that the facility was well established by the 1940s and have indicated that the two surface impoundments shown in Figure 2 (within the shaded portion of OU1) were not constructed until after March 1939. An April 1954 photo shows a railroad running from the north along the Bayou Bonfouca and ending at the bayou in the area between the north and south impoundments, although the use of this railway is undocumented. That 1954 aerial also shows a small island less than 0.25 acres located in the center of Bayou Bonfouca near the graving dock and a maintenance slip along the upstream portion of the Bayou. The island appears to have been constructed with dredge spoils.

The 1954 photo also indicates that there were no residences on the southern portion of Bayou Bonfouca near the SSC facility and that residences were only sparsely located near the opposite bank. A November 1967 aerial photograph revealed extensive dredging of coves along the southern

portion of Bayou Bonfouca and the establishment of residences along both shores of the bayou in the vicinity of the site. In addition, the small island within the middle of the bayou and the breakwater for the maintenance slip no longer appear in the 1967 photo. That photo also indicates that the size of the north and south impoundments remained approximately the same over the 13 year period.

Subsequent photographs taken during the 1970s, 1980s, and 1990s indicate growth in residential communities bordering the facility but do not identify any major alterations to the impoundments or the rest of the SSC site. It is also important to note that a review of these historical photos does not show the presence of any impoundments other than the north and south impoundments and associated systems such as the weir system.

3.0 ENFORCEMENT ACTIVITIES

The facility was issued a Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES) permit in March 1978 which was terminated in September 1984 when the company reported it had no active discharges. The Louisiana Department of Environmental Quality (LDEQ) issued a Compliance Order to SSC in November 1984 in response to unregulated releases of contaminants from the impoundments to the environment. In response to the Compliance Order, SSC prepared a new permit request which was issued by LDEQ in July 1986. SSC was issued another Compliance Order in May 1987 concerning sampling and reporting requirements and was subsequently issued a new NPDES permit in October 1987. As of October 1992, all permits associated with discharge from the impoundments had expired.

LDEQ was denied entrance to the facility on August 21, 1992, after attempting to investigate a complaint alleging the occurrence of a spill of contaminants from the impoundments. Three days later, LDEQ discovered that the unauthorized release from the impoundments had been repaired with sandbags and an estimated 325,000 gallons of contaminated materials been released into Bayou Bonfouca. LDEQ issued SSC a third Compliance Order in December 1992 directing it a stop all unauthorized discharges into the bayou.

LDEQ performed a sampling investigation in December 1992 of the impoundments, the bayou, and surrounding areas to support preliminary estimates of contaminants found on-site. Also in December 1992 EPA's Emergency Response Branch (ERB) visited the site to investigate the release of pit contents into Bayou Bonfouca. Subsequent discussions with LDEQ, SSC's operator, and the U.S. Army Corps of Engineers (USACE) concerning the stability of the levees surrounding the impoundments led to emergency removal response actions pursuant to the authority of Section 104 of CERCLA, 42 U.S.C. º 9604, as described in the following section.

On June 1, 1994, EPA issued a letter to all potentially responsible parties (PRPs) entitled "General Notice of Liability, Notice of EPA Actions, Request for Participation to Conduct Response Actions, and Request for Information under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. º 9601 et seq." EPA sent the letter to all companies or individuals identified in a log book maintained by an SSC foreman covering a time period between the late 1950s through the early 1970s.

The log book contained cryptic notations indicating a vessel or customer name, the date of service, and a brief description of the type of service rendered or work performed, such as gas freeing, hull or engine work, change of cargo or routine maintenance. EPA recovered this log book from an on-site vault prior to a fire that occurred at the facility in early 1994 that may have destroyed a substantial amount of records. The local newspaper reported the fire to have been an act of arson committed by two juveniles. The log book contained over 3,600 entries revealing over 300 different companies or individuals, but provided no addresses of those entities. Using available data bases, EPA obtained addresses for many of those parties, and thus

was able to mail the general notice correspondence. Many of those letters were returned to EPA unclaimed.

During field activities in July 1994, EPA discovered additional files at the SSC site that could provide additional information concerning the identity of PRPs. The additional files related to invoices, contracts, work orders, and other material such as purchase orders between SSC and customers. EPA prepared a summary of the information believed to be relevant to a liability determination in October 1994. After an extensive study of the file material, an additional 60 PRPs were identified that were not initially identified in the log book. EPA subsequently issued notice and information request letters to those newly-identified parties.

After a detailed review of the file material and a detailed analysis of responses to EPA's notice and information request letters, EPA concluded that it could not make out a prima facie liability case against parties it had determined had contractual arrangements with SSC for services that likely involved the discharge of vessel contents into the SSC pits. Due to the fact that the pits ceased to be used in 1972, EPA was unable to obtain any information concerning the identity or volume of material that may have been discharged from vessels of parties whom EPA had information indicating a contractual relationship with SSC. Nearly all of the recipients of EPA's information request letters responded by stating that they no longer maintained files reaching back in time from 1972.

EPA had hoped to develop evidence that would establish that a contractual relationship for the gas-freeing of cargo residues would constitute an arrangement for disposal of a hazardous substance as defined at Section 107(a)(3), 42 U.S.C. º 9607(a)(3), and therefore would be a basis of CERCLA liability for such an arranger. However, the only parties known to EPA whose vessel residues had likely been discharged into the on-site pits and whose cargo-types were readily ascertainable due to the nature of their business were crude oil carriers. Notwithstanding that knowledge and absent additional information concerning the physical make-up of that crude oil cargo, CERCLA's petroleum exclusion found at CERCLA Section 101(14), 42 U.S.C. º 9601(14), presumably applied. That provision of CERCLA reads, in pertinent part.

The term [hazardous substance] does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of this paragraph, and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

The significance of that presumption is that where EPA lacks additional evidence that would establish the presence of CERCLA hazardous substances within a petroleum mixture above what would be indigenous to crude oil, EPA lacks the authority under CERCLA to recover response costs from parties responsible for such releases. This is the case at the SSC site To date, EPA has not been able to develop additional liability evidence. Finally, SSC and its operator are not financially viable and no viable successor to the site's previous owners and operators exist.

4.0 REMOVAL ACTIONS

Response actions at the SSC site have included site investigation, site sampling, removal of thousands of cans of paints and solvents, emergency response to hazardous waste releases and removal of contaminated surface soils from OU2.

On November 17, 1987, the EPA Field Investigation Team (FIT) contractor conducted a preliminary assessment (PA) of SSC, and on November 30, 1987, the EPA FIT contractors conducted a site inspection of SSC. Since the site was in operation at this time, no further Superfund activities were conducted. On November 30 through December 4, 1992, the Louisiana Department of

Environmental Quality (LDEQ) conducted a screening site inspection that consisted of sampling across the site, in the bayou, and in the waste pits.

In August 1993, EPA conducted site assessment activities through its Technical Assistance Team (TAT) contractor. The activities were conducted to document the release of hazardous substances, pollutants, or contaminants into the environment and to determine the extent of contamination resulting from the discharge of hazardous substances, pollutants or contaminants from the waste pits. Sampling results from EPA and LDEQ investigative efforts in late 1992 and early 1993 provided evidence that the site posed an imminent and substantial endangerment to human health and the environment.

On July 27, 1993, acting in part on Army Corps of Engineers' recommendations, EPA conducted an emergency removal action pursuant to Section 104(a) of CERCLA, 42 U.S.C. º 9604(a), designed to provide additional freeboard (reduce the water level) within the on-site surface impoundments. The removal action consisted of pumping contaminated water from the surface impoundments, treating the contaminated water with sand and activated carbon filtration, and discharging the treated water to Bayou Bonfouca. Pump and treat activities ceased on September 1, 1993, after a total of 2,657,592 gallons of water were treated and discharged to Bayou Bonfouca. Approximately 2 to 3 feet of additional levee freeboard was obtained by that action.

On May 18, 1994, EPA requested a twelve-month exemption from the time limitation on removal actions imposed by CERCLA Section 104(c)(1), 42 U.S.C. º 9604(c)(1). This Action Memorandum requested additional funding to conduct further impoundment pump down operations at the site and to construct a security fence to improve site security. Pump and treat activities ceased on September 27, 1994, after 2,375,320 gallons of contaminated water were treated during this second phase.

A third removal action was initiated on November 28, 1994 and was completed in late May of 1995. This time-critical response action provided a secondary containment structure that minimized the potential for a catastrophic release of hazardous substances from the sludge pits into the bayou and retarded seepage of such wastes. The U.S. Army Corps of Engineers, under an interagency agreement with EPA, installed sheet piles along the bayou frontage of OU1. The sheet pile installation was completed on May 24, 1995.

On March 17, 1995, EPA's Regional Administrator granted approval of a $2 million emergency and consistency waiver pursuant to CERCLA Section 104(c)(1)(C), 42 U.S.C º 9604(c)(1)(C). This action allowed EPA to remove and dispose of hazardous substances contained in tanks, drums, and various other containers located on-site, and the disposal of associated contaminated debris. In addition, this action granted prospective approval to conduct as many as two additional pump, treat, and discharge operations in the event that closure of the on-site oily waste pits could not begin in a timely manner. Through this action, over 2,000 containers, varying in size from one gallon cans to 55 gallon drums, were removed from the building referred to as the "paint shed" and disposed of off-site.

In August 1995, EPA contractors collected judgmental soil samples within OU2 from areas of stained or disturbed soil, and areas that were suspect based on historical use information. Twenty-one surface and 17 subsurface soil samples were collected within OU2 to support potential removal actions. Data gathered from this sampling event was used in developing the Remedial Investigation/Feasibility Study (RI/FS) work plan and sampling approach.

The field investigation for the RI/FS was conducted from September 11 through 20, 1995, with a total of 110 grab surface soil samples collected from 100-foot grid nodes established across OU2. A total of six surface soil samples were collected within Zone E due to the historical lack of activity in that area. Eight subsurface soil samples were also collected from borings

advanced during monitoring well installations.

In response to public comment, EPA reduced the existing 100-foot grid (Zones A, B, C, and D) to 50-foot grid spacing in order to reduce the uncertainty associated with the unsampled area (117 surface and 14 subsurface soil samples) and to further delineate previously identified area of contamination (31 surface and 10 subsurface soil samples). Additionally, in December 1995, further sampling was conducted for a systematic delineation of contamination at the Zone D/E border. Twenty-two additional surface soil samples were collected at this location. The findings and conclusions of the OU2 removal assessment and RI/FS indicated that the contaminants of concern (COCs) in OU2 surface soils were lead, arsenic, polychlorinated biphenyls (PCBs), and carcinogenic polynuclear aromatic hydrocarbons (CPAHs). The CPAHs of concern were specifically associated with benzo(a)pyrene [B(a)P] equivalent toxicity calculations.

Additional delineation of contaminated soils within OU2 was conducted during April 1996. During this event, EPA established 47 additional nodes to complete the 50-foot grid over potentially contaminated areas in Zones A through D, with additional delineation of potential excavation areas surrounding nodes that exceeded removal action levels. A summary of sampling events associated with the removal assessment and RI/FS of OU2 is provided in Table 2.

Based on the results of all investigative sampling events conducted at OU2, it was determined that 30 areas exceeded established removal action levels and were proposed for excavation. Figures 3, 4, 5, and 6 provide a visual representation of contaminated areas based on computer generated contours of analytical data for lead, arsenic, B(a)P equivalents, and total PCBs, respectively. Figure 7 depicts all the areas of soil contamination within OU2 which exceeded removal action levels and were either incinerated or disposed of offsite.

Due to the extensive scrap salvaging operation conducted from 1994 to 1996, many of the proposed excavation areas were disturbed. During April and May 1996, EPA resampled those disturbed areas and based on the results of these pre-excavation removal confirmation samples, the number of proposed excavation areas was reduced from 30 to 21. However, one additional area (C02) was removed from the proposed excavation list due to Remedial-funded actions conducted in that area in support of OU1. The areas excavated during this removal action are listed in Table 3 and represented visually in Figure 7.

Using information provided in the FS, EPA elected to dispose of site soils classified as Fraction A at the Bayou Bonfouca National Priority List (NPL) site incinerator. Fraction A is defined as soil contaminated with B(a)P equivalents at concentrations greater than or equal to 10 milligrams per kilogram (mg/kg), and other COCs present in concentrations acceptable for incineration at the Bayou Bonfouca NPL site incinerator (arsenic <30 mg/kg, lead <500 mg/kg, and total PCBs <10 mg/kg). Fraction B is defined as all remaining contaminated soil above EPA established removal action levels. EPA elected to stockpile Fraction B soil on site and then collect composite samples to determine the appropriate disposal method.

EPA set forth an excavation depth criteria of up to 2 feet. Excavation was performed in either 0.5- or 1-foot lifts in areas where no visual contamination was present and a 2-foot lift in areas where visual contamination was present. Areas that were excavated to 2 feet were not sampled for cleanup confirmation prior to backfill. However, based on public comment, EPA returned to the cleaned areas and collected confirmation samples from the 2 to 2.5 foot depth.

Table 2

Surface and Subsurface Soil Sampling Events
Operable Unit 2

SAMPLING DATE	EPA REPORT	SAMPLE LOCATIONS(1)	SUBSURFACE LOCATIONS/ DEPTH	SAMPLE DESCRIPTION	CONTAMINANTS MEASURED
Sept. 1995	OU1 EE/CA(2)	4		Systematic OU1 perimeter	TAL Metals, TCL Organics
Aug. 1995	Removal Assessment Report(3)	21	17/1	Biased locations TCL Organics	TAL Metals, TCL Organics
Sept. 1995	RI Report(4)	110	8/2(6)	100-foot systematic grid	TAL Metals, TCL Organics
Sept. 1995	RI Report(4)	6		Random locations	TAL Metals, TCL Organics
Nov. 1995	Removal Assessment Report(3)	117	14/2	Phase 1:50-foot systematic grid	Lead, PAHs
Nov. 1995	Removal Assessment Report(3)	31	10/2	Systematic delineation of previously identified areas of contamination	Lead, PAHs
Dec. 1995	Removal Assessment Report(3)	22		Systematic delineations of extent of contamination	Lead, PAHs
April 1996	Removal Assessment	47		Phase II: 50-foot systematic grid	Lead, PAHs, Arsenic, PCBs

Report(3)

KEY:

(1) = Refers to the number of different locations evaluated and does not include field duplicate, inaccessible grid locations or other quality assurance analyses.

(2) = Refer to the Engineering Evaluation/Cost Analysis (EE/CA) Report for OU1.

(3) = Removal Support Report Number 2.

(4) = Refer to the Remedial Investigation (RI) Report for OU2

(5) = Borings collected during monitoring well installation

PAHs = Polynuclear aromatic hydrocarbons

PCBs = Polychlorinated biphenyls.

TAL = Target Analyte List.

TCL = Target Compound List.

Table 3

LIST OF AREAS EXCAVATED DURING THE OU2 SOIL REMOVAL ACTION AND ASSOCIATED CONTAMINANTS OF CONCERN OPERABLE UNIT 2, SOUTHERN SHIPBUILDING CORPORATION SITE SLIDELL, ST. TAMMANY PARISH, LOUISIANA

Node Location(1)	Contaminants of Concern	Soil Classification(3)
2D23	B(a)P	Fraction A
X127A	B(a)P	Fraction A
X130	B(a)P	Fraction A
X180	B(a)P	Fraction A
X200	B(a)P	Fraction A
2A24	Lead, PCBs	Fraction B
2C21	B(a)P, Lead	Fraction B
2C22	Arsenic	Fraction B
2DO6	Arsenic	Fraction B
2DO9	Arsenic	Fraction B
X047	B(a)P	Fraction B(2)
X162	PCBs	Fraction B
X163	Arsenic, B(a)P	Fraction B
X175	PCBs	Fraction B
X186	PCBs	Fraction B
X187	PCBs	Fraction B
X191	Arsenic, PCBs	Fraction B
X193	Arsenic, Lead, PCBs	Fraction B
X197	PCBs	Fraction B
X198	Arsenic, PCBs	Fraction B

Key:

(1) Refer to Plate 2 for specific node locations and Figures 7 and 8 for areas associated with the removal excavation activities.

(2) Area X047 continued only B(a)P contaminated soil, however, due to site topography and the proximity, it was excavated along with areas 2C22 and 2C21 and stockpiled as Fraction B soil.

(3) Fraction A is defined as soil contaminated with B(a)P equivalents at concentrations greater than or equal to 10 milligrams per kilogram (mg/kg), and other contaminants of concern present in concentrations acceptable for incineration at the Bayou Bonfouca National Priority List (NPL) site incinerator (Arsenic < 30 mg/kg, lead < 500 mg/kg, and total PCBs < 10 mg/kg). Fraction B is defined as all remaining contaminated soil above EPA established removal action levels (which coincide with remedial action goals established for this site

B(a)P Benzo(a)pyrene equivalents (refer to Table 1 for additional description).
PCBs Polychlorinated biphenyls.

Table 4

POST-EXCAVATION SOIL SAMPLE RESULTS
AND EXCAVATION DEPTHS
OPERABLE UNIT 2, SOUTHERN SHIPBUILDING CORPORATION SITE
SLIDELL, TAMMANY PARISH, LOUISIANA

ANALYTICAL RESULTS

SOIL EXCAVATION CLASSIFICATION	NODE LOCATION	SAMPLE DEPTH (ft)	B(a)P (mg/kg)	PCBs (mg/kg)	Lead (mg/kg)	Arsenic (mg/kg)	FINAL EXCAVATION DEPTH(ft)
Fraction A	2D23A	1.0	10.18	NA	NA	NA	
	2D23A	ò	ò	ò	ò	ò	2.0
	2D23B	1.0	3.35	NA	NA	NA	1.0
	2D23C	1.0	9.98	NA	NA	NA	1.0
	X127A	1.0	0.39	NA	NA	NA	1.0
	X130	1.0	6.99	NA	NA	NA	1.0
	X180	ò	ò	ò	ò	ò	2.0
	X200	1.0	4.97	NA	NA	NA	1.0
Fraction B	2A24A	ò	ò	ò	ò	ò	2.0
	2A24B	ò	ò	ò	ò	ò	2.0
	2A24C		ò	ò	ò	ò	2.0
	2A24B	ò	ò	ò	ò	ò	2.0
	2A24E	ò	ò	ò	ò	ò	2.0
	2C21	ò	ò	ò	ò	ò	2.0
	2C22	ò	ò	ò	ò	ò	2.0
	2C22A	0.5	3.25	NA	1,800	NA	0.5
	2C22B	0.5	4.02	NA	3,400	NA	

From April 10 to May 7, 1996, EPA excavated and stockpiled all Fraction A site soil which was comprised of five areas (X127A, X130, X180, X200, and 2D23) (Figure 7). Post-excavation composite confirmation soil samples were collected from applicable areas. Prior to post-excavation sampling, Area 2D23 was subdivided into three smaller areas (A, B, and C) to limit the surface area included as part of each composite sample. A summary of post-excavation removal confirmation sample results and final excavation depths for each Fraction A area is presented in Table 4. On May 27 and 28, 1996, EPA transported a total of 1,072 cys (67 truckloads) of Fraction A contaminated soil to the Bayou Bonfouca NPL site incinerator for disposal.

From April 23 to May 28, 1996, EPA excavated and stockpiled all Fraction B site soil which was comprised of 15 areas (X162, X163, X175, X186, X187, X191, X193, X197, X198, 2DO6, 2D09, 2A24, X047, 2C21, and 2C22). Area X047 contained only B(a)P contaminated soil, but due to site topography and the proximity to Area 2C22, it was excavated along with Areas 2C22 and 2C21 and stockpiled as Fraction B soil. Prior to post-excavation sampling, Area 2C22 was divided into four smaller areas (2C22, 2C22A, 2C22B, and 2C22C) to limit the surface area included as part of each composite sample. A summary of post-excavation removal confirmation sample results and final excavation depths for each Fraction B area is presented in Table 4.

All Fraction B soil was stockpiled on large concrete pads located within OU2. On May 7, 1996, one composite sample was collected from each of the three Fraction B stockpiles and submitted to an analytical laboratory for disposal analyses, which included pesticides/PCBs, Toxicity Characteristic Leaching Procedure (TCLP) arsenic, and TCLP lead. On May 29, 1996, one composite sample was collected from the Fraction B stockpile that contained only lead contamination. That sample was submitted to an analytical laboratory for TCLP lead analysis.

From May 21 to June 14, 1996, all excavated Fraction B soil was passed through a "Powerscreener" to remove both large and medium size debris. The screened soil was stockpiled pending off-site disposal.

During May 23 through June 14, 1996, 217 trucks were loaded with Fraction B contaminated soil. Based on analytical data, the contaminated soil was classified as non-hazardous. The non-hazardous waste was transported to the Woodside Landfill at 29340 Woodside Drive in Walker, Louisiana. From June 24 through June 27, 1996, 33 trucks were loaded with debris that had been screened from the Fraction B stockpile. The 33 truckloads of debris were also classified as non-hazardous and transported to the Woodside Landfill in Walker, Louisiana.

The capacity of each disposal truck was approximately 20 cys. Based on weight ticket data, 1 ton of excavated soil was approximately equal to 1 cy. Using this information, 4,340 cys (4,340 tons) of Fraction B contaminated soil and 660 cys (660 tons) of contaminated debris were transported offsite.

From May 17 to June 26, 1996, Approximately 5,000 cubic yards of fill dirt were delivered to the site (5,000 tons). The fill dirt was placed in all the excavated areas on site. After the fill material was graded and smoothed, the areas along Bayou Bonfouca were seeded with Bermuda grass seed. On July 3, 1996, removal activities concluded and all site personnel were demobilized.

Figures 8A, 8B, 8C, 9A, 9B, 9C, 1OA, 1OB, 1OC, 11A, 11B, and 11C show the concentrations and distribution of contaminants, excluding asbestos, after all removal and remedial actions were completed.

In addition to the chemicals of concern identified in the RI and FS, asbestos containing materials were detected in several piles of debris and small pieces were discovered to be randomly scattered across the surface of OU2. In June 1997, EPA used visual identification and

laboratory samples to remove potentially asbestos containing materials from surface soils and debris piles. Since the asbestos material was not able to be separated from the debris piles, EPA elected to dispose of the entire pile as asbestos containing material. Approximately 300 cubic yards of debris were excavated, loaded into trucks, and transported to the Woodside Landfill in Walker, Louisiana.

Based on comments received from LDEQ on July 29, 1997, EPA remobilized to the SSC site in August 1997, to remove the remaining debris piles which contained asbestos containing materials. During this removal action, EPA excavated each debris pile to 4" below grade or to the extent of contamination, placed a protective geotextile warning barrier to the limits of excavation, backfilled excavated areas with a minimum of one foot of low permeability clay, revegetated the excavated areas to prevent erosion, and transported the asbestos containing debris to an approved asbestos landfill for disposal. Figure 12 shows the location of the asbestos containing debris piles which were removed and the limits of excavation and backfilling.

The LDEQ Inspection Report, asbestos confirmation sampling results, and related correspondence have been placed in the Administrative Record. Figure 13 provides a timeline of overall site cleanup.

<IMG SRC 97123I>
<IMG SRC 97123J>
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<IMG SRC 97123V>

5.0 CONDUCT OF A REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) FOR OU2

Concurrent with the implementation of the remedy selected for OU1, EPA conducted remedial investigations for OU2, which resulted in the release to the public of a Remedial Investigation (RI) Report (August 1996) and a Final Feasibility Study (FS) Report (September 1996). The RI report described the nature and extent of OU2 contamination in soil, groundwater, sediment and air and assessed potential human health and ecological risks. The FS evaluated several technologies for addressing contamination on OU2. However, based on a review by EPA of the data collected for the RI and FS, EPA determined that the nature and extent of contamination in OU2 was confined to several small areas and that limited removal actions would be the most appropriate way to reduce risks to potential future workers and residents. Results of this work are discussed in Section 8.0 and 9.0 of this document.

6.0 COMMUNITY PARTICIPATION

EPA initiated a comprehensive community involvement program for citizens living near the site with establishment of a Community Working Group which was composed of Slidell residents concerned about EPAs responses to pollution in the community. On August 15, 1993 EPA's community participation activities for the SSC site began with door-to-door interviews of residents living near the site. These activities began following EPA's decision to conduct a non-time critical

removal action, as required by Section 300.415(m)(4) of the NCP, 40 CFR º 300.415(m)(4). From this date, SSC issues were incorporated in all subsequent community activities.

Compilation of the administrative record for the selection of response activities at the site began in summer of 1993 along with a public notification to the public of planned activities consistent with the requirements of NCP Section 300.415(m), 40 CFR º 300.415(m).

EPA has been in constant dialogue with members of the community and city of Slidell officials regrading the site. On January 25, 1996, EPA met with members of Slidell Working Against Major Pollution (SWAMP) and EPA's Community Working Group(CWG). Topics at this meeting included the progress of incineration activities, the RI/FS for OU2, and EPA's strategy for addressing contamination in OU2.

Concurrent with incineration of OU1 wastes, EPA conducted a Remedial Investigation(RI) and Feasibility Study(FS) for OU2. A draft RI and FS were completed in February 1996. The RI collected many samples from shallow groundwater, surface and sub-surface soils, and from sediments in Bayou Bonfouca. The results of this investigation showed the presence of lead, arsenic, polycyclic aromatic hydrocarbons(pah), and polychlorinated biphenyls (pcb) in several small areas within OU2.

On February 15, 1996, EPA met with members of SWAMP and the CWG to discuss OU2 wastes and EPA's plans for removal of contaminated areas. Topics at this meeting also included the EPA's integration of the Remedial and Removal programs to rapidly respond to OU2 wastes and accelerate the overall Superfund process.

On February 26, 1996, EPA held an Open House for all interested citizens to discuss OU2 wastes and removal plans. Maps of OU2 waste were presented at this meeting that defined the extent of contamination in 0U2.

March 4, 1996, EPA met with members of the CWG and other interested citizens to discuss plans for removal of OU2 contaminated areas. Topics also included EPA's securing of funds for removal of contaminated areas in OU2.

On March 14, 1996, EPA held an Open House to further define the scope of removal actions in OU2, and to introduce the EPA On-Scene Coordinator, Althea Foster, to the community.

In April 1996, EPA initiated removal of areas of elevated contamination within OU2. Removal actions were completed on July 3, 1996.

On August 2, 1996, EPA provided a site tour for members of SWAMP, the Community Working Group, and representatives of the Slidell City Council.

On November 18, 1996, EPA issued its Proposed Final Plan, which called for no further Federal or state response actions in OU2.

On November 19, 1996, EPA held an Open House at the Slidell City Council Chambers to discuss its Proposed Final Plan with members of the community. Topics included the Proposed Final Plan and a discussion of contaminated areas in OU2. Meeting notices were published in the New Orleans Times-Picayune and the Slidell Sentry-News. The public comment period for EPA's Proposed Final Plan began December 5, 1996 and lasted through January 6, 1997.

On December 19, 1996, EPA held a public meeting to receive comments on its Proposed Final Plan. A transcript of the meeting was added to the Administrative Record. Based on a request by SWAMP, EPA extended the public comment period an additional thirty days to February 5, 1997.

EPA's response to comments received during the public comment period and at the public meeting are provided in the Responsiveness Summary portion of this ROD. This decision document presents the selected remedial action chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq., the administrative record, and to the extent practicable, the National Contingency Plan (NCP), 40 CFR Part 300.

7.0 SCOPE AND ROLE OF RESPONSE ACTION

OPERABLE UNIT ONE

The focus of the Southern Shipbuilding Engineering Evaluation/Cost Analysis (EE/CA) and the ROD for OU1 was to evaluate findings of previous investigations, to collect additional information about the site that would assist in characterizing current and future risks, and to develop long term and permanent remedial action alternatives for controlling the source of contamination at the site that could then be evaluated in the OU1 ROD. The remedial action selected in that ROD addressed the SSC sludge pits and adjacent contaminated soils and the sediments within the graving dock that constitute the first planned operable unit (OU) for this site. Subsequent investigations for OU2 addressed the ground water, sediments adjacent to the site in Bayou Bonfouca, and the other operational areas of the shipbuilding facility, including the graving dock.

Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably controlled and that present a significant risk to human health and the environment should exposure occur. The principal threat at the Site was from polynuclear aromatic hydrocarbons (PAHs) that were found in highly-contaminated sludge and soil within and surrounding the pits. In addition, those highly contaminated sludges and soils posed a threat to human health from direct contact with contaminants.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of release. The marginally contaminated surface and subsurface soils in some areas surrounding the pits are identified as low level threats.

In addition to the contamination related to the sludge pits, an additional contaminant was found in an area not associated with the pits. The source of this contaminant tributyltin (TBT), is found in the graving dock and in other areas of the site that appear to have been historically associated with sandblasting operations. TBT, an anti-fouling paint, is extremely toxic to aquatic organism.

Graving dock sediments were excavated and detoxified in conjunction with the remedy for OU1. Following excavation, confirmation samples were collected and analyzed for TBT. Results from these samples showed the presence of TBT in the remaining sediments at concentrations above the cleanup level. Further excavation was hindered by the structural design of the graving dock, resulting in a decision by EPA to place a protective barrier of clay along the bottom of the graving dock to reduce potential ecosystem exposure to this toxicant. Eighteen inches of clay material were placed along the bottom of the graving dock, followed by six inches of road-base rock. This action effectively caps the remaining contamination in place and provides a barrier against future exposure.

Shallow unconfined groundwater in OU1 was found to be locally contaminated with several volatile and semivolatile organic chemicals, primarily in areas adjacent to the North and South Impoundments. This groundwater contamination did not extend below the underlying clay layer which is found at a depth of 5 to 7 feet below the surface. The shallow unconfined groundwater is not used as a drinking water supply and is not viable for such use. Residual contamination in this area will naturally attenuate over time. No further action is necessary for groundwater

contamination at this site.

OPERABLE UNIT TWO

In conjunction with the implementation of the remedy selected for OU1, EPA conducted remedial investigations for OU2, which resulted in the release to the public of a Remedial Investigation Report (August 1996) and a Final Feasibility Study Report (September 1996). The RI report described the nature and extent of OU2 contamination in soil, groundwater, sediment and air and assessed potential human health and ecological risks. The FS evaluated several technologies for addressing contamination on OU2.

Based on a review by EPA of the draft versions of the RI and FS, EPA determined that the nature and extent of contamination in OU2 was confined to several small areas and that limited removal actions would be the most appropriate way to reduce risks to potential future workers and residents.

Surface soils in OU2 were found to be contaminated with carcinogenic polynuclear aromatic hydrocarbons, lead, polychlorinated biphenyls, and arsenic. Chemicals of concern were not detected in bayou sediments, groundwater, or air at concentrations that presented a threat to human health or the environment and were therefore not retained as media of concern requiring remedial or removal attention by EPA.

In addition to the chemicals of concern identified in the RI and FS, asbestos containing materials were detected in several piles of debris and small pieces were discovered to be randomly scattered across the surface of OU2. In June 1997, EPA used visual identification to remove potentially asbestos containing materials from surface soils and debris piles.

8.0 SITE CHARACTERISTICS

8.1 DEMOGRAPHY AND LAND USE IN THE AREA OF THE SITE

The SSC site is bordered to the north and west by Bayou Bonfouca, to the east by wooded acreage, and to the south by a residential community. The bank of the bayou opposite the site is a mixed residential/commercial property with a marine services company directly across from the site graving dock. A municipal wastewater treatment facility that discharges to Bayou Bonfouca is located upstream from the site. The Bayou Bonfouca Superfund site (CERCLIS Identification Number LAD980745632) is located approximately 1.5 miles upstream from the SSC site.

Residential development has been steadily encroaching on the boundaries of the SSC site over the last forty years, as shown in the historical aerial photographs. The facility is no longer an active shipyard and workers are no longer present on a continuous or long-term basis. Commercial agriculture, silvaculture, livestock production, and grazing do not occur on the areas of observed contamination. There is no evidence that public recreation is occurring or has occurred within the areas of observed contamination.

The nearest residence is located approximately 300 feet south-southwest of the South Impoundment. The number of individuals within a 0- to 0.25-mile radius of the site is approximately 107, the number residing within a 0.25- to 0.50-mile radius is approximately 511, and the population residing within the 0 50- to 1-mile radius is approximately 7,052.

The SSC site itself is currently abandoned, although extensive salvage efforts have occurred over the past three years. The city of Slidell has allowed heavy industrial use of the property in the past. In 1994, a land use variance lapsed that had enabled SSC to accept large vessels (and thereby restricted the viability of heavy industrial usage of the property in the future).

For OU2, EPA estimated risk for both future workers and future residents and based its cleanup goes on a continued industrial land use scenario which it believes is the reasonably anticipated future land use of the property. EPA notes that this view is consistent with the current state and features of the property, as well as past uses of the property. Further, there are no active residential development plans or residential zoning changes planned for the property Cleanup activities at the Site have met or exceeded EPA's health-based cleanup standards for such an industrial land usage. Although wastes have been removed or controlled on the site, contamination remains onsite which needs to be considered with respect to both a continued light industrial or a future residential land use scenario. Therefore, EPA is making recommendations to City of Slidell officials to ensure that future land use does not present any unacceptable exposure to future users of the property. For that reason, this plan provides recommendations for local authorities to impose land use controls that will ensure long-term, protectiveness of the Southern Ship remedies in the event that the property is used for light industrial or residential purposes.

Although EPA used residential land use assumptions in compiling its Risk Assessment for OU1, it concluded that the completion of the source control remedial action for OU1, coupled with the concurrent conduct of limited removal actions for OU2, was fully protective for continued industrial land use which EPA believes is the reasonably anticipated future land use for the site. However, EPA also has acknowledged that by ensuring that areas of OU1 that consist of the capped pit areas and the graving dock not be disturbed by future invasive activities, and by placing two feet of clean topsoil over the landmass of OU2, such action will eliminate the possibility of direct contact with remaining site contaminants. Therefore, this Final ROD addresses current land use and the reasonably anticipated future land use of light industrial activity while providing specific guidance to local land use planners should the Site's land use designation change to residential.

8.3 GEOLOGY/HYDROLOGY

The SSC site is underlain by sediments of Miocene to Holocene (Recent) age. These sediments are characterized by overlapping, wedge-shaped, unconsolidated deposits that dip and thicken to the south and southwest, reflecting the regional structural features.

The city of Slidell Water Well ST-563 is the closest deep municipal water well in which a well log has been obtained and is located approximately 1.25 miles southwest of the site. Geologic formations represented by the well log for ST-563 are thought to be consistent with site stratigraphy. The well log indicates that six separate aquifers encountered during drilling of ST-563 probably underlie the SSC site. These aquifers, from shallowest to deepest, are the Shallow, the Upper and Lower Ponchatoula, the Big Branch, the Covington, and the Slidell Aquifers. According to the well log, the Shallow Aquifer is located approximately 75 feet below land surface (BLS) and is 300 feet thick. The Upper Ponchatoula is located approximately 480 feet BLS and is 150 feet thick and the Lower Ponchatoula is 800 feet BLS and is 300 feet thick. The Big Branch Aquifer is located 1,300 feet BLS and is 100 feet thick. The Covington and the Slidell Aquifers are part of the Kentwood Aquifer System. In the Slidell area, the thickness of the Covington Aquifer varies greatly and may be less than 100 feet. According to well log ST-563, the Covington is located 2,100 feet BLS and the Slidell is located 2,250 feet BLS with a thickness of 150 feet. The preceding aquifer formations are separated by layers of clay. The thickest layer is found between the Big Branch and the Covington Aquifers, and is approximately 700 feet thick.

Surface Topography

The topography of the site which has numerous man-made features and obstructions ranges from 10 to 4 feet National Geodetic Vertical Datum (NGVD) and slopes toward the southwest. The surface

water elevations of the North and South Impoundments were 4.5 and 3.5 NGVD, respectively, at the time of the survey. Significant improvements to the impoundment area and periodic dewatering to lower impoundment freeboard during past removal actions at the site may cause discrepancies between more recent water level readings and the water levels recorded in 1992. The 20-year average elevation of Bayou Bonfouca is 1.2 feet NGVD.

Site-Specific Geology

The site is characterized by recent alluvial deposits including interbedded clay, silt and sand. An upper saturated interbedded silt and clay layer ranging in thickness from 2 to 22 feet, a confining or dry clay layer ranging in thickness from near 0 to 20 feet, and an upper confined aquifer (thickness undefined) were determined to be distinct and continuous features across the site. Logs of cores obtained from 3 shallow borings, 10 monitoring well locations, and 4 monitoring wells completed into the upper confined aquifer layer are provided in Appendix B of the EE/CA.

The surface or upper interbedded silt and clay layer is composed of both naturally occurring and disturbed fill areas. Cores indicate that organic peat, fine sand, brown to gray clay, and brown silty sand comprise this layer which is saturated and determined to be contiguous with contaminated material originating from the impoundments.

The confining clay layer is composed of dry interbedded gray and tan clay with discontinuous sand and silt pockets. Physical testing of this layer was performed for the purpose of determining engineering design criteria and hydraulic characteristics. The layer is continuous across the site with the exception of the disturbed fill area west of the North Impoundment. In this area, excavation activity appears to have progressed below what was once a continuous layer. In all other sampling locations, the layer was found to be visibly dry and impeding contaminated sludge/sediment/water migration. Physical tests performed on cores obtained from monitoring well locations MW-06, MW-10, and MW-11 as well as from cores obtained from bayou sediment samples and impoundment locations reveal an average unconfined compressive strength of 1.63 tons per square foot (tsf) and an average hydraulic conductivity of 2.14 x 10-8 centimeters per second (cm/s). The material is classified as clay and, because of its low permeability compared to the permeability of the aquifer, it is defined as a confining unit. The upper confined aquifer is composed of interbedded clays, silts, and fine sands with saturated medium grain sand lenses. Monitoring wells MW-06, MW-07, MW-11, and MW-14 were installed in this layer to a depth of 49 feet. At two locations the thickness of this layer was undefined. In monitoring well MW-06 and MW-14 a clay layer was encountered at 48 to 55 feet BLS.

Site-Specific Hydrogeology

The site-specific hydrogeologic investigation was designed utilizing the information gained from the visual cores collected at the site. A series of 14 wells and one piezometer were installed to determine if impoundment-related contaminants had leached into the water table and to collect data on hydraulic gradients and conductivities. Of the 14 wells, ten were completed in the unconfined saturated zone located above the confining clay layer and four were completed below the confining clay layer in the upper confined aquifer.

These water bearing units were defined through the well installation process. The shallow wells were constructed so that the unconfined ground water above the confining clay could be sampled and gradient and conductivity measurements could be taken. The wells set in the upper confined aquifer were surface-cased and sufficiently grouted through the confining clay to allow representative samples and measurements to be collected. The wells were located across the site and around the impoundments so that any lateral migration could be defined. Limited slug tests were performed on a few wells to gain initial information on general aquifer characteristics.

Data sets run on Aqtesolv(R) ground water modeling software confirmed that conductivities are much lower than would be expected for a water bearing unit. The data gathered indicate that the hydraulic conductivities are too low to be accurately measured by field tests.

Multiple depth-to-water surveys were performed to determine the directional flow gradients. Bayou Bonfouca water level data were collected by the US Army Corps of Engineers (USACE) at a gauge station near the SSC site for the period of 1973 to 1993. A comparison of those data to on-site ground water elevations indicates that the unconfined saturated zone is predominantly discharging into the bayou. On rare occasions, the bayou level will rise above the water table and potentially recharge the water table. However, the high storability associated with the low conductivity of the saturated zone minimizes the potential for a reversal of the gradients. Therefore, any contaminant in the unconfined saturated zone will tend to migrate toward the bayou.

The hydraulic gradient of the upper confined aquifer was calculated from the four wells set in that water bearing unit. The direction of the gradient is to the south, away from the bayou. Also of interest is the artesian head the upper confined aquifer exerts on the confining clay unit. The positive head reduces the likelihood of any downward migration of ground water from the unconfined saturated zone. The zone is limited vertically by the confining clay unit which has an average hydraulic conductivity of 2.14 x 10-8 cm/s.

8.4 FIELD INVESTIGATIONS

In August 1995, EPA contractors collected judgmental soil samples within OU2 from areas of stained or disturbed soil, and areas that were suspect based on historical use information. Twenty-one surface and 17 subsurface soil samples were collected within OU2 to support potential removal actions. Data gathered from this sampling event was used in developing the RI/FS work plan and sampling approach.

The field investigation for the RI/FS was conducted from September 11 through 20, 1995, with a total of 110 grab surface soil samples collected from 100-foot grid nodes established across OU2. A total of six surface soil samples were collected within Zone E due to the historical lack of activity in that area. Eight subsurface soil samples were also collected from borings advanced during monitoring well installations.

In response to public comment, EPA reduced the existing 100-foot grid (Zones A, B, C, and D) to 50-foot grid spacing in order to reduce the uncertainty associated with the unsampled areas (117 surface and 14 subsurface soil samples) and to further delineate previously identified areas of contamination (31 surface and 10 subsurface soil samples). Additionally, in December 1995, further sampling was conducted for a systematic delineation of contamination at the Zone D/E border. Twenty-two additional surface soil samples were collected at this location. The findings and conclusions of the OU2 removal assessment and RI/FS indicated that the contaminants of concern (COCs) in OU2 surface soils were lead, arsenic, polychlorinated biphenyls (PCBs), and carcinogenic polynuclear aromatic hydrocarbons (CPAHs). The CPAHs of concern were specifically associated with benzo(a)pyrene [B(a)P] equivalent toxicity calculations.

Additional delineation of contaminated soils within OU-2 was conducted during April 1996. During this event, EPA established 47 additional nodes to complete the 50-foot grid over potentially contaminated areas in Zones A through D, with additional delineation of potential excavation areas surrounding nodes that exceeded removal action levels.

8.5 SITE CHARACTERIZATION

OU2 was characterized by sampling and analysis of surface and subsurface soils, on-site

sediments, groundwater, and air monitoring. RI data was supplemented with findings from the 1994 EE/CA field investigation of OU1, the August 1995 removal assessment of OU2, and supplemental groundwater sampling in November 1995. Additional investigations supporting the RI included a wetlands assessment, a cultural resources assessment, air analyses, and human health and ecological risk evaluations.

EPA Region 6 Risk Based Cleanup (RBC) levels were obtained from Draft Risk-Based Concentrations Associated with 10-6 Cancer Risk and HI=1 Table - Residential land Use Soil and Water (Khoury 1994). For the purpose of this evaluation, values associated with a 10-4 (one in ten thousand) cancer risk were used for comparison for carcinogenic PAHs. This represents the lower boundary of the target range (10-4 to 10-6 excess cancer risk) defined as acceptable risk in federal environmental laws and regulations. All other compounds were compared against hazardous indices (HIs) of 1 or excess cancer risks of 10-6.

In the absence of EPA Region 6 RBCs, advisory values provided by EPA Region 3 were used. These values are listed in the RBC table issued by Region 3 for July through December 1995 (EPA 1995). These RBCs and other pertinent cleanup values identified for soil were used as evaluation criteria for surface and subsurface soil, and for on-site drainage ditch sediment samples.

In addition to the RBCs identified above, advisory levels for lead included EPA Region 6 values of 500 (residential) and 2,000 mg/kg (industrial) in soil or sediment in addition to the 400 mg/kg criterion from EPA's Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities [EPA 1994a]).

Additional advisory levels were evaluated for B(a)P equivalent concentrations in soil or sediment. B(a)P equivalent concentration calculations are based on a sum of the values for seven associated PAH compounds after multiplication by the Toxicity Equivalence Factors (TEFs) provided by EPA Region 6: TEF = 0.01 for chrysene; TEF = 0.1 for benzo(a)anthracene, benzo(k)fluoranthene, benzo(b)fluoranthene, and indeno(l,2,3-cd)pyrene; and TEF = 1.0 for benzo(a)pyrene and dibenzo(a,h)anthracene. Benzo(a)pyrene equivalent concentrations are calculated using the reported value for detected compounds and one half the detection limit for nondetected compounds. The advisory levels evaluated for B(a)P equivalent concentrations are 1 mg/g and 10 mg/kg. These values were derived by the EPA from preliminary remediation goals for PAH contamination at OU1 and similar sites in Louisiana and are based on direct dermal contact in residential and industrial areas.

An advisory level of 1 mg/kg for total PCBs was also used. For each sample, the various Aroclors (PCBs) were combined to provide a measurement of total PCBs. The reported value for detected Aroclors and one half the detection limit for nondetected Aroclors were used to calculate the total PCBs in each sample.

Compounds detected in soil, sediment, or groundwater samples and determined to be non-site-related included several common laboratory contaminants: acetone, 2-butanone (also known as methyl ethyl ketone), methylene chloride, toluene, and bis(2-ethylhexyl)phthalate. Other phthalate compounds, particularly di-n-butyl phthalate, are common-field and/or laboratory contaminants. These compounds were detected at varying FODs but rarely exceeded background values and never exceeded RBC values. Phthalate compounds are not considered to be site related. These compounds were counted among the detected compounds for each subset of samples (background surface soil, remedial investigation soil borings, etc.) but were not included in discussions of frequently occurring compounds.

Inorganic and organic analytes detected in samples were evaluated based on:

- Frequency of detection (FOD) - analytes detected in less than 5% of the samples were not considered statistically significant;

- Frequency of exceedance (FOE) of background concentrations - analytes detected at or below background values or analytes detected above background values in less than 5% of all samples were not considered to be site related;

- FOE of regulatory criteria - contaminants detected at concentrations above draft RBCs, identified by EPA Region 6 (or EPA Region 3 in the absence of Region 6 criteria), or guidance or other criteria (TBCs) provided by EPA Region 6 as discussed below. Analytes that exceeded criteria in less than 5% of the samples were not considered to be statistically significant; and

- Source evaluation: contaminants that are anthropogenic (e.g., lab contaminants) or naturally occurring were identified as non-site-related.

Soils

Compared to background, surface and subsurface soils contained elevated concentrations of metals, and semivolatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAHs), pesticides, and PCBs. Volatile organic compounds (VOCs) were detected infrequently and at low concentrations, and RBCs for VOCs were not exceeded in any sample for which this analysis was performed. Contaminants were detected across OU2 and RBCs or TBCs were exceeded at statistically significant frequencies for arsenic, beryllium, cobalt, lead, carcinogenic PAHs [represented by calculated B(a)P equivalent concentrations], PCBs (represented by calculated total PCB concentrations), and the pesticides dieldrin and heptachlor epoxide (beryllium, dieldrin, and heptachlor expoxide only exceeded RBCs in subsurface soil). The exception is that Zone E samples exceeded RBCs or TBCs only for arsenic, cobalt, and B(a)P equivalents.

Based on the stated criteria, principal contaminants identified in surface soil are arsenic, cobalt, lead, carcinogenic PAHs, and PCBs. Principal contaminants identified in subsurface soil samples are arsenic, beryllium, cobalt, lead, carcinogenic PAHs, PCBs, dieldrin, and heptachlor epoxide. Inorganic and organic principal contaminants are lognormally distributed across OU2 and generally correlate positively with those in their group. Contaminants were generally detected at lower FODs and mean concentrations in subsurface soil samples as compared to surface soil samples, with the exception that organic compounds from subsurface judgmental removal assessment samples generally were detected at higher FODs and mean concentrations than for surface soils.

In addition to the above contaminants, asbestos containing materials (ACM) were found to be present in surface soils and in surface piles of mixed debris. The ACM appeared in several forms, including transite, tile, firebrick, and as insulation-type material. The ACM was primarily confined to several debris piles, but small pieces were observed randomly scattered across OU2.

Sediment

Sediment sample analytical results for the on-site drainage ditch were found to exceed soil RBCs or TBCs (used as a preliminary screen) for arsenic, beryllium, cobalt, lead, and carcinogenic PAHs. These compounds are identified as principal contaminants for on-site drainage ditch sediments. Higher concentrations of metals were detected in sediments collected near Bayou Bonfouca while the carcinogenic PAHs were similar along the entire drainage ditch. The source of these contaminants is difficult to determine due to the tidal influence of the bayou on water in the drainage ditch and the presence of industrial activities upstream of the SSC site.

Groundwater

Groundwater results for the unconfined saturated zone exceeded background and evaluation criteria for arsenic, barium, beryllium, cobalt, and lead in one to three wells, each, of the eight wells sampled during the RI. Arsenic and cobalt also exceeded evaluation criteria in unconfined saturated zone wells sampled during the 1994 EE/CA investigation that were also re-evaluated during the RI. Groundwater samples from wells set in the upper confined aquifer exceeded evaluation criteria for cobalt during the 1994 EE/CA investigation but not during the RI. No other RBCs or TBCs were exceeded for any compound during any of the groundwater sampling events. Principal contaminants for groundwater are identified as arsenic, barium, beryllium, cobalt, and lead. These contaminants are limited to the unconfined saturated zone.

Air

Organic vapors and total particulates were monitored in ambient air on site during the removal assessment and RI. Select VOCs and SVOCs from on-site and off-site ambient air were sampled and analyzed during other studies performed concurrently with on-site activities at SSC. Established action levels, where available, were not exceeded during these investigations. Based on available data, no principal contaminants were identified for ambient air across OU2. However, the data obtained suggests that activities which greatly increase traffic into and around OU2, generating dust, or which result in a large amount of subsurface disturbance, may result in localized increased concentrations of organic vapors and total airborne particulates. Asbestos fibers were not detected in ambient air.

Fate and Transport

Off-site contaminant migration is expected to be limited due to the chemical and physical properties of the contaminants and vegetative cover over large portions of OU2. The surface water and flooding pathways are the most probable routes of potential contaminant transport. Contaminants may enter these pathways through erosion of contaminated soils in surface water runoff (such as during storm events) into drainage ditches or directly into the bayou, or by a rising water table which could bring subsurface contaminants to the site surface.

8.6 RESULTS OF REMEDIAL INVESTIGATION (OU2)

This section presents the analytical results for samples collected during the RI conducted for OU2 in September 1995, incorporates results from a judgmental removal assessment conducted in August 1995 and describes supplemental groundwater sampling conducted in November 1995.

The following discussion presents analytical results for:

- Surface soil samples collected at background locations and on-site locations in OU2;
- Subsurface soil samples collected from borings, monitoring wells, and test pits at on-site locations in OU2;
- Sediment samples collected from the on-site drainage ditch;
- Groundwater samples collected from monitoring wells in and adjacent to OU2;
- QC water samples (field, trip, and rinsate blanks),
- Air monitoring results collected during the RI fieldwork and summaries of analytical findings from other air sampling events; and
- A summary of the principal contaminants that were identified.

This information has been used to delineate the principal contaminants at the SSC site. Combined with results of risk evaluations, this data was used by EPA for response-action decision making to reduce and manage potential risks associated with the SSC site.

SURFACE SOIL SAMPLING RESULTS

Metals

Fifteen metals were detected in at least one background surface soil sample. Eight metals were detected in at least 7 of 10 samples analyzed, and four metals (chromium potassium, cadmium, and antimony) were detected in only one sample. RBCs were not exceeded for any metal in any background sample.

Organics

Three VOCs, 16 SVOCs, 20 pesticides, and one PCB (Aroclor 1254) were detected in at least one of ten background surface soil samples. The only VOC detected other than common laboratory contaminants was trichloroethene. The SVOCs most frequently detected were PAHs, including B(a)P equivalent constituents. The pesticides most frequently detected in background samples were alpha-chlordane, 4,4-DDE, and dieldrin. Aroclor 1254 was detected in 50% of the background samples. The B(a)P equivalent calculated mean concentration in all background samples was 0.66 mg/kg.

CALCULATION OF BACKGROUND CONCENTRATIONS

On a parameter-specific basis, background surface soil data was used in the determination of a single soil background concentration value. As directed by EPA, a mean concentration was used to represent background. For compounds that were not detected in any of the background samples, the highest observed detection limit, followed with the "U" data qualifier, was listed as the background concentration. For compounds with at least one detection, a mean background concentration was calculated using the actual value for detected compounds and one half the detection limit for nondetected values. Surface soil background concentrations were used for comparison to on-site surface and subsurface soil values and on-site drainage ditch sediment values.

Grid Sampling

A total of 117 samples were collected from a 100-foot grid constructed over OU2. The following discussion applies to these samples.

Metals

All 23 metals of concern were detected in at least seven of the 117 grid surface soil samples. Background concentrations were exceeded in at least seven samples for each metal, and four metals (aluminum, barium, iron, and lead) were detected in all samples from these areas. The highest detected lead concentration was 8,030 mg/kg, and the mean lead concentration was 529 mg/kg. The highest detected cobalt concentration was 29.9 mg/kg, and the KBC for cobalt was exceeded in 25 of 110 samples. RBCs were exceeded in 71 samples for arsenic, in one sample for beryllium, and in four samples for antimony. Thirty-four samples exceeded the 400-mg/kg TBC for lead, the 500-mg/kg TBC for lead was exceeded in 26 samples, and the 2,000-mg/kg TBC for lead was exceeded in six samples.

The 400 mg/kg advisory level (TBC) for lead is based on EPA's Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities [EPA 1994a]). EPA Region 6 advisory

levels (TBCs) for lead contamination in soil include values of 500 mg/kg for residential and 2,000 mg/kg for industrial future land use based on risk-based calculations.

In the undeveloped wetlands area immediately adjacent to Canulette Road, each metal of concern (except antimony, cadmium, and thallium) was detected in at least one of seven surface soil samples. Background concentrations for 15 metals were exceeded in at least one sample.

The maximum lead concentration detected was 128 mg/kg. Cobalt exceeded the RBC in one sample and was detected at a maximum concentration of 8.9 mg/kg. The RBC for arsenic was exceeded in five of seven samples.

Organics

Thirty-two SVOCs, 21 pesticides, and four PCBs were detected in one or more surface soil samples. Ten of the SVOCs were detected in four or fewer samples. PAHs, including phenanthrene, anthracene, pyrene, fluoranthene, and the B(a)P equivalent constituents (except dibenzo[a,h]anthracene), were the most frequently detected SVOCs; individual PAHs were detected in 107 of 117 samples. Alpha-chlordane, gamma-chlordane, and 4,4-DDE, the most frequently detected pesticides, were each detected in at least 90 of 110 samples. Aroclor 1254, the most frequently detected PCB, was detected in 52 of the surface soil samples. The 1-mg/kg TBC for B(a)P equivalent concentrations was exceeded in 38 samples, four of which also exceeded the 10-mg/kg TBC; the maximum calculated value for B(a)P equivalent concentrations was 122.4 mg/kg. RBCs were exceeded for the individual B(a)P equivalent constituents benzo(a)pyrene (two samples) and benzo(b)fluoranthene (one sample). The RBC for aldrin was exceeded in one sample. The advisory level for total PCBs (1-mg/kg) was exceeded in 14 samples, and the RBC for Aroclor 1254 was exceeded in four samples.

In the undeveloped wetlands area adjacent to Canulette Road, two PCBs, 17 pesticides, and 13 SVOCs were each detected in at least one of seven surface soil samples. No individual B(a)P equivalent constituent exceeded its background concentration. Six SVOCs (including one common laboratory contaminant) were detected in all seven samples. Alpha-chlordane, gamma-chlordane, 4,4'-DDE, heptachlor epoxide, and methoxychlor were the most frequently detected pesticides. The maximum B(a)P equivalent concentration, 1.85 mg/kg, was calculated for the duplicate sample collected at grid node 2EO6 and exceeded the 1-mg/kg B(a)P TBC criteria. The use of elevated detection limits in the calculations rather than the two actual detected constituents accounted for a large part of this value.

Judgmental Locations - Removal Assessment

Metals

All metals of concern, except beryllium and selenium were detected in surface soil samples collected during the August 1995 removal assessment. These same detected metals exceeded background concentrations in at least one of 22 samples. Cobalt was detected at a maximum concentration of 30.2 mg/kg, and the RBC for cobalt was exceeded in 11 of 22 samples. Lead was detected at a maximum concentration of 14,900 mg/kg, and the 400-mg/kg advisory level for lead was exceeded in 10 samples. The 500-mg/kg Region 6 residential advisement value for lead was exceeded in six samples, and the 2,000-mg/kg Region 6 industrial advisement value for lead was exceeded in one sample. Arsenic was detected at a maximum concentration of 33.7 mg/kg, and the RBC for arsenic was exceeded in 20 of 22 samples.

Organics

Ten VOCs, 24 SVOCs, 19 pesticides, and three PCBs were detected in surface soil samples

collected during the August 1995 removal assessment. PAHs, including phenanthrene, anthracene, pyrene, fluoranthene, and the B(a)P equivalent constituents (except dibenzo[a,h]anthracene) were the most frequently detected SVOCs (detected in 12 or more samples). Individual PAHs were detected in 12 to 10 of 22 samples. Heptachlor epoxide and 4,4'-DDE, the most frequently detected pesticides, were each detected in at least 17 samples. The RBCs for VOCs were not exceeded in any sample. Calculated B(a)P equivalent concentrations exceeded background concentrations in 17 of 22 samples, the maximum calculated B(a)P equivalent concentration was 12.1 mg/kg. The 1-mg/kg advisory level for B(a)P equivalent concentrations was exceeded in 15 samples, and the 10-mg/kg advisory level was exceeded in four samples. The 10-mg/kg advisory level for total PCBs was exceeded in six samples, and the detected concentrations of Aroclor 1254 exceeded the RBC in two samples. The RBC for the pesticide dieldrin was exceeded in two samples.

Surface Soil Results - EE/CA Investigation

Four surface soil samples were collected as perimeter surface soil samples during the EE/CA investigation of OU1. These samples were collected within the western boundary of OU2. A review of the EE/CA results for metals and cyanide for these samples shows that the concentrations of chromium, lead, mercury, and zinc exceeded EE/CA background sample concentrations. The 400-mg/kg advisory level for lead was exceeded in two samples, and the Region 6 500-mg/kg residential advisory level for lead was exceeded in one sample. The maximum detected lead concentration was 815 mg/kg. A review of organic analytical results for these samples shows that the 1-mg/kg advisory level for B(a)P equivalent concentrations was exceeded in all four samples, and the 10-mg/kg advisory level was exceeded in three of the four samples, however, a large part of the calculated B(a)P value for two of the four samples was due to elevated nondetect values for several B(a)P equivalent constituents.

SUBSURFACE SOIL SAMPLE RESULTS

Soil Borings - Remedial Investigation

Metals

Each of the metals of concern was present at detectable concentrations in at least one soil boring sample. Background concentrations of 16 metals were exceeded in one or more of the 17 soil boring samples. Lead was detected at a maximum concentration of 966 mg/kg. RBCs were exceeded for arsenic (three of 17 samples), and beryllium (three samples). Two samples exceeded the 400-mg/kg lead advisory level, one sample exceeded the 500-mg/kg advisory level for lead, and no samples exceeded the 2,000-mg/kg lead advisory level.

Organics

Four VOCs (three of which are common laboratory contaminants) were detected in at least one of 13 soil boring samples, and 22 SVOCs, 21 pesticides, and one PCB were detected in at least one of 17 soil boring samples. In addition to two common laboratory contaminants, PAHs, including phenanthrene, fluoranthene, pyrene, and the B(a)P equivalent constituents, were the most frequently detected SVOCs (detected in five or more samples). The most frequently detected pesticide dieldrin, endrin ketone, heptachlor, alpha-chlordane, and 4,4-DDE-were each detected in at least nine samples. The maximum B(a)P equivalent concentration was calculated at 2.6 mg/kg. The 1-mg/kg advisory level for B(a)P equivalent concentrations was exceeded in two samples. No other RBCs or advisory levels were exceeded.

TEST PITS - REMOVAL ASSESSMENT

Metals

Nineteen of 23 metals of concern were detected in at least one of 16 subsurface soil samples collected from test pits. Lead was detected at a maximum concentration of 3,140 mg/kg. The background concentrations of 17 metals were exceeded in at least two samples each. The RBC for arsenic was exceeded in three samples, the RBC for cobalt was exceeded in two samples, and the 400-mg/kg advisory level for lead was exceeded in seven samples. The 500-mg/kg advisory level for lead was exceeded in six samples, one of which also exceeded the 2,000-mg/kg advisory level for lead.

Organics

Nine VOCs (four of which are common laboratory contaminants), 25 SVOCs, 20 pesticides, and two PCBs were detected in one or more subsurface soil samples collected from test pits. The most frequently detected SVOCs were carbazole, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, the B(a)P equivalent constituents, and benzo(g,h,i)perylene, which were detected in at least 11 of 16 samples. The most frequently detected pesticides were heptachlor epoxide, detected in 12 samples, and endrin aldehyde, detected in 13 samples. The 1-mg/kg advisory level for B(a)P equivalent concentrations was exceeded in 11 samples, and the 10-mg/kg advisory level for B(a)P equivalent concentrations was exceeded in three samples. The maximum calculated B(a)P equivalent concentration was 19.1 mg/kg. The RBC for benzo(a)pyrene was exceeded in one sample. Pesticide RBCs were exceeded for dieldrin (two samples) and heptachlor epoxide (three samples): The RBC for Aroclor 1254 and the advisory level for total PCBs were exceeded in two and five samples, respectively.

SEDIMENT SAMPLE RESULTS - REMEDIAL INVESTIGATION

Metals

Sixteen metals of concern were detected in all four on-site drainage ditch sediment samples collected during the RI. Cobalt (one sample) and selenium (three samples) were also detected. The soil RBC for cobalt was exceeded in the one sample in which it was detected (5.9 mg/kg). The RBCs for arsenic and beryllium were exceeded in all four sediment samples. The soil 400-mg/kg advisory level for lead was exceeded in two samples. Other advisory level criteria for lead were not exceeded in any sample.

Organics

Four VOCs (including three common laboratory contaminants), 15 SVOCs, 15 pesticides, and two PCBs were detected in at least one on-site drainage ditch sediment sample. Other than common laboratory contaminants, the most frequently detected SVOCs were fluoranthene, pyrene, and five of the seven B(a)P equivalent constituents, which were detected in at least three of four sediment samples. The remaining B(a)P equivalent constituents, dibenzo(a,h)anthracene and indeno(1,2,3-c,d)pyrene, were detected in no samples and one sample, respectively. The pesticides alpha-chlordane, gamma-chlordane, 4,4'-DDE, 4,4'-DDT, dieldrin, and endosulfan sulfate were detected in three of four sediment samples. The 1-mg/kg advisory level for B(a)P equivalent concentrations was exceeded in three of four samples, the duplicate of one of the sediment samples had a calculated B(a)P equivalent concentration of 0.9 mg/kg. The maximum calculated B(a)P equivalent concentration was 1.4 mg/kg. No other RBC or advisory level was exceeded in any sediment sample.

GROUNDWATER SAMPLE RESULTS

Background Groundwater Sample Results - Remedial Investigation

Monitoring Well 20, set in the unconfined saturated zone and near the OU2 perimeter in the wetlands area along Canulette Road, was selected as the background groundwater location. For compounds that were not detected in the sample collected from MW20, the observed detection limit followed by a "U" data qualifier was listed as the background concentration. For compounds with a reported value, the actual value obtained was listed as the background concentration.

Metals

Twelve metals were detected in samples collected from the background groundwater well. Lead and cyanide were not detected in the background well. No RBC was exceeded for any metal in the background well sample.

Organics

No VOCs, pesticide, or PCB compounds were detected in the background groundwater well sample. The SVOCs 1,2-dichlorobenzene and 1,4-dichlorobenzene were detected at concentrations of 3 Ig/L and 1 Ig/L, respectively bis(2-Ethylhexyl)phthalate was detected but is a common laboratory contaminant. No RBCs for organic compounds were exceeded in the back-ground groundwater well sample.

UNCONFINED SATURATED ZONE GROUNDWATER RESULTS - REMEDIAL INVESTIGATION

Metals

Twenty metals were detected in at least one of eight unconfined saturated zone groundwater wells. Cyanide was not detected in any unconfined saturated zone well sample. Lead was detected and exceeded the background value in six of eight wells, with a maximum detected concentration of 87.4 Ig/L. RBCs were exceeded for arsenic, barium, and lead (one sample each), and beryllium and cobalt (three samples each).

Organics

No VOCs, pesticides, or PCBs were detected in any of the samples collected from the unconfined saturated zone groundwater wells. The SVOC 1,2-dichlorobenzene was detected at a concentration of 1 Ig/L in one sample. Two phthalates were detected but represent common laboratory contaminants. No RBCs for organic compounds were exceeded in any of the samples collected from the unconfined saturated zone groundwater wells.

UPPER CONFINED AQUIFER GROUNDWATER RESULTS

Metals

Seventeen metals were detected in one or more of the seven upper confined aquifer groundwater wells sampled. Eight metals were detected in all seven samples. Cyanide was not detected in any upper confined aquifer well sample. Lead was detected in one well sample at a concentration of 5.7 Ig/L. No RBCs were exceeded for any metal in any sample from the upper confined aquifer groundwater wells.

Organics

In addition to one VOC and two SVOC common laboratory contaminants, two pesticides were detected in one each of the seven groundwater samples collected from the upper confined aquifer wells. Dieldrin and endosulfan sulfate were detected at 0.210 Ig/L and 0.013 Ig/L, respectively. No RBCs for organic compounds were exceeded in any sample collected from the upper confined aquifer

wells.

GROUNDWATER RESULTS - POST-REMEDIAL INVESTIGATION

Two monitoring wells (MW12 and MW17), both in the unconfined saturated zone, were resampled in November 1995 to further check for the presence of DNAPLs and for analysis of TCL organic compounds. DNAPL was not detected during sampling at wells MW12 and MW17 SVOCs, including PAHs [but not the B(a)P equivalent constituents] were the only organic compounds detected in the sample from MW12. No organic compounds were detected in the sample from MW17. RBCs were not exceeded for any compound in either sample

QUALITY CONTROL WATER

As part of the QA/QC program implemented during the SSC RI and removal assessment field programs, a number of field blanks, trip blanks, and equipment rinsate blanks were provided to the laboratories for analysis along with the field samples. Seven metals of concern were detected in one or more of the three blank samples analyzed by the laboratories. Cyanide was not detected in any blank sample. Results for mercury and thallium exceeded background groundwater concentrations, and the RPC for thallium was exceeded in one field blank sample.

Organic analysis of blank samples indicated the presence of six VOCs, three SVOCs, and seven pesticides in one or more samples. Organic compounds detected were generally found at low concentrations, and most were identified as common laboratory and/or field contaminants (acetone, 2-butanone, methylene chloride, toluene, and three phthalate compounds).

Compounds identified in blank water samples were evaluated during the data validation process and were used to qualify data from field samples, as appropriate. Overall data quality for the RI and the removal assessment were not significantly affected.

AIR SAMPLING AND MONITORING RESULTS

The air investigation of the SSC site consisted of three components: on-site field screening for organic vapors and particulates, sampling and analysis at the site perimeter for select VOCs and SVOCs using the Trace Atmospheric Gas Analyzer (TAGA) and Summa(R) canisters during August 1994 and October 1995 conducted by EPA's Environmental Response Team, and baseline air monitoring at the site perimeter for select VOCs and SVOCs, and inhalable particulates (PM 10) conducted during September 1995 by EPA's remedial contractor.

On-Site Field Screening

During the removal assessment, organic vapor readings were measured during test pit evaluation, during RI site activities, and during subsurface soil and groundwater sampling to support sample selection and site characterization.

During the removal assessment, elevated organic vapor readings were measured, confirming visual observation of contamination in subsurface soil samples. Elevated organic vapor readings were detected during the RI when a total vapor analyzer was used to screen subsurface soil samples and to monitor wells prior to purging and groundwater sampling. Elevated vapor readings obtained during soil borings were recorded and transferred to the combined lithologic logs/well diagrams. Elevated readings from groundwater wells were likely attributable to methane because elevated flame ionization detector (FID) readings were obtained simultaneously with minimal photoionization detector (PID) readings; many organic hydrocarbons, including those identified as potential site contaminants, which respond to the FID will also respond to the PID. Only transient, low-concentration organic vapor readings (1 to 2 parts per million [ppm] above

background) were obtained while monitoring ambient air across OU2.

Periodic transient, elevated total-particulate readings were apparently related to truck traffic associated with preparation for OU1 remedial activities; the maximum time-weighted average (TWA) over an 8-hour period was 0.25 milligram per cubic meter (mg/m3) EPA's removal contractor calculated a risk-based action level (based on the Occupational Safety and Health Administration [OSHA] Permissible Exposure Limit [PEL] for airborne lead, 0.05 mg/m3, and the maximum lead concentration, 14,900 ppm, detected during the removal assessment) for potential lead exposure from SSC site dust to be 1.7 mg/m3.

Perimeter Field Analysis

EPA instituted numerous perimeter air sampling studies to ensure that site activities were not impacting the surrounding community. Sampling for select VOCs and SVOCs was conducted in August 1994, during agitation of the North Impoundment in OU1, and again in October 1995, during preparation for remedial activities in OU1.

Measurements for benzene, toluene, xylene, 1,2,4-trimethylbenzene, and naphthalene were obtained during August 1994 using the TAGA; the measurements indicated no maximum instantaneous concentrations above quantitation limits. In addition, the Summa(R) canister results were all below the quantitation limit for TO-14 target compounds, except for trichlorofluoromethane, which is not believed to be site related. Complete details of the August 1994 air investigation are presented in the Final SSC EE/CA Report for OU1 (E & E 1995c).

The TAGA was used without Summa(R) canister confirmation analysis to monitor several neighborhoods and a school proximate to the SSC site during on-site excavation activities that took place during October 1995. The mobile van containing the TAGA also monitored on-site ambient air on three occasions. Measurements for benzene, toluene, xylene, 1,2,4-trimethylbenzene, and naphthalene using the TAGA did not yield elevated concentrations during off-site monitoring. On one occasion, an on-site measurement detected naphthalene at a reported maximum concentration of 140 parts per billion by volume (ppbv). Detected concentrations of naphthalene on this occasion were reported to increase as an on-site excavation was approached and decrease as the TAGA withdrew from the excavation area, confirming the excavation area as the source of the naphthalene. The National Institute for Occupational Safety and Health (NIOSH) and OSHA TWA for exposure to naphthalene is 10 parts per million (ppm) (NIOSH 1990), well above the detected concentration.

BASELINE AIR MONITORING

EPA conducted baseline air monitoring for select VOCs, SVOCs, and inhalable particulates (PM 10) over a 7-day period in September 1995. Three monitoring stations were established at the site perimeter (fenceline) and surrounding the site. Data for a subset of the target compounds were compared to 28-day action limits (VOCs and SVOCs), or 24-hour action limits (PM 10) as discussed ir the report (see Appendix D).

VOC target compounds and their maximum detected concentrations were: benzene (1.6 parts per billion, volume per volume [ppb v/v]); ethylbenzene (0.56 ppb v/v); naphthalene (0.56 ppb v/v); toluene (3.3 ppb v/v); 1,2,4-trimethylbenzene (0.75 ppb v/v); o-xylene (0.75 ppb v/v); m/p-xylene (2.0 ppb v/v); and n-propylbenzene, which was not detected above the reporting limit. SVOC target compounds detected above the reporting limit and their maximum detected concentrations were: acenaphthylene (maximum 0.19 micrograms per cybic meter [Ig/m 3]); acenaphthene (maximum 0.54 Ig/m 3); anthracene (maximum 0.9 Ig/m 3); fluorene (maximum 0.50 Ig/m 3; phenanthrene (maximum 0.67 Ig/m 3); and naphthalene (maximum 6.3 Ig/m 3). The remaining SVOC compound-benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene,

benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(l,2,3-c,d)pyrene, and pyrene-were not detected above reporting limits. Maximum concentrations for each station were well below action limits for benzene, ethylbenzene, naphthalene, toluene, 1,2,4-trimethylbenzene, and naphthalene. Baseline PM10 results ranged from 20.08 to 61.03 Ig/m 3, with an average concentration of 42.76 Ig/m 3. The 24-hour action limit was 150 Ig/m 3.

IDENTIFICATION OF PRINCIPAL CONTAMINANTS IN OU2

Surface Soil

The principal inorganic contaminants for surface soil in OU2 are identified as arsenic, cobalt, and lead. The 400-mg/kg advisory level for lead was exceeded in approximately one-third of all surface soil samples (32%). The RBC for arsenic was exceeded in 67% of all surface soil samples collected, and the RBC for cobalt was exceeded in 26% of all surface soil samples.

The principal organic contaminants in surface soil are identified as carcinogenic PAHs and PCBs. The most conservative advisory level for B(a)P equivalent concentrations (1 mg/kg) was exceeded in almost half (44%) of the surface soil samples collected across OU2. The 10-mg/kg advisory level for B(a)P equivalent concentrations (8%) and the 1-mg/kg advisory level for total PCBs (14%) were both exceeded above the evaluation criteria.

Detected contaminants were found to correlate positively with each other, higher concentrations of lead at a given sample location can be taken as an indication of likely higher values for other principal contaminants.

Subsurface Soil

Principal inorganic contaminants identified in OU2 subsurface soils are arsenic, beryllium, cobalt, and lead. RBCs or advisory levels were exceeded for all four principal inorganic contaminants at frequencies exceeding 5%; the 400-mg/kg advisory level for lead was exceeded in 27% of the subsurface soil samples collected.

The principal organic contaminants identified in subsurface soils are carcinogenic PAHs, PCBs, and the pesticides dieldrin and heptachlor epoxide. The 1-mg/kg advisory level for B(a)P equivalent concentrations was exceeded in more than one-third (39%) of subsurface soil samples collected from OU2. RBCs or advisory levels for the remaining principal organic contaminants each were exceeded in more than 5% of the subsurface soil samples (6% to 15%).

The principal inorganic contaminants identified in subsurface soil samples were generally detected at a lower FOD and mean concentration than were contaminants in surface soils. Advisory levels for lead and B(a)P equivalent concentrations were primarily, though not exclusively, exceeded in judgmental samples collected during the removal assessment.

Sediment

The principal inorganic contaminants identified in sediment samples collected from the on-site drainage ditch are arsenic, beryllium, cobalt, and lead. The principal organic contaminants identified in sediment from the OU2 on-site drainage ditch are carcinogenic PAHs. The metals arsenic, cobalt and lead were detected at higher concentrations in sediment samples proximate to Bayou Bonfouca, and the carcinogenic PAHs were distributed evenly along the on-site drainage ditch.

Groundwater

The principal inorganic contaminants identified in OU2 groundwater are arsenic, barium beryllium, cobalt, and lead. All RBC or advisory level exceedances for these compounds were from groundwater samples collected from wells set in the unconfined saturated zone. No principal organic contaminants were identified for groundwater in OU2.

Air

No principal inorganic or organic contaminants were identified for ambient air at OU2. Based on the data obtained from field screening and from analysis of samples collected using TAGA and/or Summa(R) canisters, localized small increases in organic vapors or total particulates could be experienced during activities in and around OU2.

8.7 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

Surface Soils

Analysis for metals (all investigations) and cyanide (EE/CA investigation only) showed that most metals were detected in all surface soil samples collected from off-site background locations and on-site areas of OU2. Cyanide was not detected in the samples collected from OU2 during the EE/CA investigation.

The principal inorganic contaminants detected in surface soil are arsenic, cobalt, and lead. The RBC for arsenic was exceeded in 67% of all surface soil samples collected, the RBC for cobalt was exceeded in 26% of all surface soil samples, and the lead advisory level of 400 mg/kg was exceeded in 32% of surface soil samples collected during the three investigations. Lead advisory levels of 500 mg/kg and 2,000 mg/kg were exceeded in 22% and 5%, respectively, of all surface soil samples collected.

Statistical analysis of the data showed that the principal inorganic contaminants were lognormally distributed across OU2. In addition, arsenic and cobalt correlated positively with lead; that is, higher concentrations of lead at a location indicated likely higher values for arsenic and cobalt at that location.

Organic analysis of surface soil samples indicated the presence of few VOCs (only analyzed during the EE/CA investigation and the removal assessment) beyond those identified as common laboratory contaminants and, therefore, none were considered to be site related. SVOCs, PAHs (including the B[a]P equivalent constituents), pesticides, and PCBs (particularly Aroclor 1254) were detected in one or more samples collected from off-site background locations and from locations across OU2 (analyzed during all three investigations).

The principal organic contaminants identified during evaluation of surface soil data from all investigations are the carcinogenic PAHs, represented by the calculated B(a)P equivalent concentration value, and PCBs, represented by the calculated total PCB concentration. B(a)P equivalent concentrations frequently exceeded the 1-mg/kg advisory level (44% of all surface soil samples, including one background sample), the 10-mg/kg advisory level was exceeded in 8% of surface soil samples. The concentration of individual B(a)P equivalent constituents rarely exceeded their respective 10 -4 cancer risk RBC values. The advisory level for total PCBs was exceeded in 14% of all surface soil samples collected.

Statistical analysis of the principal organic contaminants indicates that the individual carcinogenic PAHs are distributed lognormally across OU2 and that these compounds were highly positively correlated with each other. PCB data contained many nondetect values but suggested a normal distribution across OU2.

Further statistical analysis included a comparison of lead concentrations and calculated B(a)P equivalent concentrations and showed a positive correlation between the two values. Detected concentrations of PCBs were examined and found to exhibit a positive correlation with both lead and B(a)P equivalents.

Concentration contours were developed for each of the principal inorganic and organic contaminants present in surface soil [arsenic, B(a)P equivalents (representing carcinogenic PAHs), lead, and total PCBs] and are provided as Figures 3 through 6. Data included surface soil results within OU2 from all available sources including the 1994 EE/CA investigation, the removal assessment of OU2 (judgmental samples), and the RI (soil and sediment samples). Due to the limited data points in the wetlands area adjacent to Canulette Road, this area was excluded from the presentation.

Subsurface Soil

All metals of concern were detected in at least one subsurface soil sample collected from test pits, and most metals were detected in at least one subsurface soil sample collected from soil borings. Generally, metals of concern were detected at lower FODs and mean concentrations in subsurface soil samples than in surface soil samples (exceptions are beryllium and vanadium; in addition, mean concentrations for chromium and manganese were higher for subsurface soil samples collected during the removal assessment than for surface soils). Advisory levels for lead were exceeded primarily for judgmental samples collected during the removal assessment.

The principal inorganic contaminants identified in subsurface soil according to the stated criteria are arsenic, beryllium, cobalt, and lead. The RBC for arsenic was exceeded in 18% of all subsurface soil samples collected, the RBC for beryllium was exceeded in 9% of the subsurface soil samples, the RBC for cobalt was exceeded in 6% of all subsurface soil samples, and the 400-mg/kg advisory level for lead was exceeded in 27% of subsurface soil samples collected during the two investigations. Lead advisory levels of 500 mg/kg and 2,000 mg/kg were exceeded in 21% and 3% (one sample), respectively, of all subsurface soil samples collected.

Statistical analysis of all data, including subsurface soil, indicated similar distributions and correlations to those found for surface soil samples only. Arsenic, beryllium, and cobalt correlated positively with lead; that is, higher concentrations of lead at a location indicated likely higher values for arsenic, beryllium, and cobalt at that location.

Organic analysis of subsurface soil samples indicated the presence of few VOCs other than those identified as common laboratory contaminants and none exceeded RBCs. Several SVOCs and PAHs (including the B[a]P equivalent constituents), several pesticides, and two PCBs were detected in soil samples collected from subsurface locations across OU2 (analyzed during the removal assessment and RI).

The principal organic contaminants identified during evaluation of data from all investigations are the carcinogenic PAHs (represented by the calculated B[a]P equivalent concentration value), PCBs (represented by Aroclor 1254 and the calculated total PCB concentration), and the pesticides dieldrin and heptachlor epoxide B(a)P equivalent concentrations exceeded the 1-mg/kg advisory level in 39% of subsurface soil samples, the 10-mg/kg advisory level was exceeded in 9% of subsurface soil samples. The advisory level for total PCBs was exceeded in 15% of the subsurface samples, and the RBC for Aroclor 1254 was exceeded in 9% of subsurface soil samples collected. The RBC for dieldin was exceeded in 6% of the subsurface samples, and the RBC for heptachlor epoxide was exceeded in 9% of all subsurface soil samples.

Addition of subsurface soil samples to the data set followed by statistical examination did not affect distributions and correlations for the organic contaminants identified.

Sediments

Most metals of concern were detected in at least one sediment sample. Sediment samples were not analyzed for cyanide.

The principal inorganic contaminants identified in sediment according to the stated criteria are arsenic, beryllium, cobalt, and lead. The RBCs for arsenic and beryllium were exceeded in all four of the sediment samples. Cobalt exceeded the RBC in one (25%) of the sediment samples. The 400-mg/kg advisory level for lead was exceeded in three (75%) of the sediment samples; lead advisory levels of 500 mg/kg and 2,000 mg/kg were not exceeded in sediment samples.

Organic analysis of sediment samples indicated the presence of few VOCs other than those identified as common laboratory contaminants. No VOC RBCs were exceeded. Several SVOCs and PAHs, including six of seven B(a)P equivalent constituents, several pesticides, and two PCBs were detected in sediment samples collected during the RI.

The principal organic contaminants identified during evaluation of data from sediment samples are the carcinogenic PAHs, represented by calculated B(a)P equivalent concentration values. B(a)P equivalent concentrations exceeded the 1-mg/kg advisory level in 75% of sediment samples, the 10-mg/kg advisory level was not exceeded in sediment samples.

Metal contaminants were detected at higher concentrations in sediment samples collected from location SD01, near Bayou Bonfouca. Carcinogenic PAHs, represented by B(a)P equivalent concentrations were evenly distributed along the on-site drainage ditch. The B(a)P equivalent concentration for the sediment sample collected from location SD03, located furthest from Bayou Bonfouca, was biased high by use of elevated detection limits for some B(a)P equivalent constituents used in the calculation.

Groundwater

This section discusses contamination detected in groundwater samples collected during the RI and also includes an evaluation of samples collected and analyzed during the 1994 OU1 EE/CA investigation (well samples installed during the EE/CA and not sampled during the RI are not discussed).

Evaluating groundwater samples collected from both groundwater units during the RI shows that most metals of concern were detected in at least one of the groundwater samples collected across OU2. Cyanide was not detected in any groundwater samples. RBCs for metals were not exceeded in samples collected from the upper confined aquifer, except for arsenic during the July through September 1994 EE/CA field investigation. These exceedances were not repeated during the supplemental EE/CA sampling (December 1994) or September 1995 RI sampling events. Risk Based Concentrations (RBCs) were exceeded in one unconfined saturated zone sample each for arsenic (MW02), barium (MW15), and lead (MW17). RBCs for beryllium and cobalt were exceeded in three samples each. Unconfined saturated zone groundwater samples collected during both the EE/CA investigation and the RI showed general agreement for metals. It should be noted that the EE/CA sample results for both metals and organics were compared to lO -4 cancer risk RBCs, and the RI data was compared to 10-6 cancer risk RBCs.

The principal inorganic contaminants identified in groundwater based on previously stated evaluation criteria are arsenic, barium, beryllium, cobalt, and lead. Calculated RBC exceedances for these metals, compared to all groundwater samples collected during the RI, were 6% for arsenic, barium, and lead, and 19% for beryllium and cobalt. It should be noted that all RBC exceedances were for groundwater samples collected from the unconfined saturated zone, and the single RBC exceedance for arsenic was detected in the sample collected from MW02, which is

located in OU1.

No principal organic contaminants for groundwater were identified using established criteria. Very few organic compounds, some of which are common laboratory contaminants and are therefore not considered to be site related, were detected in groundwater samples collected during the RI, which is consistent with sample results for groundwater samples collected during the EE/CA investigation. RBCs for organic compounds were not exceeded in any of the groundwater samples collected from OU2 (or OU1 wells sampled during both investigations).

Ambient Air

Ambient air was monitored across OU2 during the removal assessment and RI, and at the SSC site perimeter (inside and outside the fenceline) through investigations by EPA during cleanup activities within OU1 and OU2.

Field screening for organic vapors and total particulates during the removal assessment and RI indicated periodic, transient elevated concentrations associated with subsurface investigations (organic vapors) or with truck traffic (total particulates,. Monitoring for select VOCs and SVOCs by EPA during on-site activities revealed that organic compounds were not measured beyond the site boundaries. Low on-site concentration detections of several target compounds were recorded. Established action levels, where available, were not exceeded during any of the monitoring conducted.

Based on available data, no principal contaminants were identified for ambient air across OU2. However, the data obtained suggests that activities which greatly increase traffic into and around OU2, generating dust, or which result in a large amount of subsurface disturbance, could result in increased organic vapors or airborne particulates. Asbestos was not detected in any sample collected during asbestos removal activities.

9.0 SUMMARY OF SITE RISKS

9.1 RISK OVERVIEW

All risk assessment discussions in this section pertain to OU2 prior to removal actions which were performed by EPA to reduce these risks.

A risk assessment is a procedure that uses a combination of fads and assumptions to estimate the potential for adverse effects on human health or the environment from exposure to hazardous substances, pollutants, or contaminants found at a site. Risks are determined by comparing actual chemical concentrations at a site versus chemical exposure limits known to have an adverse impact on human health or the environment. Carcinogenic risks are expressed in terms of the chance of developing cancer over a given period of exposure. Toxicity assessments of non-carcinogenic risks are based on comparing site contaminant concentrations to reference concentrations which are considered to be protective over a lifetime of exposure. Conservative assumptions are used in calculating risks that weigh in favor of protecting human health.

All risk assumptions are based upon the possibility of human or ecological exposure to hazardous substances, pollutants, or contaminants through inhalation, oral ingestion, or absorption through the skin where pathways for such exposure exist. Upon the completion of a CERCLA response action, where the action eliminates the previously existing pathways of exposure, the resulting theoretical risk to human health or the environment from the site would be zero.

The national incidence of risk, or probability, that an individual may develop some form of cancer from everyday sources, over a 70-year life span, is estimated at a probability of

three-in- ten. Activities such as too much exposure to the sun, occupational exposures, or dietary or smoking habits contribute to this high risk. This three-in-ten probability is considered the "background incidence" of cancer in the United States. To protect human health, EPA has set the range from one in ten-thousand to one in one-million excess cancer incidents as the remedial goal for Superfund sites. See Section 300.430(e)(2) of the NCP, 40 CFR º 300.430(e)(2). A risk of one in one-million means that one person out of one-million people could develop cancer as a result of a lifetime exposure to the site. This risk is above and beyond the "background incidence" of three in ten. This range may also be expressed as 10-4 to 10-6 risk of excess cancer deaths.

The risk from exposure to non-carcinogenic contaminants is determined by calculating a hazard index. The hazard index reflects the level that chemical contaminants might cause poisoning, organ damage, and/or health problems other than cancer. If the hand index exceeds one(1), there may be concern for potential non-cancer health effects from a extended exposure to the site contaminants.

9.2 RISK EVALUATION

A baseline risk evaluation was performed in accordance with EPA guidance to estimate the potential for adverse effects to human health or the environment from exposure to hazardous substances, pollutants, or contaminants found at the Southern Shipbuilding site. A risk evaluation is a quantitative estimate of the current and potential risks to human health and the environment from exposure to contaminants from a specific site. This risk evaluation is performed to determine whether the site poses a potential risk to human health and the environment in the absence of any removal or remedial action.

The risk evaluation follows guidance provided in the Risk Assessment Guidance for Superfund, Volume 1 - Human Health Evaluation Manual (Part A) (EPA 1989a), the Exposure Factors Handbook (1989b), and Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" (EPA 1991a). This risk evaluation is organized as follows:

LAND USE DETERMINATION: Current and future land use is discussed in this section for use in the exposure assessment.

EXPOSURE ASSESSMENT. The risk evaluation considers the human exposure pathway of incidental soil ingestion and of dermal absorption of contaminants from soil and dusts. These pathways were the most significant pathways based upon the type of contaminants at the site and the waste matrix.

TOXICITY ASSESSMENT. Quantitative risk assessment requires contaminant-specific qualitative and quantitative toxicity information. Specifically, each contaminant is evaluated for its known or suspected carcinogenic effects and its non-carcinogenic effects. For carcinogenic effects, EPA weight-of-evidence classifications and oral slope factors are determined. For non-carcinogenic effects, EPA oral reference doses (RfDs) are identified.

RISK CHARACTERIZATION. The first step of risk characterization is to calculate the intake of specific site related contaminants absorbed from the affected media. Intakes by exposed populations are calculated for the selected pathways of exposure, and converted to doses (mg contaminant per kg body weight - day). These doses are denoted as the chronic daily intake, and are used to calculate potential long term non-carcinogenic effects and potential upper bound excess lifetime cancer risk.

UNCERTAINTY ASSESSMENT. Risk evaluation involves numerous assumptions and calculations each of which have inherent uncertainties. This section will discuss whether the assumption or uncertainties might lead to an underestimate or overestimate of site risks.

9.2.1 LAND USE

OPERABLE UNIT ONE

The National Contingency Plan (NCP), 40 CFR Part 300, calls for the development of a current exposure scenario as well as a Reasonable Maximum Exposure (RME) scenario (EPA 1990b). EPA risk assessments calculate risks and exposures for both "average" or Central Tendency Exposure (CTE) and a more conservative "high end exposure" (EPA 1992a). The RME is considered a "high end exposure" (EPA 1992b). EPA utilized a reasonably anticipated future land use of residential for the site. Thus, the risk evaluation for OU1 considered a residential land use scenario for the soil ingestion and dermal absorption pathways.

The residential future land use scenario was used for OU1 because EPA had noted that residential development was expanding in the area near the site, that waterfront property has high intrinsic value for residential development, and that the city of Slidell had taken preliminary steps to develop institutional controls through resolutions adopted by the Slidell City Council.

OPERABLE UNIT TWO

EPA now believes that the reasonably anticipated future use of the property is light industrial activity. Although residential use is a possible future outcome as noted in the risk assessment for OU1, EPA notes that the past and current status and use of this property, as well as its features and structures, are consistent with light industrial use.

Therefore, EPA has chosen a light industrial land use scenario for the risk assessment for OU2, although a future residential risk assessment was also conducted to determine the need for removal or remedial actions in OU2. This ROD provides city of Slidell planners with recommendations that are implementable under city zoning ordinances that would permit a protective future residential land use of the Site even though certain parts of the site contain levels of hazardous substances that exceed residential health-based risk ranges, but are within acceptable industrial standards.

9.2.2 EXPOSURE ASSESSMENT

The exposure point concentration in the intake equation was the arithmetic average of the concentration detected in a particular medium. Because of the uncertainty associated with any estimate of exposure point concentration, the 95% upper confidence limit (UCL) on the arithmetic mean was used as the upper-bound exposure point concentration (EPA 1992d). If the 95% UCL of the mean exceeded the maximum detected concentration, the maximum detected concentration was used as the upper-bound exposure point concentration.

Soil Ingestion

The soil ingestion scenario assumes a resident with a 70-year lifetime, a child body weight of 15 kg or an adult body weight of 70 kg, and a daily RME soil ingestion of 200 mg/day and 100 mg/day for a child and adult, respectively. The exposure frequency was assumed to be 350 days/year (allows for 2 weeks of vacation). The CTE exposure duration was assumed to be 9 years which is the median time for a person to live at one residence (2 years as a child and 7 years as an adult). The RME exposure duration was assumed to be 30 years which is the 95^{th} percentile time for a person to live at one residence (6 years as a child and 24 years as an adult) (EPA 1991a).

Dermal Absorption of Soil and Dusts

The dermal absorption scenario assumes a resident with a 70 year lifetime, a child body weight of 15 kg or an adult body weight of 70 kg, and an exposed surface area of 1,800 and 5,000 cm 2/event (day) for a child and adult, respectively. The exposed surface area accounts for 25% of the total body surface. A soil adherence factor of 0.2 and 1 mg/cm 2 is assumed for the CTE and RME exposure scenarios, respectively. A default absorption factor of 0.01 is assumed for organic chemicals. The exposure frequency was assumed to be 350 days/year (allows for 2 weeks of vacation). The CTE exposure duration was assumed to be 9 years which is the median time for a person to live at one residence (2 years as a child and 7 years as an adult). The RME exposure duration was assumed to be 30 years which is the 95th percentile time for a person to live at one residence (6 years as a child and 4 years as an adult)(EPA 1991a).

9.2.3 TOXICITY ASSESSMENT

Quantitative risk assessment requires chemical-specific qualitative and quantitative toxicity information. For non-carcinogenic effects, the EPA reference doses (RfDs) are used. For carcinogenic effects, EPA weight-of-evidence classifications and upper bound cancer slope factors are used. Oral RfDs and slope factors were obtained from the Integrated Risk Information System (IRIS) and the 1994 Health Effects Assessment Summary Tables (HEAST). Carcinogenic polynuclear aromatic hydrocarbons (PAHs) are evaluated as a class on the basis of the toxicity value for benzo(a)pyrene. Toxicity equivalency factors (TEFs) are used in this evaluation. The following TEFs were used to convert each Group B2 carcinogenic PAH compound relative potency to the potency of benzo(a)pyrene.

Compound	TEF
Benzo(a)pyrene	1.0
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenzo(a,h)anthracene	1.0
Indeno(1,2,3-c,d)pyrene	0.1

Unlike the oral and inhalation routes of exposure, toxicity values are not available to address the dermal absorption route. Thus, oral RFDs and slope factors must be used to assess risks from dermal exposure.

9.2.4 RISK CHARACTERIZATION

The first step in the risk characterization is to calculate the intake of specific site-related contaminants absorbed from the affected media. Intakes by exposed populations will be calculated for the selected pathways of exposure, and converted to daily doses (in mg/kg body weight/day) by correcting for absorption efficiency across gastrointestinal or dermal boundaries. These doses are denoted by EPA as the chronic daily intake (CDI). The CDIs for non-carcinogenic and carcinogenic health effects are calculated separately to account for differences in how the toxicity values are derived.

The potential effects of contaminants on human health will be evaluated for their non-carcinogenic and carcinogenic effects. For non-carcinogenic health effects, a chronic Hazard Index (HI) is calculated by summing the quotients of the contaminant-specific CDIs and the contaminant-specific RfDs. A total (i.e., accounting for all media and pathways) HI greater than unity (one) indicates a potential human health concern.

For carcinogenic health effects, the potential upper-bound lifetime excess cancer risk (accounting for all contaminated media and pathways) is estimated by summing the products of the

contaminant-specific CDIs and the contaminant-specific slope factors. The NCP considers a lifetime upper bound cancer risk range of one excess cancer case in ten thousand individuals (1 x 10 -4) to one excess cancer case in one million individuals (1 x 10-6) to be acceptable (EPA 1990b).

Combined Exposure Pathways

Risk assessments for OU2 contamination were conducted for potential exposure to site contaminants prior to removal actions of areas of elevated contamination. Risk assessments for potential future workers, potential future residents, and aquatic plants and animals are presented in the Remedial Investigation Final Report, Operable Unit 2, August 1996, and summarized in the Final Feasibility Study Report, Operable Unit 2, September 1996.

The major conclusions from the risk assessments for OU2 for potential exposures prior to removal actions are:

1) The bulk of the estimated cancer risks are due to potential future exposure to arsenic, PAHs, and PCBs.

2) Risks from possible exposure to contaminated site soils, calculated under a potential future worker scenario, are within the 1 X 10 -4 to 1 X 10 -6 range defined as acceptable risk in federal environmental laws and regulations;

3) The total estimated upper bound cancer risk from exposure to contaminated site soils, for a potential future residential receptor, are just above the 1 X 10 -4 to 1 X 10 -6 acceptable risk range;

4) Remedial action in OU1 and removal actions in OU2 have reduced the risks from potential exposure to site contaminants. Carcinogenic and non-carcinogenic risks are currently within EPA guidelines for acceptable risk.

9.2.5 UNCERTAINTY ASSESSMENT

Risk assessment involves numerous assumptions and calculations which have inherent uncertainties. This discussion of uncertainties will specify where possible whether the assumption or uncertainty in question may lead to underestimation or overestimation of site risks. A quantitative analysis of uncertainty was not practical due to parameters where probability distributions are not known. This uncertainty analysis is approached qualitatively to provide useful information on the uncertainties of quantitative risk assessment.

There are four broad areas where uncertainty may be found in the risk assessment process. Subsections within each broad area indicate whether risk would be underestimated or overestirnated:

1) Environmental sampling and analysis

a) Location of samples (under- or overestimation)
b) Sample collection methods (under- or overestimation)
c) Analysis methods (under- or overestimation)

2) Exposure Assessment

a) Identification of pathways (overestimation)
b) Exposure parameters (overestimation)

c) Exposure frequency and duration (overestimation)

3) Toxicity Assessment

a) Toxicity factors (under- or overestimation)
b) Synergism and antagonism (under- or overestimation)

4) Risk Characterization

a) Integration of exposure assessment and toxicity assessment into the risk assessment (under- or overestimation)

These uncertainties in the streamlined risk assessment are a function of risk assessments in general and a function of the uncertainties specific to the SSC in particular. Although all risk assessments contain a certain amount of uncertainty, an attempt to reduce the uncertainty in the SSC streamlined risk assessment was made whenever possible. Based on a February 26, 1992, memorandum from EPA Deputy Administrator F. Henry Habicht II, "Guidance on Risk Characterization for Risk Managers and Risk Assessors", EPA is required to evaluate both "reasonable maximum exposure" (RME) and "central tendency" in the risk assessment at Superfund sites. The exposure assumptions associated with the RME have been used to estimate the baseline risks and to develop the remedial action goals at sites. The "central tendency" scenario represents the risk from more of an "average" exposure, compared to a "reasonable maximum" exposure.

9.3 IMPACTS TO THE ENVIRONMENT

Sensitive Ecosystems

According to representatives of the Louisiana Department of Wildlife and Fisheries (LDWF), there are no terrestrial sensitive environments specifically documented on SSC property. However, the United States Corps of Engineers (USACE) has determined that there may be some wetlands on the premises of SSC. According to the United States Fish and Wildlife Service (FWS), wetland complexes consisting of fresh marsh and cypress-tupelo swamps exist along Bayou Bonfouca. Using USGS 7.5-minute topographic maps, approximately 9.4 stream miles of wetland frontage are located along Bayou Bonfouca. In addition, a federally listed endangered species, the Gulf Sturgeon (Acipenser oxyrhynchus desotoi), has the potential to migrate into Bayou Bonfouca for breeding purposes, although no official sightings of the Sturgeon have been reported within the bayou.

Several sensitive environments have been identified in Lake Pontchartrain within 15 miles of the probable points of entries (PPEs) of contaminants from the SSC site into Bayou Bonfouca. The LDWF has stated that the above-mentioned Gulf of Mexico Sturgeon spends a portion of its life cycle within Lake Pontchartrain. Documentation of official sightings of the Sturgeon within the lake has not been obtained.

The Bayou Sauvage National Wildlife Refuge and the Big Branch Marsh National Wildlife Refuge are located Within 15 miles of the PPEs. The refuges encompass one of the largest remaining marsh areas adjacent to Lake Pontchartrain and include approximately 23,000 acres of fresh and brackish marsh. These marshes serve as nurseries for numerous fish and shellfish species. Endangered species found within the refuge include the Peregrine Falcon and the Brown Pelican. Bald eagles, which are threatened species, are also found within the refuges.

Ecological risks

Operable Unit One

An ecological risk evaluation of the SSC site was prepared by EPA Emergency Response Team (ERT) in conjunction with the Response Engineering and Analytical Contract (REAC) support (Appendix E of the EE/CA). The study was designed to reduce the uncertainty associated with the computer-assisted desk-top assessment by collecting additional environmental data and conducting site-specific toxicity tests. The original objective of the study was to assess the overall risk associated with all the contaminants previously detected at the site including PAHs, metals, and PCBs. Additional analyses for oil and grease, TPH, and tributyltin(TBT) were performed on the samples in an attempt to identify the contaminant that was responsible for the observed toxicity. Samples were collected on August 22 and 23, 1994, from bayou sediments and surface water.

Toxicity testing demonstrated a significant toxicity in the sediments in Bayou Bonfouca. However, this toxicity was not caused by the PAHs which are the primary contributors to human health risk at this site. Tributyltin, a toxic antifoulant found in marine paints, was detected with the highest values outside and upstream of the graving dock. The presence of tributyltin was not initially suspected since reported practices at the site did not include tributyltin-related activities. Presently TBT use is restricted to aluminum vessels less than 25 meters long and other vessels over 25 meters. Application was also restricted to certified applicators. Application to outboard motors and lower drive units of vessels under 25 meters was also exempted. Sources of TBT upstream of the SSC site may exist and may be contributing to the contamination in the bayou sediments.

The sediment toxicity testing was conducted using three organisms, including the aquatic invertebrate, Hyalella aztec . The sediment toxicity tests from sediments collected adjacent to the graving dock indicated significantly reduced survival compared to the laboratory control (42.2% vs. 95.6%) and reduced growth compared to the laboratory control and the upstream reference location. These data proved that the graving dock area is a source of the toxicity to aquatic organisms. Because the source of the TBT contamination in the site soils is located in a known area and the extent is limited, it was addressed as part of OU1.

Of the 29 samples collected, TBT was detected in all but 6 samples. The maximum concentration was 680 ug/kg detected in the graving dock. TBT was detected in all Bayou Bonfouca sediment samples, ranging from 15 to 90 ug/kg. No impoundment samples detected TBT.

Operable Unit Two

The U.S. EPA's Environmental Response Team (ERT) was also tasked to conduct an Ecological Risk Assessment for OU2 of the SSC site. The Final Report, dated March 1996, described the collection of 22 surface soil samples and 13 sediment samples from Bayou Bonfouca. These samples were used to test the toxicity of the contaminants to several ecological receptors such as Amphipods (Hyalella Azteca) and Paperpond Shell Clams (Uterbackia Imbecillis)

Split samples of the soil and sediment samples were used in terrestrial and aquatic toxicity evaluations. Site soils were toxic to the rape seed (Brassica rapa), but were not toxic to earthworms (Eisenia andrei). Evaluation of the data showed that an observed decrease in root growth was correlated to PAH concentration and the decrease in shoot height was correlated to normalized total PAH and tributyltin concentrations.

The sediment toxicity tests conducted for this study on amphipods showed no significant differences from field references but the variance among replicates was excessive. This may have been due to variations in a number of factors or an improperly administered toxicity test. The paperpond shell clam, which literature suggests is more sensitive than the amphipod, also showed no significant toxicity related to the field reference.

Based on all available information, a clean-up level for TBT of 80 micrograms per kilogram or 16 micrograms TBT per gram total organic carbon (TOC) in sediments would be protective for the benthic community utilizing Bayou Bonfouca in the vicinity of the SSC site. Although not a comprehensive extent of contamination study, no locations sampled in the bayou during this investigation exceeded this TBT concentration level, and as noted above, there was no toxicity associated with the paperpond shell clam test.

Imminent and Substantial Endangerment

Assuming that light industrial land usages for the Site continue, prior removal and remedial actions already undertaken at the Site have addressed actual or threatened releases of hazardous substances from this Site. Should the future land usage for the Site shift to residential, the recommendations made in this ROD, easily implementable by local land use authorities, would continue to be fully protective of human health and the environment.

9.4 REMEDIAL ACTION GOALS

9.4.1 Areas of Concern

OPERABLE UNIT ONE

The principal threat at the site was from polynuclear aromatic hydrocarbons (PAHs) that were found in highly-contaminated sludge and soil within and surrounding the pits. The sludge is the documented source of contaminants which were leaching into Bayou Bonfouca and the surrounding soils. In addition, this highly contaminated sludge and soil posed a threat to human health from direct contact. The marginally contaminated surface and subsurface soils in some areas surrounding the pits are identified as low level threats.

In addition to the contamination related to the sludge pits, tributyltin oxide (TBT) was found in sediments in the graving dock. TBT poses an ecological risk because of its high toxicity to aquatic organisms.

Remedial action was needed for both the principal and the low level threats from the carcinogenic-PAH-contaminated sludge and soil because the risk from these contaminants is greater than 10 -6 (one in one million) based on the site risk assessment. The site risk assessment used a future residential scenario. The basis for assuming a future residential scenario is discussed in the risk assessment section of this ROD.

Remedial action was needed for the TBT-contaminated graving dock soils so that they do not continue to act as a source of Bayou contamination. TBT is extremely toxic to aquatic organisms.

OPERABLE UNIT TWO

Based on the results of the remedial investigations for OU2, EPA determined that several isolated area of contamination within OU2 would present a marginally higher than allowable risk to future workers or residents on the site. However, as discussed previously in this ROD, EPA conducted extensive removal actions that addressed those areas and abated those risks. Unlike OU1, which contained primarily organic wastes such as polynuclear aromatic hydrocarbons (PAHs), OU2 contaminants included heavy metals such as lead, cobalt, and arsenic, and organics such as polychlorinated biphenyls (PCBs), and PAHs. Cobalt was removed as a contaminant of concern when subsequent sampling failed to identify elevated levels of this metal. Figures 8A, 8B, 8C, 9A, 9B, 9C, 10A, 1OB, 10C, 11A, 11B, and 11C show the concentrations and distribution of these contaminants after all removal actions and remedial actions have been completed.

9.4.2 Remedial Action Objectives

The remedial action objectives for remediation of OU1 and OU2 are:

- To prevent direct contact and/or ingestion of hazardous substances, pollutants, or contaminants that pose a human health or environmental risk, and;

- To remove or control the source of contaminants so that they do not migrate to surface water, groundwater, or air.

The selection of the appropriate remedial action goal for the SSC site is based on an evaluation of the potential health effects caused by human exposure to the hazardous substances, pollutants and contaminants from the site.

A remedial action goal is the maximum concentration of a contaminant which may remain in a specific medium (such as soil, surface water or ground water) at a site unremediated. All material that has a concentration of a contaminant above the remedial action goal for that contaminant must be treated or contained.

In this ROD, EPA has determined that the prior removal actions that were directed at OU2 principal threat media have addressed the threats to public health and the environment that are described in the FS. For OU2, the following surface and shallow subsurface soil (at depths up to 2 feet) remedial action goals were established: 10 milligrams per kilogram (mg/kg) benzo(a)pyrene equivalents, 2000 mg/kg lead, 10 mg/kg total PCBs, and 30 mg/kg arsenic (Table 1). Soils contaminated with these chemicals at greater than these concentrations would require excavation for treatment and/or off-site disposal.

The remedial action goal established for tributyltin oxide (TBT) was 80 micrograms per kilogram.

10.0 THE SELECTED ALTERNATIVE

Based upon consideration of the requirements of CERCLA, an analysis of alternatives using the nine criteria in light of the facts unique to this Site, and public comments, both EPA and the State of Louisiana have determined that No Further Federal Response Action, is the most appropriate remedy for the Southern Shipbuilding Superfund site in Slidell, St. Tammany Parish, Louisiana. Local government actions may be required to ensure that the property is managed and used safely in the future.

EPA has determined that a series of expedited removal actions have accomplished the remedial action goals set out for this site. As stated earlier in this document, for the duration of the Southern Shipbuilding project, EPA has integrated components of Superfund's removal and remedial processes to expedite overall site cleanup and eliminate duplication of efforts between the removal and remedial programs. Due to the fact that removal actions were conducted concurrent with the development of the OU2 FS, and were not halted during the development of that document, the contaminated media to have been addressed under remedial authorities by the alternatives set out in the FS had been already addressed by limited removal actions.

Therefore, this ROD memorializes the decision that no further Federal response action is necessary for the Southern Shipbuilding Corporation site since the known waste areas have been remediated through a combination of waste incineration for Operable Unit 1 (oily waste pits) and hazardous waste removal actions in contaminated areas identified in Operable Unit 2. EPA has recommended institutional land use controls on some parts of the property to ensure that the remedy remains protective of human health and the environment in the event that certain future activities take place on the site under either a continued light industrial land use scenario or

under a residential land use scenario. EPA will conduct a review of the OU1 remedy and the removal actions undertaken for OU2, annually, for the next 5 years from the date of this ROD, to ensure that these response actions remain protective of human health and the environment, in accordance with Section 104 and 121(c) of CERCLA, 42 U.S.C. º 9604, 9621(c).

Because EPA has determined that its response at this site is complete and no further action is necessary, the site now qualifies for EPA's Site Completion and Construction Completion milestones. In addition, this ROD will be used as the basis for proposing the site for removal from the National Priorities List of Superfund sites.

10.1 RECOMMENDATIONS FOR FUTURE LAND USE PLANNERS AND LAND USERS

The no further action decision for OU2, coupled with the completed remedy for OU1, is fully protective of human health and environment, assuming the Site's land use remains industrial. However, in the event that the Site's zoning changes to permit residential development, local zoning controls will ensure that such a land use is also fully protective of human health and the environment. The enactment by the city of Slidell of zoning restrictions for the area, irrespective of the future land use, will significantly reduce the potential for direct contact with the hazardous substances that are capped in place in both operable units.

Specifically, institutional controls for the property should include, at a minimum:

- Local planning officials and future property owners, users, or residents, should ensure that all excavation activities are conducted in a manner which would ensure that remaining contaminants in OU1 and OU2 are not brought to the surface, where they could pose a future direct contact threat.

- The city of Slidell is legally and physically able to enact zoning ordinances which would ensure that, in the event of a change in zoning that would allow residential development upon the Site, such development will be fully protective.

- The city of Slidell should require that prior to securing necessary city building permits, that the prospective developer place a minimum of two feet of clean fill over the remaining contaminated areas of OU2, and that it will ensure that any soil excavated beneath that cover be removed off-site or be redeposited on-site and covered with clean fill.

- The city of Slidell Planning Director has been provided with a copy of the administrative record for the Site to be filed in appropriate city land recordation files and zoning files to put future property users on notice of the above-described institutional controls recommended for the Site.

- The shallow unconfined groundwater in OU1 should not be used for any purposes unless future testing by the property owner or developer deems it fit for use.

11.0 EXPLANATION OF SIGNIFICANT CHANGES

Removal Action for Asbestos Containing Materials

In addition to the chemicals of concern identified in the RI and FS, asbestos containing materials were detected in several piles of debris and small pieces were discovered to be randomly scattered across the surface of OU2 subsequent to the issuance of the Proposed Final Plan. In June 1997, EPA used visual identification and laboratory samples to remove potentially asbestos containing materials from surface soils and debris piles. Since the asbestos material

was not able to be separated from the debris piles, EPA elected to dispose of the entire pile as asbestos containing material. Approximately 300 cubic yards of debris were excavated, loaded into trucks, and transported to the Woodside Landfill in Walker, Louisiana.

Based on comments received from LDEQ, EPA remobilized to the SSC site in August 1997, to remove the remaining debris piles which contained asbestos containing materials. During this removal action, EPA excavated each debris pile to 4" below grade or to the extent of contamination, placed a protective geotextile warning barrier to the limits of excavation, backfilled excavated areas with a minimum of one foot of low permeability clay, revegetated the excavated areas to prevent erosion, and transported the asbestos containing debris to an approved asbestos landfill for disposal. Figure 12 shows the location of the asbestos containing debris piles which were removed and the limits of excavation and backfilling.

Expansion or Clay Cap in OU1

During the month of July 1997, the U.S. Army Corps of Engineers was remobilized to the SSC site to expand the extent of the clay soil which covers the former North and South Impoundments in OU1 . The purpose of this clay cover expansion was to reduce the potential for erosion along the bayou frontage and to provide a protective barrier between minor tar seeps which occurred in the proximity of the former North Impoundment. The tar seeps occurred in an area bounded by the Graving Dock, Bayou Bonfouca, and the location of the former North Impoundment.

Excavation of Graving Dock Sediments

Although approximately 2,000 cubic yards of tributyltin (TBT)-contaminated sediments were excavated and incinerated along with the highly contaminated sludge and soil, samples collected after excavation showed that TBT contamination was still present. Due to poor structural integrity of the graving dock walls and bottom, further excavation was determined to be unsafe. The bottom of the graving dock was therefore lined with approximately 18 inches of clay and topped with 6 inches of rock. The purpose of the clay and rock liner is to prevent direct exposure to TBT by humans and aquatic life. The liner also significantly reduced ecological threats from this area of the source control operable unit(OU1).

This decision document presents the selected alternative which was chosen in accordance with CERCLA, the administrative record file, and the National Contingency Plan (NCP), 40 CFR Part 300.

12.0 RESPONSIVENESS SUMMARY

Background on Community Involvement

The community of Slidell, Louisiana, has been very active in issues concerning the Southern Shipbuilding Corporation (SSC) Superfund site. EPA initiated community participation activities for the SSC site with door-to-door interviews of residents living near the site in 1994 and continued to support and develop community involvement throughout the project by sponsoring many community meetings to share information and solicit public comment about the site. EPA has been in constant dialogue with members of the community and city of Slidell officials regarding the site.

To respond quickly and effectively to site contamination, EPA divided the site into two operable units. Operable Unit One (OU1) comprises the oily waste pits and graving dock, while Operable Unit Two (OU2) comprises the remainder of the site. On July 25, 1995, EPA completed its Record of Decision (ROD) for OU1 wastes that called for incineration of OU1 wastes at the Bayou Bonfouca site. This decision followed extensive public comment, a resolution by the Slidell City Council supporting incineration, and many community meetings. Incineration of OU1 wastes was completed on September 30, 1996, after detoxifying approximately 67,000 cubic yards of hazardous waste.

On January 25, 1996, EPA met with members of Slidell Working Against Major Pollution (SWAMP) and EPA's Community Working Group (CWG). Topics at this meeting included the progress of incineration activities, the RI/FS for OU2, and EPA's strategy for addressing contamination in OU2.

Concurrent with incineration of OU1 wastes, EPA conducted a Remedial Investigation (RI) and Feasibility Study (FS) for OU2. A draft RI and FS were completed in February 1996. The RI collected many samples from shallow groundwater, surface and sub-surface soils, and from sediments in Bayou Bonfouca. The results of this investigation showed the presence of lead, arsenic, polycyclic aromatic hydrocarbons (pah), and polychlorinated biphenyls (pcb) in several small areas within OU2.

On February 15, 1996, EPA met with members of SWAMP and the CWG to discuss OU2 wastes and EPA's plans for removal of contaminated areas. Topics at this meeting also included the EPA's integration of the Remedial and Removal programs to rapidly respond to OU2 wastes and accelerate the overall Superfund process.

On February 26, 1996, EPA held an Open House for all interested citizens to discuss OU2 wastes and removal plans. Maps of OU2 waste were presented at this meeting that defined the extent of contamination in OU2.

On March 4, 1996, EPA met with members of the CWG and other interested citizens to discuss plans for removal of OU2 contaminated areas. Topics also included EPA's securing of funds for removal of contaminated areas in OU2.

On March 14, 1996, EPA held an Open House to further define the scope of removal actions in OU2, and to introduce the EPA On-Scene Coordinator, Althea Foster, to the community.

In April 1996, EPA initiated removal of areas of elevated contamination within OU2. Removal actions were completed on July 3, 1996.

On August 2 1996, EPA provided a site tour for members of SWAMP, the Community Working Group, and representatives of the Slidell City Council.

On November 18, 1996, EPA issued its Proposed Final Plan, which called for no further federal or state response actions in OU2.

On November 19, 1996, EPA held an Open house at the Slidell City Council Chambers to discuss its Proposed Final Plan with members of the community. Topics included the Proposed Final Plan and a discussion of contaminated areas in OU2. Meeting notices were published in the New Orleans Times-Picayune and the Slidell Sentry-News. The public comment period for EPA's Proposed Final Plan began December 5, 1996 and lasted through January 6, 1997.

On December 19, 1996, EPA held a public meeting to receive comments on its Proposed Final Plan. A transcript of the meeting was added to the Administrative Record. Based on a request, by SWAMP, EPA extended the public comment period an additional thirty days to February 5, 1997. Below is EPA's response to the comments received during the public comment period. Similar comments and questions have been combined for one response. This decision document presents the selected alternative chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq., the administrative record, and to the extent practicable, the National Contingency Plan (NCP), 40 CFR Part 300.

Responses to Comments

1. Comment: I would like to see single family dwellings at Southern Shipyard lands. I would not like to see any more industry at all.

EPA Response: The former Southern Shipbuilding Corporation property is currently zoned for light industrial land use and is safe for future use as an industrial property.

With respect to future use of the property as residential, EPA believes that OU1 should be excluded from use for homes or dwellings, but that most areas of OU2 are safe for future development as residential property, provided that any developer place a minimum of two (2) feet of clean soil over the property. This fill material would place an additional barrier between the remaining contamination and any future residents, thereby removing the exposure pathway and minimizing future risks. The city of Slidell has expressed its ability and willingness to ensure the protectiveness of future development through zoning restrictions and City Council Resolutions, as appropriate.

2. Comment: The street which all transport trucks have been using is badly damaged. Whom do we contact for repairs?

EPA Response: The city of Slidell City Council or City Engineer are the appropriate contacts for this repair. Two years ago, at EPA's request, the city delayed resurfacing the road until after site cleanup actions were completed. EPA has provided a small amount of funds to the city to help with the cost of resurfacing the road. Resurfacing should occur soon.

3. Comment: With respect to maintenance of the clay cap in OU1, EPA has recommended zoning requirements that prohibit building of homes on the clay cap. Who is to monitor compliance with such a zoning regulation?

EPA Response: Responsibility for future land use at this site is shared first by local citizens and then by all levels of government. Citizens have the basic responsibility to monitor and shape future land use in their communities through participation in land use planning meetings and through election of local political representatives. Local government is responsible for the establishment and ongoing enforcement of land use controls. EPA is providing recommendations in this ROD on environmental aspects of future land use and the city has responded that, at a minimum, these will be adopted among other non-environmental controls. The Louisiana Department

of Environmental Quality is responsible for environmental protection and the Louisiana Office of Public Health is responsible for protection of health in the State of Louisiana. Future problems or concerns arising from changes in land use that adversely affect the environment or health should be reported to these two agencies, respectively. EPA was responsible for clean up of the site and will monitor the effectiveness of this remediation annually, for the next five (5) years.

4. Comment: Is the city of Slidell legally responsible for harm that may result from contamination left on the site? Is the city prepared to deal with possible liability for negligence in undertaking such responsibility in an area that may well be outside of its expertise?

EPA Response: EPA does not consider the city of Slidell to be a responsible party under section 107 of CERCLA, 42 U.S.C. 9607, and therefore, the city is not liable for site contamination under CERCLA, insofar as EPA is concerned. Based on our information, the city did not transport waste to the site. Further, the city does not own the site; and the city did not place, or arrange for disposal of, wastes on the site. The law of negligence is a matter of state law and thus is not within the purview of EPA. The commentor should either consult with counsel for the city of Slidell or with private counsel for an opinion on the city's duties and responsibilities with respect to the law of negligence.

5. Comment: EPA wants developers put on notice that there may be contamination on the site that exceeds EPA standards for homes, but it does not say where this contamination is located. QUESTIONS: Is the city of Slidell to determine where this contamination is or to guarantee that there is none? What should the city of Slidell require a developer to do to locate the contamination or to insure there is none?

EPA Response: The city of Slidell is not required to determine where contamination is, or is not, on the SSC property. All sampling data from the SSC site is currently available to any future developer, worker, or potential resident at the St. Tammany Parish Public Library, Slidell Branch, and from EPA through the Freedom of Information Act. Future developers of this property may also wish to collect their own environmental data and the city may wish to require sampling depending on the use of the property. No additional sampling is required by EPA since the site is considered by EPA to be safe for industrial use and the city has agreed to implement EPA recommendations in the event that the properly is some day zoned as residential. In addition, this ROD and the Remedial Investigation Report contain several very useful figures which help to identify the location of remaining contamination.

6. Comment: EPA recommends as follows: Essentially, in order to ensure that any future residential land use for OU1 and OU2 be fully protective where EPA may select a no further action alternative for the Site, it is necessary that any private party desiring to develop the property for residential land use be on notice, and, IF NECESSARY, be required by local authorities, to institute additional protective measures. Question: What is meant by "if necessary"?

EPA Response: "If necessary" refers to EPA's recommendations that some portions of the site will need additional protective measures, such as the addition of clean fill, depending on future land use. If the site is used as an industrial property, no additional protective measures are necessary although the city may wish to require use-specific measures depending on the properties future use. If the site is used as residential EPA has made several recommendations in this ROD which should be required by local authorities to ensure a protective future land use.

7. Comment: Would a developer only be required to bring in two feet of clean fill if there

were contamination where a house were being built? What if a developer chooses to meet EPA's recommended requirement by elevating the home?

EPA Response: In response to public comment, EPA recommends a protective clean soil cover on all areas of OU2, except the wetlands area, behind the cemetery on Canulette Road, in the event that the site is developed as residential property. Soil sampling in this area has not detected any hazardous wastes, and therefore should not require the addition of a protective barrier of soil. EPA believes that placing clean fill in this area is unnecessary. Use of elevated structures is not an acceptable equivalent of the recommendation for two feet of clean soil as a protective barrier.

8. Comment: How will the zoning regulations for the site come into existence? SWAMP is concerned that the institutional controls are not sufficient to protect the health of the community. What controls will protect families that dig through the two-foot cover when building additions to their homes, adding swimming pools, or other predictable situations that involve digging into the soil cover?

EPA Response: The city of Slidell provided comments during the Public Comment period which stated the city's intent to place deed notices and zoning restrictions on the SSC property in the event that the property is developed as residential property. In addition, the City Council has initiated preliminary steps to rezone OU1 as an "Open Land District" which would prohibit houses or residences in this area, and to limit excavation on the site. The city has not taken action on implementing zoning controls on OU2 since the site is currently zoned for industrial use and is considered safe for industrial use by EPA.

EPA has had many discussions with the city regarding their capabilities and future responsibilities with respect to the SSC site and believes that the city is capable and willing to control future land use. If the city feels it is not qualified in a specific technical area, it has expressed its willingness to hire consultants to ensure safe and accurate decisions. EPA is also willing to assist the city wherever possible.

Following any Superfund remedial action where hazardous substances, or pollutants and contaminants remain at the site, EPA is required to review its remedial action not less than every five years to determine if the remedy remains protective of public health and the environment. In addition, CERCLA provides EPA with the authority to investigate, monitor, and obtain information related to sites such as SSC. Due to community concern and the potential for residential development, EPA will not only review the remedy for OU1, but also the effectiveness of all response actions performed on OU2, annually for the next five years.

9. Comment: How can community acceptance of the selected alternative be a part of the selection process when the remedy had already been selected, implemented and completed prior to the Feasibility Study being issued to the public?

EPA Response: Since incineration of OU1 wastes was scheduled for completion in July 1996, and the uncertainty of funding for the entire Superfund program, EPA determined that a time-critical removal action to address areas of elevated contamination in OU2 was the most efficient and sure way of addressing these wastes. Although EPA is not required to solicit public comments for removal actions. EPA hosted several community meetings to discuss issues and concerns and to incorporate public comments into these removal actions. The opportunity for public comment on the selected alternative, no further Federal or state action, was offered during the public comment period which lasted from December 5, 1996 through February 5, 1997.

10. Comment: EPA should require ongoing monitoring of ground water on a periodic basis. This would allow the Agency to determine if ground water contaminant levels will decrease as a result

of the removal of the major sources of contamination.

EPA Response: EPA disagrees. Periodic monitoring of groundwater is warranted where contaminated groundwater has the potential to migrate to an area where groundwater is a source of drinking water. At the SSC site, only the shallow unconfined groundwater is contaminated, primarily in the area surrounding the former North and South Impoundments, and this groundwater is not used for any purpose. Since a substantial clay layer underlies this area at approximately 9 feet, and the source of contamination has been removed, there is not a significant threat that this contamination will spread to a drinking water aquifer. Therefore, EPA does not recommend additional periodic monitoring of groundwater.

11. Comment: In regard to OU2, the elevation of structure at lean two feet does nothing to protect residential occupants from coming in contact with contaminants in the soil. A minimum of two feet of clean fill should be a requirement for all areas of OU2 developed for residential use.

EPA Response: EPA agrees. In response to public comment, EPA has included this requirement in this ROD.

12. Comment: Regarding OU1, no excavation, invasion or intrusion into the clay cap should be a requirement.

EPA Response: EPA disagrees. Excavation into the clay cap of OU1 should be limited and controlled, but not entirely prohibited. There are many future uses for this property that could benefit the community. Prohibiting penetration of the clay cap on OU1 is unnecessary, but should be conducted with caution. We believe that institutional controls as outlined here and in the comments from the city of Slidell are sufficient to ensure protection of public health, the environment and the remedy.

13. Comment: In regard to the graving dock of OU1... this area should be off limits for any excavation and/or dredging.

EPA Response: EPA agrees that excavation and/or dredging of the Graving Dock should be limited. Since tributyltin contamination is still present in the sediments of the Graving Dock, any future excavation in this area should be limited. If excavation in this area is necessary for future land use, the sediments which underlie EPA's clay cover should be treated as hazardous waste and handled accordingly.

14. Comment: A core problem with EPA's Plan is that the action levels are scientifically unsound and unprotective, even for future industrial use scenario presumed by EPA, In regard to Benzo(a)pyrene, EPA's action level is 10ppm. This is a very high level. EPA has used a value that is not protective for industrial land use and does not protect shallow groundwater or surface water that shallow groundwater discharges to. The potential risks for residential use are very high, in fact, direct contact with contaminated soil would pose a cancer risk of over 10 to the minus 4, which is truly absurd. In regard to PCBs, EPA's action level is 10ppm. This level corresponds to a very high cancer risk. The supposedly cleaned-up Site may pose a continued threat to the health of Slidell citizens, in particular, the families and children who end up living in future homes built on the Site. EPA established an action level of 10ppm for excavation of wastes from the pits. In doing so, EPA acknowledged that this action level represents a cancer risk level of one in ten thousand for residential use. SWAMP is critical of EPA's failure to explain deviation of its action level from one in one million departure level mandated for sites at which the contemplated future use was residential.

EPA Response: EPA disagrees. To protect human health, EPA has established an acceptable human

health risk range from one-in-ten thousand (1 X 10 -4) to one-in-one million (1 X 10 -6) excess cancer incidents as the remedial goal for Superfund sites. A risk of one-in-one million means that one person out of one million people could develop cancer as a result of a lifetime exposure to contamination at a site.

In conjunction with investigation of site contaminants, EPA conducted a multi-media risk assessment to evaluate potential risks to future site workers or residents. Prior to extensive removal actions, the total estimated cancer risk for future site workers, from all cancer causing chemicals combined, was 9.6 X 10 -5, which is within EPA's range of acceptable risk. The total estimated cancer risk for future children/residents, from all cancer causing chemicals combined, was 3.7 X 10 -4, which is slightly higher than EPA's acceptable risk range. These risks, are based on soil concentrations prior to removal of approximately 5,800 cubic yards of contaminated soils. The total estimated cancer risks for future site workers and child/residents after the extensive removal actions of contaminated soils in OU2 is estimated to be significantly safer than these values, and within EPAs acceptable risk range.

Regarding SWAMP's concern about deviation from the 1 X 10 -6 guidance for the Superfund cleanup program, EPA believes that the cleanup values selected are protective of future industrial property users. In the event that the future use of the property is residential, the recommendations made in this document for a protective clean soil barrier would eliminate the exposure pathway thereby minimizing or eliminating future risk from site contaminants.

15. Comment: EPA has established a soil cleanup level of 2000 ppm for the site. The lead cleanup level should be reduced to 1000 ppm in surface soils to be protective of public health under residential conditions.

EPA Response: EPA disagrees. Since the site is zoned for light industrial use, the cleanup level of 2000 ppm is protective of future site workers. In the event that the property use is changed to residential, EPA's remedy is more protective by placing an uncontaminated soil barrier between any residual lead contamination and any future residents. As shown by Figures 8A, 8B, and C remaining lead contamination above 1000 ppm is localized and could be effectively controlled by a protective soil cover.

16. Comment: SWAMP is concerned that the remaining contamination poses a threat to Bayou Bonfouca and connecting water bodies. Soil excavation and sampling: Additional soil samples for testing were not taken at the depth of two feet. This disregards the consideration of leaching of subsurface contaminants into shallow groundwater and surface waters.

EPA Response: Although migration of contaminants into Bayou Bonfouca will occur from the SSC site, EPA believes that remaining contamination at the SSC site pose little or no threat to Bayou Bonfouca from leaching of site related contaminants. Since almost all contaminants have been detoxified by incineration or disposed of offsite at a contro1led landfill, the magnitude of any migration into the bayou is extremely small. The shallow groundwater on the SSC site is contaminated primarily with organic compounds which leaked from the North and South Impoundments and the wier system. At the concentrations observed, these chemicals will readily biodegrade and naturally detoxify over time. Metal contaminants, such as lead and arsenic, will not biodegrade, but tend to adhere to soil particles and not move through groundwater.

17. Comment: These action levels are substantially less stringent than those adopted for sites in other parts of the country. SWAMP noted that at a Maryland site with similar contamination, EPA had established an action level of 0.1 ppm for B(a)P equivalents, or 100 times better than the standard established for Southern Shipbuilding, a level consistent with the one on one million risk level. Why should Slidell get a much less stringent cleanup than the similar Southern Maryland Woodtreating Site?

EPA Response: The cleanup levels cited for the Southern Maryland Woodtreating (SMW) Superfund site are not complete. The actual action levels used call for 0.1 ppm B(a)P equivalent in surface soils and 1 ppm B(a)P equivalent in subsurface soils. The SMW site is zoned as residential property.

The SSC site in Slidell is zoned as industrial property. The cleanup level for OU2 is 10ppm B(a)P equivalent which is safe for industrial use and consistent with EPA risk management practices. In the event that the property is developed in the future as residential property, EPA Region 6 is recommending the placement of two feet of clean soil on the entire OU2 property, except as noted in an earlier response. We believe that it is safer, in a residential development scenario, to have two feet of clean soil (zero B(a)P equivalent) on the surface of the property, with institutional controls to govern subsurface excavation, than to allow exposure to 0.1 ppm on the surface as is the case at the SMW site.

EPA believe that the combination of industrial cleanup levels and institutional controls coupled with the addition of clean soil makes the property suitable for either industrial or residential development and is protective of both future workers and/or residents.

18. Comment: SWAMP requests that EPA take no further action on its current proposed plan for Southern Shipbuilding until the Agency for Toxic Substances and Disease Registry has reviewed the action and cleanup levels for the Site and the city of Slidell has in fact implemented zoning changes and ordinances designed to ensure that any residential development of the Site is undertaken in a manner that attempts to protect future residents from remaining contamination on the Site.

EPA Response: As discussed above, the city of Slidell has initiated implementation of zoning changes for the SSC property. In addition, ATSDR has reviewed the Proposed Final Plan and come to the following conclusions:

1) The action levels proposed for B(a)P, PCBs, and lead for the remediation of the site for commercial use are not protective of the health of future residents if the property is rezoned for residential use without corrective measures,

2) There are some areas of site contamination remaining in OU2 that without further site remediation would pose a health risk to future residents of the site,

3) The requirements contained in the Proposed Final Plan for the Southern Shipbuilding Site for future residential development of the site including additional soil removals, maintenance of the clay cap, and the addition and maintenance of 2 feet of clean fill over the residual contamination would protect the health of future residents.

19. Comment: The maps furnished by EPA show substantial amounts of remaining contamination in excess of the risk-based concentrations established by EPA Region III. EPA's Region III has established a risk-based concentration for PCBs of 0.1 ppm, a standard consistent with EPA's cancer risk of one in one million. EPA's recent maps for Southern Shipbuilding show substantial areas of OU2 have PCB's in excess of 0.1 ppm and the PCB map does not even show what portion of the area has remaining concentrations in excess of 0.1 ppm. EPA Region III risk-based concentration for arsenic is 0.4ppm. EPA's recent maps for Southern Shipbuilding indicate that arsenic in excess of 0.3ppm remains on virtually all of OU2, and almost half of OU2 has concentrations in excess of 3.0ppm. The common cleanup level for lead is 400-500 ppm. EPA's recent maps show a number of area on which concentrations of lead exceeding 500ppm remain.

EPA Response: The Risk-based Concentration Tables, published by EPA Region 3, present concentrations for a variety of chemicals which represent a one-in-one million risk (1 X 10 -6)

for residential exposure over a lifetime, using standard EPA assumptions. These tables are used by EPA as guidelines where a fall human health or ecological risk assessment is not performed. At the SSC site, a full human health and ecological risk assessment was performed. The cleanup levels were based on industrial exposure scenarios, although a residential exposure risk assessment was also performed.

The maps which the commentor referred to were prepared for discussion purposes during several of EPAs community open house discussions, and represent OU2 prior to removal actions. Therefore, the concentrations that are presented in the maps no longer exist in surface soils, and the site is significantly cleaner than presented therein. Figures 8A, 8B, 8C, 9A, 9B, 9C, 10A, 10B, 10C, 10A, 10B, and 10C of this ROD, graphically depict surface and subsurface contamination after all EPA removal actions.

Arsenic is a common component of soils throughout the United States. Various references indicate that the average soil concentration in the eastern United States ranges from less than 1 ppm to as much as 70 ppm, depending on location. Concentrations in the Western U.S. average slightly higher. EPA believes that the majority of the SSC site arsenic contamination is representative of the Slidell area, except for several isolated areas which were excavated and disposed of offsite.

The action level for lead at the SSC site is 2000 ppm, not 400-500 ppm as discussed by the commentor. Therefore, the maps referenced by the commentor do contain areas above 400-500 ppm.

20. Comment: If there is any possibility that homes may be built in the area of OU2, EPA must adequately sample this area and prepare an authoritative map on post-cleanup contamination.

EPA Response: EPA agrees. Maps of remaining contamination have been included with this ROD, showing surface soil contamination (zero to six inches), and subsurface (six inches to twenty-four inches), and greater than 2 feet. However, these maps are computer generated depictions of contamination and should not be used exclusively without considering all sampling efforts contained in the administrative record. No further sampling is necessary by EPA although local zoning authorities may require additional sampling by a future land developer.

21. Comment: SWAMP asks that the comment period be left open two weeks for the limited purpose of permitting SWAMP to include in the record its comments on the expected letter from Mayor Caruso outlining the city's course of action.

EPA Response: EPA has added Mayor Caruso's letter to the Administrative Record. Since it was consistent with EPA's Proposed Final Plan, there was no need to extend the comment period, beyond the original 30-day extension. In addition, EPA has attempted to respond to all subsequent comments from SWAMP in this ROD.

22. Comment: In this flood-prone area, what insurance is there that a two-foot cover will have any permanence?

EPA Response: Residential development brings with it the establishment of homes, roads, trees, grass, and other groundcovers which will withstand most floods and help to ensure the permanence of the two-foot soil cover. EPA has also expanded the original two-foot clay cover on OU1 to the edge of Bayou Bonfouca to provide an additional protective measure against flooding. In addition, EPA and LDEQ will periodically inspect the site to ensure that the remedy remains protective of the Bayou Bonfouca ecosystem.

23. Comment: The Superfund Program provides for the designation of a Natural Resource Trustee Agency to protect a natural resource such as Bayou Bonfouca. SWAMP asks that such a Trustee

Agency be designated and undertake its responsibilities for ensuring that Bayou Bonfouca is protected.

EPA Response: There are various natural resource trustee agencies that have been involved in the remedy for Southern Shipbuilding Corporation Superfund site, including the Louisiana Department of Wildlife and Fisheries (LDWF), U.S. Department of the Interior/Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, and the Louisiana Department of Environmental Quality.

24. Comment: Please ensure that the removal of the various barges that are sinking, etc. are included in this cleanup before ending the Federal and State funding.

EPA Response: Although the barge and ship remnants in Bayou Bonfouca present an eyesore, they do not present a threat to human health or the environment from chemical releases. Consequently, removal of the barge and ship remnants is not considered to be necessary or appropriate by EPA.