

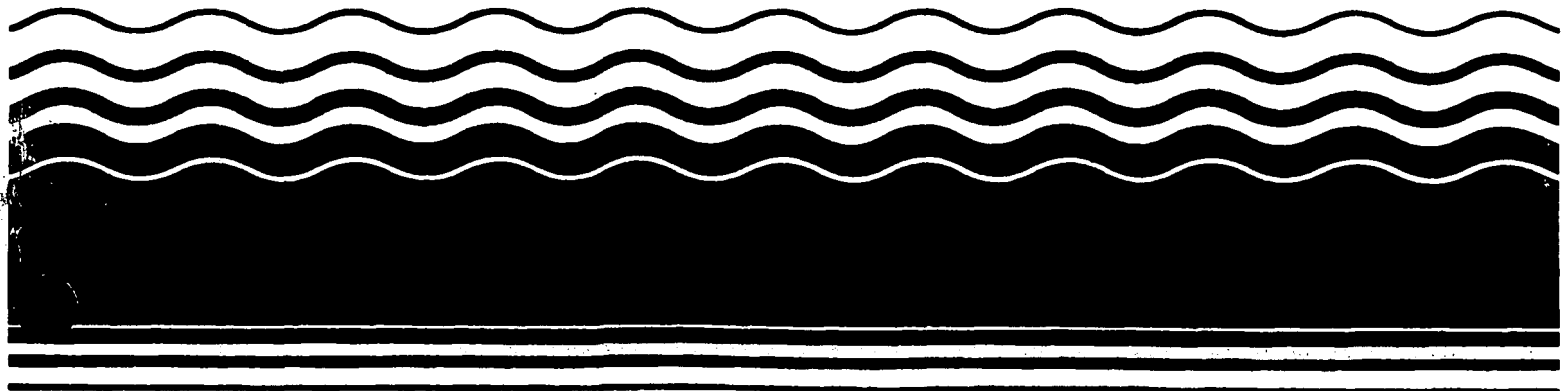
PB98-963147

EPA 541-R98-161

March 1999

**EPA Superfund
Record of Decision Amendment:**

**Petro-Chemical Systems
(Turtle Bayou)
Liberty County, TX
4/30/1998**



RECORD OF DECISION
AMENDMENT

PETRO-CHEMICAL SYSTEMS, INC.
(TURTLE BAYOU)
SUPERFUND SITE



REGION 6
APRIL 1998

**DECLARATION
PETRO-CHEMICAL SYSTEMS, INC.
AMENDED RECORD OF DECISION**

Statutory Preference for Treatment as a
Principal Element is Met
and Five-Year Review is Required

SITE NAME AND LOCATION

Petro-Chemical Systems, Inc. (Turtle Bayou)
Liberty County, Texas

STATEMENT OF BASIS AND PURPOSE

This decision document presents the amended Record of Decision (ROD Amendment) for the second operable unit (OU2) for the Petro-Chemical Systems, Inc. (a/k/a Turtle Bayou) site (the site) in Liberty County, Texas. The amended remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This ROD Amendment is based on the administrative record file for this site.

The public was provided an opportunity to provide comments on the Proposed Plan during the public comment period. The public comment period began on October 22, 1997 and ended on November 20, 1997. A public meeting was held at the site to provide the local community an opportunity to provide verbal and/or written comments on the Proposed Plan. The United States Environmental Protection Agency (USEPA) has reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, the USEPA has determined that no significant changes to the amended remedy identified in the Proposed Plan are required.

The State of Texas concurs with the ROD Amendment.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE ROD AMENDMENT

This ROD Amendment addresses a modification to the soil cleanup criteria for benzene identified in the September 6, 1991 ROD. The 1991 ROD's benzene soil cleanup criteria was based on numerical model predictions of the allowable benzene concentrations in soils that, when attained, would not result in exceeding the federal drinking water standards in the underlying shallow aquifer via leaching. The benzene soil cleanup criteria modification is based on the following:

- rerunning the numerical model using site specific data (e.g., soil moisture profiles, field permeability test results) collected during the recently completed field pilot study activities; and
- consideration of the Texas Natural Resource Conservation Commission's residential exposure standard for benzene in soil from zero to two feet below ground surface.

All other 1991 ROD performance standards, including the benzene ground water cleanup criteria, remain unchanged.

This ROD Amendment also addresses the remedy for the site's contaminated soils and contaminated ground water. The remedy for the soil contamination addresses the principal threats (i.e., areas of the site where soil is known or suspected to contain high concentrations of dissolved and/or free non-aqueous phase liquid) as well as low level threats at the site by minimizing potential exposure by way of ingestion, inhalation or direct contact with contaminants and by reducing the potential for the contaminated soil to act as a continued source for ground water contamination. The remedy for the ground water contamination addresses the principal risk at the site by minimizing potential exposure by way of direct contact and ingestion with contaminants and by eliminating the potential for migration of contaminants to deeper ground water zones.

This ROD Amendment enhances the site's remedy by identifying additional soil and ground water remedy components which can be used in combination with 1991 ROD remedy components to achieve the site's performance standards in

compliance with all Federal, state and local applicable or appropriate requirements. The identification of the additional remedy components which will be used to achieve the site performance standards is based upon further site characterization, results of field pilot studies, and the ongoing operation of the pilot systems. The additional soil and ground water remedy components include:

- in-situ aquifer bioremediation;
- bioventing;
- aqueous phase soil bioremediation;
- soil excavation and off-site treatment and/or disposal;
- soil excavation and biotreatment;
- thermal desorption;
- soil washing;
- containment (e.g., living cap);
- monitored natural attenuation; and
- institutional controls.

Remedy components identified in the 1991 ROD which will continue to be implemented include:

- soil vapor extraction;
- containment (e.g., traditional synthetic liner cap);
- selected directional containment (e.g., slurry wall);
- installation of storm water management controls;
- monitoring ground water; and
- the restoration of the site surface upon completion of the remedial action.

The primary remedy treatment components addressing site contamination are soil vapor extraction and in-situ aquifer bioremediation. The field pilot studies

have shown that a flexible approach is an effective means of addressing the varying geologic conditions at the site and area specific problems. It is anticipated that to attain the performance standards, the use of the various remedy components in succession will be required. The use of multiple remedy components maximizes the efficiency of remedial operations: over time, treatment technologies such as soil vapor extraction become less effective in removing contamination, at which point it is more efficient to change to another, more passive, technology (e.g., bioventing). The transition from one remedy component (e.g., soil vapor extraction) to a subsequent remedy component (e.g., bioventing) will generally be determined by progress sampling. In general, benzene will be the main chemical of concern; the levels of benzene will be measured over time; a significant decrease in the time rate removal of benzene will indicate a remedy component change. The ROD Amendment describes in more detail the use of various technologies in different areas of the site.

Within this ROD Amendment, EPA is narrowing the site boundary from approximately 500 acres to include only the contaminated portions of property (and all suitable property in very close proximity to the contamination necessary for implementation of the remedial design and remedial action). This redefinition of the site boundary is based upon several years of field investigations and contamination data which has been gathered since the site boundary was originally defined.

STATUTORY DETERMINATIONS

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

Because this remedy will leave hazardous substances remaining on-site, a review will be conducted five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of public health and welfare and the environment.


Jerry Clifford

Acting Regional Administrator
Region 6

4-30-98
Date

**RECORD OF DECISION AMENDMENT
PETRO-CHEMICAL SYSTEMS, INC.
SUPERFUND SITE**

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1.0 INTRODUCTION

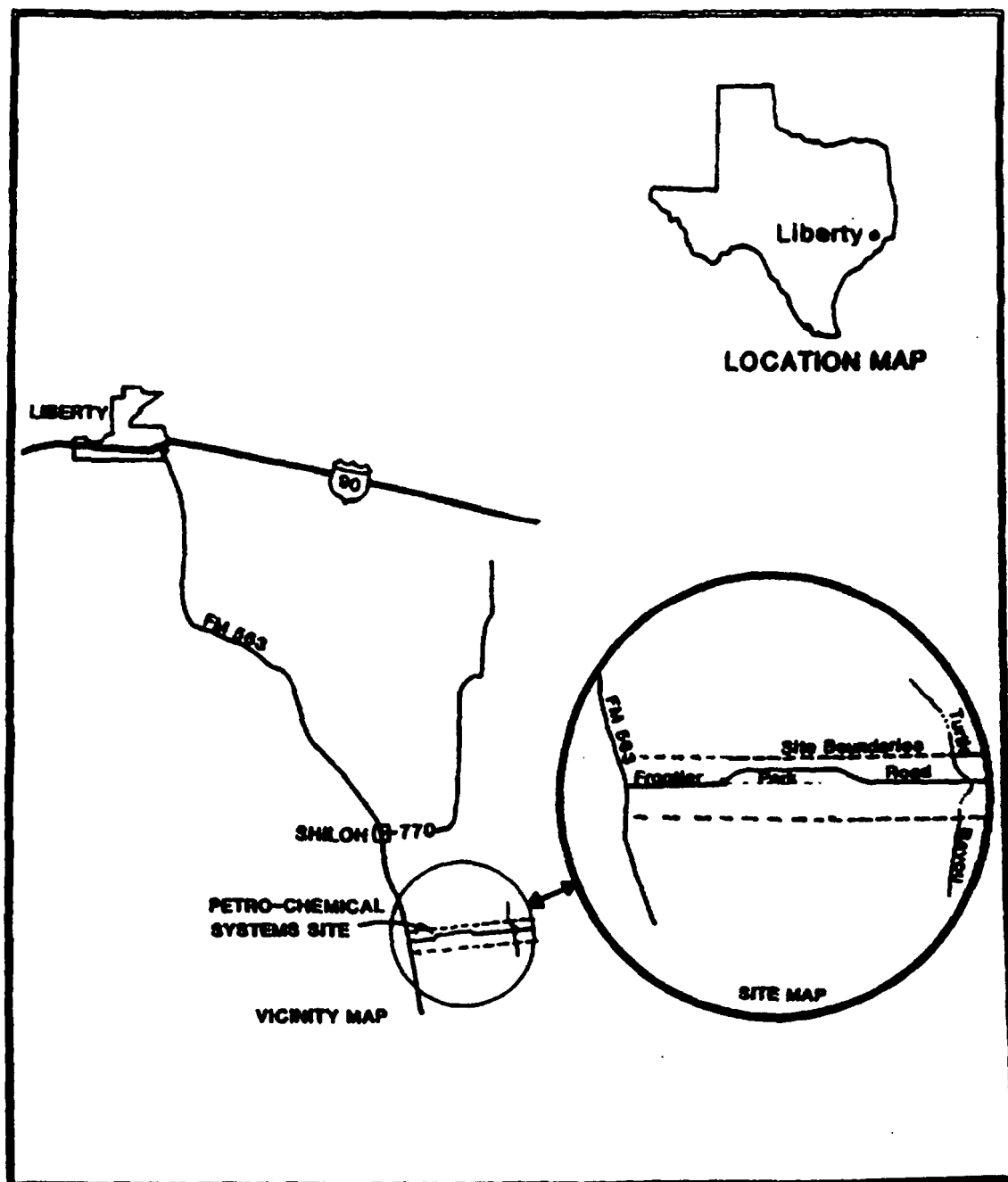
This Record of Decision Amendment (ROD Amendment) is the culmination of over two years of extensive Remedial Design (RD) field pilot studies, further site characterization, and the ongoing operation of pilot systems. Within this ROD Amendment, the United States Environmental Protection Agency (USEPA) documents the Federal Government's rationale for changing the benzene soil cleanup criteria and for enhancing the remedy approach to address contamination at the Petro-Chemical Systems, Inc. site. This ROD Amendment includes a comparison of the enhanced remedy to the 1991 ROD remedy and discusses how the enhanced remedy satisfies the statutory requirements. The enhanced remedy includes additional soil and ground water remedy components (i.e., bioventing, in-situ bioremediation) which will be used instead of or in combination with the 1991 ROD remedy components to achieve the site's performance standards. The enhanced remedy also modifies the 1991 ROD remedy for the site's Bayou Disposal Area from an engineered soil and synthetic liner cap to a "living cap." The living cap consists of a graded clay cap (infiltration barrier), with selected vegetation planted and developed so as to minimize infiltration of rainwater. The USEPA is also narrowing the current site boundary of nearly 500 acres to more precisely reflect only those areas where soil and/or ground water contamination has been defined. Because this action modifies the 1991 ROD's soil benzene cleanup standard and enhances the 1991 ROD's remedial approach, it constitutes a fundamental change to the remedy, and thus USEPA solicited public input before issuing this ROD Amendment.

1.1 Site Background

The Petro-Chemical Systems, Inc. Superfund site is located in Liberty County approximately 15 miles southeast of Liberty, Texas. The site is approximately six miles north of Interstate 10 along Farm to Market Road (FM) 563, which borders the site to the west. County Road 126 (CR 126 was previously known as Frontier Park Road) provides access to the site from FM 563. CR 126 traverses the middle of the site, ending approximately ½ mile east of Turtle Bayou and 2½ miles east of FM 563. The site is sometimes referred to as the Turtle Bayou site because Turtle Bayou, a tributary to Lake Anahuac, forms the eastern site boundary (See Figure 1).

Unpermitted waste disposal activities appear to have started in the late 1960's. Disposal of waste at the site is documented in the Texas Water Quality Board records as early as 1970. Records indicate the dumping of waste oils in unlined pits and on Frontier Park Road. Since the site was never an authorized waste disposal facility, the exact nature of the disposal activities at the site is uncertain. However, it appears that the waste was dumped indiscriminately

FIGURE 1
PETRO-CHEMICAL SYSTEMS, INC. SITE
LIBERTY COUNTY, TEXAS



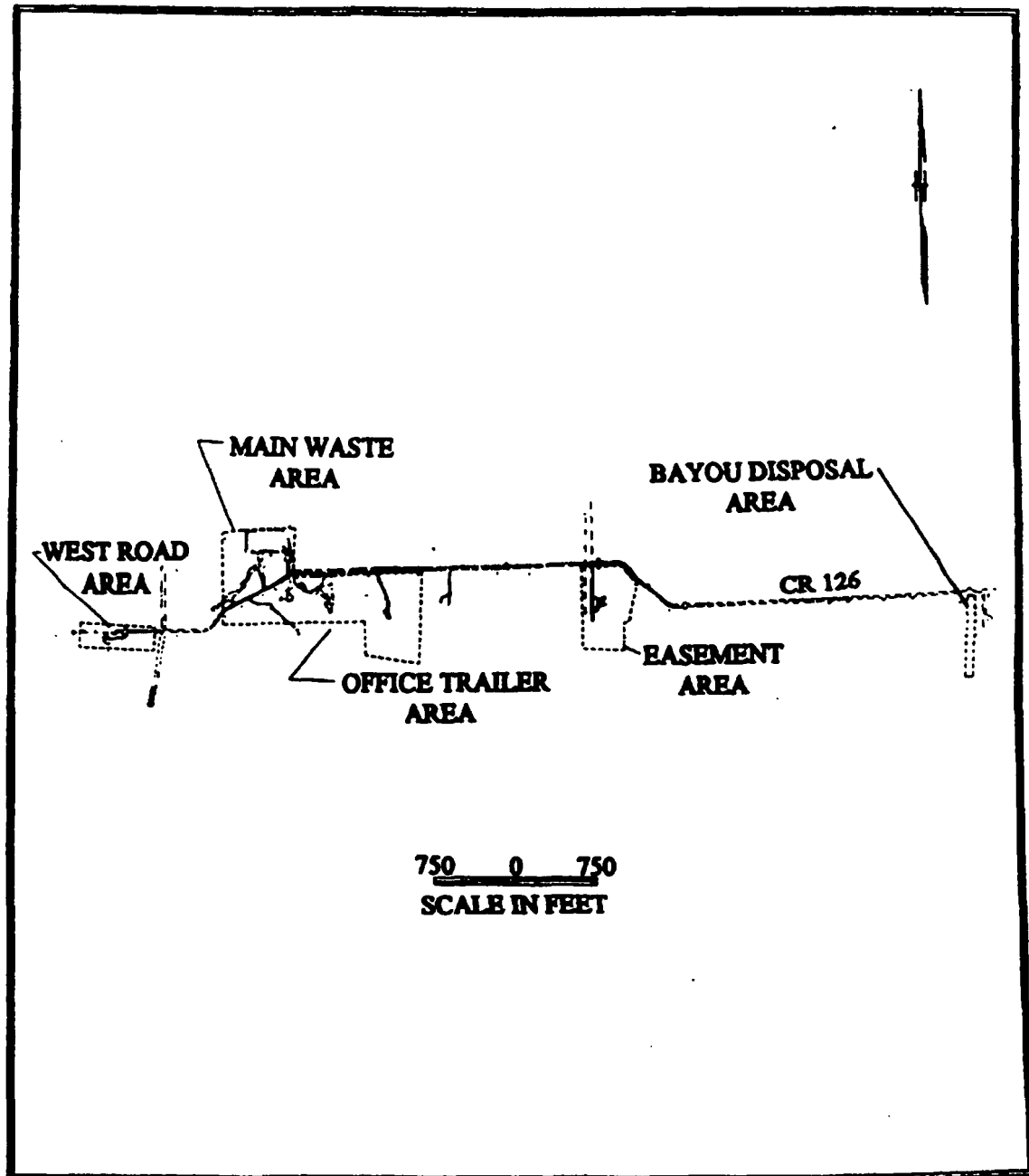
from trucks at numerous locations. In some areas, it appeared as if the waste were tilled into the soil. In addition to Frontier Park Road, five areas of the site have been identified as waste disposal areas. These areas are the West Road Area, the Main Waste Area, the Office Trailer Area, the Easement Area, and the Bayou Disposal Area (See Figure 2).

In 1971, an application for a commercial industrial waste disposal permit with the name of Petro-Chemical Systems, Inc., was filed with the State of Texas. The application included a detailed site development plan. In response to the application, local citizens organized to oppose the application. After public hearings were held and additional information was evaluated in response to a citizen's suit, the State's approval for the application was withheld indefinitely. In 1974, Petro-Chemical Systems, Inc., withdrew the application. The site has since been subdivided into five-acre and fifteen-acre plots and sold for residential development. Residential use of the site has been continuous since 1974, except during previous remedial activity on Frontier Park Road. At that time, EPA temporarily relocated the site residents. Four families live within the site boundaries as of November 1997. No residents live on any of the identified waste disposal areas; however, two families live adjacent to waste disposal areas (Easement Area and the Bayou Disposal Area). The current land use (i.e., residential), is not anticipated to change in the foreseeable future.

With the passing of CERCLA in 1980, interest in the site was renewed. In 1982, personnel from the Texas Department of Water Resources (TDWR) were sent to investigate the site. (Note: In September 1985 the TDWR became the Texas Water Commission (TWC)). TDWR personnel collected several soil samples in the pits formerly used for waste disposal. As a result of the site investigation, the TDWR determined that the site constituted a "discharge or imminent discharge, as well as the creation and maintenance of a nuisance as prohibited by the Texas Administrative Code (TAC) 335.4." The TDWR recommended that "unless a responsible party can be determined and corrective action taken, the subject site should be considered for CERCLA funding." In May 1984, the State of Texas, represented by the TDWR, requested that the site be included on the National Priorities List for funding under CERCLA.

In 1984 the USEPA proposed the site for inclusion on the National Priorities List (NPL). The site was placed on the NPL in 1986. The Texas Water Commission (TWC) (predecessor to the Texas Natural Resource Conservation Commission - TNRCC) and the USEPA decided to first address contamination along Frontier Park Road (Operable Unit 1 - OU1) and conducted a remedial investigation (RI) and feasibility study (FS) from January to November 1986. The RI found that

**FIGURE 2- SITE REFERENCE AREAS
PETRO-CHEMICAL SYSTEMS, INC. SITE
LIBERTY COUNTY, TEXAS**



several sections of Frontier Park Road were contaminated with volatile organic compounds (VOCs)(e.g., benzene) and polynuclear aromatic hydrocarbons (PNAs)(e.g., naphthalene). The *Frontier Park Road RI/FS Report* (Lockwood, Andrews & Newnam, Inc., November 1986) stated that the potential risks to local residents, particularly those living on the site, from the road contamination was high. Local residents could be exposed to PNA and VOC contamination through multiple routes (i.e., direct contact, ingestion, inhalation). To address these risks to local residents from exposure to road contamination, the report evaluated various remedial alternatives. Stated remedial goals were to:

- Improve access for equipment to the site to facilitate necessary remedial investigation sampling and monitoring and future remedial actions;
- prevent direct contact with highly contaminated soils (greater than 100 parts per million [ppm] total PNAs or 100 ppm total VOCs); and
- minimize direct exposure to moderately contaminated soils (between 10 and 100 ppm total PNAs or 10 and 100 ppm total VOCs).

On March 27, 1986, the USEPA issued a Record of Decision for Frontier Park Road (OU1 ROD) which called for the excavation and on-site consolidation of approximately 5,900 cubic yards of highly contaminated soils (containing greater than 100 ppm total PNAs or 100 ppm total VOCs). The OU1 ROD stated that excavated soils were to be placed in a temporary, above ground landfill in the site's Main Waste Area until such time that a remedy for the entire site could be implemented. The excavated areas of Frontier Park Road were backfilled with clean soil. Additionally, the entire length of Frontier Park Road was also paved to minimize direct exposure to the moderately contaminated soils (between 10 and 100 ppm total PNAs or 10 and 100 ppm total VOCs) and to improve site access for future investigations and response actions.

In June 1988 the TWC and USEPA initiated the second RI/FS which defined the nature and extent of contamination throughout the rest of the site (Operable Unit 2 - OU2), evaluated risks associated with the contamination, and developed potential remedial alternatives to address the risks. Soil contamination identified during the second RI/FS primarily included VOC's (e.g., benzene up to 7,000 ppm) and PNA's (e.g., naphthalene up to 6,700 ppm). Beneath the contaminated soils, significant shallow ground water contamination was detected and primarily included VOC's (e.g., benzene up to 480 ppm) and PNA's (e.g., naphthalene up to 13,000 ppm). The shallow ground water zone is located approximately 18 - 20 feet below the ground surface. Additionally, small isolated areas with lead contaminated soils up to 5,000 ppm were also identified. The *RI Report* (Lockwood, Andrews & Newnam, Inc., November 1990) identified the primary

site risk as exposure to contaminated groundwater. To address this risk, the *FS Report* (Lockwood, Andrews & Newnam, Inc., March 1991) evaluated various potential alternatives which could reduce contaminant levels in the ground water and the overlying contaminated soils which act as a continuing source for the ground water contamination.

In March 1991, ARCO Chemical Company and the USEPA signed an Administrative Order on Consent to conduct a supplemental remedial investigation and focused feasibility study (SRI/FFS) at the site. The objective of the SRI/FFS was to collect additional site data and further evaluate possible remedial alternatives. Based on information gathered during this effort, the site's estimated volume of contaminated soil and ground water significantly increased. This increase in contaminant volume was addressed in the 1991 ROD. The *SRI/FFS Report* (Weston, August 1991) recommended soil vapor extraction and shallow aquifer sparging as major components of the site's remedy, and the USEPA in the 1991 ROD included soil vapor extraction and shallow aquifer sparging as components of the selected remedy. Section 2.2 (Remedy Selected in 1991 ROD) of this ROD Amendment discusses the specific components of the 1991 ROD.

In December 1993, after extensive efforts to identify site Potentially Responsible Parties (PRPs) and attempting to negotiate an agreement with the PRPs to participate in the site's remedial design and remedial action (RD/RA), the USEPA issued a Unilateral Administrative Order (UAO - Docket No. CERCLA 6-05-94) to identified PRPs. ARCO Chemical Company and Atlantic Richfield Company (herein collectively referred to as ARCO) are the only PRPs currently complying with the UAO. As directed by the UAO, ARCO has been working with the USEPA and the TNRCC in performing the site's RD. As part of the RD, an extensive field pilot study program was undertaken. The overall goals of the field pilot study were as follows:

- evaluate the effectiveness of the soil vapor extraction (SVE) and other remediation technologies (i.e., bioventing, soil washing) for remediating the contaminated soils above the site's first permeable unit, and in-situ bioremediation (ISB) for the contaminated water bearing zone(s); and
- develop the data required to design and build a remedial response system for each medium (soils and ground water).

The specific objectives for the SVE field pilot tests were:

- confirm the effectiveness of SVE as a component of a remedial system for the affected soils at the site;

- generate design data for full-scale construction and operation of SVE for affected soils; and,
- project the duration of full-scale SVE operation to achieve site clean-up criteria for affected soils;

The specific objectives for the ISB pilot tests were:

- confirm the effectiveness of delivering chemical amendments (i.e., nutrients and oxygen) through the upper water bearing unit to stimulate in-situ bioremediation;
- confirm the effectiveness of ISB in reducing concentrations of chemicals of concern in soils and ground water in the upper water-bearing unit;
- generate design data for full-scale construction and operation of ISB for the upper water-bearing unit; and,
- project the duration of full-scale ISB operation to achieve site clean-up criteria for the upper water bearing unit.

1.2 Lead and Support Agencies

U.S. Environmental Protection Agency – Lead Agency
Texas Natural Resource Conservation Commission – Support Agency

1.3 Statute Requiring ROD Amendment

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), §117, as implemented by the National Oil and Hazardous Substances Contingency Plan (NCP) §300.435(c)(2)(iii).

1.4 Circumstances that led to the Need for a ROD Amendment

The ROD Amendment is necessary to document a fundamental change in the remedy, here a change in the soil cleanup criteria for benzene. This change will reduce the concentration of benzene remaining at the surface (including the surface through two feet below the ground surface), maintain the 1991 ROD's benzene soil cleanup criteria between two and four feet below ground surface, and

increase the concentration of benzene which can remain in the soil below four feet. The 1991 ROD's benzene soil cleanup criteria were based on numerical model predictions of the allowable benzene concentrations in soils that, when attained, would not result in exceeding the Federal drinking water standards in the underlying shallow aquifer via leaching. This modeling effort was performed as part the remedial investigation and used the SESOIL model. SESOIL is a one-dimensional vertical transport model for the unsaturated soil zone. The SESOIL model was used during a recent re-modeling effort which utilized site specific data generated from recent site characterization sampling and field testing. Results of this effort indicate that the benzene soil cleanup criteria can be raised above values in the 1991 ROD without adversely impacting the quality of ground water beneath the site. The benzene ground water cleanup criteria identified in the 1991 ROD is the Maximum Contaminant Level (MCL) of five parts per billion (5 ppb) and will remain unchanged. Additional information regarding the change in the benzene soil cleanup criteria is provided in Section 2.1 (Performance Standards) of this ROD Amendment.

This ROD Amendment also will enhance the site's remedy by identifying additional remedy components which will be used instead of or in combination with 1991 ROD remedy components to achieve the site's performance standards. For example, the 1991 ROD identified aquifer sparging as the major ground water remedy treatment component. Aquifer sparging would primarily address volatile organic contamination (i.e., benzene). This ROD Amendment enhances the ground water remedy by identifying in-situ bioremediation as the major ground water remedial treatment component. In-situ bioremediation will directly address both volatile and semivolatile organic contamination (e.g., benzene, naphthalene) in the ground water. To address soil contamination, the 1991 ROD identified soil vapor extraction as the major soil remedy treatment component. Soil vapor extraction would primarily address volatile organic contamination. This ROD Amendment enhances the soil's remedy by identifying additional in-situ soil treatment technologies such as bioventing, thermal desorption, and soil washing which may be used with soil vapor extraction to reach the remedial goals within three years. Bioventing, thermal desorption, and soil washing will directly address both volatile and semivolatile organic contamination (e.g., benzene, naphthalene) in the soil. In general, the remedy components will be applied in sequence (e.g., soil vapor extraction, bioventing, monitored natural attenuation) in order to attain the performance standards.

The ROD Amendment also modifies the 1991 ROD remedy for the site's Bayou Disposal Area from an engineered soil and synthetic liner cap to a living cap. The living cap will consist of a graded clay cap (infiltration barrier), with selected vegetation (e.g., pine trees) planted and developed so as to minimize infiltration of rainwater. Further discussion of the amended remedy is provided in

Section 2.3 (Amended Remedy) of this ROD Amendment.

The USEPA is also narrowing the site boundary to include only that property within the areal extent of contamination, as well as all suitable property in very close proximity to the contamination necessary for implementation of the remedial design and remedial action. This redefinition of the site boundary is based upon several years of field investigations and contamination data which have been collected since the boundary was originally defined.

1.5 Administrative Record

The Administrative Record is available to the public for review during regular business hours at the following locations:

Liberty Public Library

1710 Sam Houston

Liberty, Texas 77575

(409) 336-8901

Monday - Thursday 9:00 am - 6:00 pm;

Friday 1:00 pm - 5:00 pm; Saturday 10:00 am - 4:00 pm

USEPA, Region 6

7th Floor Reception Area

1445 Ross Avenue

Dallas, TX 75202-2733

toll free 1-800-533-3508

Monday - Friday 8:00 am - 4:00 pm

Texas Natural Resource Conservation

Commission - Central Records

12100 Park 35 Circle, Building D, Room 190

Austin, Texas 78753

(512) 239-2920

Monday - Friday 8:00 am - 5:00 pm

2.0. REASONS FOR ISSUING THE ROD AMENDMENT

A primary reason for issuing this ROD Amendment is to document a fundamental change in the remedy (i.e., a change in the soil cleanup criteria for benzene). The ROD Amendment also enhances the remedial approach by identifying additional soil and ground water remedy components which will be used instead of or in combination with 1991 ROD remedy components to achieve

the site's performance standards in compliance with all Federal, state, and local applicable or appropriate requirements. Further discussion of the site performance standards, the remedy selected in the 1991 ROD, the rationale for modifying the remedy, and the amended remedy for each of the site areas is provided below.

2.1 Performance Standards

The Performance Standards remain unchanged from those identified the 1991 ROD, with the exception of the benzene soil cleanup criteria. The Performance Standards include remediation goals, cleanup levels, remedial action objectives, standards of control, and other substantive requirements (e.g., Applicable or Relevant and Appropriate Requirements - ARARs), criteria, and limitations set forth in the 1991 ROD and this ROD Amendment. The 1991 ROD site contaminant cleanup levels selected for the contaminated soils and ground water are listed in Table 2-1.

The 1991 ROD benzene soil cleanup criteria were based on numerical model predictions of the allowable benzene concentrations in soils that when leached would not result in exceeding the Federal drinking water standards in the underlying shallow aquifer. As discussed above, this modeling effort was originally performed as part of the OU2 remedial investigation and used the SESOIL model. SESOIL is a one-dimensional vertical transport model for the unsaturated soil zone and was recently used to re-assess the soil cleanup criteria. The remodeling effort utilized post-1991 ROD site-specific data. The results of the remodeling suggest that the soil cleanup criteria for benzene can be raised above the 1991 ROD values without adversely impacting the quality of site ground water. The revised benzene soil remediation criteria are summarized in Table 2-2.

The results of the remodeling effort are documented in the *Turtle Bayou Superfund Site Soil Criteria Assessment Report* (ARCO, March 1997). This report and supporting information were reviewed by USEPA's National Risk Management Research Laboratory, Subsurface Protection and Remediation Division out of Ada, Oklahoma; Fluor Daniel (USEPA's project oversight contractor); and USEPA Region 6 personnel. Operational and long-term monitoring data will be collected to ensure that the soil standards are protective of human health and the environment. If any operational or long-term monitoring data indicate differences from the modeling assumptions, the models will be adjusted as necessary, and the standards may be re-evaluated.

It is important to note that the revised benzene soil cleanup criteria are in part based on having a soil permeability in the upper clay unit greater than 1×10^{-6} .

TABLE 2-1
1991 ROD SITE CONTAMINANT CLEANUP LEVELS

CONTAMINANT	SOIL CLEANUP LEVEL (ppm) ^A	SOIL CLEANUP CRITERIA	GROUND WATER CLEANUP LEVEL (ppb) ^B	GROUND WATER CLEANUP CRITERIA
Benzene	10 (from 0 to 10 feet) 0.35 (> 10 feet)	See ^C below	5.0	MCL ^D
Ethylbenzene	-----	-----	700	MCL
Lead	500	See ^E below	15	Action Level
Naphthalene	70	Health Based Value	327	Health Based Value
Xylene	-----	-----	10,000	MCL

^A ppm - parts per million

^B ppb - parts per billion

^C The remedial goal for benzene in the soil was determined based on the potential of the benzene contamination in the soil to leach into the underlying ground water aquifer, resulting in benzene contamination of the ground water exceeding the benzene MCL for drinking water. The SESOIL model was used to do this determination. It should also be noted that if detectable concentrations of benzene are found at depths greater than 10 feet, the entire soil column (from the ground surface to the maximum depth of contamination) will be remediated to a contaminant level of 0.35 ppm.

^D Maximum Contaminant Level (MCL)
 - Highest permissible concentration of a substance allowed in drinking water, as established by EPA.

^E The lead concentration goal was based on the Interim Guidance on establishing Soil Lead Cleanup Levels at Superfund Sites, September 7, 1989.

TABLE 2-2
REVISED BENZENE SOIL REMEDIATION CRITERIA

Depth Interval (feet BGS)	1991 ROD Standard (ppm)	Amended ROD Standard (ppm)	Rationale
0 - 2	10	1.33	TNRCC residential exposure standard for benzene in soil from 0 to 2 feet below ground surface.
2 - 4	10	10	Standard unchanged.
4 - 10	10	200	Additional site data and revised SESOIL modeling. See ^A below.
> 10	0.35	20	Additional site data and revised SESOIL modeling. See ^B below.

^A The basis for the 200 ppm benzene soil remediation criteria (from 4 to 10 feet BGS) was presented in Section 3.4 of the *Turtle Bayou Superfund Site Soil Criteria Assessment Report* (ARCO, March 1997). The 200 ppm value was based in part on the SESOIL model calculated infiltration rate (in the absence of organic fluid) and the effect of intrinsic bioremediation processes such as microbial fermentation on residual benzene concentrations. The soil criteria assessment report concluded that the post-active remediation residual benzene would not reach the aquifer, unless present as NAPL (Non-Aqueous Phase Liquid). Therefore, the 4 - 10 feet BGS soil cleanup criteria was based on the potential for NAPL to occur. The report concluded that NAPL is not likely to be present where soil benzene concentrations are less than 200 ppm. Where NAPL is identified on site, it will be removed either by focused in-situ remediation and/or excavation and onsite biotreatment or offsite treatment/disposal.

^B The basis for the 20 ppm benzene soil remediation criteria (below 10 feet BGS) was presented in Section 3.3 of the *Turtle Bayou Superfund Site Soil Criteria Assessment Report* (ARCO, March 1997). The 20 ppm value was based in part on the SESOIL model calculated infiltration rate and the migration of benzene dissolved in infiltrating water through the base of the upper clay unit to ground water, where it would be subject to aerobic in-situ bioremediation.

centimeters per second (cm/sec). The site's upper clay unit is comprised almost entirely of clay to a depth of 12 to 15 feet below ground surface. In some isolated areas of the site (i.e., hot spots), disposal of chemicals has resulted in high chemical concentrations that have elevated the permeability in present-day soils. The site's background soil permeability for the upper clay unit was generally constant around 7.6×10^{-7} cm/sec. The increase in permeability in clay soil above this value is attributed to the effect of chemicals on clay chemistry and soil structure. Several potential hot spots were identified and clay soil permeability testing was performed at each site. After testing, the only remaining hot spot exceeding the soil permeability criteria of 1×10^{-6} cm/sec was the MW-6 (Monitoring Well - 6) location in the Main Waste Area. The MW-6 hot spot covers an area of approximately 30 feet by 30 feet (900 square feet). In areas with high chemical concentrations, additional remedial steps such as thermally-enhanced focused soil vapor extraction may be conducted to expedite the cleanup. Additional remedial steps for the MW-6 hot spot may include excavation and/or the installation of a synthetic permeability barrier and graded cap or other infiltration control system. Information on soil permeability and site hot spots can be found in the *Soil Criteria Assessment Summary Report* (ARCO Chemical Company, September 1997).

A primary goal of this remedial action is to restore the shallow ground water to its beneficial use, which is, at this site, use as a potential source of drinking water. The shallow aquifer is not currently being used as a source of drinking water on site but does have the potential to be used as a drinking water in the future and is considered a class 2-B aquifer. A class 2-B aquifer has water quality such that it is a useable aquifer but for other reasons (i.e., low water yield capacity) is not currently used.

Ground water contamination may be especially persistent in the immediate vicinity of the contaminants' source, where concentrations are relatively high. The ability to achieve remedial levels at all points throughout the site's contaminated ground water plumes cannot be determined until the remedial system has been implemented, modified as necessary, and plume response is monitored over time. If the selected remedy cannot meet the remediation goals for both soils and ground water, at any or all of the monitoring points during the implementation, then contingency measures and goals may be necessary to replace the selected remedy and remediation goals. For example, if after attaining the soil benzene remediation criteria (i.e., 200 ppm (4 - 10 feet BGS) and 20 ppm (greater than 10 feet BGS)), the benzene ground water remediation criteria of 5 ppb can not be attained and/or maintained, additional remedial action will be taken to attain and/or maintain the 5 ppb benzene ground water remediation criteria. These additional actions may include more stringent soil benzene remediation criteria in certain areas of the site. If contingency measures constitute a significant or fundamental

change to what is discussed in this ROD Amendment, an Explanation of Significant Differences (ESD) or subsequent ROD Amendment will be required. Changes to the remediation goals (i.e., performance standards) would constitute a fundamental change and would require a ROD Amendment.

2.2 Remedy Selected in 1991 ROD

The remedy selected in the September 6, 1991 ROD included the following remedy components:

- soil vapor extraction to remove volatile organics from affected soils;
- air injection below affected soils to enhance removal of volatile organics;
- air injection at the base of the shallow water bearing zone to remove volatile organic contaminants from the ground water;
- vapor collection and transport system;
- catalytic thermal destruction of volatile organic compounds from the soil and ground water;
- vertical air infiltration control by an engineered soil and synthetic liner cap;
- horizontal migration control via slurry wall;
- installation of structures to control and treat surface water run-on/run-off;
- monitoring ground water; and
- the restoration of the site surface upon completion of the remedial action.

2.3 Rationale for Amending the Remedy Selected in the 1991 ROD

Amending the 1991 ROD remedy to include additional remedy components will help achieve the site's performance standards in a more cost effective and more timely manner while still being protective of human health and the environment and attaining site performance standards. The field pilot studies have demonstrated the effectiveness of soil vapor extraction in removing volatile contamination (i.e., benzene from subsurface silty soils). The field pilot studies have also demonstrated the effectiveness of additional remedial components identified in this ROD Amendment (e.g., bioventing, in-situ aquifer remediation, etc.) in addressing both volatile contaminants (e.g., benzene) and semivolatile

contaminants (e.g., naphthalene). This information has been used to develop area specific remedial systems. The systems are designed to be flexible so that they can be redefined in response to sampling data and in response to field conditions. The field pilot studies have shown this flexible approach to be an effective means of addressing varying geologic conditions at the site and area specific contamination profiles.

2.4 Amended Remedy

The amended remedy includes the use of various remedy components, used independently or in combination to achieve the site's performance standards. When the application of remedial components is sequenced, the transition from one remedy component to the following component will generally be determined by progress sampling. In general, benzene will be the primary chemical of concern; the levels of benzene will be measured periodically over time; a significant decrease in the time rate removal of benzene will indicate a remedy component change.

As part of the field pilot study program, a vapor collection and transport system has been constructed whereby the extracted vapors are piped to either the site's Main Waste Area or the Easement Area for treatment (thermal oxidation). Similarly, a ground water collection and transport system has been constructed whereby all extracted ground water is piped for treatment to a central wastewater treatment plant. The wastewater treatment plant is located within the site's Main Waste Area. These systems will continue to be used during the full-scale site remediation.

In general, contaminated soils in the West Road Area, Main Waste Area, Office Traller Area, and the Easement Area will be remediated by the sequenced application of soil vapor extraction, bioventing, and monitored natural attenuation. The contaminated soils contained within the above ground landfill located in the Main Waste Area will be remediated by a combination of soil vapor extraction and aqueous phase bioremediation. As discussed in Section 1.1 (Site Background), approximately 5,900 cubic yards of highly contaminated soils were excavated from Frontier Park Road and consolidated within the above ground landfill. The implementation of soil vapor extraction system and aqueous phase bioremediation (APB) system will be cycled (i.e., two weeks SVE only, followed by two weeks APB). Sumps of the above ground landfill be dewatered during both the SVE and APB functions to prevent the SVE vacuum from becoming water-logged from the APB injection. If necessary, additional remedial components (i.e., bioventing, soil washing, etc.) could be implemented if necessary to achieve the performance standards for the soils in the above ground landfill. In summary, Table 2-3 lists

the anticipated soil remedial components to be used to achieve the site's soil performance standards.

The 1991 ROD did not provide for treatment in the Bayou Disposal Area because of the low levels of contamination in the soil in this area. The remedy addressing the contaminated soils within the Bayou Disposal Area, as identified in the 1991 ROD, was "vertical infiltration control by engineered soil and synthetic liner cap." The amended remedy for the Bayou Disposal Area is a living cap. The living cap will consist of a graded clay cap (vertical infiltration barrier) planted with selected vegetation (e.g., pine trees). The living cap will fulfill the goal of the engineered soil and synthetic liner cap by minimizing the infiltration of rain water, thereby reducing the potential migration of soil contaminants into the underlying shallow ground water.

There are several advantages of the living cap over the traditional engineered soil and synthetic liner cap. Vegetation is aesthetically pleasing; it can provide information on the health of the site and a desirable habitat for wildlife. Vegetation can be managed inexpensively. A traditional engineered soil and synthetic liner cap would require the removal of deep rooted vegetation (i.e., saplings) to maintain its effectiveness. This is important to note given the fact that the Bayou Disposal Area is in a heavily wooded area.

Soil contamination data collected at the Bayou Disposal Area indicate that these soils already meet the soil cleanup criteria. However, within the ground water beneath these soils, benzene concentrations (up to 11 ppb benzene) which slightly exceed the benzene ground water MCL of 5 ppb benzene have been detected. In order to ensure long-term protectiveness of the Bayou Disposal Area remedy, a ground water monitoring program will occur. The purpose of the ground water monitoring program will be to ensure that contaminant levels in the ground water do not increase and are in fact being reduced by natural remediation processes (i.e., biodegradation, dilution/dispersion, adsorption). For the living cap to achieve long-term effectiveness, it will be necessary to maintain the vegetation and make repairs as necessary to correct the effects of settling, subsidence, erosion, or other events.

As previously noted, some areas of the site have been identified as hot spots. Within these hot spots, high contaminant concentrations of dissolved and/or free phase non-aqueous phase liquids (NAPLs) were found during contaminant investigations. Hot spots have been identified within the Main Waste Area, Office Traller Area, and the Easement Area which have benzene soil concentrations in excess of 100,000 ppb at depths greater than 10 feet.

**TABLE 2-3
CONTAMINATED SOIL REMEDIAL COMPONENTS**

	WEST ROAD AREA	MAIN WASTE AREA	ABOVE GROUND LANDFILL	OFFICE TRAILER AREA	EASEMENT AREA	BAYOU DISPOSAL AREA
SOIL REMEDIAL COMPONENTS	THE NUMBERING BELOW INDICATES THE ANTICIPATED APPLICATION SEQUENCE OF REMEDIAL COMPONENT PER AREA					
Soil vapor extraction *	1	1	1	1	1	
Bioventing	2	2	3	2	2	
Soil washing	3	3	4	3		
Aqueous phase bioremediation			2			
Containment *		4				1 - Living Cap
Storm water management controls *	4	5	5	4	3	2
Monitored natural attenuation	5	6	6	5	4	3
Institutional controls	6	7		6	5	4

* 1991 ROD Remedy Component

The average hot spot surface dimension is 18 feet by 30 feet with an average maximum depth of 14 feet below ground surface. In order to expedite soil cleanup in these areas, additional remediation components such as focused thermally-enhanced soil vapor extraction may be conducted. Focused thermally-enhanced soil vapor extraction is currently planned for hot spots within the Easement Area and Main Waste Area. For the MW-6 hot spot located within the Main Waste Area, excavation with on-site or off-site treatment and disposal may be necessary. Additionally, the installation of a synthetic impermeable barrier and graded cap or other infiltration control system may also be necessary to ensure remedy protectiveness in the MW-6 area. Table 2-4 lists remedial components which may be used in addition to the remedial components listed in Table 2-3 to address and expedite cleanup of site hot spots. With the exception of the Bayou Disposal Area and possibly the isolated areas with soil lead concentrations above

**TABLE 2-4
SOIL HOT SPOT REMEDIAL COMPONENTS**

Remedial Components Listed in Anticipated Application Sequence
Focused Soil Vapor Extraction *
Thermal Desorption
Focused hot spot excavation and on site biotreatment
Focused hot spot excavation and off-site disposal/treatment
Containment/infiltration control *

• **1991 ROD Remedy Component**

- Note 1)** The excavation of soils from "hot spots" and on-site or off-site treatment/disposal will be done only if the "hot spots" are negatively affecting remedial progress in specific areas (e.g., the MW-6 area where the soil permeabilities exceed 1×10^{-6} cm/sec).
- 2)** Hot spot remedial components may be performed in addition to the components listed in Table 2-3.

500 ppm, remedy components emphasizing treatment are required for all areas of the site soils.

Contaminated ground water from the West Road Area, the Main Waste Area, the Office Trailer Area, and the Easement Area will be remediated by in-situ bioremediation. If necessary, selected directional containment could be used to direct the flow of contaminated ground water to facilitate treatment and/or removal of the contaminated ground water. Table 2-5 lists the remedial components to be used to remediate contaminated ground water. Contaminated ground water pumped from the production wells is treated at the site's wastewater treatment plant to meet TNRCC's surface water discharge standards (See Tables 2-6 and 2-7) and discharged on-site.

TABLE 2-5
CONTAMINATED GROUND WATER REMEDIAL COMPONENTS

	WEST ROAD AREA	MAIN WASTE AREA	OFFICE TRAILER AREA	EASEMENT AREA
GROUND WATER REMEDIAL COMPONENTS	THE NUMBERING BELOW INDICATES THE ANTICIPATED APPLICATION SEQUENCE OF COMPONENT PER AREA			
In-Situ Bioremediation	1	1	1	1
Selected Directional Containment *	2	2	2	2
Monitored Natural Attenuation	3	3	3	3
Institutional controls	4	4	4	4

* 1991 ROD Remedy Component

TABLE 2-6
SURFACE WATER DISCHARGE LIMITATIONS

PARAMETER	Daily Maximum mg/l	Measurement Frequency	Sample Type
Carbonaceous Biochemical Oxygen Demand (5-day)	20	1/week	Composite
Ammonia as Nitrogen (NH ₃ -N)	10	1/week	Composite
Total Suspended Solids (TSS)	20	1/week	Composite
Total Organic Carbon (TOC)	100	1/week	Composite
Total BTEX (*1)	0.5	2/month	Grab
Total Lead	0.5	2/month	Grab
Naphthalene	0.047	2/month	Grab
Total Chlorinated Organics	0.5	2/month	Grab

(*1) Total of benzene, toluene, ethyl benzene, and total xylene

1. The daily average flow of effluent shall not exceed 0.20 million gallons per day (MGD).
2. The total volume discharged during any 24-hour period shall not exceed 0.50 MGD.
3. The water discharge shall not exceed the daily maximum effluent limitations listed above.
4. The pH of the effluent discharge shall not be less than 6.0 nor greater than 9.0 standard units at any time.
5. The dissolved oxygen level shall be, at a minimum, 2.0 mg/l.
6. The water discharge shall not contain floating solids, visible oil or foam in other than trace amounts.

**TABLE 2-7
OTHER EFFLUENT LIMITATIONS**

The water discharge must also comply with the following effluent limitations.

Pollutant	Daily Maximum (mg/l)
Aldrin	0.005
Aluminum	1.785
Arsenic	1.300
Cadmium	0.185
Carbaryl	0.003
Chlordane	0.004
Chlorpyrifos	0.0001
Chromium (3 +)	13.50
Chromium (6 +)	0.028
Copper	0.092
Cyanide	0.081
4-4-DDT	0.002
Dicofol	0.105
Dieldrin	0.004
Diuron	0.374
Endosulfan I (alpha)	0.0004
Endosulfan II (beta)	0.0004
Endosulfan Sulfate	0.0004
Endrin	0.0003
Heptachlor	0.0009
Hexachlorocyclohexane	0.004
Mercury	0.004
Nickel	5.792
PCB, Total	0.004
Parathion	0.0001
Phenanthrene	0.053
Pentachlorophenol	0.024
Selenium	0.036
Silver, Total Equivalent	0.015
Toxaphene	0.0014
Tributyltin	0.0002
2-4-5 Trichlorophenol	0.242
Zinc	0.708

Note: The list of pollutants above are expected to be below the effluent limitations specified and no monitoring of these pollutants is required. However, if the quality of the discharge water was to approach the effluent limitation for a specific pollutant, then the discharge water should be monitored for that parameter at a frequency of twice per month by grab sample.

Definitions:

Daily maximum concentration - the maximum concentration measured on a single day by composite sample or arithmetic average of all grab samples taken during a single day.

Composite sample - a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow collected no closer than two hours; or a sample continuously collected, proportional to flow, in a continuous 24-hour period or during the period of daily discharge if less than 24-hours.

Grab sample - an individual sample collected in less than 15 minutes.

2.5 Remedy Component Description

The following are brief descriptions of the various remedy components anticipated for the site.

Soil Vapor Extraction (SVE)

SVE involves the use of vapor extraction wells which induce air flow through the contaminated soils above the water table. The air flow facilitates the removal of volatile contaminants in the extracted vapor form from contaminated soils. The extracted vapor can then be captured or/and destroyed. During the field pilot study program, in addition to traditional SVE wells, dual media (soil vapor and ground water) extraction wells were used to enhance the recovery rate of affected ground water, lower the water table, and remove organic vapors from the expanded unsaturated zone. The extracted vapors were either captured in carbon units or destroyed in a on-site thermal oxidizer. The extracted ground water was initially shipped off-site for disposal prior to construction of the on-site water treatment plant. The existing SVE systems (extraction wells, transport systems, catalytic oxidation destruction unit) will continue to be used during the full-scale remediation effort.

Soil Excavation and Off-Site Treatment and/or Disposal

Soil excavation and off-site treatment and/or disposal may be used to address site "hot spots" and/or possibly the isolated site areas with lead contamination. Hot spots are defined as areas with high contaminant concentrations often containing dissolved and/or free phase non-aqueous phase liquids (e.g., oils). Hot spots have been identified within the Main Waste Area, Office Trailer Area, and the Easement Area which have benzene soil concentrations in excess of 100,000 ppb at depths greater than 10 feet. Excavation will only be utilized in site hot spots where in-situ treatment is not practicable. As shown in Table 2-4, only after the application of focused soil vapor extraction and thermal desorption, is the possible use of soil excavation anticipated. If soil excavation occurs, the excavated soil would be transported to a licensed off-site treatment and/or disposal facility. Clean soil would be brought to the site for use as backfill in the excavated areas. These areas would then be seeded to provide a vegetative cover and restored to their original conditions.

Soil Excavation and Biotreatment

Soil excavation and on-site biotreatment may be used to address site "hot spots." Biotreatment is a technology that uses bacteria to degrade organic contaminants in soil. These bacteria are capable of degrading organic compounds

into water and carbon dioxide. Contaminated soil requiring treatment would be excavated and placed in a treatment cell. The treated soil would be used as backfill for the excavated areas or transported to a licensed off-site disposal facility.

Bioventing

Bioventing is the process whereby SVE is operated intermittently to aerate soils so that the oxygen supplied stimulates the in-situ degradation of contaminants.

Soil Washing

The use of soil washing refers to the in-place treatment of contaminated shallow soils by flushing these soils with wash solution. No excavation or removal of contaminated soils is required. Injection wells are used in combination with extraction wells such that wash solution flow cells are developed which flush injection water through the contaminated soils. The flushing cell is essentially a closed system. However, the extraction rate is normally slightly higher than the injection rate, to ensure capture of all wash solution. The contaminants most amenable to removal by this method are those that can readily be dissolved. The extracted water would be taken off-site for disposal or pumped to the site's water treatment plant, treated to standards developed by the TNRCC, and discharged.

Thermal Desorption

Thermal desorption is a commonly used separation process for volatile organic compounds in which contaminated soils, sludge, or other waste are heated so that volatile and semivolatile organic compounds are driven off as gases. The thermal desorption process is design to separate organics from the matrix, but not destroy them (although some thermal destruction may occur). Air, combustion gas, or inert gas (such as nitrogen, which may be introduced to impede combustion) is introduced to the waste stream and carries volatilized contaminants to air pollution control equipment. At the site, contaminated soils would be heated in place (in-situ), and volatile organics would be extracted and treated using the existing SVE systems (e.g., extraction wells, transport systems, catalytic oxidation destruction unit).

Aqueous Phase Bioremediation

Aqueous phase bioremediation is an in-situ process that floods contaminated soils and circulates oxygenated water with nutrients, stimulating bacteria and other microbial forms of life to help clean up soil contamination. No excavation or

removal of contaminated soils is required. Injection wells are used in combination with extraction wells such that oxygenated water flow cells are developed in the contaminated soil zone. The flow cell is essentially a closed system. However, the extraction rate normally is slightly higher than the injection rate, to ensure capture of all injected water. The extracted water may be suitable for re-injection, or may be more appropriately discharged elsewhere and an alternative injection water supply used. During the field pilot study, extracted water from the pilot study in-situ aquifer bioremediation systems was pumped to the site's water treatment plant, treated to standards developed by the TNRCC, and discharged. The site water treatment plant will continue to be used during the full-scale site remediation. It is anticipated that this technology will be used to help remediate contaminated soils within the site's above ground landfill.

Containment

Containment involves isolating the contaminated soils and/or ground water to prevent direct contact and minimize the potential for contaminants to migrate. Containment often involves the construction of a cap and/or slurry wall. At the Bayou Disposal Area, a living cap will be constructed. The living cap will consist of a graded clay cap with selected vegetation (e.g., pine trees) planted and developed so as to minimize infiltration of rain water. In areas where high chemical concentrations that have elevated the permeability in present-day soils above 1×10^{-6} cm/sec (e.g., MW-6 hot spot), the installation of a synthetic impermeable barrier and graded cap or other infiltration control system may be necessary.

Storm water management controls

Storm water management controls include the installation of barriers and/or grading to divert storm water run-off from disturbed areas and/or completed areas of the site.

In-situ Aquifer Bioremediation

In-situ aquifer bioremediation refers to the in-place treatment of a contaminated aquifer using bacteria and other microbial forms of life to help clean up contamination. No excavation or removal of contaminated soils is required. Injection wells are used in combination with extraction wells such that groundwater flow cells are developed which flush injection water through the intervening aquifer zone. The flushing cell is essentially a closed system. However, the extraction rate normally is slightly higher than the injection rate, to ensure capture of all injected water. The injected water is normally amended with oxygen and nutrients (i.e., nitrogen, phosphate) which help to stimulate the natural

bioremediation process. During the field pilot study, extracted water from the pilot study in-situ aquifer bioremediation systems was pumped to the site's water treatment plant, treated to standards developed by the TNRCC, and discharged. The site water treatment plant will continue to be used during the full-scale site remediation.

Selected Directional Containment

Selected directional containment involves the use of an in-situ barrier (i.e., slurry wall) to direct the flow of contaminated ground water in order to facilitate treatment and/or removal of the contaminated ground water.

Monitored Natural Attenuation

Natural attenuation is an approach that focuses on the verification and monitoring of natural remediation processes (i.e., biodegradation, dilution/dispersion, adsorption) rather than relying totally on "engineered" processes. The selection of monitored natural attenuation as a component of the site remedy will be based on its ability to achieve remediation goals in a reasonable time frame (e.g., within a 15-year period) and be protective of human health and the environment. Monitored natural attenuation, just as any remedy, must comply with state groundwater use classification and cleanup standards. While monitored natural attenuation alone may be unable to achieve cleanup standards within a reasonable time, a combination of monitored natural attenuation and active remediation (e.g., source reduction, SVE, in-situ aquifer bioremediation) often will be able to attain the cleanup standards in a reasonable time. It is currently anticipated that the soil remediation goals will be attained by the active remediation phase by January 2000. In regards to ground water contamination, it is also anticipated that most areas will be able to meet the ground water remediation goals by active remediation (e.g., in-situ aquifer bioremediation) by January 2000. However, in one or two areas of the site, the monitored natural attenuation remedy component may be necessary to ensure that the ground water contamination will decrease to Federal Drinking Water Standards over a 15-year period.

Institutional Controls

Institutional controls are legal and administrative measures that prevent exposure to contaminants at concentrations above health-based risk levels that may remain at a site. Usually institutional controls limit activities at or near sites. The objective of institutional controls are to ensure the long-term protectiveness of completed remedial actions. Institutional controls include requirements for providing notice (i.e., Deed Recordation) in the real property records for properties

where residual contamination (contamination below the performance standards) will remain. Specific examples of institutional controls which will be appropriate for this site are: depth limitations on excavating soils in certain areas, restrictions on locations for potable water wells, specified foundation design for dwellings in certain locations, and specific design and construction details for potable water wells. Institutional controls at the Petro-Chemical site will supplement containment and treatment remedies to reduce potential threats to human health and the environment.

At the completion of the active remediation phase in each area of the site, concentrations of certain chemicals will exist in the soils and ground water at specific locations. It is anticipated that the concentrations of the chemicals in the shallow ground water, the water bearing unit (18 feet to 28 feet below ground surface) will decrease to Federal Drinking Water Standards over a 15-year period via natural attenuation. The concentrations of chemicals in soils at the completion of active remediation will not change significantly over time due to natural processes, but the concentrations of chemicals in the soils will be such that the soils are not a significant ongoing source of chemicals to the shallow ground water. Since concentrations of chemicals will be left on-site, it will be necessary to establish the institutional controls described above to insure no excess risk to human health or the environment.

At this time, site residents obtain their water from wells screened in a deep water-bearing zone located about 125 feet below ground surface. There is no natural vertical migration from the shallow water-bearing zone (18 feet to 24 feet below ground surface) to the deeper water-bearing zone. Care must be taken to insure that water wells into the deeper zone (deeper than 125 feet) do not create an artificial pathway for chemical migration.

Not all of the above mentioned institutional controls will be necessary for every area of the site. Some controls may be interim until specified milestones are achieved; other controls may be permanent. The effectiveness of the institutional controls and of natural attenuation will be tracked as part of the long-term monitoring program. If monitoring results indicate an increased risk to human health or the environment, then further active remediation and/or modifications of the institutional controls may be necessary. If these modifications constitute a significant change to what is discussed in this ROD Amendment, an Explanation of Significant Differences (ESD) may be required.

3.0 COMPARATIVE ANALYSIS

A comparative analysis of the 1991 ROD remedy and the ROD Amendment remedy is presented in the following sections.

3.1 Treatment Components

The contaminated soil treatment component identified in the 1991 ROD is soil vapor extraction. In addition to the basic SVE configuration, various modifications to the basic SVE configuration were evaluated during the field pilot study efforts including: using air injection wells, running the test with and without land surface cover (i.e., cap), running a SVE system as long-term bioventing system, etc. The results of the soil vapor extraction pilot study were positive (i.e., vacuum propagation was quicker than expected). The SVE extraction wells and control equipment have been effective in removing site volatile contamination.

This ROD Amendment expands the current list of 1991 ROD soil remedy components available for implementation at the site. These additional soil remedy components include bioventing, thermal desorption, aqueous phase bioremediation, soil washing, soil excavation and biotreatment, and soil excavation and offsite treatment and/or disposal. The anticipated application sequence of various soil remedial components for each site area is shown in Tables 2-3 and Table 2-4. In general, in-situ active soil remediation technologies (i.e., soil vapor extraction) will be implemented first followed by less active in-situ treatment technologies (e.g., bioventing). Soil treatment technologies involving excavation and treatment (e.g., soil excavation and biotreatment) may be necessary if the in-situ technologies are unable to achieve the performance standards. The existing pilot study treatment systems (i.e., pilot study SVE systems) will continue to be used and expanded during full-scale remediation activities. On-site treatment technologies will be utilized on all areas of the site soils except the Bayou Disposal Area and possibly the isolated areas with elevated lead concentrations (greater than 500 ppm).

The treatment component in the 1991 ROD for addressing contaminated ground water included in-situ air stripping of volatile organic contaminants. This technology basically consists of injecting air into a contaminated aquifer. The injected air facilitates the mobilization of volatile organic compounds which can then be extracted by SVE wells located above the water table.

This ROD Amendment identifies in-situ aquifer bioremediation as the primary ground water treatment component. This component was not identified in the 1991 ROD but was evaluated during the pilot study. In-situ bioremediation pilot tests have achieved steady state conditions and have shown good distribution of oxygen and nutrients. Significant remediation progress has occurred in these pilot areas. The existing in-situ aquifer bioremediation pilot study treatment systems will continue to be used and expanded during full-scale remediation activities.

During the field pilot studies, the extracted water from various pilot study

treatment systems (e.g., in-situ bioremediation systems, aqueous phase bioremediation system) was pumped to the site's water treatment plant, treated to the standards developed by the TNRCC, and discharged on site. The site water treatment plant will continue to be used during the full-scale site remediation.

Catalytic thermal destruction of volatile organics was identified as the treatment component in the 1991 ROD for addressing the extracted volatile organic vapors from the SVE and in-situ air stripping systems. During the field pilot study program, two catalytic thermal oxidizers were used to destroy extracted vapor from the pilot SVE and in-situ bioremediation systems. These units have been field tested to determine their destruction efficiencies. The destruction efficiency for volatile organic compounds exceeded 99.87% through the Easement Area oxidizer and exceeded 99.98% through the Main Waste Area oxidizer. The test runs were consistent and reproducible. Both oxidizers are operating within design ranges. Prior to the operation of the catalytic thermal oxidizer, extracted vapors from the SVE pilot tests were routed through a carbon adsorption system (CAS) consisting of two carbon canisters connected in series. The CAS has also proven to be effective in removing the organic vapors from the extracted vapor.

The amended remedy requires destruction and/or control of extracted volatile organic vapor to the extent necessary to protect health and the environment. The two catalytic thermal oxidizers will be used to the maximum extent practicable during the full-scale site remediation. It may be necessary to include an air stripper with the thermal oxidizer unit to remove chlorinated compounds if these compounds are present in concentrations detrimental to the thermal oxidizer unit. Both units will be operated in compliance with 30 TAC Chapter 106.533 (formerly TNRCC Standard Exemption No. 68). 30 TAC Chapter 106.553 states that for treating ground water or soil contaminated with petroleum hydrocarbons, the total emissions of petroleum hydrocarbons shall not exceed 1.0 pound per hour (lb/hr), except that benzene emissions also must meet the conditions of §106.262(3) and (4) of that title (relating to Facilities (Emissions and Distance Limitations)(previously TNRCC Standard Exemption No. 118)). Based upon an evaluation of the estimated emissions, the requirements of 30 TAC Chapter 106.553, and the benzene conditions of §106.262(3) and (4), the maximum allowable emission rate is 6 lbs/hr for acetone, 0.375 lb/hr for benzene, and 1 lb/hr for all remaining chemicals.

3.2 Containment Components

The containment components identified in the 1991 ROD include the use of engineered soil and synthetic liner cap to minimize storm water infiltration and the use of slurry walls to prevent the spread of contamination in ground water. As

stated previously, the cap system for the Bayou Disposal Area has been amended from an engineered soil and synthetic liner cap to a living cap. For the living cap to achieve long-term effectiveness, it will be necessary to maintain the vegetation and make repairs as necessary to correct the effects of settling, subsidence, erosion, or other events. Long-term operation and maintenance (O&M) will be conducted to ensure the integrity of the cap consistent with federal regulations (i.e., 40 C.F.R. §264.117 - Post-closure care and use of property). For other areas of the site, treatment technologies will primarily be used to address contamination. However, the use of containment components (i.e., caps, slurry walls) may be used as warranted in conjunction with treatment technologies for vertical infiltration control, horizontal migration control, and/or directional migration control.

3.3 Ground Water Components

The ground water components in the 1991 ROD include the removal of volatile organic compounds from ground water using vapor extraction (in-situ air stripping), a vapor collection and transport system, catalytic thermal destruction of volatile organics, and horizontal migration control via slurry wall. The 1991 ROD also noted that the need for remedial action in the shallow aquifer around monitoring well MW 12R (located on the west side of the Easement Area) and around monitoring well MW 19 (completed within the deep aquifer beneath the Office Area Trailer Area) would be based upon the results of subsequent sampling events. Previous sampling at these locations found benzene and lead contamination at concentrations near their respective ground water cleanup levels. For example, previous ground water samples from MW12R obtained in 1989 and 1991 slightly exceeded the lead ground water cleanup criteria of 15 $\mu\text{g/l}$ (52.4 $\mu\text{g/l}$ in 1989 and 18 $\mu\text{g/l}$ in 1991). Similarly, previous ground water samples from MW19 slightly exceeded the benzene ground water cleanup criteria of 5 $\mu\text{g/l}$ (7 $\mu\text{g/l}$ in 1990). MW19 was installed as a replacement well for an improperly installed residential well. The residential well was believed to be acting as a conduit for contaminated ground water to migrate from the shallow ground water zone to the deeper 100 foot zone. The 1991 ROD stated that if subsequent sampling indicated that remedial action in these areas was necessary, the following will be implemented:

Extract contaminated ground water by wells and/or trenches and store in surface tanks. Sample the extracted ground water. If the samples showed contaminant concentrations above surface water discharge levels - treat to below surface water discharge criteria and discharge. If the samples showed contaminant concentrations below surface water discharge criteria - the water would be discharged.

The amended remedy's ground water component specifies treatment of affected ground water using in-situ bioremediation. As stated previously, extensive in-situ bioremediation pilot tests have been conducted and have been shown to be an effective approach of addressing ground water contamination. The amended remedy will be required to meet the 1991 ROD's ground water performance standards.

If it appears that after a sufficient period of implementation that the selected ground water remedy will not be able to achieve the remedial goals set for the site, some or all of the following contingency measures may be implemented:

- Discontinuing operation of the in-situ remediation system and using extraction wells and/or trenches to remove contaminated ground water in areas where cleanup goals have not been attained.
- Establishing an Alternative Concentration Limit for the contaminants throughout the areas of attainment, provided compliance with CERCLA Section 121 (d)(2)(B)(ii) can be demonstrated;
- Waiving of the ground water ARAR for those portions of the aquifer based on technical impracticability of achieving further contaminant reduction¹;
- Containment of the contaminated soil and ground water by caps and slurry walls;
- Implementing additional source control treatment to further reduce contaminant migration to ground water.

If these contingency measures constitute a significant or fundamental change to this ROD Amendment, an ESD or subsequent ROD Amendment will be required. Changes to the remediation goals would constitute a fundamental change and would require a ROD Amendment.

3.4 General Components

The general components in the 1991 ROD include:

- site preparation and installation of office, storage, and security facilities;

¹ Technical impracticability waivers need to be done consistent with OSWER Directive 9234.2-25 (Guidance of Evaluating the Technical Impracticability of Ground Water Restoration).

- installation of structures to control and treat surface water run-on/run-off;
- monitoring ground water;
- dismantling of the on-site landfill with a determination and (if warranted) remedial action for the potentially contaminated soils underlying the vault; and restoration of the site surface upon completion of the remedial action.

The general components of the Amended ROD are the same as in the 1991 ROD except as discussed below:

- The ROD Amendment allows for the optimal use of natural trends and passive systems to achieve the performance standards.
- The ROD Amendment identifies Monitored Natural Attenuation and Institutional Controls as remedy components.

3.5 Major Applicable or Relevant and Appropriate Requirements (ARARs)

CERCLA section 121(d)(2) requires remedial actions to at least attain applicable or relevant and appropriate requirements (ARARs) of Federal and State environmental laws. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance at a Superfund site. Relevant and appropriate requirements are standards which address problems or situations sufficiently similar to those encountered at the Superfund Site which warrant their use.

3.5.1 Source Control (Soil Remediation) ARARs

The 1991 ROD identified the following source control (soil) ARARs:

Source Control Chemical Specific ARARs

- The site wastes were examined to determine if they qualified as Resource Conservation and Recovery Act (RCRA) hazardous waste. Some site wastes were identified as being RCRA characteristic hazardous wastes. Because the site wastes are RCRA waste, RCRA land disposal restrictions (LDRs) are applicable for the remedial alternatives that involve removal and placement of contaminated soils (e.g. excavation and off-site disposal). As discussed in the Office of Solid Waste and Emergency Response Superfund Publication 9347.3-05FS, for in situ treatment and consolidation of waste, if

consolidation of contaminated soils takes place within a single "Area of Contamination," placement has not occurred and LDRs would not be applicable. For the site's Bayou Disposal Area, LDRs are not applicable since the remedial alternative for this area does not involve removal and placement of contaminated soils.

- National Ambient Air Quality Standards (NAAQS), 40 CFR Part 50, establish regulations for specific air pollutants such as benzene, which was determined to be one of the primary contaminants at the site. Both the 1991 ROD and ROD Amendment alternatives have the potential to generate air emissions during implementation and therefore NAAQS are applicable.
- The Texas Natural Resource Conservation Commission (formerly the Texas Air Control Board (TACB)) General Rules require compliance with USEPA Federal Clean Air Act and NAAQS.
- National Emission Standards for Hazardous Air Pollutants (NESHAP) establish regulations for specific air pollutants such as benzene, which was determined to be one of the primary contaminants at the site.

Source Control Action-Specific ARARs

The 1991 ROD identified the following action-specific ARARs for treatment of extracted contaminant-laden vapors, for leaving low level contaminant concentrations on the site, and for excavation and offsite disposal of waste:

- The Clean Air Act, under the regulatory section on Permitting (40 CFR Part 61), requires permits for the discharge of pollutants for point sources, area sources or fugitive emissions. The substantive requirements for a permit will be required for site discharges.
- The TNRCC General Rules, specifically 30 TAC Chapter 101, require compliance with USEPA Federal Clean Air Act and NAAQS. The substantive requirements for a permit will be required for all site operations.
- The requirements of 30 TAC Chapter 106 will be met. 30 TAC Chapter 106.533 (formerly TNRCC Standard Exemption No. 68) states that for treating ground water or soil contaminated with petroleum hydrocarbons, the total emissions of petroleum hydrocarbons shall not exceed 1.0 pound per hour (lb/hr), except that benzene emissions also must meet the conditions of §106.262(3) and (4) of this title (relating to Facilities (Emissions and Distance Limitations)(previously TNRCC Standard Exemption No. 118).

- Fugitive emissions monitoring, as specified in TNRCC 30 TAC Chapter 115 (Regulation V) or USEPA's New Source Performance Standards (40 CFR Part 60) or USEPA's National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61) will apply.
- Since contaminants will be left on site, the RCRA Closure and Post Closure requirements may be relevant and appropriate. CERCLA establishes that remedial actions must be reviewed should contaminants be left on site. Other substantive requirements will be necessary, including monitoring and deed recordation.
- Offsite disposal of waste will need to comply with USEPA's Offsite Rule (40 C.F.R. Part 300.440), the RCRA land disposal restrictions, and all current federal and state regulations for transport of waste to the receiving facility.
- The Solid Waste Disposal Act, Contingency Plan for Emergency Procedures, Subpart D, will also be applicable since on-site treatment has been selected.

Source Control Location-Specific ARARs

- Resource Conservation and Recovery Act (RCRA) requirements for location of a Treatment, Storage or Disposal facility in a 100-year floodplain, 40 CFR Part 264.18, and also general requirements for the protection of floodplains, 40 CFR Part 6, Appendix A, are relevant and appropriate because the site's Bayou Disposal Area is within a 100-year flood plain.

3.5.2 Ground Water Remediation ARARs

The 1991 ROD identified the following ground water remediation ARARs:

Ground Water Remediation Chemical Specific ARARs

- The National Primary Drinking Water Standards establish health-based standards for public drinking water systems (maximum contaminant levels - MCLs). MCLs are ARARs for the site since the affected ground water may be potentially used as a future drinking water source.
- Sections of the Clean Water Act and regulations concerning Water Quality Criteria (WQC) and Ambient Water Quality Criteria (AWQC), 40 C.F.R. Part 131 set criteria for water and ambient water quality based on human health and toxicity to aquatic organisms, respectively. WQCs and AWQCs for site chemicals are ARARs if the selected alternative calls for discharge to a

surface water. Because activities will be performed on-site, permits may not be required, but the technical standards of the permits must be met.

- The Drinking Water Standards for Public Water Supply Systems establish health-based standards for a specific list of contaminants for public water supply systems. These are identical to federal standards promulgated under the Safe Drinking Water Act and are site ARARs.
- Under the State of Texas Rules, Surface Water Quality Standards (30 T.A.C. Chapters 307.1 - 307.10), criteria are established for surface water quality and criteria and control procedures for specific toxic substances. These are ARARs since the selected alternative calls for discharge to a surface water.

Action Specific Ground Water Remediation ARARs

- Resource Conservation and Recovery Act (RCRA) requirements for Post-Closure and Monitoring, 40 CFR Part 264.117(a) (1), will be requirements for at least 30 years.
- The source control action-specific ARARs previously discussed (i.e., 30 TAC Chapter 106.533, 30 TAC Chapter 101.4, and 40 CFR Part 61), which relate to the use of equipment to reclaim or destroy chemicals removed from contaminated ground water for the purpose of remedial action are also action specific ground water ARARs.
- The National Pollutant Discharge Elimination System (NPDES), 40 CFR Part 125, requires permits for the discharge of pollutants for any point source and storm-water runoff for specific standard industrial classification (SIC) codes into waters of the United States. Substantive requirements for a permit must be met for discharge to a surface water body at the Petro-Chemical Systems, Inc. site.
- The Safe Drinking Water Act, Underground Injection Control Regulations (40 CFR Parts 144-147), provides for protection of underground sources of ground water. This will be an ARAR if ground water remediation involves injection to enhance remediation.
- Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal (TSD) Facilities, Subpart I (Use and Management of Containers), and Subpart J (Tanks) are also ARARs. These will be ARARs for ground water because the selected alternative involves storage of containers of hazardous waste or involve the use of tanks to treat or store hazardous materials.

- The State of Texas Rules, Wastewater Permitting, Texas Water Code Section 26.027, 30 TAC 305, allow TNRCC to issue permits for the discharge of waste into or adjacent to waters of the state. The substantive requirements of permits may be an ARAR since the remedy includes discharge of treated wastewater or storm-water.
- Under 30 TAC 115.132, volatile organic compound water separators must apply one of the following control measures:
 Sealed vessel (vapor tight), or
 Floating roof or internal floating cover, or
 Vapor recovery systems which meets requirements of 30 TAC 115.131(a).

Exemptions are provided in 30 TAC 155.137. This will be an ARAR if volatile organic compound water separators are used.

Location-Specific Ground Water Remediation ARARs

- Under the State of Texas Rules, Ground Water Protection Act, Texas Water Code Section 26.401, ground water is required to be restored, if feasible. This is an ARAR because ground water is affected.
- RCRA requirements for location of a Treatment, Storage or Disposal facility in a 100-year floodplain, 40 CFR Part 6, Appendix A and 40 CFR Part 264.18, are applicable since the eastern end of the site is within the 100-year flood plain of a Turtle Bayou tributary.

3.5.3 ROD Amendment ARARS

The ARARs previously identified in sections 3.5.1 and 3.5.2 are also applicable or relevant and appropriate for the amended remedy. While not identified in the 1991 ROD, the effluent limitations (Tables 2-6 and 2-7) for the ground water treatment plant's surface water discharge are also ARARs. These effluent limitations were derived from the following regulatory rules and guidelines: Texas Surface Water Quality Standards (TSWQS)(30 TAC Chapter 307), General Regulations Incorporated Into Permits (30 TAC Chapter 319, Subchapter B: Hazardous Metals), and 40 CFR 414 Subpart J. Additionally, the TNRCC in a letter dated January 22, 1998 stated, "the Texas Natural Resource Conservation Commission (TNRCC) Risk Reduction Standards, Subchapter S, 30 TAC 335.551-569, do constitute a State ARAR for the Federal Superfund Program in Texas." This ROD Amendment meets the substantive provisions of the Texas Risk Reduction Standards.

3.6 To-Be-Considered Requirements (TBCs)

Many Federal and State environmental and public health agencies develop criteria, advisories, guidance, and proposed standards that are not legally enforceable but contain information that would be helpful in carrying out, or in determining the level of protectiveness of, selected remedies. In other words, "to be considered" (TBCs) materials are meant to complement the use of ARARs, not to compete with or replace them. The following were identified as TBCs:

- Under 44 CFR Part 9 (Floodplain Management and Protection of Wetlands), Federal agencies are required to evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, the adverse impacts associated with direct and indirect development of a floodplain. This is applicable since the eastern end of the site is within the 100-year floodplain of the Turtle Bayou tributary.
- The Archeological and Historic Preservation Act, 16 USC 469, 40 CFR Part 6301(c) provides for preservation of historical and archeological data which might be destroyed through alteration of terrain as a result of Federal construction projects or Federally licensed activities or programs. No historical or archeological data is known to exist at the site, but could be encountered during remediation.

4.0. EVALUATION OF ALTERNATIVES

The USEPA uses nine criteria, or standards, to evaluate alternatives for addressing a Superfund site. These nine criteria are categorized into three groups: threshold, primary balancing, and modifying. The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major tradeoffs among alternatives. The modifying criteria are taken into account after public comment is received on the Proposed Plan of Action.

The nine criteria used in evaluating all of the alternatives identified are as follows:

Threshold Criteria

Overall Protection of Human Health and Environment

This criterion addresses the way in which a potential remedy would reduce, eliminate, or control the risks posed by the site to human health and the environment. The methods used to achieve an adequate level of protection may

be through engineering controls, treatment techniques, or other controls such as restrictions on the future use of the site. Total elimination of risk is often impossible to achieve. However, a remedy must minimize risks to assure that human health and environment are protected.

Compliance with ARARs

Compliance with ARARs, or "applicable or relevant and appropriate requirements," assures that a selected remedy will meet all related Federal, state, and local requirements. The requirements may specify maximum concentrations of chemicals that can remain at the site; design or performance requirements for treatment technologies; and restrictions that may limit potential remedial activities at a site because of its location.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence

This criterion addresses the ability of a potential option to reliably protect human health and the environment over time, after the remediation goals have been accomplished.

Reduction of Toxicity, Mobility, or Volume of Contaminants

This criterion assesses how effectively a remedy will address the contamination problem. Factors considered include the nature of the treatment process; the amount of hazardous materials that will be destroyed by the treatment process; how effectively the process reduces the toxicity, mobility, or volume of waste; and the type and quantity of contamination that will remain after treatment.

Short-Term Effectiveness

This criterion addresses the time factor. Remedies often require several years for implementation. A potential remedy is evaluated for the length of time required for implementation and the potential impact on human health and the environment during implementation.

Implementability

This criterion addresses the ease with which a potential remedy is put in place. Factors such as availability of materials and services are considered.

Cost

This criterion includes capital costs required for design and construction, and projected long-term maintenance costs. Cost is considered and compared to the benefit that will result from implementing the remedy.

Modifying Criteria

State Acceptance

This criterion addresses state concerns, comments on ARARs, and concurrence or lack of concurrence on the selected remedy.

Community Acceptance

During the 30-day public comment period from October 22, 1997 through November 20, 1997, interested persons or organizations were provided the opportunity to comment on the Proposed Plan. The USEPA considered these comments in making its final selection. The comments are addressed in a document called a responsiveness summary, which is included as Appendix B of this Amended ROD.

The remedial alternatives originally considered for the Petro-Chemical Systems, Inc. site are described in detail in the March 1991 Feasibility Study report. An additional evaluation of the remedial alternatives based upon a supplemental remedial investigation are described in detail in the August 1991 Supplemental Remedial Investigation Focused Feasibility Study report. Documents concerning the ongoing field pilot studies can be found in the updated Administrative Record file. A copy of the updated Administrative Record Index is provided in Appendix C. A comparison of the 1991 ROD remedy to the ROD Amendment remedy follows:

4.1 Overall Protection of Human Health and the Environment

The original selected remedy, if successfully implemented, would be protective of human health and the environment by reducing levels of contaminants in the soils and ground water through extraction and treatment. The USEPA expected that the contaminants in the site soils and ground water could be reduced to the remedial levels within five years by implementing the 1991 ROD's remedy. However, the ability to achieve the remedial goals throughout the areas

of contamination could not be fully determined until the treatment components of remedy had been tested in the field pilot studies, modified as necessary, and monitored over time. Together with the containment components (cap and slurry wall), the threat of exposure currently posed to residents from contaminated soils and from contaminated ground water would be significantly reduced if not eliminated. A engineered cap would specifically deal with the estimated 700 cubic yards of elevated lead contamination (lead concentrations greater than 500 ppm) found in the upper 6.5 feet in two areas of the Main Waste Area.

The amended remedy is required to achieve the Performance Standards identified in the 1991 ROD, as slightly modified in this ROD Amendment. The amended remedy also reduces levels of contaminants in the site soils and ground water through treatment, although, like the remedy in the 1991 ROD, it also has containment components for certain areas of the site. Attainment of the Performance Standards (which include MCLs, contaminant specific action levels, and calculated health-based values) will insure the following: soil contaminants will cease to act as a source of ground water contamination, such that any potential leaching of the remediated soils will not result in ground water contaminant concentrations above the MCLs; and, exposure to the ground water will not pose adverse effects to the potentially exposed future site population. The amended remedy will include several components of the original remedy (i.e., soil vapor extraction, containment, vapor control, ground water monitoring, etc.) along with additional or modified remedial action components (e.g., in-situ aquifer bioremediation, bioventing, etc.). Approximately 13.2 million dollars have been expended for the extensive field pilot study program and subsequent detailed design activities in order to develop the amended remedy. The amended remedy will provide the same or better overall protection to human health and the environment as the remedy selected in the 1991 ROD.

4.2 Compliance With Applicable Relevant and Appropriate Requirements (ARARs)

The amended remedy will be performed in full compliance with all chemical, location, and action-specific ARARs and other criteria, advisories and guidelines which are applicable (i.e., surface water discharge limits established by the TNRCC) or considered relevant and appropriate. ARARs are identified in Section 3.5 (Major Applicable or Relevant and Appropriate Requirements).

4.3 Long-Term Effectiveness and Permanence

The 1991 ROD's remedy provides for permanence by removing and destroying volatile organic contaminants from soils and ground water by in-situ remedies (soil vapor extraction and aquifer air sparging). The addition of

containment remedy components (i.e., caps and slurry walls) in the 1991 ROD provide additional effectiveness for certain areas of the site, although the containment components must be maintained.

The amended remedy will also provide for permanence by treatment of soils and ground water and also requires attainment of the site's Performance Standards. The limited use of containment remedy components will provide additional effectiveness, as long as maintenance of the containment components (e.g., cap) is continued. Results of the field pilot study program indicate that soil vapor extraction and in-situ bioremediation followed by less-active remedial components (e.g., bioventing) have a high likelihood of success (i.e., achieving performance standards). The amended remedy will provide long-term effectiveness by removing and/or bioremediating both volatile (i.e., benzene) and semivolatile contaminants (e.g., naphthalene) from the affected media (soil and ground water) and will provide permanence by destroying and/or degrading these compounds. In contrast, the treatment components of the 1991 ROD addressed primarily volatile organic compounds. The amended remedy has a higher likelihood of achieving the performance standards than the 1991 ROD remedy.

4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The original remedy included soil vapor extraction and aquifer sparging treatment components. Both components would remove volatile organic contaminants from the affected media (soil and ground water) followed by catalytic thermal destruction of the volatile organic contaminants. Because catalytic thermal destruction destroys the volatile organic contaminants, the treatment is irreversible for these contaminants. The mobility and toxicity of the extracted volatile organic contaminants from the affected media is essentially eliminated.

The amended remedy also includes the use of in-situ treatment components (e.g., soil vapor extraction and in-situ aquifer bioremediation) to treat volatile organic contamination. Contaminant-laden extracted vapor from these treatment components will be treated in catalytic thermal destruction units. As stated previously, catalytic thermal destruction destroys the volatile organic contaminants, and the mobility and toxicity of the extracted volatile organic contaminants from the affected media will be essentially eliminated. The amended remedy will require destruction and/or control of volatile organics from the extracted vapor to the extent necessary to achieve Performance Standards, ground water remediation to the extent necessary to achieve Performance Standards, and treatment of affected ground water.

4.5 Short-term Effectiveness

In-situ remedies (discussed in the 1991 ROD and this Amended ROD) which do not require the excavation of contaminated soils are favored over remedy components which require excavation. This is due to the increased potential for worker accidents during excavation activities as well as the potential for fugitive emissions resulting during the excavation of soils containing volatile contaminants (i.e., benzene). It is possible, however, that some excavation of hot spots may occur if in-situ treatment is unable to attain the performance standards.

The 1991 ROD remedy included the use of engineered soil and a synthetic liner cap for vertical infiltration control for the Bayou Disposal Area. The amended remedy identifies a living cap for the Bayou Disposal Area. Both alternatives can be implemented quickly (within a year) and have a low potential for generating emissions.

Occupational Safety and Health Administration (OSHA) Regulations shall be followed for all site activities. In addition, community protection will be provided by air quality monitoring and engineering controls to regulate air emissions produced by on-site treatment processes and any excavation activities. Dust control may also be necessary during any excavation and can be accomplished with water or foam sprays.

The estimated time required to implement the 1991 ROD's remedy was five years. Field pilot study data indicates that the active remediation phase of the project may be completed by January 2000.

4.6 Implementability

An overall goal of the field pilot study program was to confirm the effectiveness of in-situ remedy components discussed in the 1991 ROD (i.e., soil vapor extraction) as well as potential amended remedy components (i.e., in-situ bioremediation). As demonstrated by the field pilot studies, the necessary materials and services required to implement the remedy are readily available.

4.7 Cost

The 1991 ROD cost estimate to implement the remedy selected in the 1991 ROD is \$26,430,000. An overall goal of the field pilot study program was to develop data required to design and build the most effective response system for each medium (soils and ground water). Current data indicates that the amended

remedy will cost approximately \$20 million dollars. This amount does not include the long-term monitoring cost beginning after completion of active remediation. To date, approximately \$13.2 million dollars have been expended during the extensive field pilot study program.

4.8 State Acceptance

The State's letter expressing its concurrence with the ROD Amendment is attached.

4.9 Community Acceptance

The USEPA recognizes that the community in which a Superfund site is located is the principal beneficiary of all remedial actions undertaken. The USEPA also recognizes its responsibility to inform interested citizens of the nature of Superfund environmental problems and solutions, and to learn from the community what its desires are regarding these sites. The Amended Proposed Plan of Action was released for public comment in October 1997. The public comment period began on October 22, 1997 and ended on November 22, 1997. A public meeting was held on November 3, 1997 at the site to provide the local community an opportunity to provide verbal and/or written comments on the Amended Proposed Plan of Action. A court reporter was present to record a transcript of the meeting. Verbal questions asked at the public meeting were in regards to the estimated time frame for completing work at the site and in regards to County Road 126. During the 30-day public comment period, one written comment was received. None of the questions or comments received expressed concerns with what was identified in the Amended Proposed Plan of Action. The questions received during the public comment period and EPA's responses to these questions are provided in the Responsiveness Summary (Appendix B).

In an effort to keep the public apprised, remedial design documents will be made available to the public in a timely manner. Additionally, community relation activities (i.e., generation of site fact sheets, open houses) will be performed throughout the remedial process.

5.0 REDEFINITION OF THE SITE BOUNDARY

The USEPA is herein redefining the site, originally defined to encompass approximately 500 acres (as depicted in Figure 1), to include only that property which includes the areal extent of contamination and all suitable property in very close proximity to the contamination necessary for implementation of the remedial

design and remedial action. This property includes the areas designated as the West Road Area, the Main Waste Area (including the above ground landfill), the Office Trailer Area, the Easement Area, the Bayou Disposal Area, and County Road 126 (formerly Frontier Park Road)(See figure 2). Maps and metes and bounds descriptions have been generated by a State of Texas professional land surveyor for each of the areas mentioned above. Copies of the professional land surveyor's maps and metes and bounds descriptions are included in the administrative record for this ROD Amendment. The redefinition of the site is based upon several years of field investigations and contamination data which has been gathered since the site boundary was originally defined in the 1980s.

6.0. STATUTORY DETERMINATIONS

The USEPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. Section 121 of CERCLA also requires that the selected remedial action for the site comply with applicable or relevant and appropriate environmental standards established under Federal and state environmental laws, unless a waiver is granted. The selected remedy must also be cost-effective and utilize permanent treatment technologies or resource recovery technologies to the maximum extent practicable. The statute also contains a preference for remedies that include treatment as a principal element. The following sections discuss how the amended remedy at the site meets the statutory requirements.

6.1 Protection of Human Health and the Environment

In order to protect human health and the environment, the contaminated soils and contaminated ground water that exceed remedial action goals will undergo a combination of treatment and containment. These media will be treated and contained to meet the Performance Standards set forth in the 1991 ROD, and modified in this ROD Amendment. The area where containment is a principal element of the remedial action is the Bayou Disposal Area. At all other areas, treatment by one or more of the specified technologies will be the primary means of attaining the Performance Standards. Attainment of Performance Standards will assure that the site risks fall within the target cancer risk range of 10^{-4} to 10^{-6} and the non-carcinogenic hazard index will be reduced to, equal to, or less than one. Attainment of the Performance Standards will insure that: 1) soil contaminants will cease to act as a source of ground water contamination, such that any potential future leaching of the remediated soils would not result in ground water contaminant concentrations above the MCLs; and 2) exposure to the ground water will not pose adverse effects to the potentially exposed future site population. No

unacceptable short-term risks or cross-media impacts will be allowed during implementation of the amended remedy.

6.2 Attainment of Applicable or Relevant and Appropriate Requirements of Environmental Laws

The amended remedy will be performed in full compliance with all chemical, location, and action-specific ARARs and other criteria, advisories and guidelines which are applicable (i.e., surface water discharge limits established by the TNRCC) or considered relevant and appropriate. ARARs are identified in Section 4.5 (Major Applicable or Relevant and Appropriate Requirements).

6.3 Cost Effectiveness

The USEPA believes that the amended remedy is cost-effective in mitigating the principal threat waste and low level threat waste at the site. Section 300.430(f)(ii)(D) of the NCP requires the USEPA to determine cost-effectiveness by evaluating the following three of the five balancing criteria to determine overall effectiveness: long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost effective. The current estimated cost for the amended remedy is \$20 million dollars. This amount includes the \$13.2 million dollars already expended during the extensive remedial design field pilot study program. This represents a cost savings of \$6.43 million dollars over the 1991 ROD.

6.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practical

The USEPA believes the amended remedy includes to the maximum extent practical permanent solutions and treatment technologies which can be utilized in a cost-effective manner for the site. The USEPA is certain that the amended remedy will provide the best balance in considering long-term effectiveness and permanence; reduction in toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost, as well as considering the statutory preference for treatment as a principal element and considering State and community acceptance.

The Amended ROD's remedial treatment technologies in combination with appropriate containment components (i.e., living cap), complies with ARARs and reduces the toxicity, mobility, and volume of the contaminants in the site soils and ground water. The in-situ aspect of these alternatives was critical in choosing

these alternatives based on the estimated volume of contaminated soils and ground water requiring remedial action and the volatile nature of the site contaminants. Short-term effectiveness and protection of human health and the environment, as well as site remedial costs criterion, will be satisfied by the amended remedy.

6.5 Preference for Treatment as a Principal Element

The amended remedy will satisfy the statutory preference for treatment as a principal element. The primary risk to human health is from ingestion of and direct contact with contaminated ground water. The amended remedy reduces levels of site contaminants in ground water through treatment (in-situ aquifer bioremediation). The amended remedy also addresses the source areas by treating the contaminated soils (the principal threat waste) by soil vapor extraction, bioventing, aqueous phase bioremediation, biotreatment of excavated soils, soil washing, and thermal desorption. Extracted contaminate-laden vapor from the in-situ remediation systems will be treated by the catalytic thermal oxidation units. Extracted contaminated ground water will be treated in the site's water treatment plant. These remedy components will be combined with the containment alternatives to contain the low level threat waste.

Because the amended remedy will result in hazardous substances remaining on-site, a review will be conducted five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of public health, welfare and the environment.

7.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The State of Texas is in concurrence with the selected amended remedy. The Proposed Plan for the Petro-Chemical Systems, Inc. site ROD Amendment was released for public comment in October 1997. The public comment period began on October 22, 1997 and ended on November 20, 1997. A public meeting was held at the site to provide the local community an opportunity to provide verbal and/or written comments on the Proposed Plan. A court reporter was present to record a transcript of the meeting. In addition to the court reporter, the USEPA personnel, and TNRCC personnel, 16 persons attended the public meeting. The USEPA has reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, the USEPA has determined that no significant changes to the amended remedy identified in the Proposed Plan are necessary. Comments received during the public comment period are addressed in the Responsiveness Summary (Appendix B).

APPENDIX A

**PETRO-CHEMICAL SYSTEMS, INC.
(TURTLE BAYOU)
SUPERFUND SITE
RECORD OF DECISION AMENDMENT**

**STATE OF TEXAS
LETTER**

Barry R. McBee, *Chairman*
 R. B. "Ralph" Marquez, *Commissioner*
 John M. Baker, *Commissioner*
 Dan Pearson, *Executive Director*



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

April 23, 1998

Mr. Myron O. Knudson, P.E., Director
 Superfund Division
 U.S. Environmental Protection Agency
 Region 6
 1445 Ross Avenue, Suite 1200
 Dallas, TX 75202-2733

Re: Petro-Chemical Systems, Inc. (Turtle Bayou) Superfund Site
 Record of Decision (ROD) Amendment - April 1998

Dear Mr. Knudson:

Your letter to the Texas Natural Resource Conservation Commission (TNRCC) dated February 9, 1998, requested our concurrence on the Petro-Chemical Systems, Inc. (Turtle Bayou) Superfund Site, Final ROD Amendment, February 1998. This ROD amendment was subsequently modified. We recently received a letter from Mr. Chris Villareal, Project Manager, Superfund Division, U.S. Environmental Protection Agency, Region 6, dated April 10, 1998, which included a revised ROD Amendment, April 1998.

We have reviewed the proposed April 1998 ROD Amendment for the Petro-Chemical Systems, Inc. Superfund Site, and concur that this ROD Amendment is the most appropriate for this site.

This ROD Amendment attains the Federal Applicable or Relevant and Appropriate Requirements (ARARs) as well as the substantive requirements of the State Risk Reduction Standards. The substantive requirements include the residential surface soils and the residential groundwater cleanup levels under Risk Reduction Standard No. 2.

This ROD amendment includes a calculated site-specific Residential Soil-to-Groundwater Cross-Media Protection Concentration for benzene using the Seasonal Soil Compartment Model (SSOIL). Although the modeled concentrations are higher than the Residential Soil-to-Ground Water Cross-Media Protection Concentration for benzene under RRS No. 2, the TNRCC believes the substantive requirements of RRS No. 2 will be attained by this ROD Amendment. This conclusion is based upon the requirement that additional soil remedial actions will be required if

Mr. Myron O. Knudson, P.E., Director
Page 2

conclusion is based upon the requirement that additional soil remedial actions will be required if the benzene groundwater remediation criteria of 5 $\mu\text{g/l}$ cannot be attained and/or maintained with the calculated soil cleanup values.

If you have any questions please contact Mr. Alvie L. Nichols, Project Manager, at (512)239-2439 or Ms. Nancy E. Overesch, Section Manager, at (512)239-2433.

Sincerely,



Dan Pearson
Executive Director

DP/AN/lz

cc: Mr. Chris Villareal, EPA Region 6 ✓

APPENDIX B

**PETRO-CHEMICAL SYSTEMS, INC.
(TURTLE BAYOU)
SUPERFUND SITE
RECORD OF DECISION AMENDMENT**

RESPONSIVENESS SUMMARY

APPENDIX B

**PETRO-CHEMICAL SYSTEMS, INC.
(TURTLE BAYOU)
SUPERFUND SITE
RECORD OF DECISION AMENDMENT**

RESPONSIVENESS SUMMARY

PETRO-CHEMICAL SYSTEMS, INC. (TURTLE BAYOU) SITE
AMENDED RECORD OF DECISION
RESPONSIVENESS SUMMARY

This Responsiveness Summary has been prepared to provide written responses to comments received on the USEPA's Amended Proposed Plan of Action. The summary is divided into two sections.

Section I - Background of Community Involvement and Concerns

This section provides a brief history of the community interest and concerns in relation to the Petro-Chemical Systems, Inc. (Turtle Bayou) Superfund site (site). There has been a long history of citizen awareness of the site. In 1971, when an application was made with the State of Texas for a commercial industrial waste disposal permit in the name of Petro-Chemical Systems, Inc., local citizens organized to oppose the application. Due in part to the community's opposition to the permit, State approval of the permit was withheld and the permit was eventually withdrawn in 1974. More recently, with the exception of site property owners and residents living on the site, community interest in the site has been low. The low general community interest is probably due in part to the site's rural location.

Section II - Summary of Major Comments

Public notice announcing the public comment period and the public meeting was published in the *Liberty Vindicator* on Saturday, October 18, 1997 and in the *Liberty Gazette* on Wednesday, October 22, 1997. The public comment period started October 22, 1997 and ended November 20, 1997. The Amended Proposed Plan of Action was distributed through the mail during the week of October 20, 1997 to all parties on the site's mailing list. Additionally, postcard meeting reminders were mailed the week of October 27 to all parties on the site's mailing list. On November 3, 1997 the public meeting was held at the site's office area. The purpose of the meeting was to discuss the major components of the Amended Proposed Plan of Action and to provide the local community an opportunity to provide verbal and/or written comments on the Amended Proposed Plan of Action. In addition to USEPA personnel, TNRCC personnel, and the court reporter, 16 persons attended the public meeting.

The USEPA received a few oral comments during the public meeting as well as one written comment received on October 28, 1997. Comments pertinent to USEPA's Amended Proposed Plan of Action are summarized below, followed by USEPA's response. A full account of the public meeting can be found in the

public meeting transcripts. The public meeting transcripts are included in the site's Administrative Record for this Amended ROD.

COMMENTS RECEIVED AT THE PUBLIC MEETING:

1. Comment - Mr. Donnie Taylor (landowner):

Mr Taylor asked, "What is your proposed realistic timetable for getting out of here?"

USEPA Response:

The current estimate for completion of site remedial activities is January 2000. At that time, all site contractors will demobilize from the site and the site's long-term monitoring will begin.

2. Comment - Mr. Donnie Taylor (landowner):

Mr. Taylor asked, "What are you going to do with the road [County Road 126] when you're done? Are we going to have a 50-cent patch job, what we got now or are y'all going to put the road back into . . . the same condition it was when y'all all got here?"

USEPA Response:

At the completion of remedial action activities, the road will be restored to its previous condition. At the public meeting, an ARCO Chemical Company representative stated that the entire road will essentially be repaved. Please note, areas of this site that are not currently paved will not be paved. Additionally, please note that the road was constructed to support light residential traffic. Any potential heavy traffic loads (e.g., from logging operations) may impact the quality of the road.

WRITTEN COMMENT(S) RECEIVED DURING THE PUBLIC COMMENT PERIOD:

3. Mr. Carl Norman - affiliation (R.A. Schriewer Hauling - landowner):

"I would like to know exactly what areas are "Hot Spots" to determine how my property is affected. Certainly my property has been de-valued due to this action. Is tax abatement available & or enumeration because of my potential loss?"

USEPA Response:

Site "Hot Spots" have been identified within the Main Waste Area, Office Trailer Area, and the Easement Area. These areas are not on or adjacent to the R.A. Schriewer Hauling Property. The ROD Amendment provides further definition of what has been classified as a "hot spot." In fact, as the R.A. Schriewer Hauling property is not an area where soil and or ground water contamination has been identified, this property will no longer be identified as part of the Petro-Chemical Systems, Inc. (Turtle Bayou) Superfund site. In regards to any tax abatement & or the enumeration of the taxable property values, the USEPA has no authority to grant such relief.

Prepared for
United States Environmental Protection Agency
Region 6

ADMINISTRATIVE RECORD INDEX
RECORD OF DECISION AMENDMENT

FOR
PETRO CHEMICAL/TURTLE BAYOU SUPERFUND SITE
OPERABLE UNIT 2

EPA ID No. TXD980873350

ESS VI
Work Assignment No. ESS8033

Chris Villarreal
Remedial Project Manager
U.S. EPA Region 6

Prepared by
TechLaw Incorporated
750 N St. Paul Street, Suite 600
Dallas, Texas 75201

April 30, 1998
P. 6833.0681

INTRODUCTION

Section 113(j)(1) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. Section 9613(j)(1), provides that judicial review of any issues concerning the adequacy of a response action shall be limited to the administrative record compiled for the site. CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), requires the U.S. Environmental Protection Agency (EPA) to compile documents which form the basis for the selection of the remedial CERCLA and SARA response actions. These supporting documents form an "administrative record" (AR) which the Agency must provide for public review. The ARs are maintained at relevant EPA Regional Offices as well as "at or near the facility at issue."

The following AR Index was compiled in accordance with Office of Solid Waste and Emergency Response Directive Number 9833.3A-1, "Final Guidance on Administrative Records for Decisions on Selection of CERCLA Response Actions" (December 3, 1990). Documents listed as bibliography sources in response decision documents may not be listed in the AR Index. An index to the "Compendium of CERCLA Response Selection Guidance Documents" is enclosed in the AR. The AR file is compiled as documents related to the response action are being generated. All documents that are clearly relevant and non-privileged are placed in the record file, entered into the index, and made available to the public as soon as possible. The documents included in the index are predominately arranged in chronological order. EPA may send supplemental AR volumes and indexes to the designated repository. These supplements should be placed with the initial record file. Documents attached to or referenced in the Proposed Amended Record of Decision are incorporated by reference into the AR.

The AR file must be indexed. The index plays a key role in enabling both lead agency staff and members of the public to help locate and retrieve documents included in the record file. In addition, the index can be used for public information purposes or identifying documents located elsewhere, such as those included in the compendium of guidance documents. The index also serves as an overview of the history of the response action at the site. The AR Index helps readers locate and retrieve documents in the file. It also provides an overview of the response action history. The index includes the following information for each document:

- **AR Page No.** - The sequential numbers stamped on each page of the AR. The six-digit numbers are located in the upper right-hand corner of each page.
 - **Document Date** - The date the document was published and/or released. "Undated" means no date was recorded.
 - **No. of Pages** - Total number of printed pages in the document, including attachments.
 - **Author** - Name and title of the originator.
 - **Company/Agency** - Originator's affiliation.
 - **Recipient** - Name, title, and affiliation of the recipient.
 - **Document Type** - General identification, e.g., correspondence, Remedial Investigation Report, Record of Decision, etc.
 - **Document Title** - Descriptive title or synopsis.
-

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000001 - 000058
DOCUMENT DATE: 12/22/93
NUMBER OF PAGES: 58
AUTHOR: Allyn M. Davis, Director, Hazardous Waste Management Division
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Jack Kramer, Director, Pollution Cleanup Division, Texas
Natural Resource Conservation Commission (TNRCC), et al.
DOCUMENT TYPE: Administrative Order
DOCUMENT TITLE: Remedial Design/Remedial Action (RD/RA) for Turtle Bayou
Superfund site

DOCUMENT NUMBER: 000059 - 000087
DOCUMENT DATE: 08/12/94
NUMBER OF PAGES: 29
AUTHOR: John M. Cotterell, Inc.
COMPANY/AGENCY: Project Manager and Supervising Contractor for Respondents to
Unilateral Administrative Order (UAO)
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: RD

DOCUMENT NUMBER: 000088 - 000089
DOCUMENT DATE: 07/05/95
NUMBER OF PAGES: 2
AUTHOR: Community Involvement Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Petro Chemical/Turtle Bayou Site Mailing List
DOCUMENT TYPE: Fact Sheet
DOCUMENT TITLE: EPA update on site activities

DOCUMENT NUMBER: 000090 - 000092
DOCUMENT DATE: 07/19/95
NUMBER OF PAGES: 3
AUTHOR: Allyn M. Davis, Hazardous Waste Management Division Director
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Administrative Order
DOCUMENT TITLE: Administrative Order for Remedial Design and Remedial Action,
CERCLA Docket No. CERCLA 6-05-94

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000093 - 000161
DOCUMENT DATE: 09/12/95
NUMBER OF PAGES: 69
AUTHOR: Chris G. Villarreal, Remedial Project Manager (RPM)
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: John M. Cotterell, Inc., Project Manager and Supervising Contractor for Respondents to UAO
DOCUMENT TYPE: Correspondence; Work Plan
DOCUMENT TITLE: Approval of pilot study work plans

DOCUMENT NUMBER: 000162 - 000213
DOCUMENT DATE: 09/12/95
NUMBER OF PAGES: 52
AUTHOR: John M. Cotterell, Inc.
COMPANY/AGENCY: Project Manager and Supervising Contractor for Respondents to UAO
RECIPIENT: Petro Chemical Site Group and U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: Sampling and Analysis Plan

DOCUMENT NUMBER: 000214 - 000228
DOCUMENT DATE: 09/12/95
NUMBER OF PAGES: 15
AUTHOR: John M. Cotterell, Inc.
COMPANY/AGENCY: Project Manager and Supervising Contractor for Respondents to UAO
RECIPIENT: Petro Chemical Site Group and U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: Site Access and Security Plan

DOCUMENT NUMBER: 000229 - 000253
DOCUMENT DATE: 09/12/95
NUMBER OF PAGES: 25
AUTHOR: John M. Cotterell, Inc.
COMPANY/AGENCY: Project Manager and Supervising Contractor for Respondents to UAO
RECIPIENT: Petro Chemical Site Group and U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: Release Prevention/Contingency Plan

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000254 - 000291
DOCUMENT DATE: 09/12/95
NUMBER OF PAGES: 38
AUTHOR: John M. Coterell, Inc.
COMPANY/AGENCY: Project Manager and Supervising Contractor for Respondents to
UAO
RECIPIENT: Petro Chemical Site Group and U.S. EPA Region 6 Superfund Site
Files
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: Ambient Air Monitoring Plan

DOCUMENT NUMBER: 000292 - 000343
DOCUMENT DATE: 09/12/95
NUMBER OF PAGES: 52
AUTHOR: John M. Coterell, Inc.
COMPANY/AGENCY: Project Manager and Supervising Contractor for Respondents to
UAO
RECIPIENT: Petro Chemical Site Group and U.S. EPA Region 6 Superfund Site
Files
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: Health and Safety Plan

DOCUMENT NUMBER: 000344 - 000408
DOCUMENT DATE: 09/30/95
NUMBER OF PAGES: 65
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: Quality Assurance Project Plan

DOCUMENT NUMBER: 000409 - 000528
DOCUMENT DATE: 09/30/95
NUMBER OF PAGES: 120
AUTHOR: John M. Coterell, Inc.
COMPANY/AGENCY: Project Manager and Supervising Contractor for Respondents to
UAO
RECIPIENT: Petro Chemical Site Group and U.S. EPA Region 6 Superfund Site
Files
DOCUMENT TYPE: Work Plan
DOCUMENT TITLE: Soil Vapor Extraction (SVE) and In-Situ Bioremediation (ISB)
Field Pilot Tests

007128

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000529 - 000544
DOCUMENT DATE: 02/06/96
NUMBER OF PAGES: 16
AUTHOR: John M. Coterell, Inc.
COMPANY/AGENCY: Project Manager and Supervising Contractor for Respondents to
UAO
RECIPIENT: Chris G. Villarreal, Remedial Project Manager (RPM), U.S. EPA
Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: Additional pilot study areas

DOCUMENT NUMBER: 000545 - 000546
DOCUMENT DATE: 02/09/96
NUMBER OF PAGES: 2
AUTHOR: John M. Coterell, Project Manager
COMPANY/AGENCY: John M. Coterell, Inc.
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: January progress report

DOCUMENT NUMBER: 000547 - 000548
DOCUMENT DATE: 02/13/96
NUMBER OF PAGES: 2
AUTHOR: John M. Coterell, Project Manager
COMPANY/AGENCY: Petro Chemical Site Group
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Notice
DOCUMENT TITLE: Community meeting notices for 02/20/96 open house

DOCUMENT NUMBER: 000549 - 000558
DOCUMENT DATE: 02/28/96
NUMBER OF PAGES: 10
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRC
DOCUMENT TYPE: Report
DOCUMENT TITLE: February progress report

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000559 - 000560
DOCUMENT DATE: 03/30/96
NUMBER OF PAGES: 2
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: March Progress Report is not physically included in the admin. record (AR) located at Liberty Public Library, Liberty, TX, due to the large amount of data generated for report. (Contact Chris Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000561 - 000609
DOCUMENT DATE: 04/17/96
NUMBER OF PAGES: 49
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Notice; Map
DOCUMENT TITLE: Request review and approval of refinement notices for improving scope and results of field pilot study program

DOCUMENT NUMBER: 000610 - 000611
DOCUMENT DATE: 04/30/96
NUMBER OF PAGES: 2
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The April Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000612 - 000615
DOCUMENT DATE: 05/30/96
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The May Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

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FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000616 - 000619
DOCUMENT DATE: 06/30/96
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The June Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000620 - 000627
DOCUMENT DATE: 07/19/96
NUMBER OF PAGES: 8
AUTHOR: Alvie L. Nichols, Pollution Cleanup Division
COMPANY/AGENCY: TNRCC
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Facsimile Transmittal; Permit
DOCUMENT TITLE: Standard exemptions

DOCUMENT NUMBER: 000628 - 000649
DOCUMENT DATE: 07/25/96
NUMBER OF PAGES: 22
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Application
DOCUMENT TITLE: Application for Standard Exemption Number 68 for emissions from SVE Test Unit

DOCUMENT NUMBER: 000650 - 000656
DOCUMENT DATE: 07/30/96
NUMBER OF PAGES: 7
AUTHOR: Terry Gulliver
COMPANY/AGENCY: Applied Hydrology Associates, Inc.
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company, Jim Thomson and Mark Collins, ARCO Chemical Company
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Work Plan: Resource Conservation Recovery Act Vault Wells

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000657 - 000660
DOCUMENT DATE: 07/30/96
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The July Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000661 - 000661
DOCUMENT DATE: 08/05/96
NUMBER OF PAGES: 1
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Use of thermal oxidizer during SVE field pilot study program

DOCUMENT NUMBER: 000662 - 000663
DOCUMENT DATE: 08/14/96
NUMBER OF PAGES: 2
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis
DOCUMENT TITLE: Analytical results on collected TO-1 (Tenax) and TO-14 (Summa Canister) samples

DOCUMENT NUMBER: 000664 - 000670
DOCUMENT DATE: 08/14/96
NUMBER OF PAGES: 7
AUTHOR: Steven G. Stancel
COMPANY/AGENCY: Applied Hydrology Associates, Inc.
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Memorandum; Maps
DOCUMENT TITLE: Deep soils characterization

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000671 - 000677
DOCUMENT DATE: 08/28/96
NUMBER OF PAGES: 7
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum; Maps
DOCUMENT TITLE: Maps showing: 1) extent of affected soil; 2) existing cleanup area; and 3) proposed cleanup area

DOCUMENT NUMBER: 000678 - 000682
DOCUMENT DATE: 08/30/96
NUMBER OF PAGES: 5
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The August Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000683 - 000686
DOCUMENT DATE: 09/30/96
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The September Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000687 - 000689
DOCUMENT DATE: 10/16/96
NUMBER OF PAGES: 3
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Drawing
DOCUMENT TITLE: Shallow soil remediation strategy

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000690 - 000708
DOCUMENT DATE: 10/18/96
NUMBER OF PAGES: 19
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Work Plan
DOCUMENT TITLE: Well installation plan for MW-34 ISB and SVE systems

DOCUMENT NUMBER: 000709 - 000710
DOCUMENT DATE: 10/21/96
NUMBER OF PAGES: 2
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Drawing
DOCUMENT TITLE: Remediation area designation

DOCUMENT NUMBER: 000711 - 000719
DOCUMENT DATE: 10/22/96
NUMBER OF PAGES: 9
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Work Plan
DOCUMENT TITLE: MW-10 Unit (Area J) Well Installation Plan

DOCUMENT NUMBER: 000720 - 000722
DOCUMENT DATE: 10/23/96
NUMBER OF PAGES: 3
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Drawing
DOCUMENT TITLE: Process flow diagram for groundwater treatment plant

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000723 - 000733
DOCUMENT DATE: 10/24/96
NUMBER OF PAGES: 11
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Work Plan; Map
DOCUMENT TITLE: Area K and Area L ISB design

DOCUMENT NUMBER: 000734 - 000737
DOCUMENT DATE: 10/30/96
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The October Progress Report is not physically included in AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000738 - 000741
DOCUMENT DATE: 11/06/96
NUMBER OF PAGES: 4
AUTHOR: Skip Meier
COMPANY/AGENCY: Applied Hydrology Associates, Inc.
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Memorandum; Sampling & Analysis
DOCUMENT TITLE: Respirometry testing program at B53 and MW6 SVE test areas

DOCUMENT NUMBER: 000742 - 000744
DOCUMENT DATE: 11/08/96
NUMBER OF PAGES: 3
AUTHOR: Terry Gulliver
COMPANY/AGENCY: Applied Hydrology Associates, Inc.
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Bayou disposal area work plan

ADMINISTRATIVE RECORD INDEX

FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000745 - 000756
DOCUMENT DATE: 11/13/96
NUMBER OF PAGES: 12
AUTHOR: Steven G. Stancel
COMPANY/AGENCY: Applied Hydrology Associates, Inc.
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Memorandum; Drawing;
DOCUMENT TITLE: Continued MW-06 area hot spot excavation

DOCUMENT NUMBER: 000757 - 000760
DOCUMENT DATE: 11/13/96
NUMBER OF PAGES: 4
AUTHOR: Steven G. Stancel
COMPANY/AGENCY: Applied Hydrology Associates, Inc.
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Memorandum; Map
DOCUMENT TITLE: Definition soil borings, K Zone, MW-10 area

DOCUMENT NUMBER: 000761 - 000765
DOCUMENT DATE: 11/15/96
NUMBER OF PAGES: 5
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Work Plan
DOCUMENT TITLE: MW-10 (South) area definition

DOCUMENT NUMBER: 000766 - 000769
DOCUMENT DATE: 11/19/96
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Work Plan
DOCUMENT TITLE: Definition borings, MW-10 South area (K Zone)

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000770 - 000773
DOCUMENT DATE: 11/20/96
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Work Plan
DOCUMENT TITLE: Expansion, MW-67 ISB system

DOCUMENT NUMBER: 000774 - 000790
DOCUMENT DATE: 11/21/96
NUMBER OF PAGES: 17
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis; Graph
DOCUMENT TITLE: Soil remediation criteria, SESOIL modeling

DOCUMENT NUMBER: 000791 - 000810
DOCUMENT DATE: 11/22/96
NUMBER OF PAGES: 20
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report; Sampling & Analysis
DOCUMENT TITLE: Ambient air management

DOCUMENT NUMBER: 000811 - 000815
DOCUMENT DATE: 11/25/96
NUMBER OF PAGES: 5
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Sampling & Analysis
DOCUMENT TITLE: Bioventing/respirometry test plan

ADMINISTRATIVE RECORD INDEX

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000816 - 000825
DOCUMENT DATE: 11/26/96
NUMBER OF PAGES: 10
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Map
DOCUMENT TITLE: MW-67 area (Zone P) ISB System

DOCUMENT NUMBER: 000826 - 000829
DOCUMENT DATE: 11/26/96
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: SVE wells, MW-67 area (N and P Zones)

DOCUMENT NUMBER: 000830 - 000832
DOCUMENT DATE: 11/26/96
NUMBER OF PAGES: 3
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Map
DOCUMENT TITLE: Deep well sampling

DOCUMENT NUMBER: 000833 - 000841
DOCUMENT DATE: 11/27/96
NUMBER OF PAGES: 9
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: ISB system MW-10 south area (Zone K)

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000842 - 000845
DOCUMENT DATE: 11/30/96
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The November Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000846 - 000853
DOCUMENT DATE: 12/02/96
NUMBER OF PAGES: 8
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Sampling & Analysis
DOCUMENT TITLE: MW-34 SVE system

DOCUMENT NUMBER: 000854 - 000855
DOCUMENT DATE: 12/10/96
NUMBER OF PAGES: 2
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Remediation technology

DOCUMENT NUMBER: 000856 - 000859
DOCUMENT DATE: 12/11/96
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: RCRA vault air injection

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000860 - 000865
DOCUMENT DATE: 12/16/96
NUMBER OF PAGES: 6
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Map
DOCUMENT TITLE: Easement area ISB construction

DOCUMENT NUMBER: 000866 - 000897
DOCUMENT DATE: 12/20/96
NUMBER OF PAGES: 32
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: RCRA Vault Characterization Report

DOCUMENT NUMBER: 000898 - 000901
DOCUMENT DATE: 12/30/96
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The December Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about report.)

DOCUMENT NUMBER: 000902 - 000907
DOCUMENT DATE: 01/08/97
NUMBER OF PAGES: 6
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: D-Zone (MW-45) ISB System

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FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000908 - 000910
DOCUMENT DATE: 01/08/97
NUMBER OF PAGES: 3
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Drawing
DOCUMENT TITLE: Piping and instrumentation drawings for injection water system

DOCUMENT NUMBER: 000911 - 000917
DOCUMENT DATE: 01/17/97
NUMBER OF PAGES: 7
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: Well installation plan for D-Zone (B-53)/MW-45 area) ISB starter system

DOCUMENT NUMBER: 000918 - 000918
DOCUMENT DATE: 01/20/97
NUMBER OF PAGES: 1
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Soil Criteria Assessment Report

DOCUMENT NUMBER: 000919 - 000919
DOCUMENT DATE: 01/23/97
NUMBER OF PAGES: 1
AUTHOR: Chris G. Villarreal, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: Terrence M. Lyons, Superfund Technical Response Team Leader, National Risk Management Research Laboratory, U.S. EPA, Ada, Oklahoma
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Soil Criteria Assessment

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FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000920 - 000923
DOCUMENT DATE: 01/27/97
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Maps
DOCUMENT TITLE: Survey maps for 1) West Road area; 2) Main Waste area; 3) Office Trailer area; and 4) Easement area

DOCUMENT NUMBER: 000924 - 000943
DOCUMENT DATE: 01/28/97
NUMBER OF PAGES: 20
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Summary of status of Turtle Bayou project

DOCUMENT NUMBER: 000944 - 000950
DOCUMENT DATE: 01/29/97
NUMBER OF PAGES: 7
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum ;Map
DOCUMENT TITLE: Well installation plan for office trailer area (Zones F and H) ISB system

DOCUMENT NUMBER: 000951 - 000974
DOCUMENT DATE: 01/30/97
NUMBER OF PAGES: 24
AUTHOR: Unspecified
COMPANY/AGENCY: TNRCC
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Permit
DOCUMENT TITLE: TNRCC Standard Exemption No. 68

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FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 000975 - 000981
DOCUMENT DATE: 01/30/97
NUMBER OF PAGES: 7
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Map
DOCUMENT TITLE: Well installation plan for main waste area (Zone B) ISB system

DOCUMENT NUMBER: 000982 - 000985
DOCUMENT DATE: 01/30/97
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The January Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 000986 - 001338
DOCUMENT DATE: 01/30/97
NUMBER OF PAGES: 353
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: MW-34 (West Road Area, Zone A) Definition/Field Study Report

DOCUMENT NUMBER: 001339 - 001344
DOCUMENT DATE: 01/31/97
NUMBER OF PAGES: 6
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: Work Plan for second set of respirometry tests

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 001345 - 001381 *
DOCUMENT DATE: 02/11/97
NUMBER OF PAGES: 37
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Design report for West Road area

DOCUMENT NUMBER: 001382 - 001385
DOCUMENT DATE: 02/11/97
NUMBER OF PAGES: 4
AUTHOR: W. Jared Fuqua, Project Manager
COMPANY/AGENCY: Fluor Daniel, Inc.
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis
DOCUMENT TITLE: Comments for Soil Criteria Assessment (January 1997 review)

DOCUMENT NUMBER: 001386 - 001386
DOCUMENT DATE: 02/19/97
NUMBER OF PAGES: 1
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Registration for TNRCC Standard Exemption No. 68 (MW-67 Area)

DOCUMENT NUMBER: 001387 - 001391
DOCUMENT DATE: 02/19/97
NUMBER OF PAGES: 5
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Map
DOCUMENT TITLE: Monitoring well in vicinity of MW-13, Basement Area, MW-67 Unit, North Zone

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FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 001392 - 001396
DOCUMENT DATE: 02/20/97
NUMBER OF PAGES: 5
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Map
DOCUMENT TITLE: Main Waste Area remediation

DOCUMENT NUMBER: 001397 - 001627
DOCUMENT DATE: 02/21/97
NUMBER OF PAGES: 231
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: MW-10 Site Characterization and Field Pilot Test Report

DOCUMENT NUMBER: 001628 - 001633
DOCUMENT DATE: 02/28/97
NUMBER OF PAGES: 6
AUTHOR: Chris G. Villarreal, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: Review comments from EPA's National Risk Management Research Laboratory on Soil Criteria Assessment

DOCUMENT NUMBER: 001634 - 001637
DOCUMENT DATE: 02/28/97
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The February Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about report.)

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 001638 - 001639
DOCUMENT DATE: 03/20/97
NUMBER OF PAGES: 2
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis
DOCUMENT TITLE: Groundwater Treatment Plant Discharge Report

DOCUMENT NUMBER: 001640 - 002025
DOCUMENT DATE: 03/20/97
NUMBER OF PAGES: 386
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: MW-67 Unit (Easement Area) Site Characterization and Field Pilot Test Report

DOCUMENT NUMBER: 002026 - 002028
DOCUMENT DATE: 03/21/97
NUMBER OF PAGES: 3
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: Focused work plan for dual media extraction system for F-Zone of Office Trailer area

DOCUMENT NUMBER: 002029 - 002330
DOCUMENT DATE: 03/25/97
NUMBER OF PAGES: 302
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Soil Criteria Assessment, Revised March 1997

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 002331 - 002334
DOCUMENT DATE: 03/30/97
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The March Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about report.)

DOCUMENT NUMBER: 002335 - 002338
DOCUMENT DATE: 04/01/97
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: Soil-moisture profiling

DOCUMENT NUMBER: 002339 - 002344
DOCUMENT DATE: 04/02/97
NUMBER OF PAGES: 6
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Map
DOCUMENT TITLE: ISB System Refinements

DOCUMENT NUMBER: 002345 - 002349
DOCUMENT DATE: 04/07/97
NUMBER OF PAGES: 5
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Response to 03/20/97 letter requesting information on pilot test for which standard exemption requested on 07/25/96

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 002350 - 002355
DOCUMENT DATE: 04/08/97
NUMBER OF PAGES: 6
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Graph
DOCUMENT TITLE: Soil moisture content related to soil criteria assessment

DOCUMENT NUMBER: 002356 - 002359
DOCUMENT DATE: 04/14/97
NUMBER OF PAGES: 4
AUTHOR: Terry Gulliver
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: R.L. Sloan, Manager, Remediation and Jim Thomson, ARCO Chemical Company
DOCUMENT TYPE: Memorandum; Graph
DOCUMENT TITLE: Repeated soil profiles for Soils Criteria Assessment report

DOCUMENT NUMBER: 002360 - 002362
DOCUMENT DATE: 04/15/97
NUMBER OF PAGES: 3
AUTHOR: W. Jared Fuqua, Project Manager and Robert K. Franke, ARCS Program Manager
COMPANY/AGENCY: Fluor Daniel, Inc.
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Additional review comments of Soil Criteria Assessment (March 1997 Review)

DOCUMENT NUMBER: 002363 - 003044
DOCUMENT DATE: 04/15/97
NUMBER OF PAGES: 682
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Definition report for B-53/MW-45 area (west end of Office Trailer area)

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 003045 - 003784
DOCUMENT DATE: 04/23/97
NUMBER OF PAGES: 740
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: MW-19/MW-42 Unit Site Characterization and Field Pilot Study Report

DOCUMENT NUMBER: 003785 - 003786
DOCUMENT DATE: 04/30/97
NUMBER OF PAGES: 2
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Soil remediation criteria

DOCUMENT NUMBER: 003787 - 003790
DOCUMENT DATE: 04/30/97
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Graph
DOCUMENT TITLE: Repeated soil profiles for Soils Criteria Assessment Report

DOCUMENT NUMBER: 003791 - 003794
DOCUMENT DATE: 04/30/97
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Report
DOCUMENT TITLE: The April Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for report. (Contact Chris Villarreal, RPM, for further information about report.)

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FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 003795 - 003802
DOCUMENT DATE: 05/09/97
NUMBER OF PAGES: 8
AUTHOR: Chris G. Villarreal, RPM
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Correspondence; Memorandum; Report
DOCUMENT TITLE: Review comments on revised Soil Criteria Assessment Report

DOCUMENT NUMBER: 003803 - 003806
DOCUMENT DATE: 05/20/97
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum; Map
DOCUMENT TITLE: Work plan to install 2 additional wells in A-Zone to better define east end and west end of active remediation area

DOCUMENT NUMBER: 003807 - 003831
DOCUMENT DATE: 05/28/97
NUMBER OF PAGES: 25
AUTHOR: Steven G. Stancel
COMPANY/AGENCY: Applied Hydrology Associates, Inc.
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Memorandum; Table; Map; Graph
DOCUMENT TITLE: Infiltration study water level data

DOCUMENT NUMBER: 003832 - 003835
DOCUMENT DATE: 05/29/97
NUMBER OF PAGES: 4
AUTHOR: Terry Gulliver
COMPANY/AGENCY: Applied Hydrology Associates, Inc.
RECIPIENT: R.L. Sloan, Manager, Remediation, ARCO Chemical Company
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Clarification of derivation of some soil parameters

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 003836 - 003839
DOCUMENT DATE: 05/30/97
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: The May Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about report.)

DOCUMENT NUMBER: 003840 - 004127
DOCUMENT DATE: 06/03/97
NUMBER OF PAGES: 288
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Design report for east section of Office Trailer Area, MW-10 area (J and K Zones)

DOCUMENT NUMBER: 004128 - 004307
DOCUMENT DATE: 06/04/97
NUMBER OF PAGES: 180
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Design report for west end of Office Trailer Area, B-53/MW-45 area (D Zone)

DOCUMENT NUMBER: 004308 - 004765
DOCUMENT DATE: 06/06/97
NUMBER OF PAGES: 458
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Design report for Easement area or MW-67 area (N and P Zones)

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FINAL

SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 004766 - 004907
DOCUMENT DATE: 06/09/97
NUMBER OF PAGES: 142
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Site Characterization and Field Pilot Study (Text)

DOCUMENT NUMBER: 004908 - 005734
DOCUMENT DATE: 06/09/97
NUMBER OF PAGES: 827
AUTHOR: ARCO Chemical Company
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: Site Characterization and Field Pilot Test Report (Appendices A-E)

DOCUMENT NUMBER: 005735 - 005739
DOCUMENT DATE: 06/16/97
NUMBER OF PAGES: 5
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Technology sequencing

DOCUMENT NUMBER: 005740 - 005996
DOCUMENT DATE: 06/30/97
NUMBER OF PAGES: 257
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Main Waste Area Design Report

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TKD980873350

DOCUMENT NUMBER: 005997 - 006000
DOCUMENT DATE: 06/30/97
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: The June Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about report.)

DOCUMENT NUMBER: 006001 - 006195
DOCUMENT DATE: 07/02/97
NUMBER OF PAGES: 195
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Design report for Office Trailer Area, MW-19/MW-42 unit

DOCUMENT NUMBER: 006196 - 006209
DOCUMENT DATE: 07/02/97
NUMBER OF PAGES: 14
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Groundwater remediation progress sampling plan for July 1997

DOCUMENT NUMBER: 006210 - 006235
DOCUMENT DATE: 07/23/97
NUMBER OF PAGES: 26
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis
DOCUMENT TITLE: Clay permeability testing results comparing "hot spot" areas with "background" areas

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 006236 - 006254
DOCUMENT DATE: 07/24/97
NUMBER OF PAGES: 19
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis
DOCUMENT TITLE: Infiltration results

DOCUMENT NUMBER: 006255 - 006261
DOCUMENT DATE: 07/28/97
NUMBER OF PAGES: 7
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis
DOCUMENT TITLE: Permeability testing, Phase 3

DOCUMENT NUMBER: 006262 - 006305
DOCUMENT DATE: 07/30/97
NUMBER OF PAGES: 44
AUTHOR: ARCO Chemical Company
COMPANY/AGENCY: Unspecified
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Report
DOCUMENT TITLE: Vault Area Design Report

DOCUMENT NUMBER: 006306 - 006309
DOCUMENT DATE: 07/30/97
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: The July Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 006310 - 006340
DOCUMENT DATE: 07/30/97
NUMBER OF PAGES: 31
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis
DOCUMENT TITLE: Flow path lengths

DOCUMENT NUMBER: 006341 - 006369
DOCUMENT DATE: 08/13/97
NUMBER OF PAGES: 29
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Sampling & Analysis
DOCUMENT TITLE: "Hot Spot" Response Plan

DOCUMENT NUMBER: 006370 - 006373
DOCUMENT DATE: 08/13/97
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Soil parameters

DOCUMENT NUMBER: 006374 - 006377
DOCUMENT DATE: 08/14/97
NUMBER OF PAGES: 4
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Work plan, "hot spot" evaluation

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 006378 - 006405
DOCUMENT DATE: 08/18/97
NUMBER OF PAGES: 28
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Rainfall infiltration

DOCUMENT NUMBER: 006406 - 006416
DOCUMENT DATE: 08/19/97
NUMBER OF PAGES: 11
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: August 1997 groundwater progress sampling plan

DOCUMENT NUMBER: 006417 - 006426
DOCUMENT DATE: 08/20/97
NUMBER OF PAGES: 10
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Soil vapor sampling

DOCUMENT NUMBER: 006427 - 006428
DOCUMENT DATE: 08/25/97
NUMBER OF PAGES: 2
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Construction and maintenance cost estimate for Bayou Disposal area cap

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 006429 - 006433
DOCUMENT DATE: 08/26/97
NUMBER OF PAGES: 5
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: Affected soil definition

DOCUMENT NUMBER: 006434 - 006437
DOCUMENT DATE: 08/30/97
NUMBER OF PAGES: 4
AUTHOR: Petro Chemical Site Group
COMPANY/AGENCY: Respondents to UAO
RECIPIENT: U.S. EPA Region 6 and TNRCC
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: The August Progress Report is not physically included in the AR located at Liberty Public Library, Liberty, Texas due to large amount of data generated for the report. (Contact Chris G. Villarreal, RPM, for further information about the report.)

DOCUMENT NUMBER: 006438 - 006461
DOCUMENT DATE: 09/02/97
NUMBER OF PAGES: 24
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Air emissions testing report for the two thermal oxidizers

DOCUMENT NUMBER: 006462 - 006484
DOCUMENT DATE: 09/12/97
NUMBER OF PAGES: 23
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Memorandum
DOCUMENT TITLE: Memorandum describing "living cap" approach proposed for remediation of Bayou Disposal Area

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 006485 - 006936
DOCUMENT DATE: 09/12/97
NUMBER OF PAGES: 452
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Soil criteria assessment summary, September 1997

DOCUMENT NUMBER: 006937 - 006976
DOCUMENT DATE: 09/16/97
NUMBER OF PAGES: 40
AUTHOR: R.L. Sloan, Manager, Remediation
COMPANY/AGENCY: ARCO Chemical Company
RECIPIENT: Chris G. Villarreal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Report
DOCUMENT TITLE: Site Characterization and Design Report for the Bayou Disposal Area

DOCUMENT NUMBER: 006977 - 006978
DOCUMENT DATE: 10/13/97
NUMBER OF PAGES: 2
AUTHOR: Jared Fuqua
COMPANY/AGENCY: Fluor Daniel Environmental Services - Dallas
RECIPIENT: Chris G. Villareal, U.S. EPA Region 6
DOCUMENT TYPE: Fax Transmittal; Notice
DOCUMENT TITLE: Final public notice enclosed for EPA's review

DOCUMENT NUMBER: 006979 - 006996
DOCUMENT DATE: 10/22/97
NUMBER OF PAGES: 18
AUTHOR: Community Relations Section
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Proposal
DOCUMENT TITLE: Amended Proposed Plan of Action

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 006997 - 006998
DOCUMENT DATE: 10/28/97
NUMBER OF PAGES: 2
AUTHOR: Carl Norman, (Landowner)
COMPANY/AGENCY: R.A. Schriewer Hauling
RECIPIENT: U.S. EPA Region 6
DOCUMENT TYPE: Public Comment
DOCUMENT TITLE: Comments on the Amended Proposed Plan of Action and the Administrative Record File

DOCUMENT NUMBER: 006999 - 006999
DOCUMENT DATE: 11/03/97
NUMBER OF PAGES: 1
AUTHOR: Unspecified
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Notice
DOCUMENT TITLE: Public meeting to discuss EPA's proposed plan

DOCUMENT NUMBER: 007000 - 007037
DOCUMENT DATE: 11/03/97
NUMBER OF PAGES: 38
AUTHOR: Krista Williamson, Certified Shorthand Reporter
COMPANY/AGENCY: Charlotte Smith Reporting, Inc.
RECIPIENT: U. S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Public Meeting Transcript
DOCUMENT TITLE: Public meeting concerning EPA's Amended Proposed Plan of Action

DOCUMENT NUMBER: 007038 - 007049
DOCUMENT DATE: 12/02/97
NUMBER OF PAGES: 12
AUTHOR: R. L. Sloan, Manager, Remediation
COMPANY/AGENCY: Arco Chemical Company
RECIPIENT: Chris G. Villareal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Maps
DOCUMENT TITLE: Site maps and notes and bounds descriptions for the West Road Area, Main Waste Area, Office Trailer Area, Power Easement Area, and Bayou Disposal Area

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 007050 - 007054
DOCUMENT DATE: 01/13/98
NUMBER OF PAGES: 5
AUTHOR: Alvie L. Nichols, Project Manager, Superfund Engineering
Section
COMPANY/AGENCY: TNRCC
RECIPIENT: Chris G. Villareal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: Revised Treated Water Discharge Standards

DOCUMENT NUMBER: 007055 - 007055
DOCUMENT DATE: 01/22/98
NUMBER OF PAGES: 1
AUTHOR: Alvie L. Nichols, Project Manager, Superfund Engineering
Section
COMPANY/AGENCY: TNRCC
RECIPIENT: Chris G. Villareal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: TNRCC Risk Reduction Standards, Final Record of Decision (ROD)
Amendment

DOCUMENT NUMBER: 007056 - 007060
DOCUMENT DATE: 02/24/98
NUMBER OF PAGES: 5
AUTHOR: Alvie L. Nichols, Project Manager Superfund Cleanup Section
COMPANY/AGENCY: TNRCC
RECIPIENT: Chris G. Villareal, RPM, U.S. EPA Region 6
DOCUMENT TYPE: Correspondence; Memorandum
DOCUMENT TITLE: Revised Treated Water Discharge Standards, Final ROD
Amendment, February 1998

DOCUMENT NUMBER: 007061 - 007062
DOCUMENT DATE: 04/23/98
NUMBER OF PAGES: 2
AUTHOR: Don Pearson, Executive Director
COMPANY/AGENCY: TNRCC
RECIPIENT: Myron O. Knudson, Director, Superfund Division, U.S. EPA
Region 6
DOCUMENT TYPE: Correspondence
DOCUMENT TITLE: TNRCC concurs with proposed April 1998 ROD

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SITE NAME: PETRO CHEMICAL/TURTLE BAYOU
SITE NUMBER: TXD980873350

DOCUMENT NUMBER: 007063 - 007160
DOCUMENT DATE: 04/30/98
NUMBER OF PAGES: 97
AUTHOR: Jerry Clifford, Acting Regional Administrator
COMPANY/AGENCY: U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: ROD; Correspondence
DOCUMENT TITLE: ROD Amendment (Responsiveness Summary located in Appendix B)

DOCUMENT NUMBER: 007161 - 007198
DOCUMENT DATE: 04/30/98
NUMBER OF PAGES: 38
AUTHOR: TechLaw, Incorporated
COMPANY/AGENCY: Contractor for U.S. EPA Region 6
RECIPIENT: U.S. EPA Region 6 Superfund Site Files
DOCUMENT TYPE: Index
DOCUMENT TITLE: Administrative Record Index, Record of Decision Amendment for Petro Chemical/Turtle Bayou Site, Operable Unit 2