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Region IX

Record of Decision

for

Dual Site
Groundwater Operable Unit

Montrose Chemical and Del Amo Superfund Sites

Volume I:
Declaration and Decision Summary

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March 1999

Record of Decision: Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

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Acronyms

AOC	Administrative Order on Consent
ARARs	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BHC	benzene hexachloride
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Act Information System
C.F.R.	Code of Federal Regulations
CIC	community involvement coordinator
CPA	Central Process Area of the former Montrose Plant
CPF	cancer potency factor
DCA	dichloroethane
**See below*	
DCE	dichloroethylene
DDT	dichlorodiphenyl-trichloroethane
DNAPL	dense nonaqueous phase liquid
Dow	Dow Chemical Corporation
DTSC	California Department of Toxic Substances Control
FBR	Fluidized Bed Reactor
FSP	field sampling plan
FTC	focused transport calibration
gpm	gallons per minute
GSA	United States General Services Administration
ISGS	in-situ groundwater standards
JGWFS	Joint Groundwater Feasibility Study
JGWRA	Joint Groundwater Risk Assessment
LBF	Lower Bellflower Aquitard
LGAC	liquid-phase granular activated carbon
LNAPL	light nonaqueous phase liquid
MBFB Sand	Middle Bellflower "B" Sand
MBFC Sand	Middle Bellflower "C" Sand
MBFM	Middle Bellflower Muds
MCL	maximum contaminant level (promulgated drinking water standard)
µg/L	micrograms per liter
mg/kg/day	milligrams per kilogram per day
mg/L	milligrams per liter
NAPL	nonaqueous phase liquid

NCEA	National Center for Exposure Assessment
NCP	National Contingency Plan
NOEL	No Observed Adverse Effect Level
NRRB	National Remedy Review Board
O&M	operations & maintenance
OSHA	Occupational Safety and Health Administration
pCBSA	para-chlorobenzene sulfonic acid
PCE	perchloroethylene
ppb	parts per billion
PRG	Preliminary Risk Goal
PRP	potentially responsible party
QAPP	Quality Assurance Project Plan
RCRA	Resource, Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RME	reasonable maximum exposure
RMS	root mean square
ROD	Record of Decision
ROST™	Rapid Optical Screening Tool
RPM	remedial project manager
Shell	Shell Oil Company
SVE	soil vapor extraction
TBC	To-Be-Considered Criterion
TCA	trichloroethane
TCE	trichloroethylene
TDS	total dissolved solids
TI	technical impracticability
UBF	Upper Bellflower
U.S.C.	United States Code
VOCs	volatile organic compounds

*Note: The term "Del Amo Respondents" refers to Shell Oil Company and Dow Chemical Company, collectively.

I. DECLARATION

Statutory Preference for Treatment as a Principal Element is Met and Five Year Reviews Are Required

1. Site Name and Location

This Record of Decision (ROD) applies to *both* the Montrose Chemical Superfund Site and the Del Amo Superfund Site, in Los Angeles County, California. Portions of these sites lie within the City of Los Angeles, and adjacent to the City of Torrance, California.

2. Statement of Basis and Purpose

This ROD presents the selected remedial action for (1) groundwater contamination, and (2) isolation and containment of non-aqueous phase liquids (NAPL) at the Montrose Chemical and Del Amo Superfund Sites. EPA has selected this remedy in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. §9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, P.L. 99-499, 100 Stat. 1613 (1986) (CERCLA) and with the relevant provisions of the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300 (NCP). This decision is based on consideration of the administrative record, including public comments and the detailed analysis of the alternatives which are discussed and summarized in the Decision Summary.

This ROD establishes a *dual-site operable unit remedy*. This operable unit remedy is anticipated to be consistent with any other operable unit remedies, and the final remedies, for both the Montrose Chemical Superfund Site and the Del Amo Superfund Site. Such other remedies may apply to one or the other site individually, in contrast to the dual-site nature of this remedy.

This document identifies applicable or relevant and appropriate requirements (ARARs) and other criteria and requirements which shall be met in implementing this remedy. During investigations of the Montrose Chemical and Del Amo Superfund Sites, data has been collected in accordance with approved sampling and quality assurance management plans. EPA considers site data to be of adequate quality to support the remedy presented in this ROD. Remedial designs, actions, and operation and maintenance undertaken in the course of implementing this remedy shall comply with all standards, requirements and specifications in this ROD.

The State of California, acting by and through its Department of Toxic Substances Control, concurs with the remedy selected in this document.

The authority to select CERCLA remedial actions has been delegated to the U.S. EPA Region IX Superfund Division Director *(See* U.S. EPA CERCLA Delegations Manual, Delegation 14.5 (April 15, 1994) and redelegated by EPA Region IX Delegation Order, Selection of Remedial Actions (September 29, 1997)).

3. Assessment of the Site

Releases of hazardous substances, pollutants or contaminants from the former DDT pesticide manufacturing plant operated by Montrose Chemical Corporation, including but not limited to chlorobenzene, DDT, and parachlorobenzene sulfonic acid, have resulted in hazardous substances contamination in the groundwater. Releases of hazardous substances from the former Del Amo Synthetic Rubber Manufacturing plant, including but not limited to benzene, ethylbenzene, and naphthalene have resulted in hazardous substances contamination in the groundwater. Releases of hazardous substances including but not limited to benzene, trichloroethylene (TCE), perchloroethylene (PCE), and dichloroethylene (DCE) have occurred potentially as a result of the operations at both the former Montrose Chemical and Del Amo plant properties and otherwise as a result of the operations of additional facilities in the immediately surrounding area. These releases have also resulted in groundwater contamination. Some of the hazardous substances discussed above are present below the ground surface in the form of non-aqueous phase liquids (NAPL) as well as dissolved in water and adsorbed to soils.

Contamination in groundwater from the two sites has partially commingled, or merged. Remedial actions selected for the contamination originating from either site individually would affect the contamination, execution, and implications of remedial actions selected for the contamination originating from the other site. The groundwater contamination from both sites is being addressed by EPA as a single technical problem with a unified remedial strategy which has been developed in part by considering the interrelationships of the various areas of groundwater at the Montrose Chemical and Del Amo Superfund Sites.

The groundwater contamination at and from the former Montrose and Del Amo plant properties; and the contamination from additional sources that is commingled, or within the area that might be subject to significant hydraulic influences from this remedy; are collectively referred to by EPA as "the Joint Site." This term is being used only with respect to this selected groundwater remedy. Additional description and caveats pertaining to the use of this term are provided in the Decision Summary of this ROD. Unless otherwise noted, where used in this ROD the term "both sites," shall refer to the Montrose Chemical Superfund Site and the Del Amo Superfund Site.

Actual or threatened releases of hazardous substances from both the Montrose Chemical Superfund Site and the Del Amo Superfund Site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public

health, welfare, or the environment.

4. Description of the Remedy

The implementation of the remedial actions selected by this ROD shall meet the description and all specifications and requirements as provided in this section, and the accompanying Decision Summary. The Decision Summary contains more detail on remedy description.

The primary principal threat at both of these sites related to groundwater is the NAPL which continues to dissolve into the groundwater. The dissolved contamination in the groundwater poses an unacceptable potential human health risk over the long term.. This selected remedial action is the first of two phases of remedial decisionmaking for the groundwater operable unit of the Montrose Chemical and Del Amo Superfund Sites. This ROD selects remedial actions that will:

- Contain the principal threat by containing the dissolved-phase groundwater contamination that surrounds the NAPL, thereby isolating the NAPL;
- Reduce the concentrations of dissolved contaminants in groundwater, outside the area of groundwater being contained, to levels that no longer pose an unacceptable health risk; and
- Prevent human exposure to groundwater contamination at these Superfund sites.

The containment of the principal threat shall be accomplished by (1) hydraulic extraction and treatment (with aquifer injection), and (2) reliance on intrinsic biodegradation, a form of natural attenuation. The manner in which each of these shall be applied is specified in the Decision Summary.

The reduction of concentrations of dissolved contaminants outside the area of groundwater being contained shall be accomplished by hydraulic extraction, treatment, and aquifer injection. This reduction shall occur at rates and meet time- and efficiency-based performance requirements specified in the Decision Summary. Some treated water may under this remedial action also may be discharged under permit to surface water channels. Provisions for institutional controls, monitoring, additional data acquisition, acceptable forms of groundwater treatment, and waivers of certain ARARs based on technical impracticability, shall also apply to this remedial action as specified in the Decision Summary.

EPA has determined that the remedial action selected in this ROD is protective of human health and the environment. However, the remedial action selected by this ROD does not remove NAPL

from the ground nor immobilize it. As extensively discussed in the Decision Summary, the remedial action selected by this ROD will remain in place over an extended time frame. The existing mass of NAPL and the potential for NAPL migration create significant uncertainties that the remedial action selected in this ROD will continue to remain protective of human health and the environment over the long term. To address such uncertainties, EPA will undertake a second phase of remedial decisionmaking for this groundwater operable unit, which will address whether and to what degree NAPL shall be recovered (removed) from the ground and/or immobilized at each of the two sites. Recovery and/or immobilization of the NAPL may enhance the long-term effectiveness of the remedial action selected in this ROD and may reduce these long-term uncertainties. If, as a result of such evaluations, EPA determines that additional remedial actions are required, EPA will select the second phase remedial actions in an *amendment* to this ROD. EPA may issue such an amendment, if any, as a stand-alone document or within the framework of another ROD for the Montrose and Del Amo site, including final site-wide ROD(s) which may be issued.

Performance of the second phase of remedial selection is authorized by and consistent with the NCP provision at 40 C.F.R. 300.430(f)(5)(iii)(D) which provides that the ROD may:

> ...When appropriate, provide a commitment for further analysis and selection of long-term response measures within an appropriate time frame.

This operable unit ROD finalizes the interim provisions of the operable unit ROD that EPA issued for the Del Amo Waste Pits on September 5, 1997, as specified and described in detail in the Decision Summary. These provisions were designed to control the Waste Pits as a source of continuing contamination to groundwater.

Remedial Actions

Three areas of groundwater at the Joint Site are defined by convention in the Decision Summary of this ROD, as the ***chlorobenzene plume***, the ***benzene plume***, and the ***TCE plume***. This ROD establishes differing remedial requirements and objectives for each of these plumes, within the context of the overall remedial action, as discussed in the Decision Summary. The Decision Summary provides numerous details and additional specifications related to each of the following elements which are incorporated in this Declaration by reference. In addition, the Decision summary includes specifications for the monitoring and evaluation of the performance of the remedial action, for the chemical pCBSA, for actions to be taken during the course of the remedial action, and other specifications.

The remedy shall consist of the following actions and meet the following requirements, as further discussed and developed later in this ROD:

- Dissolved phase contamination in a specifically-bounded, monitored zone of groundwater, as defined in the Decision Summary, shall be contained and isolated indefinitely such that the contamination cannot escape the zone. This zone is referred to by this ROD as the ***containment zone.***[1] By containing the dissolved phase contamination surrounding the NAPL, this action isolates the NAPL from the remainder of groundwater.

- Specific ARARs shall be waived due to technical impracticability ("TI waiver"). The waived ARARs are identified in Appendix A of the ROD. The TI waiver of these ARARs shall apply solely to a zone of groundwater that is defined in the Decision Summary of this ROD and is referred to as the ***TI waiver zone.*** The TI waiver zone and the containment zone are congruent and refer to the same physical space.

- Contaminants within the containment zone shall be contained by two methods: (1) groundwater extraction and treatment, and (2) monitored intrinsic biodegradation. The method which shall apply shall differ for various portions of groundwater, as specified and in accordance with all requirements and provisions in the Decision Summary.

- The concentrations of dissolved phase contaminants in all groundwater at the Joint Site that lies *outside* the containment zone shall be reduced to concentrations at or below standards identified and discussed in the Decision Summary of this ROD in a reasonable time frame. These standards are referred to by this ROD as ***in-situ groundwater standards,*** or ***ISGS***. This reduction shall be accomplished by extraction and treatment of groundwater. This requirement does not apply to the chemical pCBSA. Special actions for pCBSA are discussed in the Decision Summary.

- The reduction of the volume of water outside the containment zone that is contaminated at concentrations above ISGS levels shall be achieved at the groundwater extraction rates and in accordance with the performance standards, requirements, and provisions in the Decision Summary.

- The remedial action shall, while still meeting all other requirements and objectives of the remedial action as specified by this ROD, limit inducing adverse migration of NAPL (residual phase) contaminants. Additional definitions and exceptions with respect to this requirement are provided in the Decision Summary.

- The remedial action shall, while still meeting all other requirements and objectives of this

[1]The use of the term "containment zone" is this ROD does not reflect a formal establishment of a containment zone as that term is used in, and per the requirements of, California State Water Resources Control Board Resolution No. 92-49(III)(H).

remedial action as specified by this ROD, limit the migration of existing contamination where such migration would be of a nature that would lengthen the remedial action, result in a greater potential health risk, or result in spreading of the contamination. Additional definitions and exceptions with respect to this requirement are provided in the Decision Summary.

- Any of several technologies (or combinations of those technologies), identified in the Decision Summary shall be considered acceptable for treatment as determined in the remedial design phase. This remedy shall attain all ARARs identified by this ROD that pertain to any of the technologies that are actually implemented.

- For the chlorobenzene and TCE plumes, groundwater shall be injected back into the aquifers after treatment to standards selected in this ROD. Additional specifications are provided in the Decision Summary.

- For the benzene plume, after treatment groundwater shall be discharged after treatment in one of the following ways as determined in the remedial design phase: (1) discharge to the storm sewer, (2) discharge to the sanitary sewer, or (3) aquifer injection. The discharge shall meet all ARARs identified in this ROD and any independently applicable standards for such discharges.

- Contingent actions, as put forth in the Decision Summary, shall be implemented in the event that the remedial action does not contain groundwater contamination within the containment zone.

- The hydraulics of the affected groundwater aquifers, the nature, extent, fate, and transport of contamination, and compliance with the requirements of this ROD, shall be continually monitored in accordance with the objectives, requirements and provisions presented in the Decision Summary.

- Existing drinking water production wells in the vicinity of the Joint Site shall be routinely monitored for the contaminants from the Joint Site and actions shall be taken to ensure that contamination from the Joint Site does not enter the potable water supply, as provided in the Decision Summary.

- Additional field data shall be acquired during the remedial design phase, including monitoring well data from new and existing monitoring wells, well surveys, aquifer tests, and other data as required and as specified in the Decision Summary.

- Institutional controls are identified in Sections 11 and 13 of the Decision Summary to reduce the potential for groundwater use in the area of contaminated groundwater

presently and during the course of the remedial action and to limit the potential for the spreading of existing contamination during the course of the remedial action.

5. Statutory Determinations

The selected remedy is protective of human health and the environment. In addition, as required by the terms of this ROD, EPA will conduct a second phase of remedial decisionmaking for this operable unit to address unresolved uncertainty regarding whether certain remedial actions selected in this ROD will continue to remain protective of human health and the environment over the long term. This second phase of remedial decisionmaking will address whether and to what degree NAPL recovery and/or NAPL immobilization shall occur at the Montrose Chemical and Del Amo Superfund Sites.

The selected remedy complies with Federal and State requirements that are legally applicable or relevant and appropriate (ARARs) to the remedial action, except where such ARARs have been waived. The waiver of certain ARARs, which are identified in Appendix B and explained in the Decision Summary of the ROD, is justified due to technical impracticability. This waiver applies to a specific zone of groundwater identified by the Decision Summary.

The selected remedy is cost effective and utilizes permanent solutions and alternative treatment technology to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces the mobility, toxicity, or volume as a principal element.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of the remedial action, and again every five years subsequently for as long as hazardous substances remain on-site, to ensure that the remedy continues to provide adequate protection of public health or welfare or the environment. As part of these reviews, EPA shall evaluate toxicological studies which may have been performed since the issuance of this ROD to determine whether remedial actions selected in this ROD to address the groundwater contaminant pCBSA remain protective of human health and the environment. This discussed in detail in the Decision Summary of this ROD.

Keith Takata 3-30-99

Keith Takata, Director
Superfund Division
United States Environmental Protection Agency, Region IX

Date

II. DECISION SUMMARY

1. Site Names and Location

This record of decision (ROD) documents and establishes the dual-site operable unit remedy for groundwater at the Montrose Chemical and Del Amo Superfund Sites[1] (Figures 1-1 and 1-2) in Los Angeles, California (near the Cities of Torrance and Carson)(See Section 4 of this ROD for the context of this selected remedial action). The EPA CERCLIS identification numbers for these sites are CAD008242711 and CAD029544731, respectively. These separate, but adjacent Superfund sites have commingled groundwater contamination. Groundwater contamination at these two sites originated primarily from (1) the former Montrose Chemical plant and property, which manufactured the pesticide DDT between 1947 and 1982, and (2) the former Del Amo Synthetic Rubber plant and property, which operated between 1942 and 1972. There are other sources of groundwater contamination which are discussed in later sections of this ROD and in the remedial investigation reports. More details are provided in the Section 2 of this ROD, in the Remedial Investigation Reports, and Section 2 of the Joint Groundwater Feasibility Study.

The "Harbor Gateway" is a half-mile-wide strip of the City of Los Angeles that extends south from Los Angeles proper and provides the City a contiguous jurisdiction to Los Angeles Harbor. The former Montrose Chemical and Del Amo plants were located in the Harbor Gateway between the Cities of Torrance and Carson. The former Montrose plant property is at 20201 Normandie Avenue, lying on the west side of Normandie Avenue between Del Amo Boulevard on the south and Francisco Street (extended) on the north. The former Del Amo plant property lies in an area *roughly* bounded by Normandie Avenue on the west, Interstate 110 on the east, 190th Street on the north, and Del Amo boulevard on the south. The actual former plant property boundaries can be seen on Figure 1-2. The area surrounding the former plants contains portions of the cities of Carson, Gardena, and Torrance. A strip of land immediately east of the former Del Amo plant, and the residential area directly south of the former Del Amo plant, are part of unincorporated Los Angeles County. Overall, groundwater contamination associated with these two sites has

[1]On February 19, 1999, the United States Court of Appeals for the District of Columbia Circuit overturned EPA's final rule by which EPA had added the Del Amo Superfund Site to the Superfund National Priorities List. [Harbor Gateway Commercial Property Owners' Association, et al., v. U.S. EPA, 1999 U.S. App. LEXIS 2504 (D.C. Cir. 1999] Regardless of the NPL status of the Del Amo Site, it is appropriate to continue to refer to the Del Amo Site as the "Del Amo Superfund Site" because EPA, as the lead agency under the NCP, is continuing to undertake Superfund response actions at and with respect to that site, due to substantial actual or threatened releases of hazardous substances which pose an imminent and substantial endangerment to human health and the environment, and consistent with EPA's delegated CERCLA authority and the NCP [e.g., see 42 U.S.C. §9604(a-b); 40 C.F.R. §300.425(b)(4)].

come to be located over an area extending more than 1.3 miles in length, but its extent differs widely with the depth of the water-bearing unit as well as the lateral location being considered (see Section 7 of this ROD, Summary of Site Characteristics, for discussion of distribution of contamination and land use characteristics).

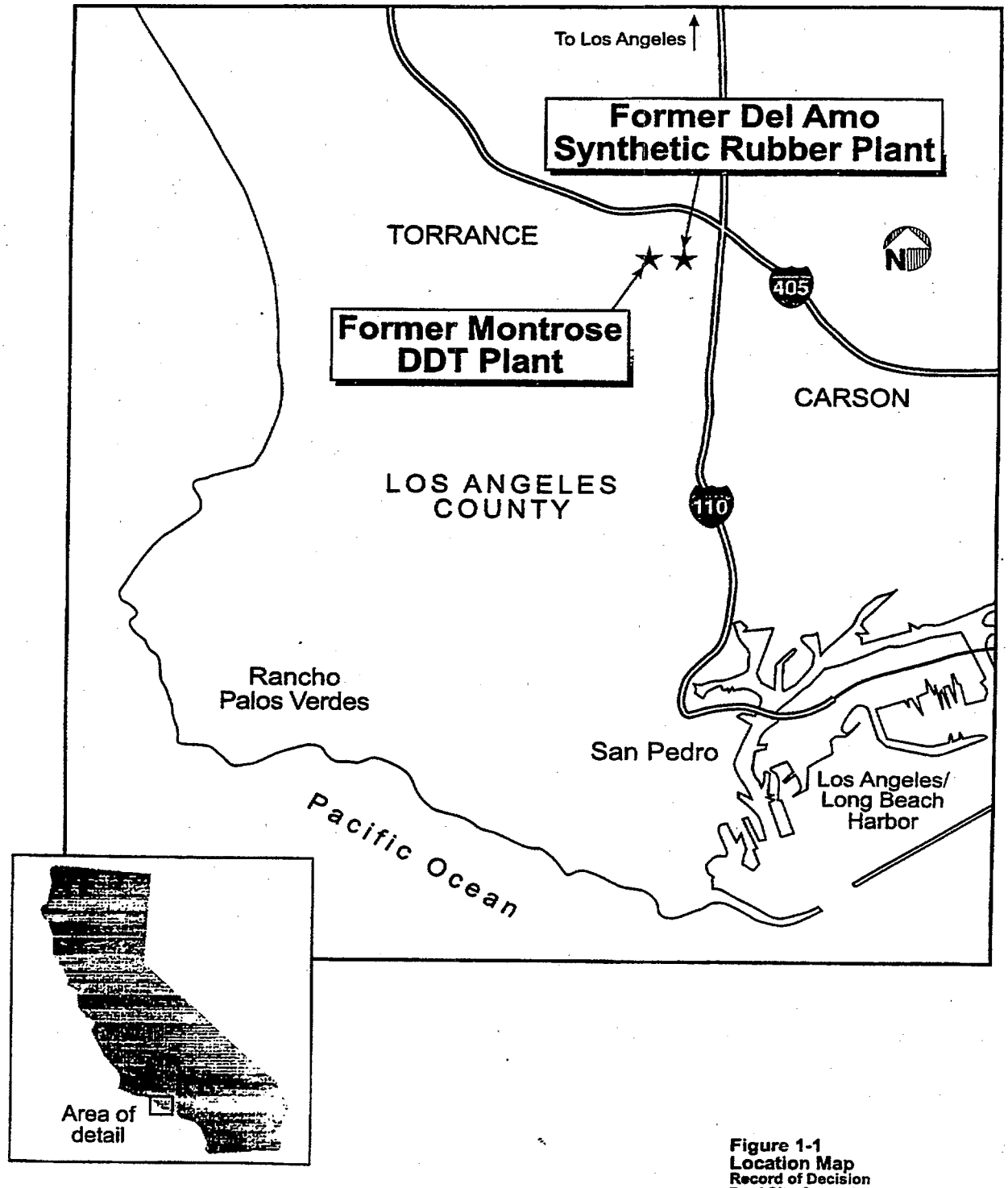

Figure 1-1
Location Map
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

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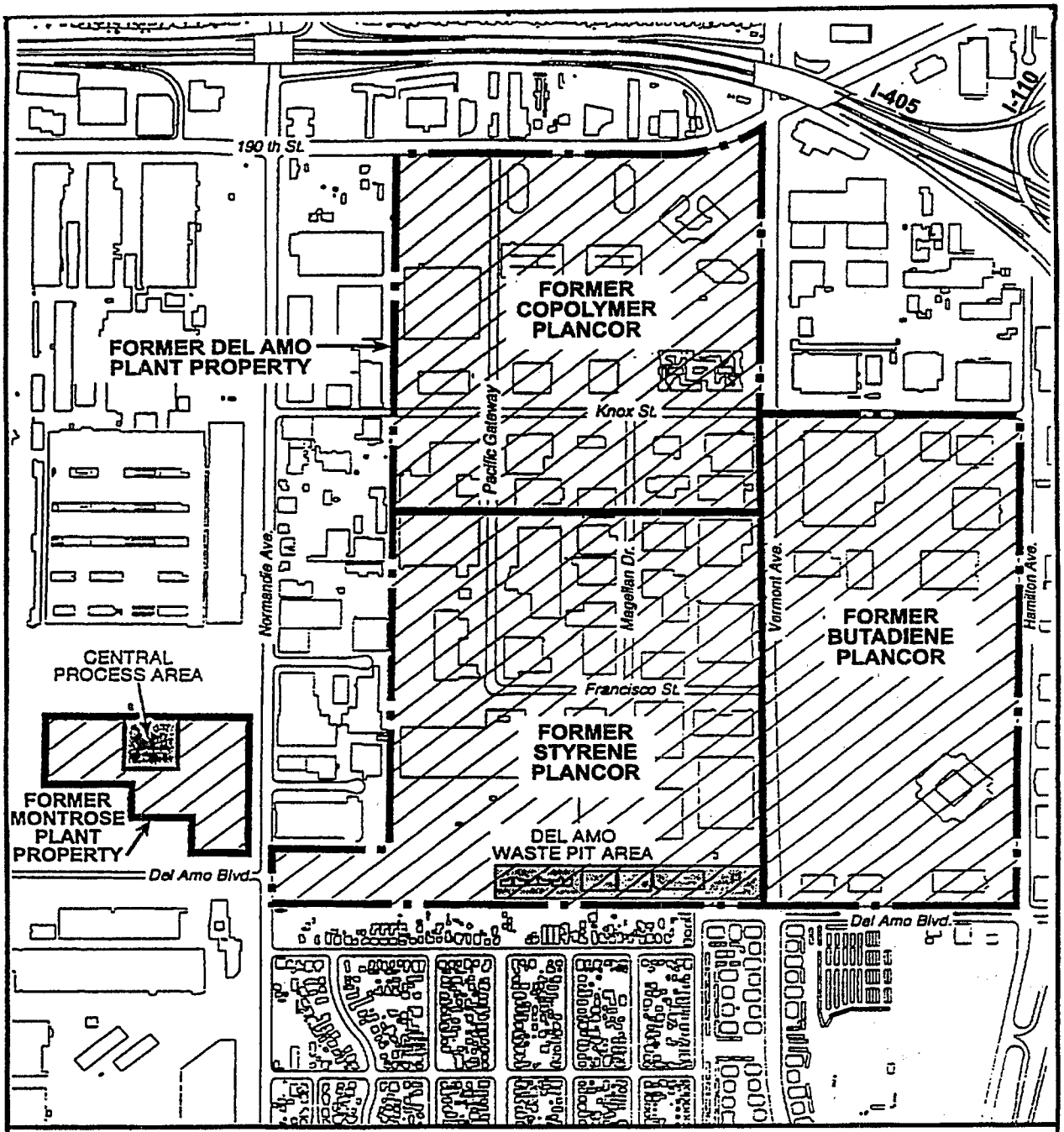

N

SCALE IN MILES

Base Map: USGS Topographic Quadrangle: Torrance, CA 1964; Photorevised 1981

Figure 1-2
Montrose and Del Amo Plant Boundaries
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

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2 Site History and Enforcement Activities

Figures 2-1, 2-2 and 2-3 show many of the features discussed in this text. Most major sources of contamination at the former Montrose and Del Amo plant properties, as well as minor sources between these major sources, are shown on Figure 2-3a. Areas of known or highly suspected non aqueous phase liquids (NAPL) are shown on Figure 2-3b. Section 2 of the JGWFS (1988), the Montrose Remedial Investigation Report (1988), and the Del Amo Groundwater Remedial Investigation Report (1988) each contain more detail on contaminant sources. See Section 7 of this ROD, Summary of Site Characteristics, for more details and conclusions about contaminant distributions.

2.1 Former Montrose Chemical Corporation Plant

Montrose Chemical Corporation operated a technical grade dichloro-diphenyltrichloroethane (DDT) pesticide manufacturing plant at 20201 S. Normandie Avenue in Los Angeles, California from 1947 to 1982. The 13-acre former plant property lies just outside the City of Torrance, in the Harbor Gateway (See Section 1 and Figures 1-1 and 1-2). Historical documents from the time of the plant's operations refer to the plant as "the Torrance plant," and the former plant property has a Torrance mailing address, despite the fact that it was not formally located within the boundaries of the City of Torrance. The layout of the former Montrose plant property is depicted in Figure 2-1.

DDT was one of the most-widely used pesticides in the world until 1972, when the use of DDT was banned in the United States for most purposes. After 1972, Montrose continued producing DDT at the former plant to be sold in other countries. In 1982-1983, the plant ceased operations, was dismantled, and all buildings were razed. Since 1985 there is a temporary asphalt covering over the former plant property, which is otherwise fenced and vacant.

During its 35 years of operation, the Montrose plant released hazardous substances, pollutants or contaminants, into the surrounding environment, including surface soils, surface drainage and storm water pathways, sanitary sewers, the Pacific Ocean, and groundwater. The primary raw materials Montrose used for making the pesticide DDT were ***monochlorobenzene*** (hereafter, "chlorobenzene") and ***trichloroacetaldehyde***, known as "chloral." Montrose placed these in batch reactors in the presence of a powerful sulfuric acid catalyst called oleum. The resulting chemical reaction produced DDT. Chlorobenzene and DDT are two of the primary contaminants found in the environment at the Montrose Chemical Site today. DDT does not significantly dissolve in water but will readily dissolve in chlorobenzene. When in its pure form, chlorobenzene is a dense non-aqueous phase liquid (DNAPL).

An unwanted by-product of DDT manufacture at the Montrose chemical plant was the highly water-soluble compound ***para-chlorobenzene sulfonic acid***, or pCBSA. This compound was created when chlorobenzene was directly sulfonated by sulfuric acid in Montrose's operations. To EPA's knowledge, pCBSA occurs in industry only in connection with DDT manufacture. There are no chronic toxicity data, and virtually no acute toxicity data for this compound. There are no promulgated health standards for pCBSA, which is found extensively in groundwater at the Montrose and Del Amo Superfund Sites. Additional information about pCBSA is provided in later sections of this ROD, including Section 8, Summary of Groundwater-Related Risks, and Section 12, Summary of Comparative Analysis of Alternatives and Rationale for Selected Alternative.

Montrose operations included a series of trenches used to convey wastes and a waste disposal pond (impoundment) which received wastewaters, DDT, and chlorobenzene. This pond also received caustic liquors and acid tars. Activities at the plant caused discharges of chemicals to the ground surface and to the waste pond. The soils under the Central Processing Area of the former Montrose plant contain large quantities of chlorobenzene in DNAPL form, as well as chlorobenzene dissolved in groundwater. The DNAPL occurs both above and below the water table. Data collected during the remedial investigation suggest that this DNAPL is a primary continuing source of groundwater contamination.

There were also periodic discharges of contamination from the Montrose plant into the storm water pathway leading from the Montrose plant. The evolution of this pathway and the discharges of wastes into it are described in detail in Chapter 1 of the *Remedial Investigation Report for the Montrose Superfund Site* (Montrose Site RI Report) (EPA, 1998). Some of these discharges may have resulted in standing contaminated water of significant quantity and over sufficient time that groundwater could have become newly or additionally contaminated by recharge from the ground surface.

Chapter 1 of the final Montrose Site RI Report gives additional details on the Montrose operating history. Section 7 of this ROD provides a more-detailed discussion of contaminant distribution; the most detailed description of contaminant distribution can be found in the Montrose Site RI Report, the Del Amo Groundwater RI Report (Dames & Moore, 1988), and the Joint Groundwater Feasibility Study (JGWFS), Section 2 (EPA, 1998). References for these documents are provided in Section 5 of this ROD.

2.2 Enforcement Activities Related to the Montrose Superfund Site

In 1982, EPA conducted an inspection of the Montrose property and determined that DDT was present in surface drainages leading from the Montrose property. In 1983, EPA and the California Regional Water Quality Control Board issued a enforcement orders to Montrose, requiring them to cease and desist their discharge of hazardous wastes to the storm drain and surface water drainages. On October 15, 1984, the Montrose Superfund Site was proposed for the National Priorities List, or NPL. The Site was listed final on the NPL on October 4, 1989. EPA began a remedial investigation of the Montrose Chemical Site under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA). Montrose demolished the former plant and graded the site in 1984 and 1985 without the prior approval of EPA. Montrose covered the entire property, except for an area in the southeastern corner, with an asphalt cap. On February 19, 1988, EPA issued a unilateral administrative order to Montrose requiring Montrose to cover the uncovered portion of the southeastern portion of the site with asphalt (EPA Docket No. 88-10). Montrose ultimately complied with this request.

On October 28, 1985, Montrose and EPA entered into an Administrative Order on Consent (AOC) (EPA Docket No. 85-04) which obligated Montrose to perform a remedial investigation and feasibility study (RI/FS) of the entire Montrose Chemical site. This AOC was subsequently amended twice, once in 1987 and again in 1989. The AOC required that Montrose evaluate the nature and extent of contamination at Montrose under EPA oversight and subject to EPA approval, including surface and deep soils at and surrounding the former plant site, surface soils in neighborhoods, groundwater, sanitary sewers, and surface water pathways. It also required that Montrose perform a feasibility study, subject to EPA oversight and approval, of alternatives for addressing the contaminants in all of these areas.

Montrose installed groundwater monitoring wells in four separate hydrostratigraphic units, installed onsite NAPL wells, drilled and sampled from soil borings on and near the former plant property, and performed a number of other investigation-related tasks. Montrose generated drafts of the remedial investigation report as well as several drafts of feasibility studies related to screening and evaluating alternatives for soils and groundwater. However, Montrose did not modify any of these drafts adequately, nor did Montrose address EPA's comments on these documents sufficiently, such that EPA could approve and finalize the RI or FS documents. In January 1998, pursuant to the provisions of the AOC, EPA took back from Montrose the work to complete the RI Report and EPA completed it using EPA staff and contractor resources.

See discussion below about the JGWFS for further information about enforcement activities after the initiation of the joint remedial effort for groundwater.

2.3 The Former Del Amo Synthetic Rubber Plant

The United States War Assets Administration (this former federal agency was succeeded by the U.S. General Services Administration [GSA]), owned a synthetic rubber manufacturing facility in Harbor Gateway, between the cities of Torrance and Carson, beginning in 1942. The War Assets Administration entered into operating agreements with Shell Oil Company (Shell), Dow Chemical Company, and several other companies, to operate the plant and to produce synthetic rubber for the United States during World War II. In 1955, Shell purchased the facility and began operating it directly. Shell operated the facility until 1972, at which time operations ceased, the plant was dismantled, and the plant buildings were razed. The plant property has been entirely redeveloped with light industrial and commercial enterprises, with the exception of the area at the south-central border of the former plant property, which is owned by Shell and is the location of the "Del Amo Waste Pits" (see below). The site did not take on the name "Del Amo" until later. The former Del Amo synthetic rubber plant property covered 270 acres, roughly 21 times the size of the neighboring Montrose plant property.

The layout of the former Del Amo plant property is depicted in Figure 2-2. The Del Amo plant had three sub-plants within it, commonly called "plancors." The styrene and butadiene plancors produced styrene and butadiene, respectively, and the rubber plancor chemically combined styrene and butadiene to make synthetic rubber. Of the three plancors, it has been shown that the majority of the contamination (there are exceptions) is found in the area of the former styrene plancor, in which large quantities of liquid benzene and ethylbenzene were stored and used. Over the years of its operation, the Del Amo plant released hazardous substances, pollutants, or contaminants into the surrounding environment. There are, at a minimum, eleven areas at the former Del Amo plant, nine of which are in the styrene plancor, which are under investigation as sources of benzene NAPL to the subsurface (See Figure 2-3a, Item Nos.2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12; and also Figure 2-3b). In some of these areas, the evidence of NAPL is conclusive because NAPL has been directly encountered. In the other areas, the evidence of NAPL presence is very strong, but based on deduction from indirect indicators. These areas remain under further investigation by Shell Oil Company and Dow Chemical Company under the oversight of EPA.

All of these NAPL sources lie within or close to the distribution, or "footprint", of the observed groundwater contamination. The "MW-20 area," so-named because it is near monitoring well MW-20, lies near a former benzene storage tank of at least a half-million gallons capacity (Item No.3 on Figure 2-3a; also shown on Figure 2-3b). South of MW-20 is a tank farm which stored benzene and ethylbenzene (Item No. 6 on Figure 2-3a; also shown on Figure 2-3b).

At the southern boundary of the former Del Amo plant property are the unlined "waste pits," in which both tarry and aqueous wastes were discharged, including wastes containing benzene, ethylbenzene, and naphthalene (Item No.10 on Figure 2-3a; also shown on Figure 2-3b). The

waste pits also received surfactants which may account for unusual contaminant migration patterns under the pits. While the pits have a thick soil cover, there is still 55,000 cubic yards of viscous waste remaining in the pits underground. In September 1997, EPA signed a ROD for an operable unit remedy for the waste pits. Pursuant to that selected remedy, an engineered impervious cap complying with requirements of the Resource, Conservation and Recovery Act (RCRA) will be constructed over the waste, which will be left in place. In addition, soil vapor extraction (SVE) will be performed on the soils under the waste. This remedial action is currently in the remedial design phase.

On the eastern end of the former rubber plant lies another area with extensive benzene contamination in soils and groundwater (Item No.12 on Figure 2-3a; also shown on Figure 2-3b). Plant history indicates the presence of laboratories, above-ground pipelines, chemical storage and processing areas, and wastewater treatment areas. All of these have been the subject of the Superfund remedial investigation effort, and some remain under investigation. Enough information is known, however, to select the remedial actions set out in the ROD for groundwater.

In the southeastern area of the former Del Amo plant site, directly east of the waste pits, is another area with confirmed benzene NAPL contamination (Item No.11 on Figure 2-3a; also shown on Figure 2-3b). The source of this benzene is not immediately apparent, though there was a major pipeline in this area while the plant was in operation.

2.4 Enforcement Activities Related to the Del Amo Superfund Site

On May 7, 1992, EPA, Shell Oil Company (Shell), and Dow Chemical Corporation (Dow) entered into an Administrative Order on Consent (AOC) (EPA Docket No. 92-13) which required Shell and Dow, acting as "the Del Amo Respondents," to perform a remedial investigation and feasibility study for the Del Amo site, including the entire 270-acre former plant site. Among the requirements of this AOC was that the Del Amo Respondents perform a 2-phase remedial investigation, a feasibility study, and several focused investigations, including the NAPL near well MW-20, as well as a focused investigation/feasibility study for the Del Amo Waste Pits. To date the Del Amo Respondents have produced a draft Phase I remedial investigation report, a final groundwater remedial investigation report (see below), a final focused feasibility study for the waste pits area, a series of reports and documents related to its investigation of the NAPL at MW-20 and a pilot NAPL hydraulic extraction test (treatability study) for that area, a report on NAPL near monitoring well P-1 and the transmission pipelines, and numerous other satellite documents. The Phase 1 RI report was never finalized by the Respondents, with the agreement that EPA's comments on that document would be addressed in the final RI and that the draft Phase I RI would not be referenced. Phase II work is now in progress.

When the joint groundwater work was initiated, EPA acknowledged that a separate remedial investigation report would be needed for the Del Amo Site which addressed groundwater only, while all remaining aspects of the remedial investigation would need to be documented in a separate report which would be issued later. The Del Amo Respondents voluntarily agreed to produce a "Del Amo Groundwater Remedial Investigation Report," which was completed to EPA's satisfaction in May of 1998.

2.5 Enforcement History Related to the Joint Groundwater Remedial Effort

Because the investigation of the Montrose Chemical Site had begun earlier than that for the Del Amo Site, originally there had been insufficient data to determine (1) the degree to which groundwater contamination from the Montrose and Del Amo Sites were commingled, and (2) the degree to which contamination from the Montrose Chemical Site might be affected by remedial actions that were being considered in feasibility studies for groundwater at the Montrose Chemical Site. The Montrose remedial investigation had identified the existence of extensive Del Amo-related groundwater contamination, but initially the remedial investigation at the Del Amo Site had not progressed to the point that this contamination was adequately defined. Accordingly, EPA considered selecting limited interim groundwater remedies for the Montrose Chemical Site until these factors could be resolved.

However, by late 1995, sufficient data had been obtained from the Del Amo groundwater investigation to determine that (1) the groundwater contamination from the two sites was commingled, and (2) the evaluation of remedial alternatives related to groundwater contamination at one site was inseparable from the same evaluation at the other site. Groundwater contamination at both sites had to be considered together in order to properly evaluate and select groundwater alternatives for the two sites (See Section 4, Context, Scope and Role of the Remedial action, in this ROD).

In late 1995 and early 1996, EPA informed and opened a dialogue with Montrose Chemical and the Del Amo Respondents (Shell Oil Company and Dow Chemical Company) that EPA intended to unite the remedial selection processes with respect to groundwater, thereby leading to a single feasibility study and a dual-site groundwater ROD. EPA initiated a process to generate a single feasibility study, called a Joint Groundwater Feasibility Study (JGWFS) to provide analysis for this ROD. While the separate AOC documents did not directly discuss a JGWFS, the parties agreed to proceed with the joint work as envisioned by EPA on a voluntary basis.

In March of 1996, a joint groundwater modeling effort was initiated. This technical effort was intensely overseen by EPA and was carried out by technical consultants to both parties. A series of meetings occurred from one to three times per month for six months in which a sophisticated

groundwater flow and contaminant transport model was developed. The model was run and results compiled in late 1996. Summary details, results, and limitations of this model are discussed in a later section of this document. Those wishing technical or complete detail are referred to the Joint Groundwater Feasibility Study (EPA, 1998).

While the draft JGWFS was due on March 10, 1997, the joint parties did not submit the draft document to EPA until May 20, 1997. Upon reviewing this document, EPA found it highly deficient and misleading in numerous respects (*See* A.R. No. 4742; EPA DCN 0639-03730). EPA formally took over the work to complete the JGWFS on August 14, 1997. EPA found that while the modeling effort was technically sound and usable, the draft JGWFS report required wholesale revision. EPA took over the work and rewrote the JGWFS, and released the public comment draft on June 26, 1998. The JGWFS is considered final with the issuance of this ROD.

In January, 1998, EPA took over the effort to complete the Montrose Site RI Report after Montrose did not produce an acceptable draft after almost a decade of multiple iterations of Montrose drafts and comments by EPA. EPA completed its revision to this draft document on June 26, 1998. This was referred to as the "Public Comment Draft."

The Del Amo Respondents completed the Groundwater Remedial Investigation Report pertaining to the Del Amo Site on May 18, 1998, in accordance with EPA's comments and EPA has approved that document.

Both Montrose Chemical and the Del Amo Respondents completed the *Joint Groundwater Risk Assessment* in accordance with EPA comments in February, 1998. This document was approved by EPA as amended by EPA's *Supplement to Joint Groundwater Risk Assessment* (EPA, 1988).

2.6 Contaminant Sources Other Than the Montrose Chemical and Del Amo Plants

Within the Joint Site (See Section 6 for formal definition of Joint Site), there are several actual or potential sources of benzene and chlorinated solvents in addition to the former Montrose Chemical plant and former Del Amo plant. Montrose Chemical is the only known source of chlorobenzene, DDT, and pCBSA to groundwater at the Joint Site. As part of the Joint Site, these sources are by definition either entirely within the current area of groundwater contamination from the Montrose Chemical and Del Amo Sites, partly within it, or sufficiently close that contamination will have to be addressed as part of the remedial action selected in this ROD (See Section 6 of this ROD for definition of the term, "Joint Site."). *This section is intended for the purposes of providing background and does not necessarily identify all such sources.* The sources are listed below with the likely primary contributing contaminant in parentheses (). Other contaminants may also be present in each case, as identified by Section 7 of

this ROD and the remedial investigation reports for this remedial action, as referenced in Section 5 of this ROD.

- **Petroleum transmission pipelines (benzene).** A series of petroleum transmission pipelines, unrelated to the former Montrose and Del Amo plants, have been and still are used to transfer petroleum products from the port to the refineries in the area (Figure 2-3a, Items "K," "M," and "N"). There are several locations directly under these pipelines where groundwater concentrations are indicative of the likely presence of benzene NAPL and which may be related to these pipelines. The pipelines occur in separate bundles. Most of these bundles run in an east-west direction just south of both the former Montrose Chemical and Del Amo plant properties. One suspect location along this pipeline is south of Montrose along the pipeline, and east of the Jones Chemicals facility (See below for discussion of Jones). Another bundle is a feeder line that runs in a north-south direction into the east-west transmission line, parallel to Berendo Avenue south of the former Del Amo plant. Petroleum NAPL containing benzene has been directly observed along this feeder line near historical groundwater monitoring well P-1.

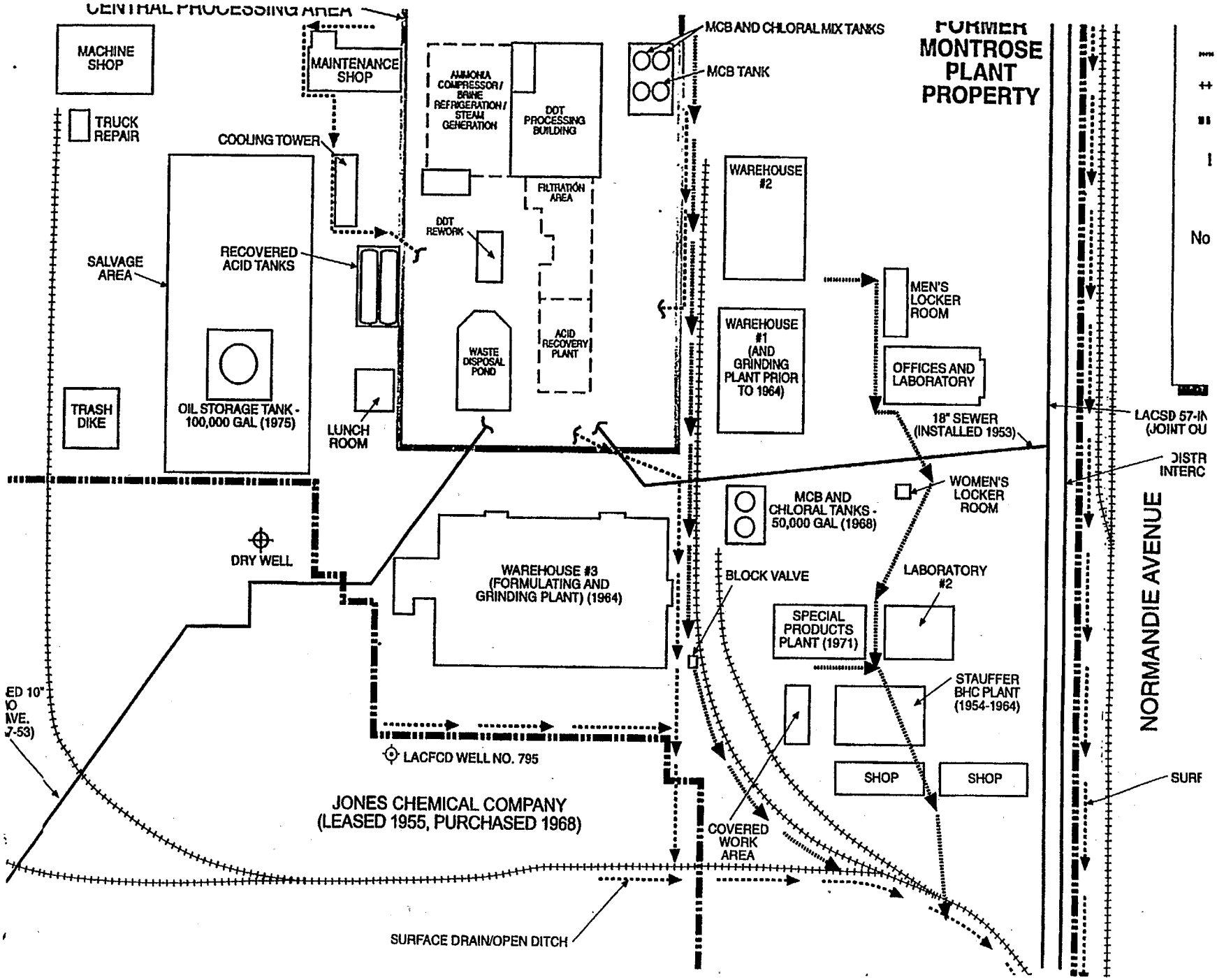
- **Stauffer Chemical (benzene).** A potential source of benzene in groundwater near the former Montrose plant is Stauffer Chemical, which historically operated a chemical plant on the Montrose property that manufactured benzene hexachloride (BHC), another pesticide. BHC manufacture requires benzene as a feedstock. In the process, benzene is chlorinated to form BHC. The gamma isomer of BHC is known as lindane.

- **Montrose (benzene).** A potential source of benzene in groundwater near the former Montrose plant is the benzene that occurred in raw chlorobenzene, most likely at a rate of less than 1%. Because of the copious quantities of chlorobenzene released, this could account for some of the benzene contamination in groundwater.

- **The Jones Chemicals, Inc. plant (TCE, PCE, DCE, and benzene).** This plant manufactures bleach and sells other chemical products in bulk and has been in operation immediately south of the former Montrose plant since the mid-1950s (Items "J" and "L" on Figure 2-3a). Based on investigations by EPA and the State of California, Jones Chemicals, Inc. is known to have discharged chlorinated solvents to a dry well on their property. Likewise, there are fuel tanks which may have leaked petroleum products into the subsurface. Jones also stored PCE on its property in bulk, packaged PCE in drums, and sold PCE for a number of years. Jones also operated a drum washing facility which was also a likely source of chlorinated aliphatic solvents released to the subsurface.

- **Solvent-handling Facilities (TCE, PCE)** There are facilities near 196th Street at the western border of the former Del Amo plant which have handled chlorinated solvents and

have soils with significant concentrations of these solvents (Item No. 2 on Figure 2-3a; also shown on Figure 2-3b). The operations at these facilities occurred or continue to occur subsequent to the closure of the Del Amo plant.


CENTRAL PROCESSING AREA
MACHINE SHOP
MAINTENANCE SHOP
TRUCK REPAIR
COOLING TOWER
AMMONIA COMPRESSOR / BRINE REFRIGERATION / STEAM GENERATION
DOT PROCESSING BUILDING
FILTRATION AREA
DOT REWORK
MCB AND CHLORAL MIX TANKS
MCB TANK
FORMER MONTROSE PLANT PROPERTY
WAREHOUSE #2
SALVAGE AREA
RECOVERED ACID TANKS
WASTE DISPOSAL POND
ACID RECOVERY PLANT
WAREHOUSE #1 (AND GRINDING PLANT PRIOR TO 1964)
MEN'S LOCKER ROOM
OFFICES AND LABORATORY
TRASH DIKE
OIL STORAGE TANK - 100,000 GAL (1975)
LUNCH ROOM
18" SEWER (INSTALLED 1953)
WOMEN'S LOCKER ROOM
MCB AND CHLORAL TANKS - 50,000 GAL (1968)
DRY WELL
WAREHOUSE #3 (FORMULATING AND GRINDING PLANT) (1964)
BLOCK VALVE
LABORATORY #2
SPECIAL PRODUCTS PLANT (1971)
STAUFFER BHC PLANT (1954-1964)
LACFCD WELL NO. 795
SHOP
SHOP
JONES CHEMICAL COMPANY (LEASED 1955, PURCHASED 1968)
COVERED WORK AREA
SURFACE DRAIN/OPEN DITCH
NORMANDIE AVENUE
LACSD 57-IN (JOINT OU
DISTR INTERC
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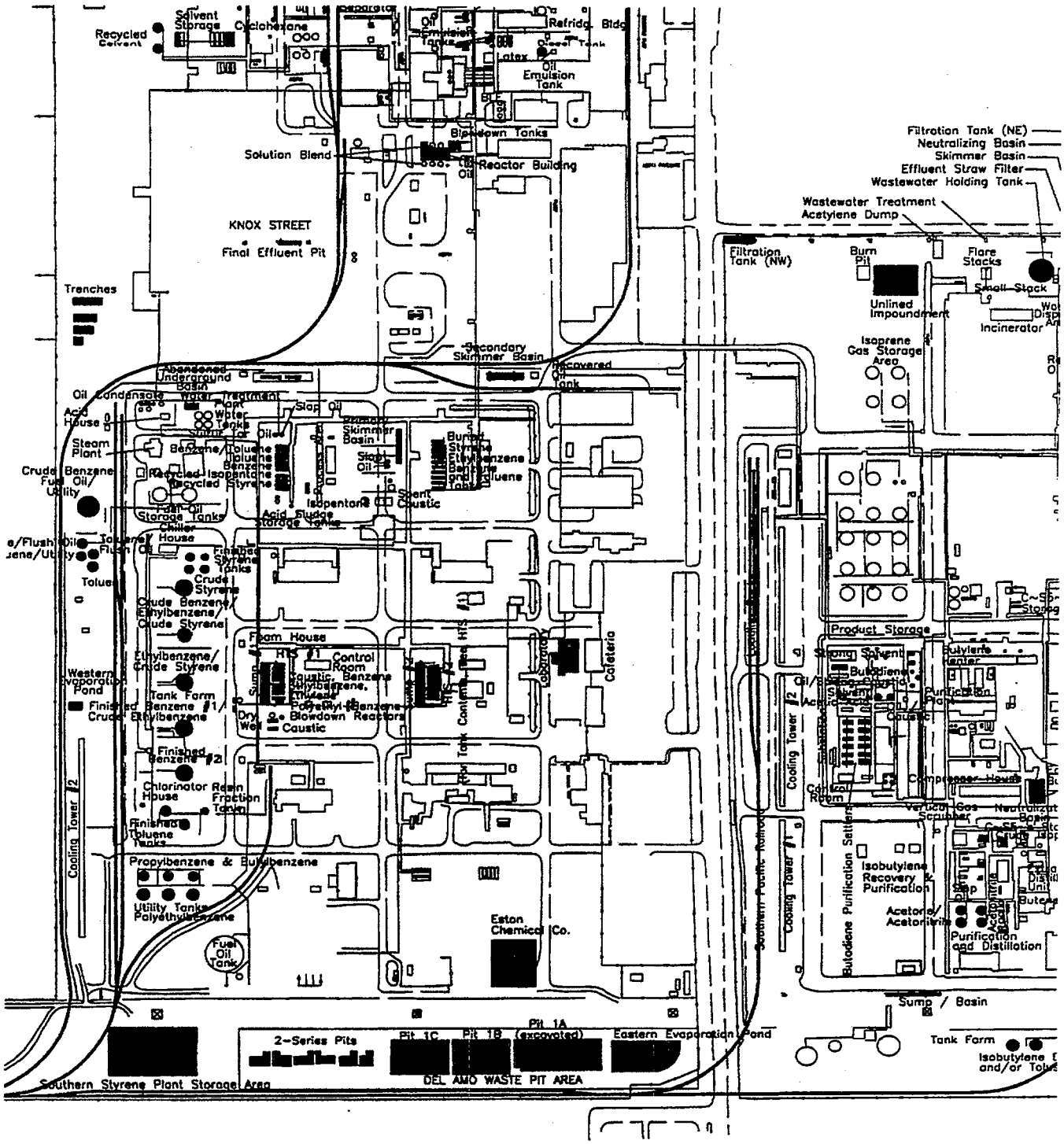
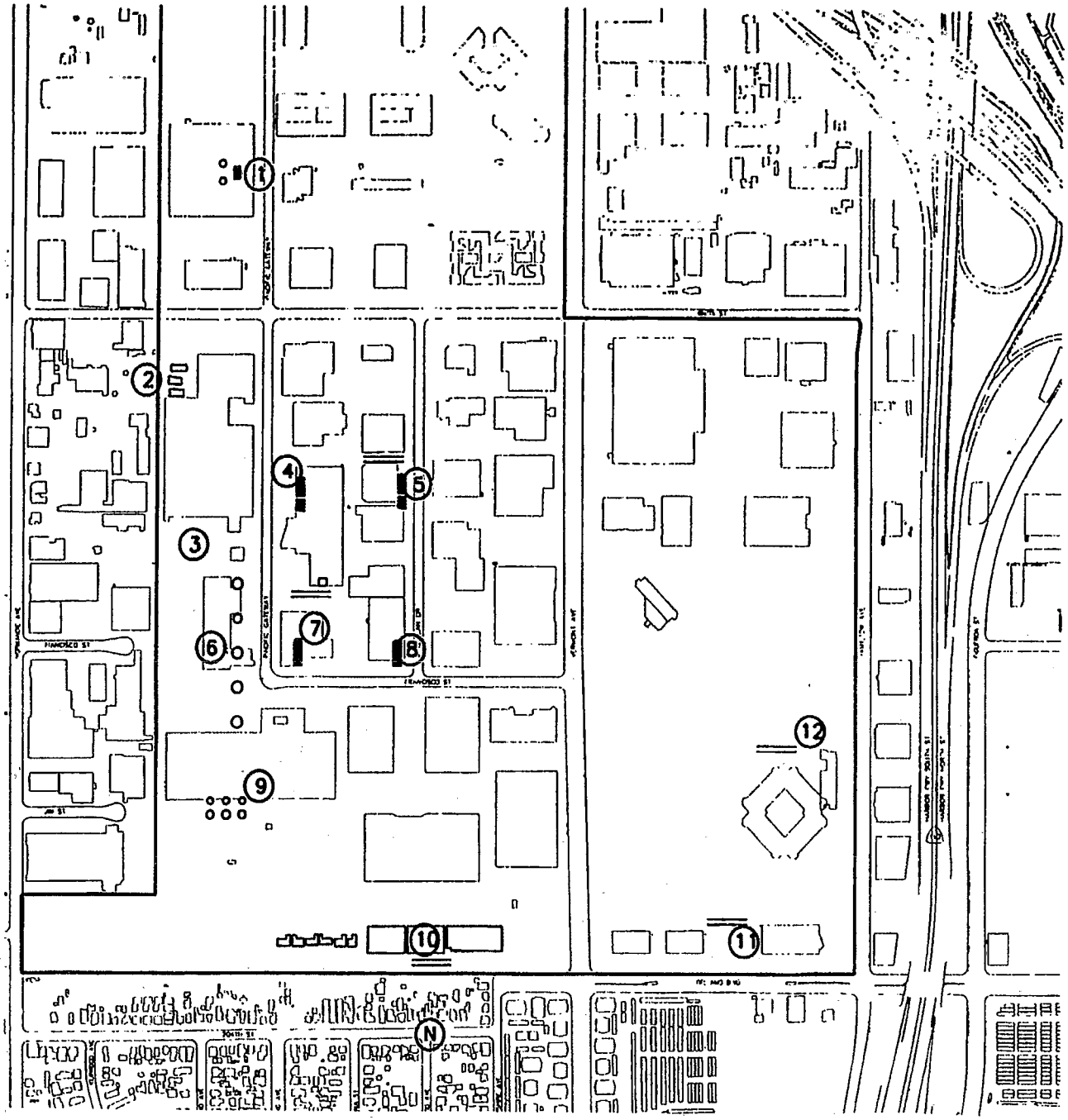


EXPLANATION



EX

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9	Fo
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12	Fo labo
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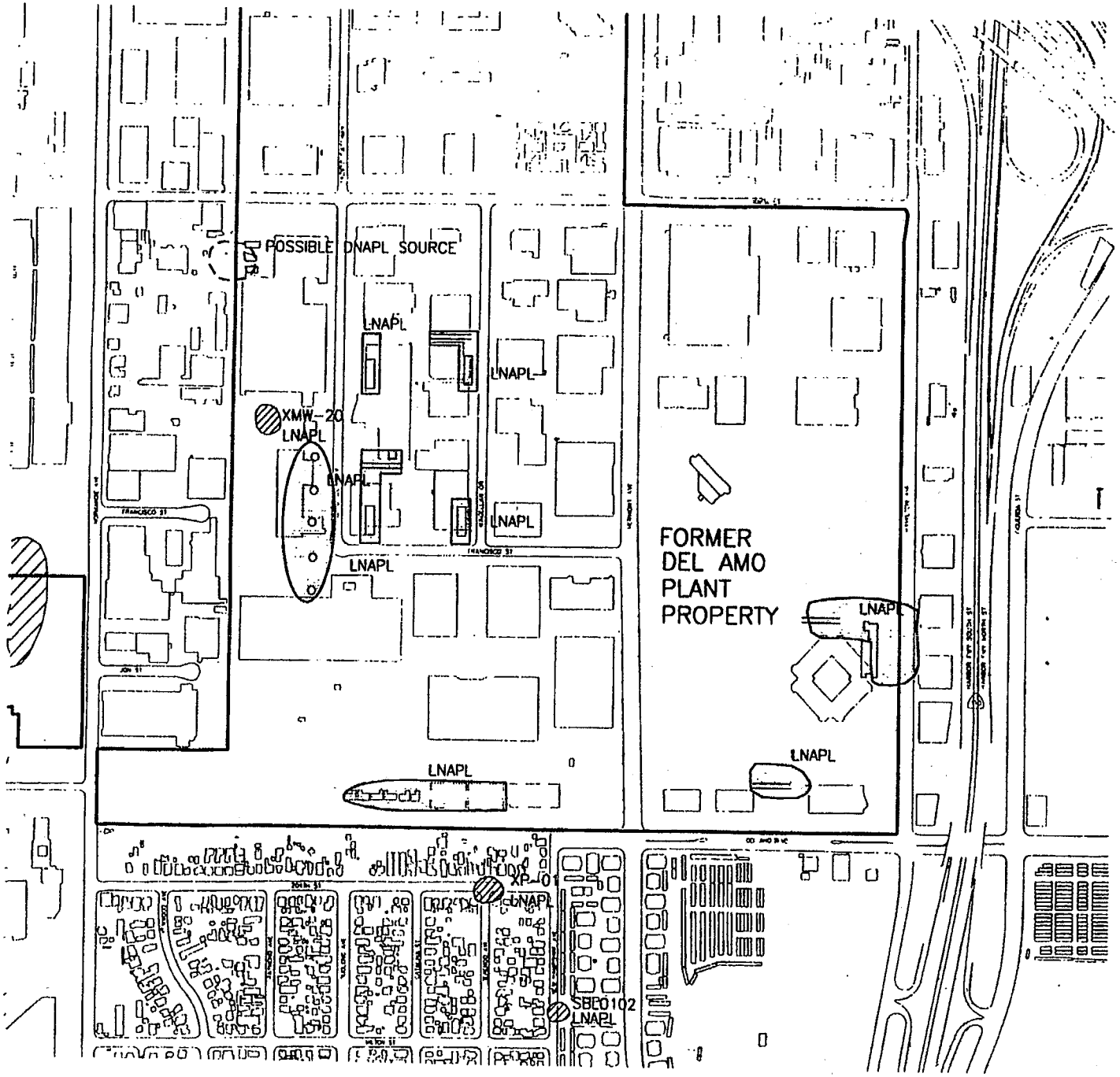

EXPLANATION

Note:
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3. Highlights of Community Involvement Activities

3.1 Communities and General Community Involvement

A community relations plan was developed and issued by EPA in July of 1985 (EPA DCN 0639-00482). EPA issued an updated community relations plan in November of 1996 (EPA DCN 0639-02277). These plans were issued in accordance with EPA guidance to facilitate the Community involvement with respect to all Superfund actions for the Montrose Chemical and Del Amo Sites. This plan has been followed by EPA with respect to general community involvement as work at the two sites has proceeded over more than a decade.

EPA has maintained a mailing list database, which is updated on a continuous basis, and has issued fact sheets to persons and business entities on this mailing list throughout the Superfund project, which began for the Montrose Chemical Superfund site in 1983 and for the Del Amo Superfund site in 1991. As discussed earlier in this ROD, there are many aspects of the Montrose Chemical and Del Amo Superfund sites which are undergoing separate investigation and cleanup actions; groundwater is one of these actions and is being addressed in a dual-site manner. Beginning in 1983 and onward, EPA issued fact sheets to the mailing list and to any parties interested in the Superfund sites, addressing either some or all of the various actions and investigations underway. Groundwater was among these actions and investigations. These fact sheets provided the public with historical and up-to-date data and information about the sites and EPA's approach to the sites. They also encouraged the public to approach EPA with any concerns and comments they may have, and gave an opportunity to add or remove names from the mailing list.

During the period 1983 to 1993, community interest in these sites was modest. In 1993, fill material contaminated with DDT was found in residential yards along 204th Street, which were immediately adjacent to the former Del Amo waste pits. A community group, the Del Amo Action Committee, was formed at that time. Over time, this group took up the broader issues of health concerns and possible contamination throughout the wider neighborhood. Other groups and individuals with other interests and positions also existed in the community near the Montrose Chemical and Del Amo sites. Beginning in 1994, to address issues associated with the temporary relocation of some neighborhood residents and other concerns in the neighborhood, EPA substantially increased its community relations effort, including meetings and workshops monthly and as often as weekly, numerous fact sheets, special hot-lines, and media relations.

Although a majority of community involvement since 1994 has been focused on actions related to neighborhoods and neighborhood soils, EPA often "piggybacked" on these efforts (meetings, fact

sheets, etc.) to provide the community with reports on progress, data, and changes in approach with respect to the groundwater investigation and feasibility study.

In 1997, members of the community, the Del Amo Action Committee, the EPA, agencies of the State of California, and many local agencies, formed a group called the Montrose and Del Amo Neighborhood Partners, which now meets regularly. EPA provides information to this group on groundwater and has received feedback on concerns related to groundwater.

3.2 Information Repository

EPA has maintained an information repository at the Torrance and Carson public libraries with hard copies of selected critical documents related to the investigation and response actions for the Montrose Chemical Superfund site and the Del Amo Superfund site. This repository contains the administrative record for the remedial action selected by this ROD.

3.3 Community Involvement Activities Specific to the Proposed Plan for the Groundwater Remedial Action Selected by this ROD

On April 17, 1997, EPA held an informational workshop about groundwater geared to the segment of the community without substantial scientific background. EPA advertised the meeting via a flyer sent out on our mailing list. The EPA remedial project manager (RPM) and community involvement coordinator (CIC) used a computer-generated slide show, various demonstration aids, and a groundwater model as visual aids to explain: (1) the nature and operational history of the sites, (2) what groundwater is and how water moves in aquifers and aquitards, (3) the extent of contamination in each aquifer at the Joint Site[1], (4) what non-aqueous phase liquids are and how they behave, (5) why some of the groundwater cannot be cleaned up fully, (6) the approach of using a NAPL isolation zone and restoring groundwater outside that zone, (7) the concept of intrinsic biodegradation, (8) the concept of groundwater pumping for containment or for full cleanup, and (9) some possible types of generalized actions EPA might take to address the groundwater. This meeting took place prior to the release of the Joint Groundwater Feasibility Study and was designed to be a primer to help people understand the proposed plan when it was issued. Approximately 50 people attended. EPA answered questions of the community during this workshop and fielded concerns to take back into the remedy development process.

In May 1998, the CIC approached both the Del Amo & Montrose Partnership as well as the Del Amo Land Use Community Advisory Panel and offered to provide them with additional

[1]See Section 6 for formal definition of Joint Site.

workshops or briefings on EPA's proposed groundwater remedy prior to the Dual Site Proposed Plan Public Meeting. Neither group accepted our offer, preferring to participate at the public meeting instead.

On June 26, 1998, EPA released two versions of the *Proposed Plan; Dual Site Groundwater Operable Unit, Montrose and Del Amo Superfund Sites.* Both versions of the plan were made available in English and Spanish. One version, the general fact sheet version, was less technical and was targeted primarily at the average person. The technical and expanded version was more technical in its terminology and analysis, was much longer, and was aimed primarily at the technical community. Each version was written to serve as a stand-alone document. Any person could receive either or both versions, in either language, upon request. The following activities accompanied this release:

- The general fact sheet version was sent to the mailing list of approximately 1900 individuals, and informed them about how to receive a copy of the technical and expanded version of the proposed plan if desired;
- The general fact sheet version was made available to anyone else who requested a copy;
- The general fact sheet version was posted on the Del Amo/Montrose web site; (URL: http://www.epa.gov/region09/waste)
- The technical and expanded version was sent to the Montrose/Del Amo Neighborhood Partners, potentially responsible parties, their attorneys and representatives, and anyone who requested a copy;
- The availability of the fact sheet and the administrative record file, and the commencement date and duration of the public comment period, were published in a local newspaper announcement; and
- A press release was issued announcing EPA's proposal, the availability of the proposed plan and administrative record file, and the commencement and duration of the public comment period.

On July 1, 1998, the administrative record file for the Dual Site Groundwater Operable Unit was made available in the Torrance and Carson public libraries, on microfilm. Selected critical documents, including the remedial investigation reports, the Joint Groundwater Feasibility Study (JGWFS), the Joint Groundwater Risk Assessment, and EPA's supplement to the risk assessment were made available in hard copy in the libraries.

On July 2, 1998, EPA opened a formal public comment period on the proposed plan and administrative record file. The original notice provided that the comment period would have a duration of 30 days and close on July 31, 1998. Subsequently, in response to requests by members of the public, EPA extended the public comment period by an additional 30 days, to August 30, 1998. An announcement of this change was placed in the same local newspaper which carried the original announcement. The public comment period spanned a total of 60 days. Because August 30 fell on a Sunday, EPA considered comments that were received or postmarked on or before Monday, August 31, 1998.

A formal public meeting on EPA's proposed plan and administrative record file was held during the afternoon on Saturday, July 25, 1998 at the Torrance Holiday Inn on Vermont Street. EPA presented an in-depth presentation about groundwater and EPA's proposal, using computer graphics and slides, and a highly sophisticated model with dye representing contaminants under the ground. EPA summarized the problems posed by the two sites. The information provided in the April 17, 1997 workshop was largely repeated and expanded upon. EPA answered the public's questions during and after this presentation. The EPA presentation was followed by a formal comment period. Both EPA's presentation, the questions and answers, and the formal comment period were transcribed by a court reporter. Approximately 35 people attended, including representatives of Del Amo Action Committee, the Del Amo Land Community Advisory Panel, local businesses, and other members of the general public. Comments read into the record during the formal comment portion of the public meeting were addressed by EPA prior to issuance of this ROD. EPA's responses can be found in the response summary.

4. Context, Scope and Role of the Remedial Action

This operable unit remedy addresses cleanup of contaminated groundwater and the containment of dissolved phase contamination surrounding non-aqueous phase liquids (NAPL), with respect to *both* the Montrose Chemical and the Del Amo Superfund Sites.[1] EPA refers to this action as a ***dual-site operable unit remedy***. The term "dual site" refers to its application to two Superfund sites within a single ROD. As an operable unit remedy, this remedy addresses only a specific portion of all contamination at the Montrose Chemical and Del Amo Superfund Sites. Overall site remedies will, and other operable unit remedies may, be selected for each of the sites. Subsequent amendments to this ROD may be on either a dual-site or site-specific basis, as determined appropriate by EPA.

This ROD establishes remedial actions and standards that differ among various areas of groundwater within the Montrose and Del Amo Sites. The ROD defines these areas both laterally and with depth (i.e. 3-dimensionally) within the system of hydrostratigraphic units present at the Joint Site[2]. This is because (1) the nature and extent of NAPL contamination has made it necessary to address contaminated groundwater that is near NAPL differently than contaminated groundwater at a greater distance from NAPL, and (2) there are physical differences among the various areas of dissolved phase contamination within the overall contaminant distribution that justify differing goals and actions. The details of these distinctions are summarized later in this ROD.

This ROD contains multiple specialized issues and approaches which require substantial discussion. As just mentioned, the ROD utilizes a dual-site approach, and selects differing actions for multiple areas of groundwater. In addition, this ROD 1) reflects only the first of two phases of remedy decisionmaking with respect to this operable unit, 2) includes a waiver of certain applicable or relevant and appropriate requirements based on technical impracticability for a defined area of groundwater, and 3) relies on more than one general response action (both intrinsic biodegradation, a form of natural attenuation, as well as hydraulic extraction and treatment) to meet remedial objectives. This section places these factors and the remedial approach being used into context so as to define the scope of the remedial action clearly and provide a contextual backdrop for the other sections of this document.

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[1]Groundwater at the Montrose Chemical and Del Amo Sites is contaminated by hazardous substances and other pollutants or contaminants as defined by Section 101 of CERCLA, 42 U.S.C. §9601, and/or listed by EPA as CERCLA hazardous substances in 40 C.F.R. Table 302.4. *See also* 40 C.F.R. §302.4.

[2]See Section 6 for formal definition of the term "Joint Site."

4.1 Dual-Site Basis and Approach

The groundwater contamination from the Montrose Chemical and Del Amo Superfund Sites has partially commingled, or merged. Originally, EPA oversaw separate remedial investigations and feasibility studies for groundwater at the two sites. However, EPA has found that factors and considerations related to evaluation of remedial alternatives and implementation of remedial actions for groundwater at these sites is inextricably related. Remedial actions taken for groundwater at one site will, to some extent, affect remedial actions taken at the other site, either by affecting the type of action taken or the manner in which the action is implemented, or both.

The groundwater contamination at these two sites presents as one interrelated technical problem. This is not to say that there are not technical distinctions worth identifying and considering between the Montrose and Del Amo Sites with respect to groundwater contamination and these have been considered by EPA, as appropriate. However, it is appropriate to frame a single remedy selection process for groundwater at the two sites. The nature and extent of contamination and the nature of the EPA Superfund remedy selection process lead to the following conclusions:

1. The implications of possible remedial actions for one site must be viewed in the context of those being considered for the other site;

2. The remedial actions for both sites must be mutually consistent; and

3. The nine remedy selection criteria in the National Contingency Plan (NCP) must not be evaluated in terms of either site alone, but in relation to the groundwater contamination from both sites as a whole.

As an example, a principal goal of the JGWFS was to evaluate the degree to which groundwater contamination at either site may be adversely moved by remedial actions being considered for the groundwater contamination at the other site. Likewise, consideration was given to whether taking certain actions for one site might affect the range or latitude of options for, or the efficacy of, addressing the other site. Such factors had to be considered together, both in time and within a single vehicle.

As another example, objectives strongly valued at one site, such as cleaning up more quickly and/or keeping existing contamination contained, bring about consideration of actions at the other site, or make some results at the other site more acceptable than they would otherwise be when considered alone. A balancing among the "site-specific" objectives is required.

Attempts to separate evaluations of remedial alternatives independently "by site" would have become artificial and awkward. The likely result of such an effort would have been two largely redundant and duplicative remedy selection processes, each with a set of reports straining to confine its evaluation of criteria within the sphere relating to one site, when the considerations needed cross site boundaries and pertain to the interrelated dual site. Such an approach also would have presented the formidable administrative risk of being either technically or administratively inconsistent and making the remedy selection process muddled or incomprehensible to the public.

Accordingly, EPA has employed a unified process of evaluation, public comment, and remedy selection to apply to this groundwater operable unit at both sites. Using a unified approach has: (1) provided for technical consistency and completeness, (2) minimized and simplified the administrative process of remedy selection, and (3) facilitated public understanding and the ability of the public to comment on the remedy when it was proposed to the public.

4.2 Site-Wide Context of This Operable Unit

Table 4-1 shows the contaminated media affected by each of the Superfund sites. The operable unit remedy selected in this ROD addresses only groundwater and NAPL, the first two items under each site in Table 4-1. EPA is conducting separate investigations and planning separate remedy selection processes for the other affected media at these sites, as shown in Table 4-1. The other affected media, and the activities being undertaken to address them, are not covered by this document or this remedy. The interim provisions of an operable unit ROD for the Del Amo Waste Pits, issued September 5, 1997, are finalized by this ROD.

4.3 The Problem Posed by NAPL at the Joint Site

The presence of NAPL contamination at both the Montrose and Del Amo sites strongly influences (1) the nature and scope of this remedy, (2) the remedial approach used in all remedial alternatives considered, and (3) the evaluation of alternatives. While more information is provided on NAPL and its distribution in later sections, a discussion is provided here to establish how NAPL relates to these contextual aspects.

At most sites where it occurs, contamination in groundwater is present in one of three forms: (1) dissolved in the water, called *the dissolved phase*; (2) adsorbed to soil particles, called *the sorbed phase*; and (3) as non aqueous phase liquid, called the *residual phase* or *NAPL phase*. Contaminant mass can be transferred among these three phases as subsurface conditions change. Generally speaking, NAPL is the presence of the pure, undissolved form of a chemical which is a liquid at standard temperature and pressure and which has a low enough water solubility that it is significantly immiscible with water and can exist as a separate phase when present in water. The

term "NAPL" does not refer to the chemical content of a substance but rather to its form. Many chemicals and mixtures of chemicals display NAPL properties but their chemical composition can only be resolved with site-specific sampling and analysis.

NAPL is usually associated with one or more of the following characteristics: (1) high interfacial tension with the water phase; (2) a density difference with the water phase; (3) movement that is dominated more by the relative saturations of NAPL/water/air, buoyancy forces, gravity and capillary pressures, rather than by hydraulic gradients, and (4) heightened viscosity. However, it is important to note that there are many chemicals for which the NAPL form is not highly viscous. An example of this is chlorinated aliphatic solvents. NAPL that has density less than the density of water is called "light non-aqueous phase liquid," or "LNAPL," and NAPL with density greater than that of water is called "dense non-aqueous phase liquid," or "DNAPL."

EPA's experience at Superfund sites is that NAPL often creates serious challenges for remedial efforts. This is because, on the one hand, it dissolves into groundwater and causes high concentrations of contaminants (up to the solubility limit) in groundwater; yet, on the other hand, complete dissolution of NAPL takes a very long period of time, and it cannot be easily flushed and removed from the aquifer. It can be exceedingly difficult to determine with a significant or reasonable degree of certainty: (1) the location of NAPL at a site, (2) the distribution of NAPL, (3) the total NAPL mass, and (4) the lowest elevation in the subsurface at which NAPL occurs ("bottom of the NAPL-contaminated zone"). NAPL can remain in the soils indefinitely, either above or below the water table, where it continually dissolves, either directly into groundwater, or into soil moisture which percolates into groundwater. In this way, NAPL represents a continuing and often recalcitrant source of dissolved phase contaminants into groundwater. Once in groundwater, the movement of the dissolved contaminants is controlled by the processes of advection, dispersion, retardation, and degradation. Figure 4-1 provides a simple depiction of this process. In order to clean groundwater when a NAPL source is present, the NAPL must either be removed, destroyed, or isolated; otherwise, continuing dissolution from the NAPL will re-contaminate groundwater which has been cleaned.

NAPL is present in many areas in the subsurface at the Montrose and Del Amo Sites, surrounded by larger areas of dissolved-phase contamination in groundwater. At these sites, NAPL is present under conditions such that it is technically impracticable with existing technologies to remove enough NAPL to reduce groundwater concentrations to health-based standards at all points in the groundwater plume. Attaining groundwater standards in the midst of the NAPL-impacted areas would require virtually complete elimination of the NAPL from the ground, which EPA has determined to be technically impracticable. This is further discussed and supported in Section 10 of this ROD.

4.4 Use of a Containment Zone for NAPL

This operable unit remedy isolates the NAPL within a ***containment zone.***[3] The containment zone includes both NAPL and some dissolved phase contamination surrounding the NAPL. Dissolved phase contaminants within the containment zone will be prevented from escaping the containment zone by the remedial actions selected by this ROD. These actions thereby isolate the NAPL and the dissolved phase contamination *inside* the containment zone, from the dissolved phase contamination and clean groundwater *outside* the containment zone. The size of the containment zone is limited in size based on technical principles (discussed in Section 10 of this ROD and Appendix E of the JGWFS).

NAPL dissolution continues to occur within the containment zone, therefore, concentrations of contaminants within the containment zone cannot be appreciably reduced; the containment zone must be contained indefinitely. However, once the containment zone is established, the dissolved phase contamination *outside* the containment zone can be cleaned up to health-based standards because NAPL dissolution no longer effects the groundwater outside the containment zone. All alternatives that EPA considered prior to selecting this remedy (except for the No Action Alternative) assumed that NAPL was isolated within a containment zone in this way. This concept is depicted in Figure 4-2.

Two means are utilized within this ROD for achieving containment of dissolved phase contaminants within the containment zone: (1) hydraulic extraction and treatment, and (2) reliance on intrinsic biodegradation. The application of these means vary depending on the area of groundwater being addressed. This is further discussed in Sections 11 and 12 of this ROD with Sections 7, 9 and 10 providing significant supporting information.

4.5 Two Phases of Remedy Selection to Address Groundwater and NAPL

This operable unit remedy represents the first of *two* phases of remedy selection that will address groundwater and NAPL at these sites. This first phase establishes a containment zone and addresses dissolved phase contamination. More specifically, this phase:

[3]The use of the term "containment zone" in this ROD does not reflect a formal establishment of a containment zone as that term is used in, and per the requirements of, California State Water Resources Control Board Resolution No. 92-49(III)(H).

(1) ***Contains dissolved phase contaminants in groundwater surrounding the NAPL*** in a containment zone, thereby isolating the NAPL principal threat and the contaminated groundwater immediately surrounding it from the groundwater outside the containment zone; and

(2) Outside the containment zone, ***reduces dissolved phase concentrations*** of contaminants in groundwater to health-based standards and in accordance with the specifications in this ROD.

The second phase of remedial selection for this operable unit will address whether and to what degree ***NAPL Recovery*** and/or ***NAPL immobilization*** shall occur at the Montrose and Del Amo Sites. This distinction between the two phases is further described as follows.

It is important to make certain distinctions between the dissolved phase and the NAPL phase in order to put the two phases of remedial selection into context. While it addresses NAPL by isolating it within an area of groundwater, this first phase remedial action does *not* address ***NAPL recovery***, which refers to removing the NAPL itself from the ground. The action selected by this ROD, therefore, does not significantly affect the mass of NAPL remaining in the ground.

Also, the actions selected in this ROD prevent the migration of dissolved phase contaminants *in the water surrounding the NAPL,* but do not prevent the migration of the NAPL phase itself. While this ROD requires that the remedial action be designed to prevent or limit *inducing* the movement of NAPL, a certain degree of NAPL movement may occur naturally. EPA has determined that this remedy is protective of human health and the environment. However, the potential for movement of the NAPL phase itself in the future, as well as the lingering mass of NAPL, creates uncertainty with respect to the long-term effectiveness of the remedial actions selected in this ROD, and the ability of those actions to maintain protectiveness of human health and the environment over the long term. To address these uncertainties, EPA is performing a second phase of remedial decisionmaking for this groundwater operable unit.

Some degree of NAPL recovery and/or immobilization of NAPL would likely enhance the long-term effectiveness and certainty of long-term protectiveness of the first phase remedial actions selected by this ROD. When NAPL is recovered from the ground, its mass and saturation are reduced. In principle, this can (1) reduce the amount of time that the containment zone must be maintained, (2) reduce the potential for NAPL to move naturally either vertically or laterally, and (3) increase the long-term certainty that the remedial action will be protective of human health and remain effective. In addition to technologies which physically remove NAPL, there are other technologies which, while not removing NAPL from the ground, may reduce its mobility in place, thereby immobilizing it. Evaluations of the potential for NAPL recovery or immobilization to be

effective are underway but have not been completed specifically with respect to the Montrose Chemical and Del Amo Sites.

Whether and to what degree NAPL recovery and/or NAPL immobilization should occur at the Montrose Chemical and Del Amo Superfund sites will be determined in a separate but related second-phase remedial selection process. As of the date of this ROD, EPA is presently overseeing separate feasibility studies (one for the Montrose Chemical Site, and another for the Del Amo Site) that are examining the feasibility of various NAPL recovery and immobilization alternatives. If EPA determines that an additional remedial action is necessary, EPA will select the second phase remedial actions in an *amendment* to this ROD. EPA may issue such an amendment, if any, as a stand-alone document or within the framework of another ROD for the Montrose and Del Amo Site, including final site-wide ROD(s) which may be issued.

Performance of the second phase remedial selection process for this operable unit is authorized by and consistent with the NCP provision at 40 C.F.R. 300.430(f)(5)(iii)(D) which provides that the ROD shall:

> ...When appropriate, provide a commitment for further analysis and selection of long-term response measures within an appropriate time frame.

The second phase is also in accordance with the *Guidance for Evaluating the Technical Impracticability of Groundwater Restoration* [EPA OSWER Directive 9234.2-25, October 1993], which directs that when waivers of applicable or relevant and appropriate requirements (ARARS) are issued based on technical impracticability in groundwater remedies, EPA should demonstrate:

> ...that contamination sources [in the case of the Joint Site, the NAPL sources] have been identified and have been, or will be, removed and contained to the extent practicable [Section 4.3].

This ROD makes no determination or specification as to NAPL recovery or immobilization, or the feasibility of these actions at these sites, other than to determine that enough NAPL cannot be recovered with existing technologies to reduce contaminant concentrations to drinking water standards at all points in the contaminant distribution (this is further discussed in Section 10 of this ROD).

Both the remedial actions selected in this ROD, and any remedial actions for NAPL recovery or immobilization that may be selected by EPA in ROD amendments subsequently, may be necessary to fully address the principal groundwater-related threat. However, because it will be technically impracticable to recover enough NAPL to reduce groundwater concentrations to drinking water standards in the containment zone, the remedial actions selected in this ROD to isolate the NAPL

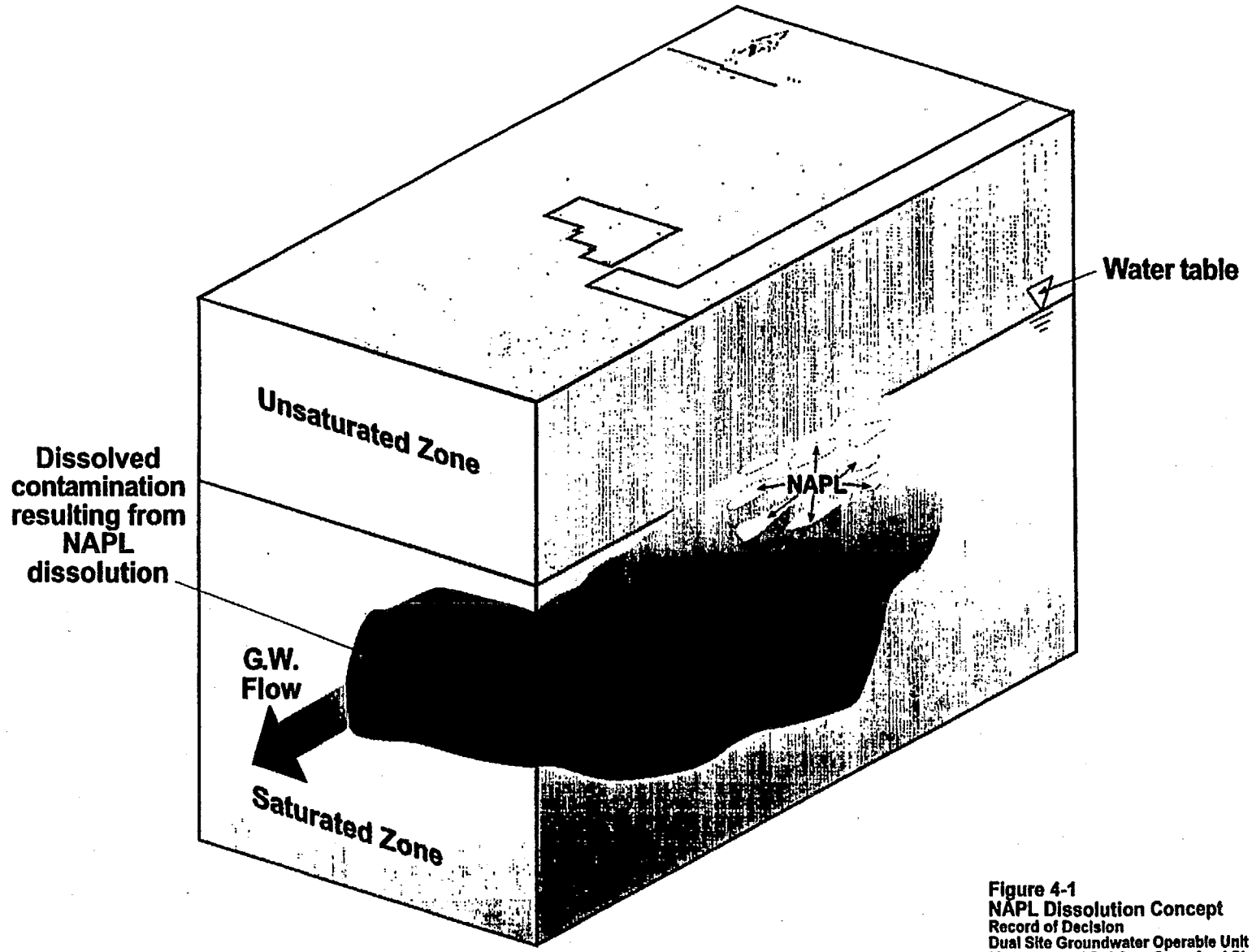
will be necessary *regardless* of the degree of NAPL recovery or immobilization ultimately selected in the second phase. Because of this, and because the process of evaluating alternatives for NAPL recovery or immobilization is not yet completed, EPA is proceeding with the selection of this remedial action in advance of the completion of the remedy selection process where NAPL recovery and/or immobilization will be addressed.

4.6 Finalization of Del Amo Waste Pits ROD

This ROD finalizes the provisions of the Del Amo Waste Pit remedy that EPA had designated as interim when it issued its ROD for that remedy in 1997. Specifications and details related to this are discussed in Sections 12 and 13 of this ROD.

Table 4-1
Affected Media at the Montrose Chemical and Del Amo Superfund Sites
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

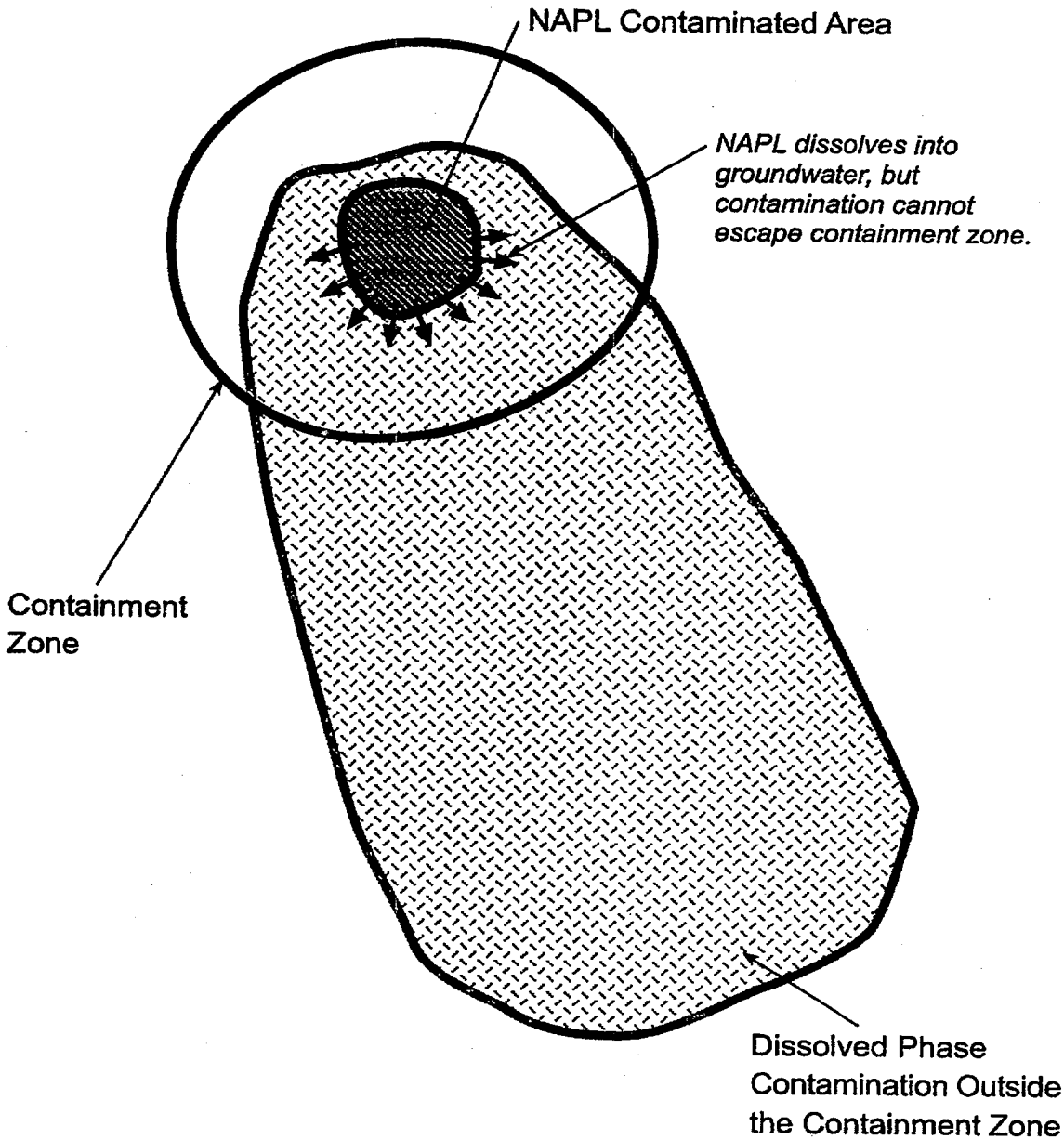
MONTROSE CHEMICAL SUPERFUND SITE	DEL AMO SUPERFUND SITE
Groundwater	Groundwater
NAPL	NAPL
Surface soils on and near the original plant property	Surface Soils on the original plant property
Sediments in existing storm water pathways	Indoor air in businesses
Sediments and soils in neighborhoods contaminated by DDT due to historical surface water pathways and/or aerial dispersion	Del Amo Waste Pits area (separate interim ROD finalized by this ROD)
Sediments in the sanitary sewer system	
DDT-contaminated fill in a neighborhood	
DDT-contaminated sediments on the Pacific Ocean floor	



Conceptual Representation

Figure 4-1
NAPL Dissolution Concept
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX



Conceptual Representation

Figure 4-2
Containment Approach for NAPL and Dissolved Phase
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

5. Major Documents

The documents that EPA considered in selecting this remedy appear in EPA's administrative record for this remedy which contains more than 6000 documents and is available at the Torrance and Carson public libraries and at EPA's Region IX Offices in San Francisco. Various documents are also available at the State Department of Toxic Substances Control in Cypress. The following seven documents are required by the NCP and are of particular importance to the remedy selected by this ROD:

1. *Final Remedial Investigation Report for the Montrose Site; Los Angeles, California*; May 18, 1998; originally prepared by Montrose Chemical Corporation of California and Revised by U.S. Environmental Protection Agency, Region IX. 2 volumes.

2. *Final Groundwater Remedial Investigation Report; Del Amo Study Area;* May 15, 1998; prepared by Dames & Moore for the Shell Oil Company and The Dow Chemical Company. 3 volumes.

3. *Final Joint Groundwater Feasibility Study for the Montrose and Del Amo Sites; Los Angeles, California;* May 19, 1998; prepared by CH2M Hill for the U.S. Environmental Protection Agency, Region IX. 1 volume.

4. *Joint Groundwater Risk Assessment; Montrose and Del Amo Sites; Los Angeles County, California*; February 1998; prepared by McLaren Hart for the Montrose Chemical Corporation, and Dames & Moore for the Shell Oil Company and The Dow Chemical Company. 1 volume.

5. *Supplement to the Joint Groundwater Risk Assessment for the Montrose and Del Amo Sites; Los Angeles, California*; May 18, 1998; prepared by CH2M Hill for the U.S. Environmental Protection Agency, Region IX. 1 volume.

6. *Fact Sheet: Montrose and Del Amo Superfund Sites: EPA Proposes Groundwater Cleanup Plan; (General Fact Sheet Version)*; June 1998 by the United States Environmental Protection Agency Region IX. 14 pages.

7. *Remedy Proposed Plan for Dual Site Groundwater Operable Unit, Montrose and Del Amo Superfund Sites; Technical and Expanded Version;* June 1998 by the United States Environmental Protection Agency Region IX. 47 pages plus graphics.

All of these documents appear in EPA's administrative record for this remedy.

6. Definition of the Term "Joint Site"

The National Contingency Plan (NCP), the regulation governing the Superfund Program, defines "on site" at 40 C.F.R. §300.5 as:

> *"...the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action."*

The boundary of a Superfund site occurs at the limits of the areal extent to which contamination has come to be located. Knowledge of this boundary changes as remedial investigations reveal additional areal extent that is contaminated, or as the contamination spreads. It usually is not possible to know with complete certainty all places where contamination has come to be located, even at the conclusion of the remedial investigation, and so in turn the site boundary cannot be known with complete certainty. What is considered the boundary of a site is not static but changes as the knowledge about the extent of contamination changes.

This ROD does not make formal determinations as to the boundaries of the Montrose Chemical Superfund Site nor the Del Amo Superfund Site. Again in accordance with the above definition, each "site" is neither congruent with nor confined by the boundaries of any specific property with which the former Montrose Chemical plant or the former Del Amo plant were associated.

In the case of this remedy, several factors gave rise to the need for EPA to define a term to refer, in concept and by convention, to the area to which the remedy selected by this ROD is assumed to apply:

- As discussed, this ROD is addressing the contamination from the two sites as a single technical problem.
- For convenience and simplicity a shorthand term was needed to encompass the lengthy and awkward reference to groundwater at "the Montrose Chemical and Del Amo Superfund Sites."
- The Montrose and Del Amo Sites lie in an industrial area where other sources of groundwater contamination exist. Some of these other sources will be directly affected by this proposed remedial action, others will not. There needed to be a conceptual (as opposed to absolute) basis for determining how the remedial action selected by this ROD applies to some of these areas and not to others.

- This ROD defines several areas of contaminated groundwater within the Montrose Chemical and Del Amo Superfund sites, to which differing requirements shall apply (e.g. ARAR waivers, containment only, full cleanup, etc.). All such areas occur by definition within the union of the two Superfund sites, and a conceptual basis for this region was needed.

Because of these factors, this ROD does not refer to either site individually unless specifically mentioned. Rather, the ROD uses the term ***Joint Site*** to refer to the area within which the selected remedial action will apply. The area within the Joint Site is based on: 1) the extent of the contamination and 2) the nature and likely effects of the remedial actions selected by this ROD. The latter consideration is included because the remedial action may have a hydraulic influence on certain overlying and surrounding contamination sources that must be considered part of the Joint Site due to their proximity to the remedial action. These hydraulic influences on the sources have been identified with the assistance of the groundwater model (see Section 1.2.3, Section 2, and Appendix B of the Joint Groundwater Feasibility Study (JGWFS), EPA 1988). Specifically, the term "Joint Site" in this ROD refers to:

- The former Montrose Chemical and Del Amo plant properties;

- The areal extent of groundwater affected by the contamination originating or emanating from the former Montrose Chemical and Del Amo plant properties;

- Any areas of groundwater contamination originating or emanating from sources in the vicinity of the former Montrose and Del Amo plant properties that is wholly contained within the areas described in the preceding bullet items;

- Any areas of groundwater contamination that are partially overlapping, or distinct, but in proximity to the areas of groundwater described in the preceding bullet items ***and*** that likely would be significantly affected by the remedial action selected in this ROD.

There are sources of groundwater contamination farther afield surrounding the former Montrose and Del Amo plant properties that are not likely to be affected by this remedy. These sources are not considered to be part of the Joint Site. Most of these are subject to cleanup investigation and/or other cleanup actions directed or overseen by the State of California. While EPA has made no such determination at present, it is possible that in the future such sources would be shown to have an influence on the Joint Site that cannot be avoided. By definition, these sources would then be part of the Joint Site.

The use of the term Joint Site does not imply that a formal Joint Site boundary exists that can be depicted on a map. Rather, EPA intends to give conceptual guidelines as to the area being addressed by the remedial action.

It is further noted that *Joint Site* refers not only to the existing known extent of contamination as described by the above bullet items, but to the *actual* extent of contamination so-described, whether known or not known, both presently and in the future.

7. Summary of Site Characteristics

7.1 Extent and Distribution of Contamination

An understanding of the distribution of contamination in each of the hydrostratigraphic units in question is crucial to the understanding of this selected remedy. The reader is referred to the critical documents listed in Section 5 of this ROD; including the remedial investigation reports and Section 2 of the Joint Groundwater Feasibility Study (JGWFS), for a complete summary of the extent and distribution of contamination. This ROD only summarizes this information.

This remedy defines a number of zones laterally and vertically within the groundwater, and assigns differing remedial actions to each. These zones are based on the characteristics summarized in this section. This ROD relies heavily on the special definition and use of the term ***plume*** for special zones of groundwater. This definition is given later in this section in Section 7.2, "Conventions for Dividing the Contamination into Plumes." A thorough understanding of the use of the term *plume* is essential to comprehension of the remedial action selected by this ROD, and the reader is encouraged to carefully review Section 7.2 before proceeding to other sections of the ROD. The intervening information on contaminant distributions greatly facilitates and elucidates the definition of plumes and is therefore presented first.

Driving Chemicals of Concern for Remedy Selection Purposes

More than 30 hazardous substances and pollutants or contaminants have been detected in groundwater at the Joint Site. These are identified in the remedial investigation reports (see Section 5). Among the hazardous substances or chemicals of concern at the Joint Site are: chlorobenzene, benzene, ethylbenzene, dichlorobenzene, naphthalene, DDT, benzene hexachloride (BHC), chloroform, trichloroethylene (TCE), perchloroethylene (PCE), dichloroethylene (DCE), and trichloroethane (TCA). Of these, however, **benzene, chlorobenzene, TCE and PCE** are by-far the most-widely distributed, consistently detected, and are found in the highest concentrations at the Joint Site. These chemicals also present the greatest potential toxicity to a potential groundwater user when their innate toxicity and concentrations are considered together (See Section 8, Summary of Groundwater-Related Risks).

While EPA's risk assessment addressed all chemicals in groundwater, EPA's feasibility study focused on remedial actions for these four chemicals. The distributions of all other chemicals in groundwater at the Joint Site, except pCBSA, fall within one or more of the distributions of these three chemicals. EPA has determined that the same remedial actions selected for chlorobenzene, benzene, TCE, and PCE will also address the other chemicals of concern in the course of remedial

implementation. Requirements in this ROD that apply to chlorobenzene, benzene, TCE and PCE also shall apply to the other chemicals in the contaminant distributions at the Joint Site, as specified in this ROD.

TCE, PCE, DCE, and TCA are chlorinated aliphatic organic solvents. For simplicity, unless otherwise noted, the term "TCE" hereafter in this ROD refers to TCE, PCE, DCE, and TCA.

The chemical pCBSA is also present in groundwater. The distribution and remedial action selected for this contaminant represents an exception to the statements in the preceding paragraph. pCBSA is addressed separately from the other contaminants as further-described in Sections 8, 11, 12, and 13 of this ROD.

Non-aqueous Phase Liquids (NAPL)

As described previously in Section 4 of this ROD, several of the hazardous substances and chemicals or concern at the Joint Site are present both in the dissolved phase and as NAPL. The NAPL is the primary principal threat at the Joint Site. The NAPL continues to dissolve in the groundwater, feeding the distribution of dissolved contamination which can move in the groundwater laterally and vertically and pose a health threat. It is the NAPL which gives rise to the inability to cleanup all groundwater at the Joint Site (See Section 10) and the need to develop strategies in which the contamination surrounding the NAPL is contained and isolated (discussed in Section 4, 9, 10, and 11). Because the NAPL largely provides the genesis for the dissolved phase contamination, the nature and extent of NAPL at the Joint Site is discussed in this section in advance of discussing the distribution of dissolved phase contamination, and "plumes" of groundwater contamination. The distribution of dissolved phase contamination, and its behavior, is better understood in the context of the nature and distribution of NAPL sources.

DNAPL at the Montrose Chemical Superfund Site

Chlorobenzene is the primary chemical which occurs as NAPL at the former Montrose plant. Chlorobenzene is a dense non-aqueous phase liquid, or ***DNAPL***, which means it is denser than water and tends to sink in aqueous media due to a positive density gradient. DNAPL likely entered the ground at the Montrose Chemical Site through the bottom of the Montrose waste disposal pond, through trenches, and via the operations such as the filter press rework facility (See Chapter 1 of the Montrose Site RI Report, EPA 1998). DNAPL at the Montrose Chemical Site may have penetrated as far as the Gage Aquifer (see Section 2 of the JGWFS and discussion of hydrostratigraphic units, below) to a depth potentially exceeding 130 feet below the ground surface. The exact depth to which NAPL has migrated is not known, but the lack of such knowledge is not unusual at NAPL sites because making determinations of NAPL depth and distribution can be exceedingly difficult, particularly in the heterogeneous soils found at the

Montrose Chemical Site. Concentrations of chlorobenzene in groundwater in the Gage aquifer remain reasonably consistent with the presence of DNAPL. Concentrations in the Lynwood Aquifer do not appear to be consistent with the presence of NAPL at this time.

In a treatability test at the former Montrose plant, DNAPL was actively pumped from the MBFB Sand (see discussion of hydrostratigraphic units, below) at rates of up to 10 gallons per day, which demonstrated that mobile DNAPL (i.e. above residual saturation levels) is present in some locations under the former Montrose plant property. DNAPL resides in a lateral area of about 600 feet by 350 feet, centered on the Central Processing Area of the former plant (See Section 2 and Appendix E of the JGWFS). The total mass, volume, and relative saturation distribution of the DNAPL is unknown, though this also is not unusual at DNAPL sites. Multiple lines of evidence indicate that there are significant quantities of DNAPL beneath the Central Processing Area of the former Montrose plant, including: (1) chlorobenzene concentrations in groundwater over a significant area near the NAPL are at or near the saturation limit, (2) a significant amount of DNAPL can be removed by hydraulic extraction (pumping), and (3) DNAPL accumulates in some wells even when no pumping is taking place.

Data indicate that the chlorobenzene DNAPL contains a significant percentage (perhaps up to 50%) of dissolved DDT. This does *not* refer to DDT dissolved in the aqueous phase, but to DDT dissolved in the chlorobenzene DNAPL itself. This process is called co-solvation. Chlorobenzene is an effective organic solvent for DDT (i.e. DDT has a high solubility in pure chlorobenzene). DDT at the former Montrose plant normally adsorbs strongly to soils and therefore remains contained in the top several feet of soil. However, where chlorobenzene NAPL is present, significant DDT is co-solvated in the chlorobenzene. The DDT dissolved in chlorobenzene DNAPL migrated with the DNAPL to the groundwater. This transport process allowed DDT to reach the groundwater. However, because of DDT's low water solubility, the distribution of dissolved DDT is limited, and represents a tiny fraction of the distance that dissolved-phase chlorobenzene has migrated in groundwater.

Dissolved chlorobenzene has left the Montrose property and has migrated laterally up to 1.3 miles in five successively deeper aquifers (See below). While dissolved contamination has been able to migrate vertically from shallower to deeper hydrostratigraphic units, it is highly likely that the expansion of dissolved groundwater contamination in the deeper units was greatly hastened as NAPL arrived in the deeper units, allowing dissolution to originate directly in those units. Due to the extensive depth and quantity of DNAPL and other factors, EPA considers it technically impracticable to remove enough DNAPL to allow for attaining drinking water standards in the groundwater in the vicinity of the DNAPL. Support for this conclusion is provided in the Joint Groundwater Feasibility Study, Appendix E, and summarized in Section 10 of this ROD.

LNAPL at the Del Amo Superfund Site

To the east of the former Montrose plant at the former Del Amo plant, benzene is the primary chemical present as NAPL. Benzene, when in NAPL form, is less dense than water and therefore tends to float upward in aqueous media under a negative density gradient (buoyancy forces). This is referred to as Light NAPL, or ***LNAPL***. This LNAPL originally spread out and floated on the water table when the water table was lower. In the 1960s, the local groundwater basin was adjudicated to reduce the amount of water being withdrawn from the basin and, in turn, limit saltwater intrusion into the basin. As less water was withdrawn from production wells, the water table slowly but steadily rose and overtook the LNAPL, smearing it upward. As a result of this upward movement in the heterogeneous sediments of the Upper Bellflower (see description of hydrostratigraphic units, below), some LNAPL was trapped underneath the water table by layers and lenses of the low-permeable formations. Most of the benzene LNAPL that was discovered during the remedial investigation to date at the former Del Amo plant property now occurs in the *saturated* zone, near and under the water table. At some of the source areas where NAPL investigations remain ongoing, LNAPL could also be present in the vadose zone and/or floating on top of the water table, in addition to being present below the water table. LNAPL sources are depicted in Figures 2-3a and 2-3b of this ROD, in Section 2 and Appendix E of the JGWFS, and in the Del Amo Groundwater Remedial Investigation Report.

LNAPL at the Del Amo Site occurs in several distinct locations, separated by no more than 600-1000 feet. These LNAPL sources have been slowly dissolving into groundwater, and have therefore resulted in corresponding distributions of dissolved contamination, which have largely merged and overlapped over time. These areas of LNAPL and dissolved phase benzene contamination were also discussed in Section 2 of the JGWFS (see also figures 2.3a and 2.3b), and in the Del Amo Groundwater RI Report.

An extensive amount of NAPL-related data has been collected at the ***MW-20 Area***, which refers to the area around Monitoring Well No. MW-20. This well is located near what was historically a crude benzene storage tank of at least 500,000 gallons capacity, and a number of pipelines which carried benzene at the former Del Amo plant. Floating benzene product has been observed in this well. An extensive number of borings were drilled in this area and analyses of microstratigraphy as well as LNAPL indicator techniques were used. In addition, a six-month hydraulic extraction test was performed in which four NAPL extraction wells were pumped. Only approximately 23 gallons of benzene LNAPL was recovered, while a total of about 400,000 gallons of water was pumped, which results in a total LNAPL: water ratio (fluid ratio) of 0.00006 to 1. The results of this test, in conjunction with the LNAPL saturation data obtained by laboratory analyses of the selected soil sampled, indicated that the NAPL near the wells is likely to be present at relatively low average saturations. While an overall effort to assess NAPL at the MW-20 area was more extensive than that performed at most NAPL sites, the actual distribution of LNAPL, LNAPL

saturation, and the total LNAPL mass in the subsurface cannot be determined with a high degree of certainty from these studies. As previously stated, such determinations are exceedingly difficult to make in virtually all large sites with NAPL where stratigraphy is highly heterogeneous, as is the case at the Joint Site. As mentioned earlier, studies at both the Montrose Chemical and Del Amo Sites continue with respect to the evaluation of NAPL characteristics and the potential for NAPL recovery and immobilization.

The historical operations and the high concentrations of dissolved benzene in groundwater at the locations of the waste pits, the tank farm, and the styrene plant production units (east of the tank farm) are consistent with and strongly suggestive of a NAPL source in these areas. Mixtures containing NAPL were disposed in the waste pits. NAPL has not been directly detected in wells at these locations; however, this does not preclude the presence of NAPL. It is highly likely that NAPL is present but at low enough saturations that it would not flow into the wells. Additional sampling is taking place to characterize these areas with respect to NAPL for the second phase of remedial decisionmaking for this operable unit which shall address NAPL recovery/ immobilization, as previously discussed in the Declaration and in Section 4 of this ROD. It is important to note that precisely locating NAPL can be difficult, and further investigation may or may not directly reveal the NAPL presence, even though NAPL is present. For this reason, the presence of NAPL is evaluated not only from the standpoint of its presence in wells but the entire historical context and observed characteristics of contamination in these areas.

Recent studies using the Remedial Optical Scanning Tool (ROST™) near the former laboratories in the butadiene plancor and near the pipeline directly east of the waste pits have confirmed the presence of NAPL with relatively high certainty. Dissolved benzene concentrations in groundwater in well XMW-04HD near the pipeline east of the waste pits have been measured in excess of 1 million parts per billion (ppb), which is more than half the solubility limit for benzene. This provides exceptionally strong evidence for the presence of NAPL at this location.

It appears that the NAPL at other locations at the Del Amo Site occurs as "smeared" under the water table, similar to that at the MW-20 area. However, there is the possibility that LNAPL may be present in the vadose zone or floating on top of the water table at any of the LNAPL source areas defined in the JGWFS (See Section 2 of the JGWFS).

Hydrostratigraphic Units and Groundwater Flow

As shown in Figure 7-1, there are seven hydrostratigraphic units under the Joint Site that are currently affected by contamination. These are: the Upper Bellflower (UBF), the Middle Bellflower "B" Sand (MBFB Sand) the Middle Bellflower "C" Sand (MBFC Sand), the Lower Bellflower Aquitard (LBF), the Gage Aquifer, the Gage-Lynwood Aquitard, and the Lynwood Aquifer. The water table is inclined relative to the interface between the UBF and the MBFB Sand, and it crosses this interface roughly between the two sites. Therefore, the water table occurs in the UBF at most of the Del Amo site, but it occurs in the MBFB Sand at the Montrose Chemical Site. The UBF is only saturated under (most of) the former Del Amo plant - it is unsaturated under the former Montrose plant.

The greatest contaminant migration potential, as well as the greatest potential facility in applying hydraulic extraction or aquifer injection, exists in the coarser-grained MBFC Sand, Gage Aquifer, and Lynwood Aquifer, because of the relatively higher hydraulic conductivity of these units. These units typically can sustain maximum pumping rates of 50-100 gpm per well. The UBF and MBFB Sand are much finer-grained and can typically sustain maximum pump rates on the order of 1 gpm and 10 gpm, respectively, at the Joint Site. The degree of heterogeneity of the UBF and MBFB Sand is high, especially near the former Montrose plant. The State of California has classified all hydrostratigraphic units under the Joint Site, including the UBF and MBFB Sand, as potential drinking water sources.

The lateral hydraulic gradient of the groundwater varies locally in the upper units, but is largely consistent in the MBFC Sand and all hydrostratigraphic units beneath it. The direction of groundwater flow in the UBF has local perturbations but is generally to the south. The groundwater flow direction in the MBFB Sand, MBFC Sand, Gage Aquifer, and Lynwood Aquifer, is to the south to south/southeast. The magnitude of the eastward component of the horizontal groundwater flow vector increases slightly as the depth of the unit increases. Under natural gradients (i.e. in the absence of local pumping) the vertical component of the hydraulic gradient is generally downward between all hydrostratigraphic units discussed above.

Wells were not installed in the aquitards (the LBF and the Gage-Lynwood Aquitard) in the course of the remedial investigation. Monitoring these units is extraordinarily difficult due to their low hydraulic conductivities.

Generalized Dissolved Contaminant Distributions

The distribution of dissolved-phase contaminants at the Joint Site is based on remedial investigation efforts performed, with EPA oversight, both by Montrose Chemical Corporation for the Montrose Chemical Site, and Shell Oil Company and Dow Chemical Company for the Del Amo Site. More than 100 wells have been installed. In addition, wells previously-installed by other parties have been sampled and/or past sampling data associated with such wells has been obtained. Figure 7-2 shows the overlapping distributions of benzene, chlorobenzene, and TCE in the UBF, MBFB Sand, MBFC Sand, and Gage Aquifer. The superimposed icon represents the hydrostratigraphic layers in the vertical plane and serves to orient the surrounding lateral plane figures. The observations discussed below are crucial to the development of the zones of groundwater to which remedial actions under this ROD are established.

The chlorobenzene downgradient of the former Montrose plant has moved as far as about 1.3 and 0.6 miles from the Montrose plant source in the MBFC Sand and Gage Aquifer, respectively. This contamination has traversed all of the water-bearing units above the Silverado Aquifer. Near the DNAPL source at the former Montrose plant, chlorobenzene is present in concentrations up to its solubility limit, near 400,000 ppb.

Concentrations of benzene up to its solubility limit, approximately 1,700,000 ppb, are present at the Joint Site, both near the former Montrose Chemical plant and the former Del Amo plant, near benzene LNAPL sources. The dissolved benzene distribution displays differing characteristics depending on its location.

In contrast to the chlorobenzene distribution, the dissolved benzene distribution near the LNAPL sources at the former Del Amo plant relatively closely surrounds the NAPL itself (Figure 7-3). This benzene lies outside (is not presently commingled with) the chlorobenzene distribution. There are very steep benzene concentration gradients in this portion of the benzene distribution.

There is also dissolved benzene at the Joint Site that *is* commingled with the large chlorobenzene distribution. In contrast to the benzene near the NAPL sources under the former Del Amo plant, the benzene that is commingled with the chlorobenzene does not exhibit steep concentration gradients at the leading (i.e. downgradient) edges of the plume, but rather a flatter and larger distribution similar to that found in the chlorobenzene plume (Figure 7-2).

TCE (including, by reference, the related chlorinated organic solvents such as PCE) is present both within the Joint Site and in the areas surrounding the Joint Site. The TCE within the Joint Site is present (1) commingled with the chlorobenzene distribution under and just downgradient of the former Montrose plant, and (2) in another distribution not commingled with (outside) the chlorobenzene distribution extending upgradient of and beneath the former Del Amo plant

(Figure 7-2).

Concentrations of TCE are present in groundwater up to about 9,400 ppb at the Joint Site. With respect to the TCE near the former Del Amo plant, the proximity of the TCE distribution to the benzene distribution differs with the hydrostratigraphic unit. In the Upper Bellflower and the MBFB Sand, the TCE is commingled with the benzene, but in the deeper MBFC Sand, data from the remedial investigation indicates that the TCE distribution is still to the north of the benzene distribution, which is limited to the area under the Del Amo Waste Pits at the southern end of the former Del Amo plant. Therefore, in the MBFC Sand, under and near the former Del Amo plant, the TCE and the benzene are not commingled (Figures 7-4 and 7-2).

There are fewer data available pertaining to the TCE present near the former Del Amo plant than for chlorobenzene and benzene. TCE at these locations may or may not be present as DNAPL. Additional field data about the TCE distribution will be necessary in remedial design; however, the remedial actions selected by this ROD for TCE are justified based on the data that are available. PCE is present in distributions largely similar to those for TCE, but, for the most part, in lower concentrations. The concentrations of chlorinated solvents at the Joint Site are small in comparison to those for chlorobenzene and benzene, but still are up to thousands of times above the drinking water standards for these compounds.

Because it is much more water-soluble than chlorobenzene, pCBSA is more mobile in groundwater and the lateral extent of the pCBSA in groundwater exceeds that of the chlorobenzene in all directions. The pCBSA plume is commingled with the benzene on the west side of the former Del Amo plant. The maximum concentration of pCBSA is about 1,500,000 ppb, near the Central Process Area. The concentration of pCBSA is 500-1000 ppb at the toe of the chlorobenzene plume (point where chlorobenzene concentrations are at the MCL for chlorobenzene, which is 70 ppb). The pCBSA distribution is shown in Figure 7-5. Because it has no promulgated or provisional health-based standards associated with it, pCBSA is addressed independently of all other chemicals in this ROD. See Sections 11, 12, and 13 for actions selected with respect to this contaminant and Section 8 for a discussion of its toxicological status.

7.2 Conventions for Dividing the Contamination into Plumes

As can be seen in the discussion of contaminant distributions above and in Figure 7-2, the groundwater contamination at the Joint Site displays differing physical, chemical, spatial and situational characteristics depending on its location within the overall contaminant distribution. Most notably, such characteristics differ widely depending on whether chlorobenzene is present. Where chlorobenzene is absent, such characteristics also differ depending on the relative spatial distributions of the other primary contaminants (most notably benzene and TCE) to each other.

As previously discussed, this ROD selects a single unified action; all remedial actions selected in this ROD have been considered as part of an interrelated whole. However, because of the differences just mentioned, it was necessary in the development and evaluation of remedial alternatives to make distinctions among various portions of the overall contaminant distribution in groundwater. The particular physical and chemical properties exhibited by the combinations of contaminants in groundwater appeared to be a better basis for evaluating remedial alternatives than did a simple consideration of where any given contaminant was located. For instance, because the benzene commingled with the chlorobenzene exhibits differing characteristics than the benzene not commingled, it would have been tedious and complicated, and likely would have lead to confusion, to try to evaluate remedial actions for "the benzene," if referring to all benzene at the Joint Site.

In order to facilitate the evaluation and selection of remedial alternatives, EPA defined and identified areas that were subsets of the overall groundwater such that one set of remedial objectives and requirements could apply within each area, consistent with the particular chemical and physical characteristics of the groundwater within the area. By convention, EPA has used the term ***plume*** to refer to each of these areas. These plumes are depicted in Figure 7-6 and discussed below.

In order to avoid confusion, it is particularly important to note that *plume* is not used in this ROD in its most-common sense. Usually, the term refers to the entire distribution of a particular contaminant in groundwater at a given site. So, for instance, "chloroform plume" would usually mean the distribution of chloroform in groundwater. In the more specialized case of this ROD, *plume* refers to a defined area in the groundwater based on physical and chemical characteristics. Under this approach, a plume in some cases includes only a subset of the distribution of the chemical bearing its name. Hence, for example, in this ROD the term *benzene plume* does <u>not</u> refer to all benzene in groundwater at the Joint Site; and, there is benzene in the *chlorobenzene plume* not considered to be part of the benzene plume. The term "plume" refers to all hydrostratigraphic units in which the contamination identified by the plume definition occurs, unless otherwise noted.

EPA has not defined the plumes for the purposes of allocating responsibility or liability for cleanup, or to designate from which site (Montrose Chemical or Del Amo Site) particular contamination in groundwater originated. For instance, the contributions of benzene may have arrived in either the chlorobenzene plume or the benzene plume from multiple sources. The purpose of this ROD is simply to select the remedial actions that will address contamination in Joint Site groundwater.

The JGWFS considered a separate set of remedial options, which it called "scenarios," for each plume. Each full remedial alternative considered in the JGWFS contained one scenario for each plume. Because each scenario for one plume had potential interrelationships with scenarios for the other plumes, this process could not be achieved by simply combining scenarios considered independently for each plume. Rather, the JGWFS screened and evaluated scenarios for each plume individually first, with respect to the immediate objectives for each plume. Then the JGWFS performed a second screening and evaluation in assembling the scenarios into alternatives. This second evaluation considered potential interactions and interrelationships that would exist if scenarios for differing plumes were implemented together. Only those combinations of scenarios for each plume which survived the second screening were evaluated as full alternatives in the detailed analysis of alternatives.

Upon consideration and evaluation of the information derived during the remedial investigation and feasibility study, EPA decided that the smallest reasonable number of plumes which can be used to define the Joint Site is three. The union of the three plumes encompasses all groundwater at the Joint Site; hence, actions selected for each of the plumes completely address the Joint Site groundwater. The basis for the EPA's decision to use these particular plumes is provided in the course of the ensuing discussions in this ROD with regard to the presence of reliable intrinsic biodegradation, the designation of the TI waiver zone, the technical considerations pertaining to the benzene and TCE plume, and the remedial alternatives considered for this remedy.

The plumes are defined below. These definitions are repeated in Section 13 of this ROD to facilitate the use of that section and for clarity. Section 13 contains other requirements and specifications with respect to the plumes which shall apply in this remedy.

- ***Chlorobenzene plume*** refers to the entire distribution of chlorobenzene in groundwater at the Joint Site, *and* all other contaminants that are commingled with the chlorobenzene. Benzene, TCE, PCE, and a variety of other contaminants are present within the chlorobenzene plume. The chlorobenzene plume is present in the MBFB Sand (note that the UBF is generally not saturated in the area where the chlorobenzene plume occurs), the MBFC Sand, the Lower Bellflower Aquitard (LBF), the Gage Aquifer, the Gage-Lynwood Aquitard, and the Lynwood Aquifer, based on data collected in the remedial investigation.

- ***Benzene plume*** refers to the portion of the distribution of benzene in groundwater at the Joint Site *that is not commingled* with chlorobenzene. Put another way, the benzene plume is that benzene within the Joint Site that lies outside the chlorobenzene plume. The benzene plume occurs in the Upper Bellflower, the MBFB Sand, the MBFC Sand, and may occur in the LBF, based on data collected in the remedial investigation. Benzene that is commingled with chlorobenzene is not considered to be part of the benzene plume, but is instead part of the chlorobenzene plume. The benzene plume includes ethyl benzene and naphthalene, among other contaminants.

- ***TCE* and *TCE plume*.** The term *TCE,* when used in this ROD, unless otherwise noted, represents a series of chlorinated solvents, including TCE, PCE, DCE, TCA, and any isomers of these compounds in groundwater at the Joint Site. The term *TCE plume* refers to the portions of the distributions of any such contaminants in groundwater at the Joint Site *that are not commingled* with the chlorobenzene plume. The TCE plume occurs in the UBF, the MBFB Sand, and the MBFC Sand, and may occur in the LBF, based on data collected during the remedial investigation. The TCE plume in the Upper Bellflower and MBFB Sand is commingled with and contained within the benzene plume; the TCE plume in the MBFC Sand lies *under* the benzene plume in the MBFB Sand and north of the benzene plume in the MBFC Sand (See Figure 7-4). TCE (chlorinated solvent) contamination outside the chlorobenzene plume which may exist in the Gage Aquifer is addressed separately and not as part of the TCE plume. TCE that is commingled with chlorobenzene is not considered part of the TCE plume but is part of the chlorobenzene plume.

Figure 7-6 shows the three plumes (see legend). Note that this Figure uses, as a base, Figure 7-2 which shows the actual distribution of the major contaminants. However, Figure 7-6 outlines the actual plume boundaries on this distribution. Notice, for example, that the benzene commingled with the chlorobenzene is visible on Figure 7-6; but that such benzene is in the *chlorobenzene plume,* not in the benzene plume.

Some of the requirements and provisions in this ROD differ according to the plume being referenced. Additionally, this ROD in some instances assigns differing remedial action requirements to various hydrostratigraphic units *within* a plume (e.g. the benzene plume in the MBFC Sand versus the benzene plume in the MBFB Sand). The specifications and requirements are established in Section 13 of this ROD.

7.3 Presence of Intrinsic Biodegradation

The term ***intrinsic biodegradation*** refers specifically to the process of the chemical breakdown of a contaminant by microorganisms that are native and innate to the existing soils. In general, intrinsic biodegradation occurs in association with the metabolic processes of microorganisms which use inorganic materials in soil (such as oxygen, nitrate, sulfate, and ferric iron) as terminal electron acceptors and break down the contaminant into carbon dioxide, water, and in some cases, methane. The microorganisms then live off the energy produced by such processes.

Intrinsic biodegradation is a specific form of the more general term, ***natural attenuation***. While natural attenuation sometimes is used so as to be synonymous with intrinsic biodegradation, the former can also refer to other processes, including but not limited to dilution and dispersion.

This ROD makes a distinction between natural attenuation and intrinsic biodegradation because EPA has evaluated the potential for *relying* on intrinsic biodegradation (specifically, as opposed to all forms of natural attenuation) as a remedial mechanism to assist in obtaining remedial objectives at the Joint Site. This is discussed in detail in Sections 11 and 12. This ROD and the JGWFS make use of the more specific term to remove ambiguities that might arise.

It should be noted that, as intrinsic biodegradation is a specific form of natural attenuation, the two are consistent terms in the context of EPA's policy, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites,* (EPA OSWER Directive 9200.4-17, December 1997).

As this section focuses on site characteristics and not yet on remedial selection, only a short presentation as to the *presence* of intrinsic biodegradation is provided here. It is important to note that there is a key difference between demonstrating the presence of intrinsic biodegradation at a site, on one hand, and demonstrating its reliability as a remedial mechanism in a remedy selection process, on the other. The latter is addressed in Section 11 of this ROD.

Potential for Intrinsic Biodegradation in the Benzene Plume

At the Joint Site, there is substantial and significant evidence that significant intrinsic biodegradation of the benzene plume is occurring in the UBF, MBFB Sand, and MBFC Sand. These factors include:

- The concentration gradients at the leading edge of the benzene plume are steep;
- The lateral extent of the dissolved plume outside of the NAPL sources is small;

- The benzene plume is much smaller than what would be expected based on groundwater velocity and expected retardation in the absence of intrinsic biodegradation; benzene has not migrated far from the NAPL sources despite likely being in the ground 20-40 years;

- The plume appears to be at stable and does not appear to be migrating laterally;

- In-situ measurements of geochemical parameters (e.g. dissolved oxygen, nitrate, sulfate, methane, etc.) indicate biological activity that is related to (varies spatially with) the benzene concentration in groundwater;

- Biodegrader organism counts in groundwater indicate greater biological activity inside the benzene plume than outside the benzene plume;

- Computer modeling runs could not be reasonably calibrated without assuming significant benzene biodegradation.

Potential for Intrinsic Biodegradation in the Chlorobenzene Plume

The lines of evidence just discussed for the benzene plume do *not* exist for the benzene that is commingled with the chlorobenzene plume (this benzene is, by definition, *in* the chlorobenzene plume). This benzene has migrated up to ¾ mile in the MBFC Sand from the former Montrose Chemical and Del Amo plants with no known intervening sources.

Similarly, observations do not support the presence of intrinsic biodegradation in the chlorobenzene plume. The chlorobenzene plume has migrated up to 1/3 miles from the former Montrose plant, has traversed six hydrostratigraphic units, and is more than 1000 feet wide at its widest point. Contamination has not remained near the sources. Concentration gradients are relatively flat. Moreover, even though the modeling effort performed in the remedial selection process (see Section 11) assumed no degradation of chlorobenzene, approximate attempts at modeling transport calibration resulted in less simulated migration than that observed, further indicating a lack of significant chlorobenzene intrinsic biodegradation. The rate of biodegradation of chlorobenzene has not been directly measured nor modeled for several reasons which are presented in Appendix B of this ROD, and is discussed in the Response to Comments received from Montrose Chemical Corporation. More critical details on the issue of the potential for the reliability of intrinsic biodegradation of chlorobenzene are presented in Section 11 of this ROD.

Potential for Intrinsic Biodegradation in the TCE Plume

EPA has not measured nor modeled the rate of intrinsic biodegradation of TCE within the TCE plume. The limited modeling of TCE migration in the JGWFS, which was performed only for No Action assumptions, assumed that TCE degrades at rates similar to those found at other sites (See Section 2 and Appendix B of the JGWFS). It is important to note that data from the remedial investigation indicate that TCE and PCE are migrating under existing conditions (that is, the TCE plume is not presently spatially stable with time, and is not naturally contained by intrinsic biodegradation). However, as assumed by the limited modeling of TCE in the JGWFS, intrinsic biodegradation may be occurring to some degree in the TCE plume. In fact, the significant rate of biodegradation of benzene in the benzene plume may be enhancing the rate of biodegradation of TCE in a process called co-degradation. This could potentially result in reductions in the field resident half-life of TCE at the Joint Site compared to typical half-lives for TCE in the absence of benzene biodegradation.

7.4 Land Use and Zoning

A brief discussion of the land use and zoning was given in Section 1 of this Decision Summary. Land use at the Joint Site facilities includes heavy and light industrial, commercial, and residential zoning. Government jurisdictions within the Joint Site include the City of Los Angeles and unincorporated Los Angeles County. The Cities of Torrance and Carson lie to the west and east, respectively, of the Joint Site which lies primarily within the Harbor Gateway (see Section 1 of this ROD).

The former Montrose plant property is vacant and sits under a temporary asphalt cover. This property is zoned industrial. The former Del Amo plant property has been subdivided and redeveloped and contains light industrial enterprises. This property is zoned industrial and commercial. Areas directly south of the former Del Amo plant and southeast and southwest of the former Montrose plant contain primarily low-income residential properties. Some of these homes lie in unincorporated Los Angeles County. The general area surrounding the former plant properties includes industrial, commercial, and residential zoning. In several instances, heavy industrial and residential land use are adjacent to the former plant properties, particularly where islands of Los Angeles county jurisdiction exist among the Harbor Gateway and the Cities of Torrance and Carson (See Figure 7-7). Active petroleum refineries are operating within several miles to the east and west of the former plant properties.

Low-to-moderate-income residential areas lie adjacent to the two former industrial plants. Most of the benzene plume lies under the former Del Amo plant, but some of it lies under the northern edge of the residential zone south of the former plant. Most of the chlorobenzene plume lies under residential and commercial areas south and southeast of the former Montrose plant;

although most of this portion of the chlorobenzene plume is in the MBFC Sand and Gage Aquifer, with most of the overlying water table zone being uncontaminated. The TCE plume (as specifically defined in this ROD) lies entirely within industrial areas. An estimated 2400 homes lie within one mile and 3000 people live within one quarter mile to the south, southeast, and southwest of the former Montrose plant.

7.5 Groundwater Use and Designations

The State of California designates all of the water-bearing hydrostratigraphic units under the Joint Site as having potential potable beneficial use, i.e. as being a potential source of drinking water. Therefore, EPA considers drinking water standards (maximum contaminant levels, or MCLs) to be relevant and appropriate requirements for in-situ cleanup of groundwater at the Joint Site (See Section 9 of this ROD). The ARARs pertaining to this determination are discussed in Appendix A of the ROD.

There currently is no known municipal water or municipal production wells in use within the area of contaminated groundwater under the Joint Site. EPA also is not aware of current use of private potable water wells within the contaminated groundwater affected by the Joint Site. The nearest municipal supply wells are about ½ to 1 mile downgradient of the current leading edge of the chlorobenzene plume in the MBFC Sand. These wells are screened primarily in the Silverado aquifer, though some are screened in the Lynwood Aquifer. Wells within a 2-mile radius of the Joint Site are shown on Figure 7-8. The Silverado Aquifer is the most extensively used water-bearing unit for municipal supply purposes in the southern west coast groundwater system. This aquifer occurs at approximately 450 feet below land surface near the Joint Site. There are a number of other private and industrial wells within a mile of the plume, some of which have screens in the Gage Aquifer. None of these are located within the current contaminant distribution of the Joint Site. It appears likely that some water use within the Joint Site would exist if the aquifers were not contaminated. The groundwater basin under the Joint Site is presently adjudicated to reduce salt water intrusion problems which were occurring in the 1960s. At present, this would limit, but not eliminate, the degree of use of groundwater in the area were the groundwater not contaminated.

EPA is concerned that the groundwater contamination may continue to move both laterally outward and vertically downward, and may eventually reach locations where it would be drawn into wells which are used for drinking or other potable purposes. As contamination spreads, less of the groundwater resource can be used in the future.

The laws and policies of the State of California are generally focused on protecting potential future beneficial uses of groundwater, even where it is not currently used. In addition, the National Contingency Plan (NCP) requires that EPA consider future potential groundwater uses

in making decisions on remedial actions for groundwater.

Without the Joint Site contamination, the Lynwood and the Gage Aquifers would be of sufficient water quality and production to make them strong candidates as actual sources of drinking water. The MBFC Sand and shallower units contain sufficiently high levels of total dissolved solids and total suspended solids such that future direct use of the water, particularly for potable purposes, would be less likely. In addition, the MBFB Sand and Upper Bellflower units generally do not yield enough water to make major production wells in these units cost-effective.

Migration of contaminants from the upper to the lower units at these sites has occurred and there is the potential for continued migration. Therefore, the potential for such migration to affect units which currently are not significantly impacted or used was strongly considered by EPA, in conjunction with the direct current water use and State designations for all the hydrostratigraphic units. Because of the potential hydraulic connection between the upper units and the underlying Gage and Lynwood Aquifers, non-potable as well as potable water uses are considered possible in all of the affected units. While there is not evidence that persons have been exposed to groundwater contaminants from these sites, EPA is concerned about preventing future threats to public health and with preserving the groundwater resource.

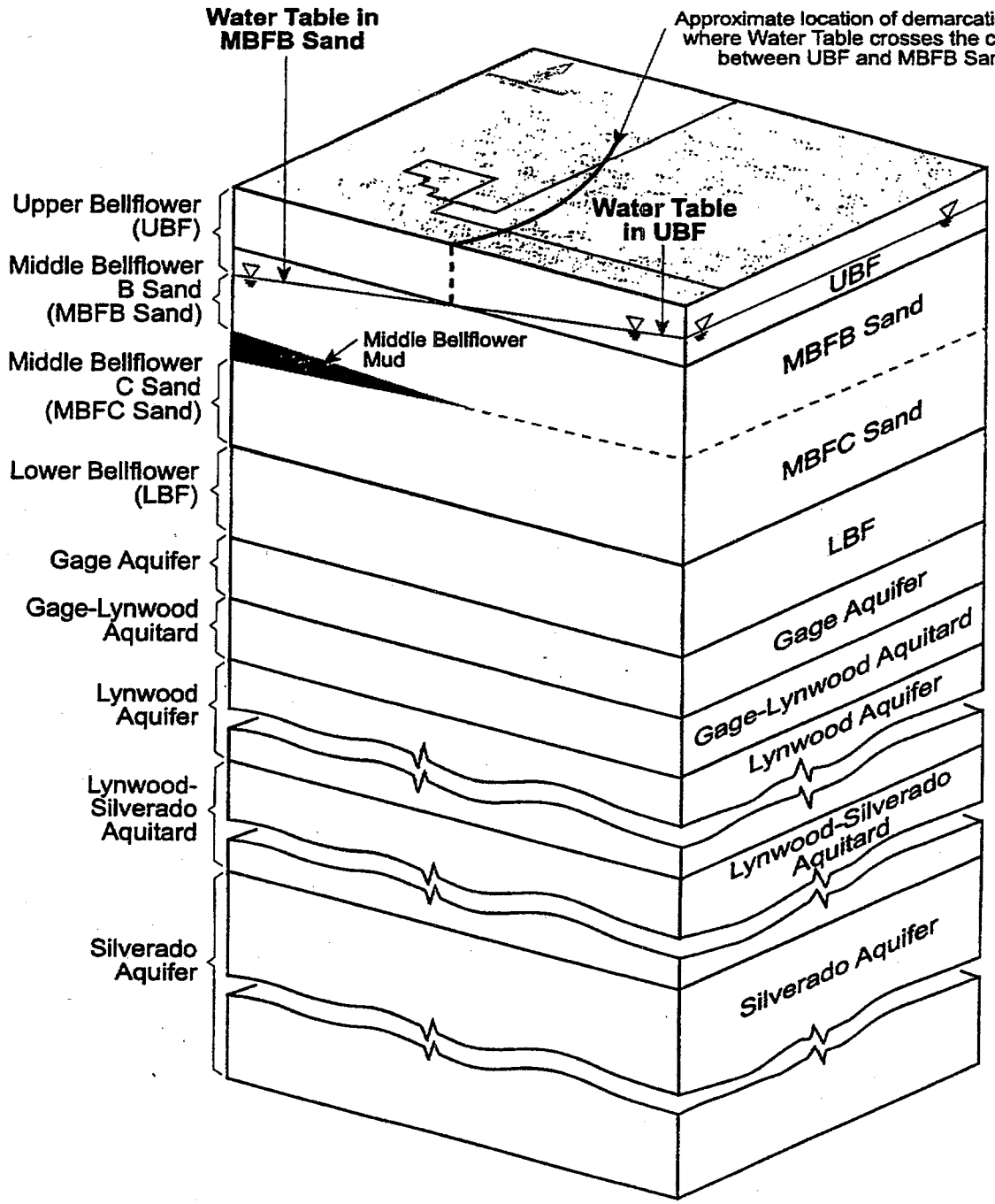
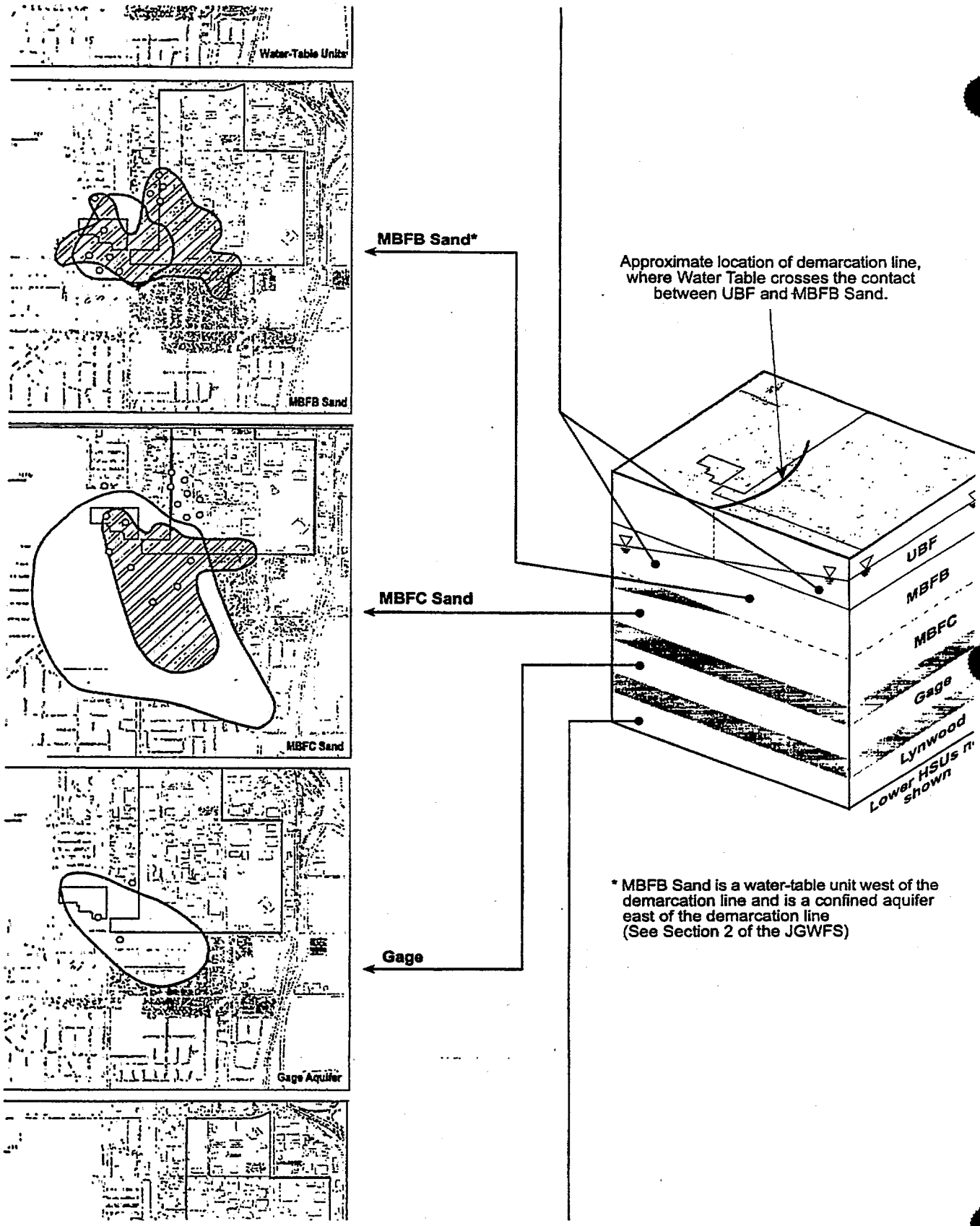


Figure 7-1
Schematic Presentation of Hydrostratigraphic Units at the Joint Site
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

Not to scale

EPA US EPA Region IX


Water-Table Units
MBFB Sand*
MBFB Sand
MBFC Sand
MBFC Sand
Gage
Gage Aquifer
Approximate location of demarcation line, where Water Table crosses the contact between UBF and MBFB Sand.
UBF
MBFB
MBFC
Gage
Lynwood
Lower HSUs n
shown
* MBFB Sand is a water-table unit west of the demarcation line and is a confined aquifer east of the demarcation line
(See Section 2 of the JGWFS)

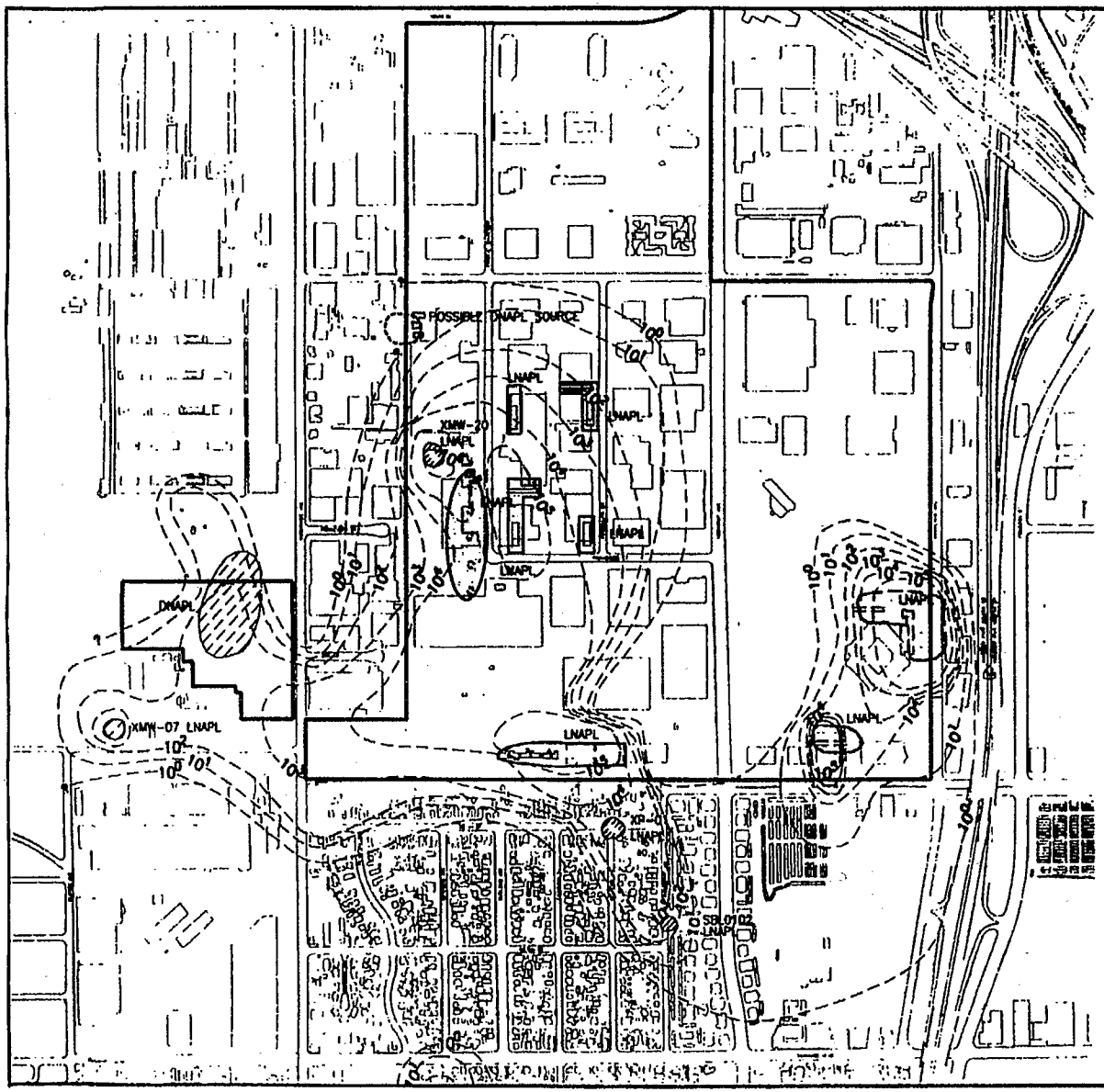
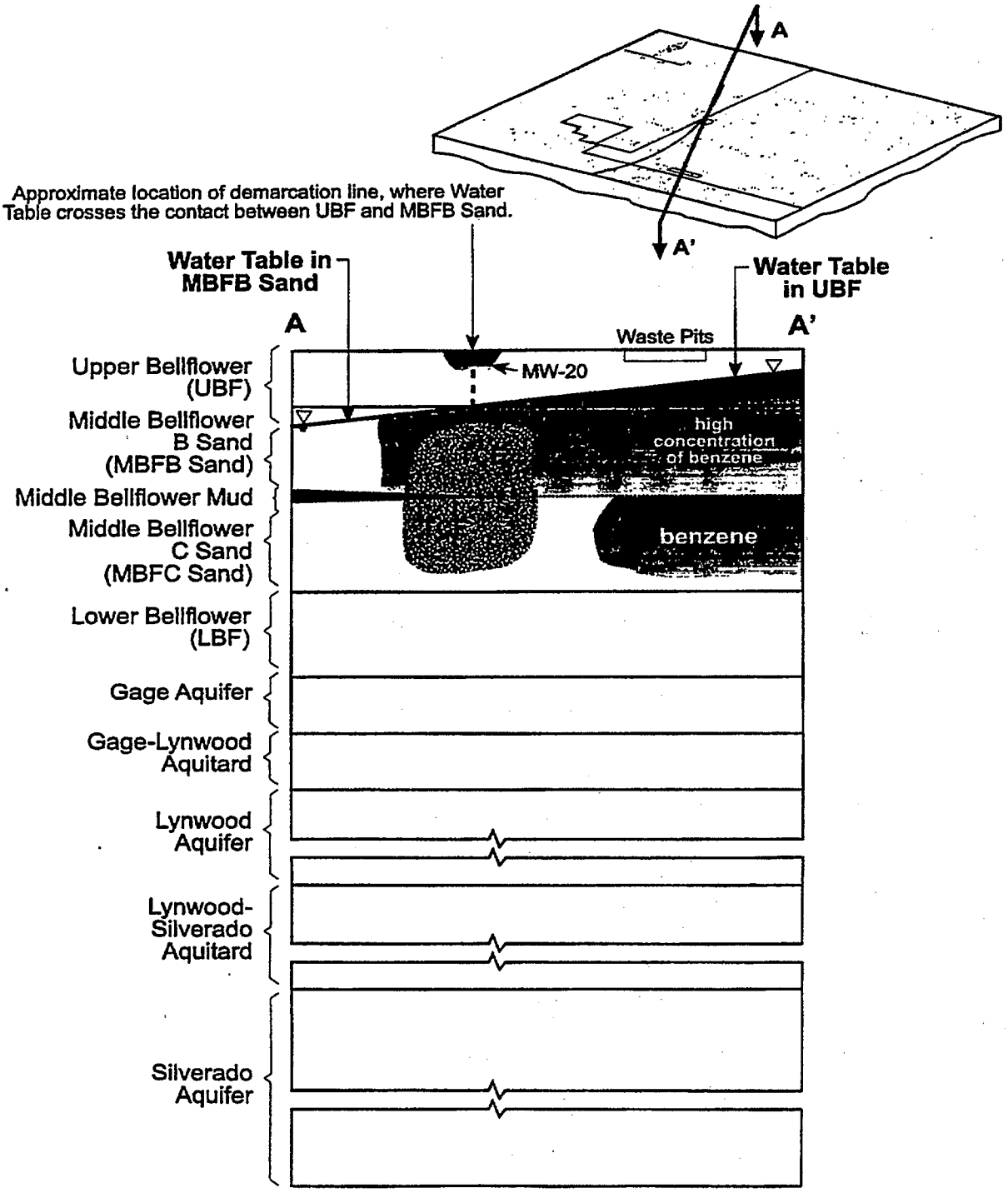


FIGURE 7-3

Benzene Distribution Relative to the Locations of Areas of Known or Highly Suspected NAPL

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX

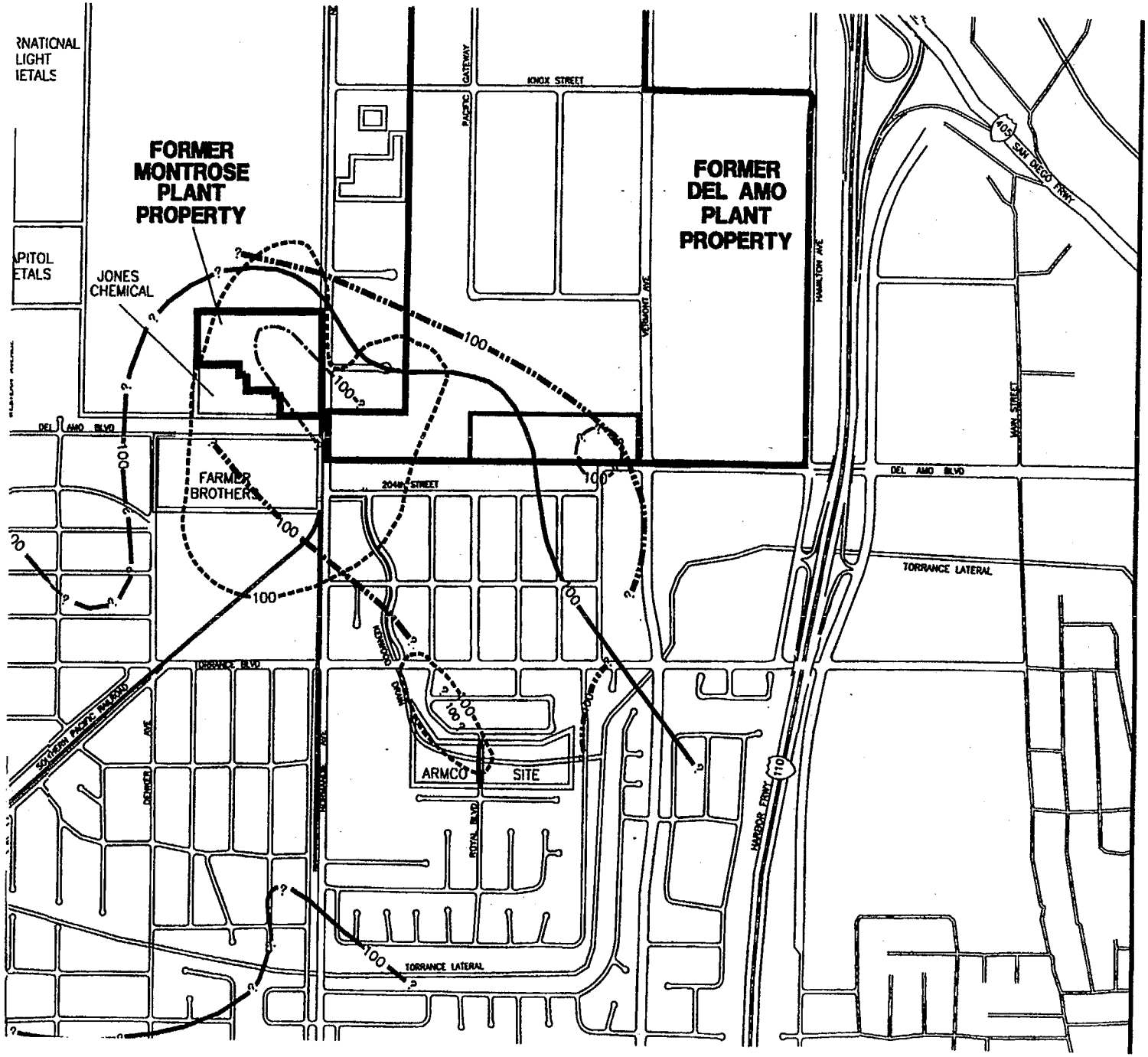


Conceptual Representation

Not to scale

Figure 7-4
TCE Distribution Relative to Benzene
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX



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NOTE:

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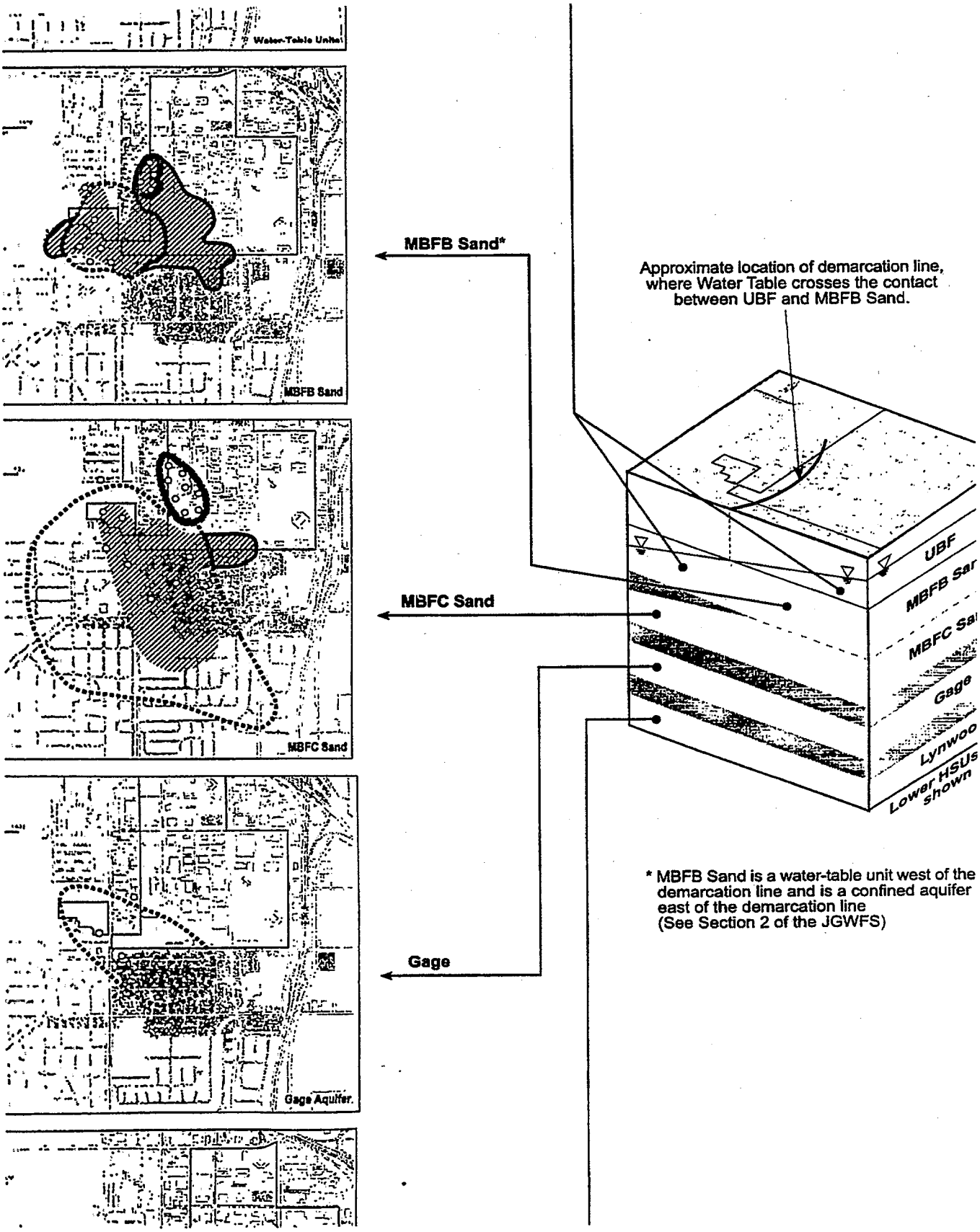
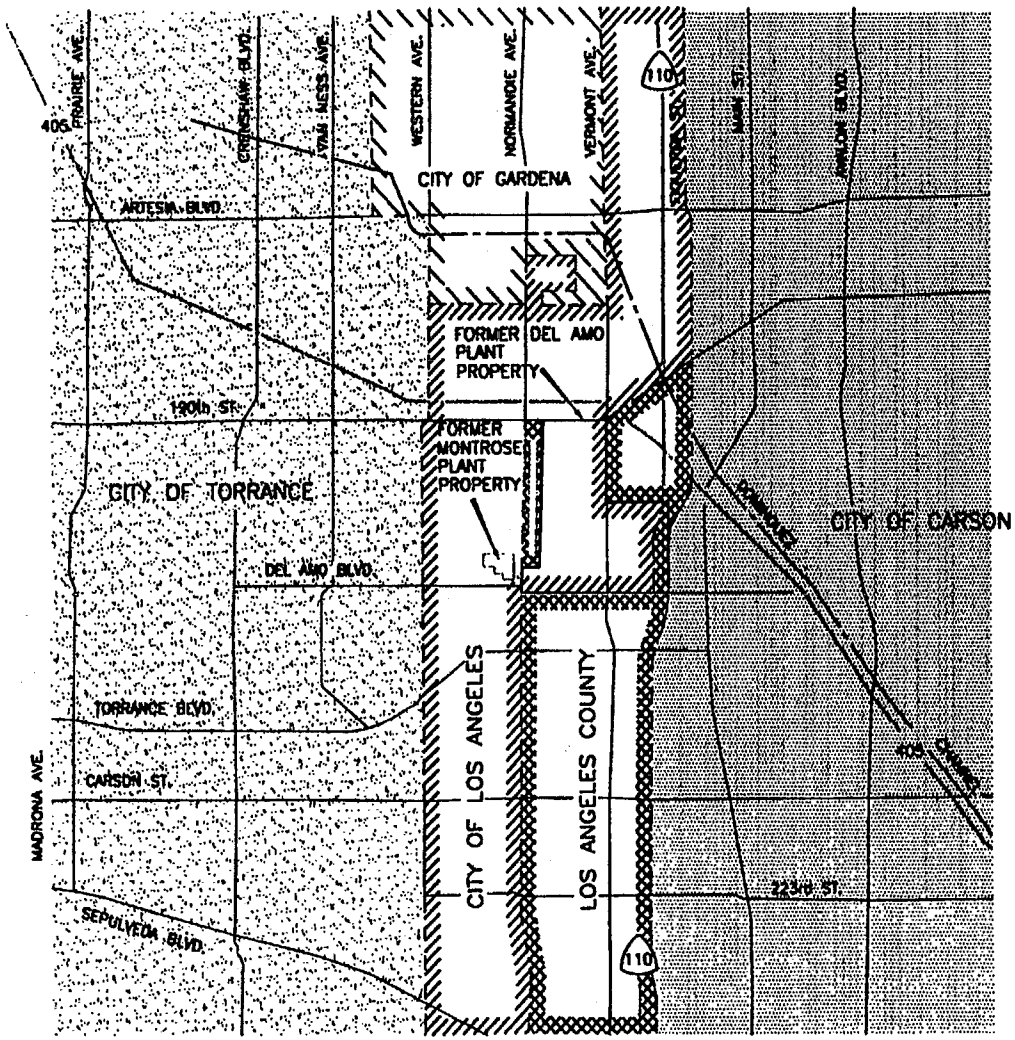

Water-Table Units
MBFB Sand
MBFC Sand
Gage Aquifer
MBFB Sand*
MBFC Sand
Gage
Approximate location of demarcation line, where Water Table crosses the contact between UBF and MBFB Sand.
UBF
MBFB Sar
MBFC Sa
Gage
Lynwoo
Lower HSUs shown
* MBFB Sand is a water-table unit west of the demarcation line and is a confined aquifer east of the demarcation line
(See Section 2 of the JGWFS)



EXPLANATION

- CITY OF GARDENA
- CITY OF LOS ANGELES
- LOS ANGELES COUNTY
- JURISDICTIONAL BOUNDARY
- CITY OF CARSON
- CITY OF TORRANCE

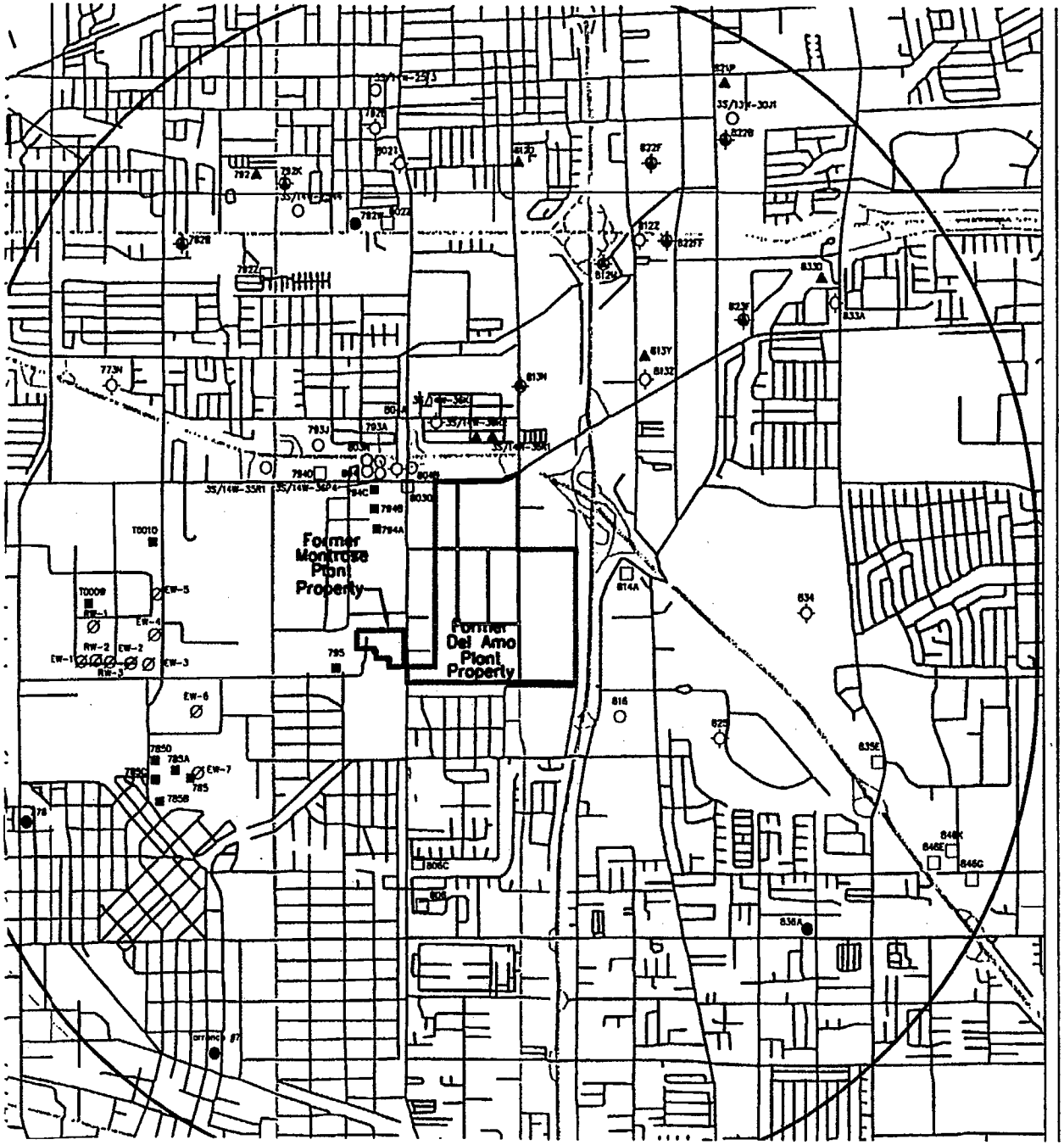
N

0 3,000 6,000
FEET

FIG. 7-7

LAND JURISDICTIONS
IN THE VICINITY OF THE JOINT SITE
RECORD OF DECISION
DUAL SITE GROUNDWATER OPERABLE UNIT
MONTROSE AND DEL AMO SUPERFUND SITES

US EPA Region IX



EXPLANATION

- Municipal supply
- Domestic supply
- Irrigation supply
- Domestic/Irrigatio
- Industrial supply
- Remediation/clea
- Observation well
- Well of unkrown

8. Summary of Groundwater-Related Risks

To determine the potential health risks associated with contamination at hazardous waste sites, EPA conducts a risk assessment. EPA's risk assessment does not evaluate past exposures or existing health effects. Such exposures and health effects are evaluated by the Federal Agency for Toxic Substances and Disease Registry (ATSDR).

Currently, there is not an immediate *direct* risk from groundwater at the Joint Site because no one is currently drinking the contaminated groundwater and so there is no current exposure to groundwater contaminants. However, EPA's goal is to ensure that actual exposure of people to contaminated groundwater at the Joint Site does not occur. The remedy selected in this ROD is expected to take a minimum of 50 years, and may take significantly longer, to complete. Groundwater use is discussed in Section 7 of this ROD and in Section 2 of the JGWFS. Because there is the potential that contaminated groundwater could be used in the future, EPA's risk assessment evaluates what the risk *would* be *if* someone were to use the groundwater. Such a person could be exposed to contaminants by such activities as ingestion of the water, direct contact, or by inhalation of certain contaminants which volatilize out of the water during showering, toilet flushing, and clothes washing.

Two reports document the risks presuming use of groundwater at the Joint Site. The Joint Groundwater Risk Assessment (JGWRA) was completed by the responsible parties under EPA oversight, and the Supplement to the JGWRA was completed by EPA. Both documents calculate the hypothetical risk to a person who uses the groundwater from a given hydrostratigraphic unit, based on conditions which exist in groundwater today. When evaluating possible remedial actions, EPA typically relies on reasonable maximum exposure (RME) risks, including groundwater uses that result in ingestion, inhalation, and dermal contact. Risks from these pathways have been calculated for each hydrostratigraphic unit. The risk assessment did not focus solely on chlorobenzene, benzene, and TCE, though these do provide the vast majority of the total potential human health risk. Rather, all chemicals in groundwater were considered by the risk assessment documents.

8.1 Two Methods of Risk Characterization: Complexities in Assessing Groundwater Risks

The potential risks (cancer and non-cancer) from Joint Site groundwater have been calculated for this proposed remedy by two methods. The first, used in the JGWRA, utilized a *"plume averaging" approach* in which it was assumed that the receptor was exposed to the average of concentrations measured in monitoring wells in a given hydrostratigraphic unit. The second

method, used in EPA's Supplement to the JGWRA, was to generate *risk contours,* which present a *spatial distribution of risk.* With contours, one can see how the risk to a person placing a single well would vary from point to point in any of the plumes; in effect, how the risk is distributed spatially within the plume.

Neither of these approaches is intended to supersede the other; rather, it is EPA's intention that they be used together to provide a better picture of overall risk for the Joint Site. This two-method approach is indicated due to complexities related to evaluating risks associated with groundwater.

Assessing risks associated with the use of groundwater as a medium is, by most accounts, complex. Among other reasons, this is because groundwater must be drawn from a well or wells before it is used. The concentration of contaminants in the water drawn from the ground (and correspondingly, the risk to an individual using the water) will depend on many factors, including the number of wells being used, the rate at which the water is pumped and the zone of hydraulic influence of the well(s), the depth or depths at which the well is screened to take in water, and changes in the groundwater concentrations over time at the location of the well(s).

To determine what the risk may be to an individual using groundwater, an estimate of the concentration of chemicals in the water that may be used by the individual must be derived. The factors just mentioned complicate the ability to calculate a concentration term that will uniquely represent the exposure to any hypothetical individual. The exact area of groundwater to which a person would be exposed via a well or wells can be difficult to define, and adequate data are not always available for sophisticated risk-based calculations. As with most areas of the field of risk assessment, simplifying assumptions must be made, and these must be acknowledged when interpreting risk calculations.

The description of these methods, and a statement as to the relative drawbacks and benefits of each, is provided in the JGWRA, the Supplement to the JGWRA, and in Section 3 of the JGWFS. The following provides a brief summary of the reasons that EPA supplemented the calculations performed by the plume-averaging approach with risk contours. The JGWRA calculated the concentration term for any given contaminant as the average of concentrations for all wells within the hydrostratigraphic unit for which a risk was being calculated. When used alone, this introduces the following uncertainties and issues:

1. The monitoring wells for the calculation were not installed for the purpose of determining the true average concentration of contaminants in the groundwater, but to determine the extent of the contamination. The result is that the average of concentrations found in all wells is not truly the average concentration in the contaminant distribution;

2. If a person were to use water from a well in the affected groundwater, it is unlikely that their well would produce water with a concentration equal to the average concentration in the overall distribution, unless they were receiving water from a large number of wells within the contaminated area and water was being blended prior to service;

3. Because a single risk value is used to represent the plume, the value cannot reflect information about the spatial distribution of risk within the contaminant distribution in groundwater;

4. The plume-averaging approach cannot take into account the extent of the contaminated area, so that a very large area at medium concentration is computed as having a higher risk than a tiny area at high concentration; and

5. The number of wells used in the calculation varied from hydrostratigraphic unit to unit and the number of wells sampled varied from contaminant to contaminant within each unit.

These issues are more thoroughly discussed in the Supplement to the JGWRA (Section 1).

To mitigate some of these issues with plume-averaged risk, risk contours were developed in the Supplement to the JGWRA. Risk contours are derived from concentration contours, which are interpolated lines of equal concentration derived from sampling results at multiple well points. Each point on the contour is based on an assessment of concentrations at all wells around it. A concentration of a contaminant in groundwater, given an exposure scenario, implies a certain hypothetical risk that can be calculated. Therefore, the continuous spatial distribution of chemical concentrations in groundwater, represented by concentration contours, can be directly translated into a continuous distribution of risk, represented by risk contours. The values of the risk contours for all contaminants can be added to obtain a distribution of total risk within a given hydrostratigraphic unit. By finding the location of a hypothetical future well on such a total risk contour map, one can read an *estimate* of the risk associated with using water from that location, and see how that risk might differ from the risk at any other location in the contaminant distribution.

Risk contouring does not generate a single risk value, but rather a risk distribution that allows one to see the range of risks over the contaminant distribution and to see spatially which areas of the distribution may present particularly high risk or low risk, relative to the other areas. It should be noted that because a given location on a risk contour accounts not only for the concentration from the nearest well but for all wells surrounding that point, risk contouring does not represent "single-point" risk assessment but takes into account all groundwater data available for the Joint Site.

Risk contouring also has uncertainties, including uncertainty in the interpolation to determine contour lines, uncertainty as to the movement of contaminants over time, and uncertainty that the concentration found in monitoring wells would be the same at a production well. However, it is noted that the last two forms of uncertainty also exist for the plume-averaging approach.

The Supplement to the JGWRA produced risk contour sets for the RME exposure scenario in the UBF, MBFB Sand, MBFC Sand, and Gage Aquifer. Because of the small size of the contaminant distribution in the Lynwood Aquifer, it was decided that a risk based on plume- averaged concentrations in this hydrostratigraphic unit would be sufficient and that a risk contour for the Lynwood Aquifer would not add significant value. The JGWRA produced risks based on plume-averaged concentrations as the basis for exposure terms for the MBFB Sand, the MBFC Sand, the Gage Aquifer, and the Lynwood Aquifer, with the exception of the chlorobenzene plume, for which a plume-averaged risk was not computed for the MBFB Sand. EPA did compute a risk contour for this unit, however.

8.2 Summary of Factors for Toxicity Assessment and Exposure Assessment

Cancer potency factors (CPFs) have been developed by EPA's National Center for Exposure Assessment (NCEA) for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of milligram per kilogram per day $(mg/kg/day)^{-1}$, are multiplied by the estimated intake of a carcinogen in mg/kg/day, to provide an upper bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied to account for the use of animal data to predict effects on humans.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects (chemicals may exhibit both carcinogenic and noncarcinogenic effects, in which case EPA accounts for both effects in the risk assessment). RfDs, which are expressed in units of mg/kg/day, are chemical-specific estimates of exposure levels at which noncancer effects would not be expected to occur. Estimated intakes from environmental media can then be compared to the RfD. The ratio of the actual intake to the RfD for a chemical is called the *hazard index* for that chemical. RfDs are derived from human epidemiological studies or animal studies to which safety factors have been applied. These safety factors ensure that the RfDs will not underestimate the potential for noncancer effects to occur.

Of the primary and most prevalent contaminants in groundwater at the Joint Site, benzene, TCE, and PCE are considered potential human carcinogens. Chlorobenzene is not considered a potential human carcinogen but does pose a significant non-cancer risk. The reader should consult the JGWRA for more detailed information on the cancer and noncancer effects of other chemicals in groundwater at the Joint Site.

Both the JGWRA and the Supplement to the JGWRA used the same toxicity and exposure assumptions. However, the JGWRA, utilizing solely the approach of plume-averaging, calculated "average" and "industrial" scenarios of risk as well as the RME scenario. The Supplement, calculating risk contours, provided estimates using only the RME scenario. In the JGWRA, the "average" scenario did not assume upper bound but rather average values for exposure parameters, including concentration. The "industrial scenario" assumed that only workers were exposed during a normal work day. It is noted that the industrial scenario in the JGWRA does *not* represent the risk that would be incurred by a worker using groundwater from directly under the former Montrose or Del Amo plants. Rather, because it uses the average concentration of all wells in the contaminant distribution, it simulates an "average" risk to workers who might use groundwater throughout the entire contaminant distribution. Workers at the former Montrose and Del Amo facilities would experience much higher risks than those represented in the industrial scenario in the JGWRA if they used groundwater from directly under the properties, because the concentrations of contaminants at these locations are at the heart of the distribution, and are extremely high.

The JGWRA and its Supplement considered hypothetical risks from groundwater use at the site by three pathways, including ingestion, inhalation, and dermal contact. The inhalation pathway included activities such as showering, toilet flushing, clothes washing, etc.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g. 10^{-6}). An excess lifetime cancer risk of $1x10^{-6}$ would indicate that, as a plausible upper bound, an individual has a one in one million excess chance of developing cancer as a result of exposure to the contaminants that are the subject of the risk assessment, over a 70-year lifetime under the specific exposure conditions at the site. There are exceptions from site to site, but EPA generally takes remedial actions when the site-related excess cancer risks exceed 10^{-4} and may take action when the site related excess cancer risks are between 10^{-6} and 10^{-4}.

For noncancer risks, the total hazard index for the site is obtained by adding the hazard indices for all contaminants under all pathways. Total hazard indices exceeding unity (1) indicate the possibility for noncancer effects due to the environmental exposures being analyzed in the risk assessment.

8.3 Summary of Risks

Table 8-1 provides a summary of the plume-averaged risks (cancer and noncancer) for the Joint Site by hydrostratigraphic unit. Tables 8-2 and 8-3 provide more detailed breakdowns of the risk at the Joint Site, as calculated by the plume averaging method. These tables breakdown risks by pathway and by plume. Figures 8-1a through 8-1h show the combined risk contours for the Joint Site.

The result of the risk assessment is that the risks from the Joint Site, should anyone use the groundwater, are extremely high. Risks calculated by the plume-averaging method are as much as 12,000 times what EPA would consider a safe concentration for potable use and are above acceptable levels in all of the affected hydrostratigraphic units. Risks at the center of the plumes, calculated by either method, are as much as 100,000 times greater than EPA's point of departure guideline of one in a million excess lifetime cancer risk (10^{-6}) and between 10,000 and 100,000 times greater than the acceptable non-cancer hazard index of 1. Users of water within the Joint Site are not exposed to this contamination presently and such risks would only be realized if the water at the Joint Site were used, either at locations presently affected or after the contamination has spread further.

8.4 Risk Status of para-Chlorobenzene Sulfonic Acid (pCBSA)

pCBSA is a unique by-product of the DDT manufacturing process and is present in high concentrations up to 110,000 ppb downgradient of the Montrose facility at the Joint Site (in the NAPL area directly under the former Montrose plant, concentrations of pCBSA reach 1,100,000 ppb.) pCBSA occurs in all aquifers in which chlorobenzene occurs, and covers a wider lateral area of the aquifers than does chlorobenzene (See discussion in Section 7 of this ROD, Section 2 of the JGWFS, and in the Montrose RI Report, cited in the list in Section 4 of this ROD).

There are no promulgated health-based standards for pCBSA, and there are no accepted toxicological values (slope factor, risk reference dose (RfD), dose-response relationships, etc.) for this compound. In addition, there are no acceptable surrogate compounds upon which to base toxicological values for pCBSA. There are no chronic studies and a few limited acute studies of the toxicity of pCBSA in animals. The few and limited short-term studies, taken alone, provided no indication of mutagenic or teratogenic health effects and suggested that gavage dosages could be raised above 1000 mg/kg/day without observable toxic effects. In addition, another study indicated that another chemical was converted into pCBSA by the body in order to excrete it: pCBSA has a high water solubility. This *may* mean that pCBSA residence time in the human body is short compared to other chemicals at the Joint Site. These factors would suggest a low toxicity. However, the design of the studies performed had definite limitations, and more short-term studies would be needed to confirm these results. More importantly, no chronic (long term)

studies have been done on pCBSA. Therefore, these results are not definitive and cannot be used to quantify the risk associated with pCBSA. In turn, EPA believes there are insufficient data upon which to establish provisional standards for pCBSA. Based on one sub-chronic non-cancer study, the State of California has established with respect to the Joint Site a non-promulgated and provisional No Observed Adverse Effect Level (NOEL) of 1 mg/kg/day for pCBSA, that would approximately translate to a provisional drinking water standard of 25,000 ppb.

EPA intends to monitor any future toxicological studies on pCBSA, however no studies currently are planned. EPA will ensure that the persons making decisions on prioritization of toxicological studies are aware of the presence and nature of pCBSA at the Joint Site.

8.5 Basis for Action

The principal threat for this action, as discussed earlier in this ROD is the NAPL. This NAPL continually and slowly dissolves in the groundwater in any hydrostratigraphic unit in which it is present, creating a distribution of dissolved phase contamination. Also, the NAPL *itself* may move to greater depths.

Through dissolution, the NAPL gives rise to a large distribution of dissolved phase contamination in the groundwater at concentrations in excess of health-based standards. Dissolved contamination may arrive to deeper units either by: (1) dissolved contamination migrating downward from/through the shallower units, or (2) NAPL migrating directly to the deeper unit followed by direct dissolution into the deeper unit. Dissolved contamination also moves outward laterally in most of the affected units. Because of the large extent of existing contamination, and this potential for migration, this contaminated water may eventually be used by persons, may migrate and reach existing wells that are being used for groundwater or reach locations that are the site for future wells, and destroy the usability of the groundwater resource.

This section showed that the health risk posed by the contaminated groundwater at the Joint Site is unacceptable, should the groundwater be used. While the contaminated groundwater at the Joint Site is not being used presently, EPA considered that:

- The groundwater would pose an extreme risk if it were ever used (exceeding 10^{-2} cancer risk and hazard indices in excess of 10,000);
- The groundwater is classified by the State of California as having a potential beneficial use which includes use as drinking water;
- The laws and policies of the State of California are generally focused on protecting potential future beneficial uses of groundwater, even where it is not currently used;
- The NCP requires that EPA consider the potential future uses of groundwater;
- The groundwater is contaminated over a very large area both laterally (covering several square miles) and vertically (covering six hydrostratigraphic units to depths exceeding 200 feet);
- The groundwater contamination may continue to move either as a result of a direct or indirect movement of NAPL or as a result of continued dissolved phase contamination;

- The contamination may move from aquifers or areas which are not presently utilized for drinking water to aquifers or areas which are utilized for drinking water. Protection is necessary for the heavily used Silverado Aquifer which underlies the present extent of contamination at the Joint Site;

- While adjudication may limit the installation of new wells, it does not preclude such installations in the future;

- The groundwater would likely be used to some degree if it were not contaminated, as evidenced by the presence of some wells in the area and plans by cities to install more wells; and

Because of these factors, the risks posed, and the principal threats discussed, EPA considers the groundwater at the Joint Site actionable.

Table 8-1

Summary of Cancer and Non-Cancer Groundwater-Related Risks by the Plume Averaging Method

Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

	Cancer Risk		Non-Cancer Hazard Index	
	Chlorobenzene Plume	**Benzene Plume**	**Chlorobenzene Plume**	**Benzene Plume**
MBFB Sand	Calculated Only By Risk Contours Method	$3x10^{-1}$	Calculated Only By Risk Contour Method	12,724
MBFC Sand	$7x10^{-4}$	$1.3x10^{-1}$	178	9,839
Gage Aquifer	$1x10^{-5}$	*	50	*
Lynwood Aquifer	N/A†	N/A‡	7.2	N/A‡

* The benzene in the Gage Aquifer is in the chlorobenzene plume
† N/A - Not applicable because chlorobenzene is not a carcinogen and other carcinogens are not in the Lynwood
‡ N/A - Not applicable because there is no benzene plume in the Lynwood Aquifer

Table 8-2
Future Residential Use of Hypothetical Groundwater Well
RME Hazard Index
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Dermal Contact with Tap Water					
Total DDT	NA	0.003	0.046	0.0019	NA
Total BHC	NA	0.00055	0.0089	NA	NA
Acetone	NA	0.0017	0.0010	0.000077	NA
Benzene	600	250	0.074	0.02	NA
sec-Butylbenzene	6	NA	NA	NA	NA
Carbon tetrachloride	NA	0.48	0.095	NA	NA
Chlorobenzene	0.05	0.063	1.4	0.44	0.064
Chloroform	0.2	0.2	0.040	NA	NA
1,4-Dichlorobenzene	NA	0.0083	0.0010	NA	NA
1,1-Dichloroethane	0.004	NA	NA	NA	NA
1,2-Dichloroethane	0.03	NA	NA	NA	NA
1,1-Dichloroethene	0.03	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.02	NA	NA	NA	NA
Ethyl benzene	3	0.94	0.048	0.010	NA
Methylene chloride	0.002	0.0023	0.00040	NA	NA
Naphthalene	0.3	NA	NA	NA	NA
Tetrachloroethylene	1	1.6	0.18	NA	NA
Toluene	0.9	0.15	0.014	0.0033	NA
Trichloroethylene	3	3.0	0.23	NA	NA
Xylenes	0.007	0.0012	0.00027	NA	NA
Arsenic	0.03	NA	NA	NA	NA
Manganese	0.002	NA	NA	NA	NA
Total HI by Pathway	**615**	**256**	**2.1**	**0.47**	**0.064**

Table 8-2
Future Residential Use of Hypothetical Groundwater Well
RME Hazard Index
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Inhalation of Chemicals from Tap Water					
Total DDT	NA	0.0019	2.5	0.0034	NA
Total BHC	NA	0.0046	0.075	NA	NA
Acetone	NA	0.77	0.44	0.11	NA
Benzene	10,000	8,400	0.48	0.71	NA
sec-Butylbenzene	20	NA	NA	NA	NA
Carbon tetrachloride	NA	32	6.2	NA	NA
Chlorobenzene	4	6.4	144	44	6.4
Chloroform	2	1.8	0.36	NA	NA
1,4-Dichlorobenzene	NA	0.15	0.018	NA	NA
1,1-Dichloroethane	0.4	NA	NA	NA	NA
1,2-Dichloroethane	7	NA	NA	NA	NA
1,1-Dichloroethene	2	NA	NA	NA	NA
cis-1,2-Dichloroethene	3	NA	NA	NA	NA
Ethyl benzene	1	0.35	0.018	0.0039	NA
Methylene chloride	0.04	0.059	0.010	NA	NA
Naphthalene	4	NA	NA	NA	NA
Tetrachloroethylene	4	4.7	0.54	NA	NA
Toluene	2	0.32	0.029	0.0069	NA
Trichloroethylene	20	15	1.2	NA	NA
Xylenes	1	0.018	0.0039	NA	NA
Arsenic	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA
Total HI by Pathway	**10,070**	**8,462**	**156**	**45**	**6.4**

Table 8-2
Future Residential Use of Hypothetical Groundwater Well
RME Hazard Index
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Ingestion of Chemicals in Tap Water					
Total DDT	NA	0.0011	0.049	0.0020	NA
Total BHC	NA	0.0018	0.030	NA	NA
Acetone	NA	1.4	0.83	0.064	NA
Benzene	2,000	1,100	0.31	0.86	NA
sec-Butylbenzene	9	NA	NA	NA	NA
Carbon tetrachloride	NA	10	2	NA	NA
Chlorobenzene	0.5	0.72	16	5	0.73
Chloroform	0.7	0.72	0.14	NA	NA
1,4-Dichlorobenzene	NA	0.011	0.0076	NA	NA
1,1-Dichloroethane	0.2	NA	NA	NA	NA
1,2-Dichloroethane	3	NA	NA	NA	NA
1,1-Dichloroethene	0.8	NA	NA	NA	NA
cis-1,2-Dichloroethene	1	NA	NA	NA	NA
Ethyl benzene	2	0.11	0.022	0.0049	NA
Methylene chloride	0.2	0.024	0.042	NA	NA
Naphthalene	2	NA	NA	NA	NA
Tetrachloroethylene	2	1.9	0.23	NA	NA
Toluene	0.4	0.072	0.0065	0.0015	NA
Trichloroethylene	7	6.0	0.47	NA	NA
Xylenes	0.04	0.0072	0.0015	NA	NA
Arsenic	10	NA	NA	NA	NA
Manganese	1	NA	NA	NA	NA
Total HI by Pathway	**2,040**	**1,121**	**20**	**5.9**	**0.73**
Total HI, All Pathways	**12,725**	**9,839**	**178**	**51**	**7.2**

Table 8-3
Future Residential Use of Hypothetical Groundwater Well
RME Cancer Risk
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Dermal Contact with Tap Water					
Total DDT	NA	7×10^{-8}	3×10^{-6}	1×10^{-7}	NA
Total BHC	NA	1×10^{-7}	2×10^{-6}	NA	NA
Benzene	2×10^{-2}	9×10^{-3}	3×10^{-6}	8×10^{-7}	NA
Carbon tetrachloride	NA	2×10^{-5}	4×10^{-6}	NA	NA
Chloroform	4×10^{-6}	5×10^{-6}	1×10^{-6}	NA	NA
1,2-Dichloroethane	3×10^{-6}	3×10^{-6}	6×10^{-7}	NA	NA
1,1-Dichloroethene	6×10^{-5}	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	2×10^{-5}	2×10^{-6}	NA	NA
Methylene chloride	3×10^{-7}	4×10^{-7}	8×10^{-8}	NA	NA
Tetrachloroethylene	3×10^{-4}	3×10^{-4}	4×10^{-5}	NA	NA
Trichloroethylene	8×10^{-5}	8×10^{-5}	7×10^{-6}	NA	NA
Vinyl Chloride*	8×10^{-5}	NA	NA	NA	NA
Arsenic	5×10^{-6}	NA	NA	NA	NA
Total Cancer Risk by Pathway	**2×10^{-2}**	**9×10^{-3}**	**6×10^{-5}**	**9×10^{-7}**	**NA**

Table 8-3
Future Residential Use of Hypothetical Groundwater Well
RME Cancer Risk
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

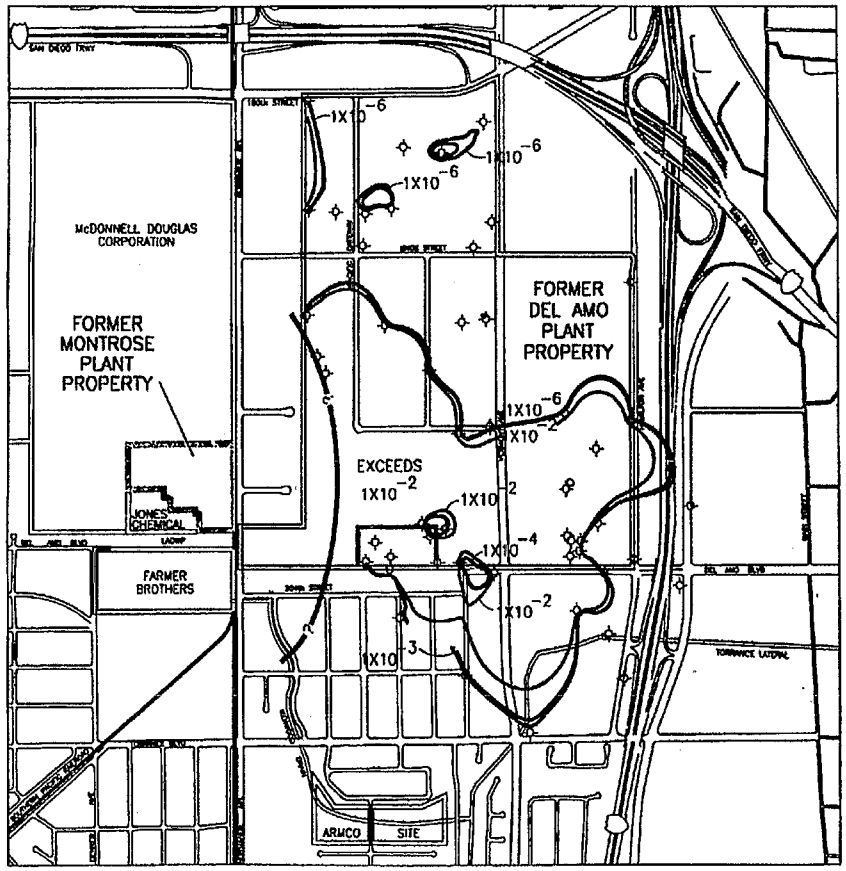
CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Inhalation of Chemicals from Tap Water					
Total DDT	NA	1×10^{-7}	5×10^{-6}	2×10^{-7}	NA
Total BHC	NA	8×10^{-7}	1×10^{-5}	NA	NA
Benzene	2×10^{-1}	8×10^{-2}	2×10^{-5}	8×10^{-6}	NA
Carbon tetrachloride	NA	3×10^{-4}	1×10^{-4}	NA	NA
Chloroform	6×10^{-4}	5×10^{-4}	9×10^{-5}	NA	NA
1,2-Dichloroethane	8×10^{-4}	6×10^{-4}	1×10^{-4}	NA	NA
1,1-Dichloroethene	2×10^{-3}	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	3×10^{-4}	3×10^{-5}	NA	NA
Methylene chloride	2×10^{-5}	3×10^{-5}	4×10^{-6}	NA	NA
Tetrachloroethylene	3×10^{-5}	3×10^{-5}	3×10^{-6}	NA	NA
Trichloroethylene	3×10^{-4}	2×10^{-4}	1×10^{-5}	NA	NA
Vinyl Chloride*	6×10^{-4}	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA
Total Cancer Risk by Pathway	**2×10^{-1}**	**8×10^{-2}**	**4×10^{-4}**	**8×10^{-6}**	**NA**

Table 8-3
Future Residential Use of Hypothetical Groundwater Well
RME Cancer Risk
Risk Calculated by Plume-averaging Method

Record of Decision
Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

CHEMICAL	BELLFLOWER B-SAND Benzene	BELLFLOWER C-SAND Benzene	BELLFLOWER C-SAND Chlorobenzene	GAGE AQUIFER Chlorobenzene	LYNWOOD AQUIFER Chlorobenzene
Ingestion of Chemicals in Water					
Total DDT	NA	8×10^{-8}	4×10^{-6}	1×10^{-7}	NA
Total BHC	NA	4×10^{-7}	7×10^{-6}	NA	NA
Benzene	9×10^{-2}	4×10^{-2}	1×10^{-5}	3×10^{-6}	NA
Carbon tetrachloride	NA	4×10^{-4}	8×10^{-5}	NA	NA
Chloroform	2×10^{-5}	2×10^{-5}	4×10^{-6}	NA	NA
1,2-Dichloroethane	3×10^{-4}	3×10^{-4}	6×10^{-5}	NA	NA
1,1-Dichloroethene	2×10^{-3}	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	1×10^{-4}	2×10^{-5}	NA	NA
Methylene chloride	4×10^{-5}	5×10^{-5}	8×10^{-6}	NA	NA
Tetrachloroethylene	4×10^{-4}	4×10^{-4}	5×10^{-5}	NA	NA
Trichloroethylene	2×10^{-4}	2×10^{-4}	1×10^{-5}	NA	NA
Vinyl Chloride*	5×10^{-3}	NA	NA	NA	NA
Arsenic	3×10^{-3}	NA	NA	NA	NA
Total Cancer Risk by Pathway	**1×10^{-1}**	**4×10^{-2}**	**2×10^{-4}**	**3×10^{-6}**	NA
Total Cancer Risk, All Pathways	**3×10^{-1}**	**1×10^{-1}**	**7×10^{-4}**	**1×10^{-5}**	NA

*The risk calculation for vinyl chloride does not reflect the most recent guidelines for addressing the impact of vinyl chloride on developing organisms (i.e., children). This "exquisite sensitivity" calculation would result in a vinyl chloride-specific (not overall) risk of up to 10 times the value shown in this table. This calculation was not performed because the risk from all other contaminants is already high, and, even if the vinyl chloride risk were 10 times higher, the overall risk would not be appreciably affected by modifying the calculation. However, the potential impact on vinyl chloride-specific risks is noted.



N

0 1000 2000
SCALE IN FEET

LEGEND:

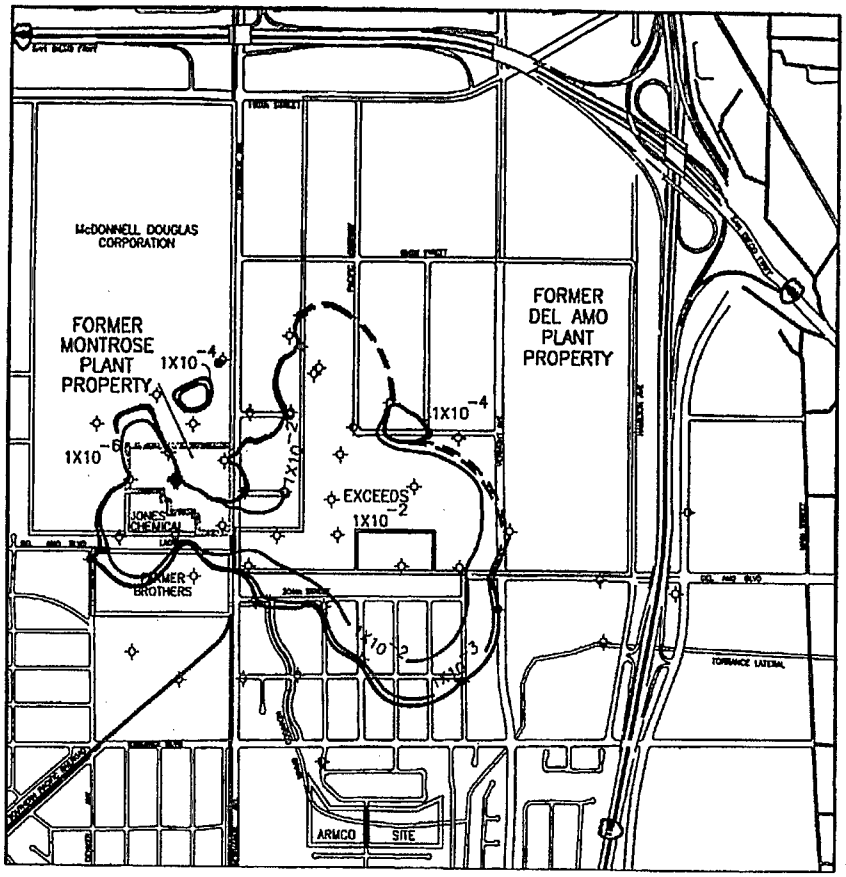
Well Location

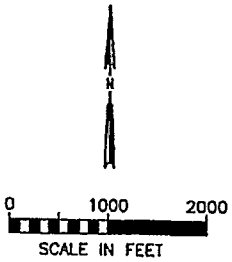
Inferred intersection of water table surface with top of middle Bellflower B sand. The overlying upper Bellflower aquitard is unsaturated west of the inferred intersection

$1X10^{-6}$ Risk Isopleth

Figure 8-1a
Total Excess Cancer Risk
Upper Bellflower Aquitard (UBF)
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX





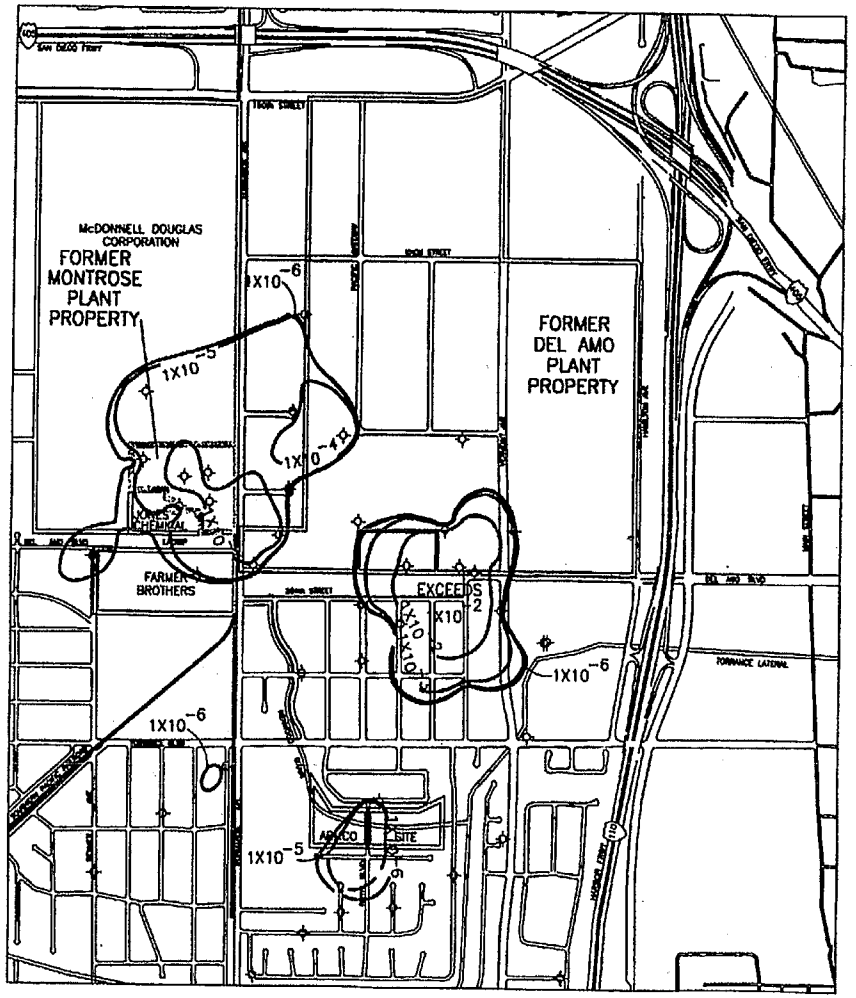
LEGEND:

- Well Location
- 1X10^{-2} Risk Isopleth
- 1X10^{-2} Estimated Risk Isopleth

Figure 8-1b
Total Excess Cancer Risk
Middle Bellflower B Sand (MBFB Sand)

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX



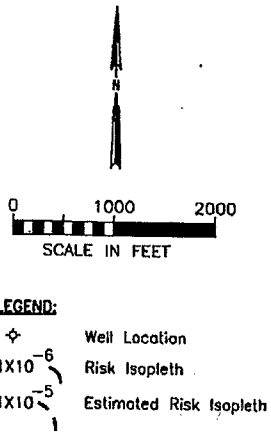
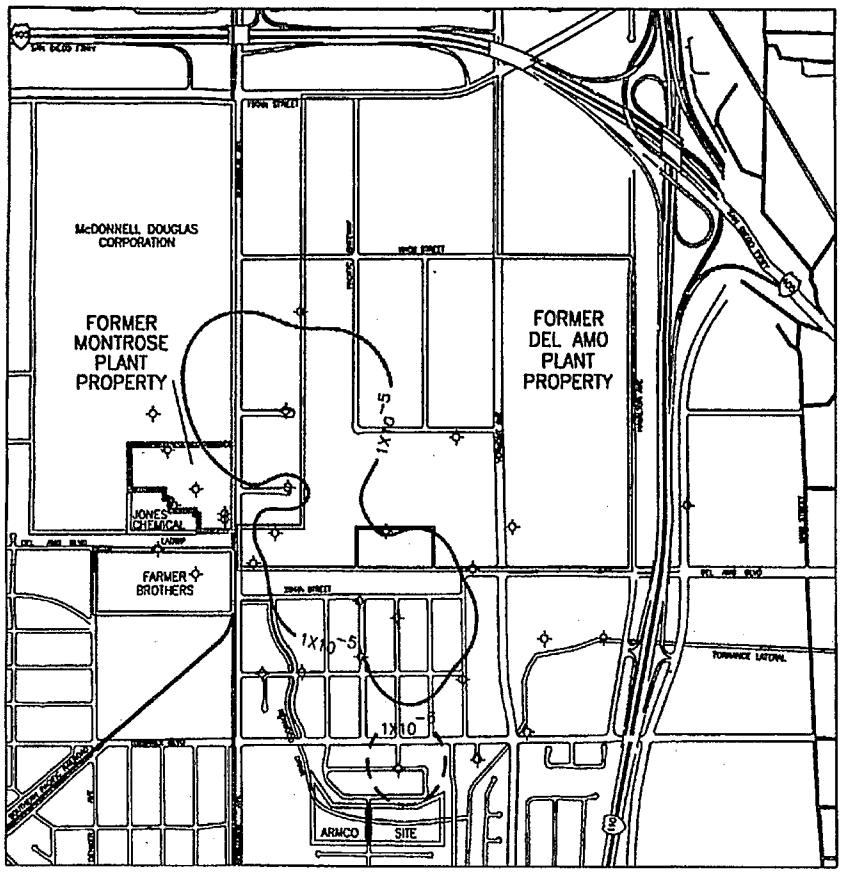
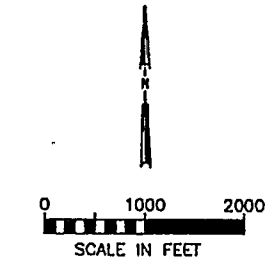


Figure 8-1c
Total Excess Cancer Risk
Middle Bellflower C Sand (MBFC Sand)

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX





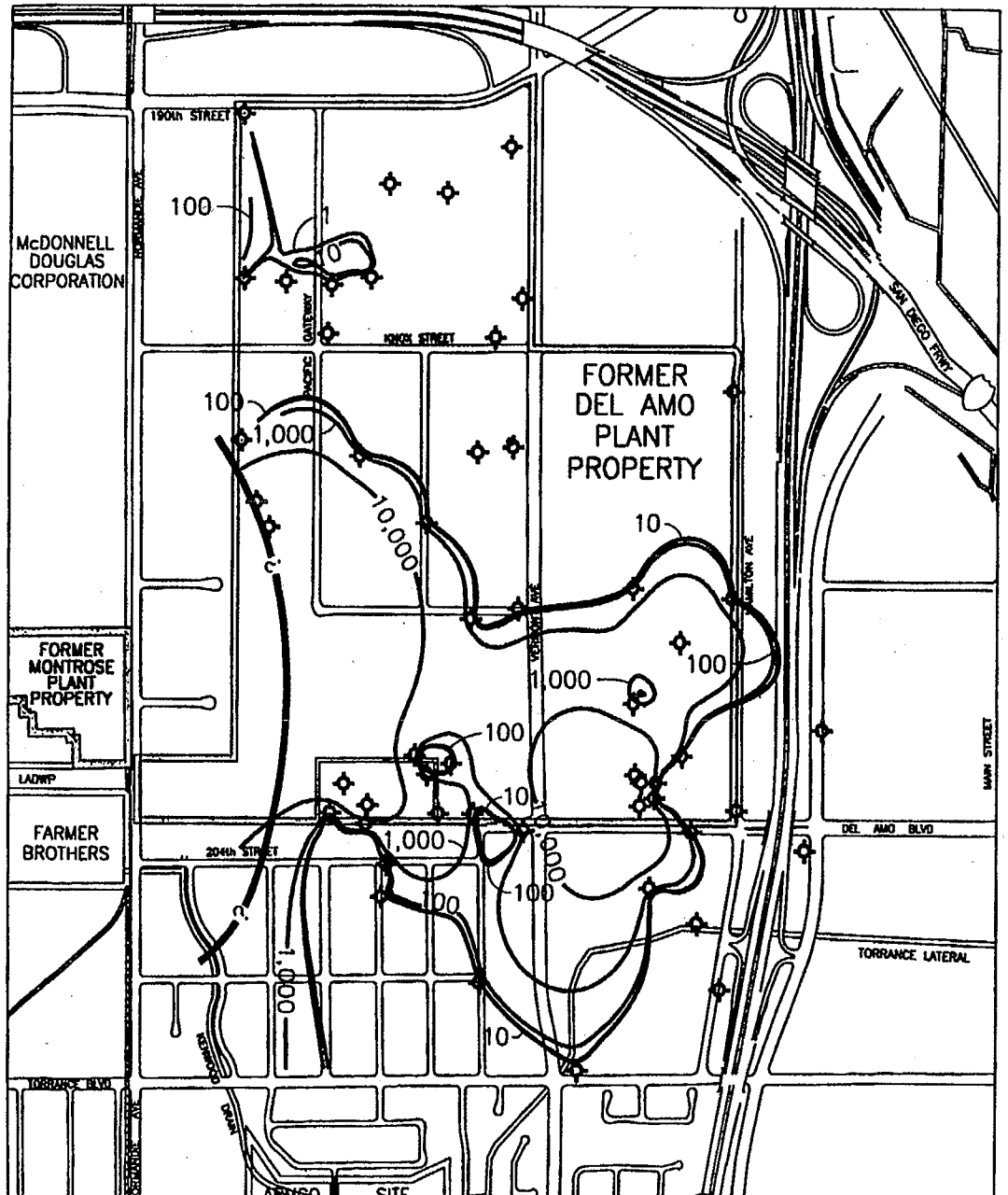
LEGEND:

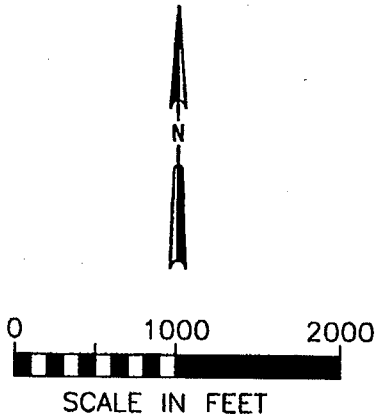
- Well Location
- $1X10^{-5}$ Risk Isopleth
- $1X10^{-6}$ Estimated Risk Isopleth

Figure 8-1d
Total Excess Cancer Risk
Gage Aquifer

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

US EPA Region IX



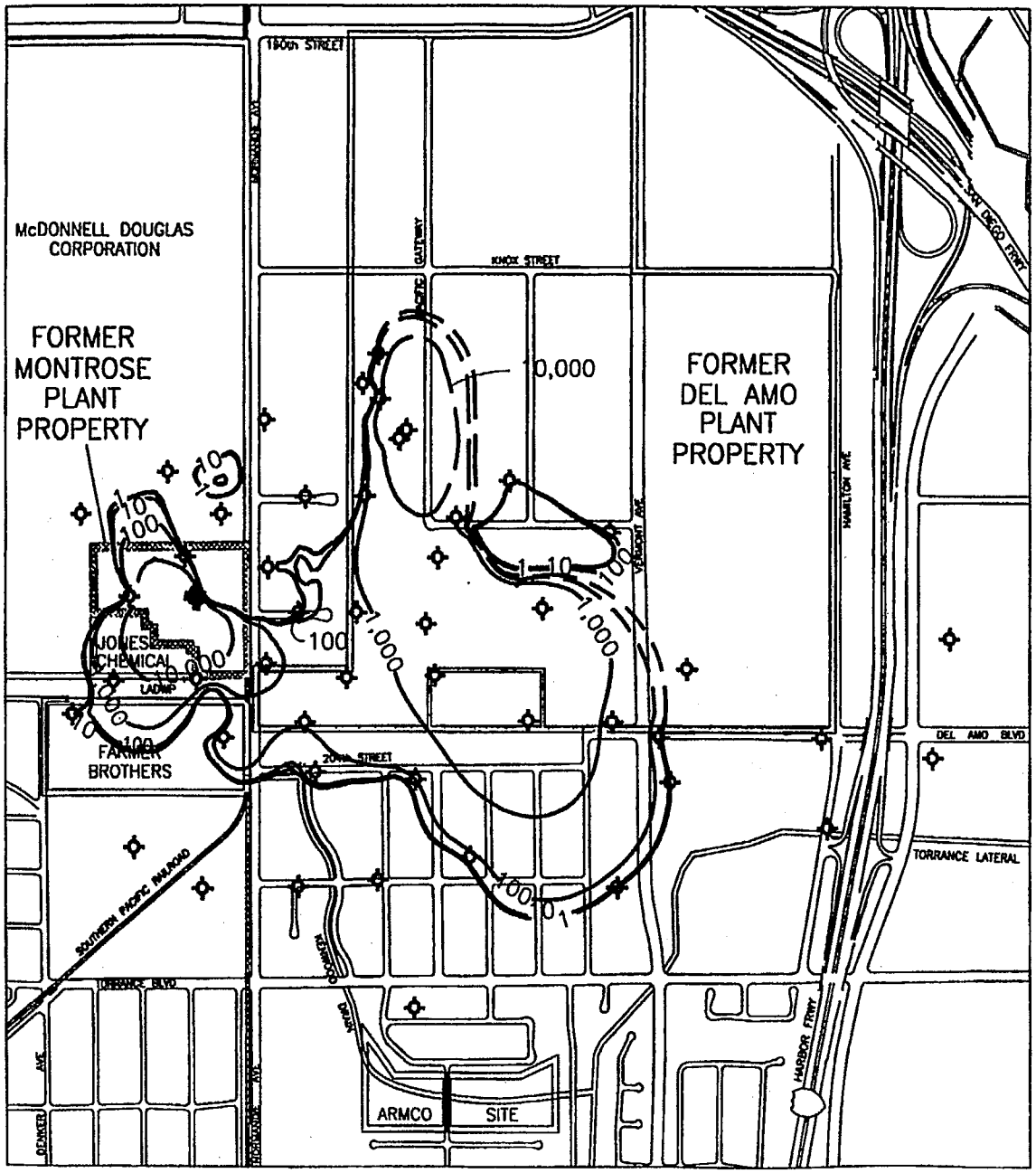


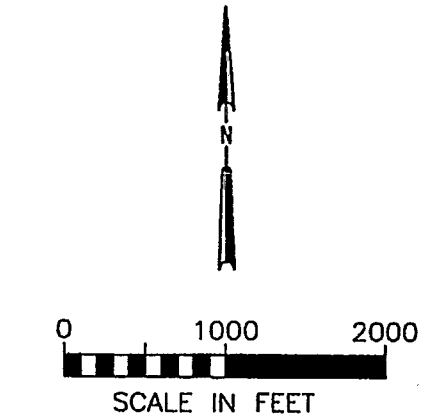
LEGEND:

- Well Location
- Inferred intersection of water table surface with top of middle Bellflower B sand. The overlying upper Bellflower aquitard is unsaturated west of the inferred intersection
- 1,000 HI Isopleth

Figure 8-1e
Montrose/Del Amo
Total Noncancer Hazard Index
Upper Bellflower Aquitard
(UBF)
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

CH2MHILL





LEGEND:

- Well Location
- 1,000 HI Isopleth
- 10 Estimated HI Isopleth

Figure 8-1f
Montrose/Del Amo
Total Noncancer Hazard Index
Middle Bellflower B Sand
draft
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

CH2MHILL

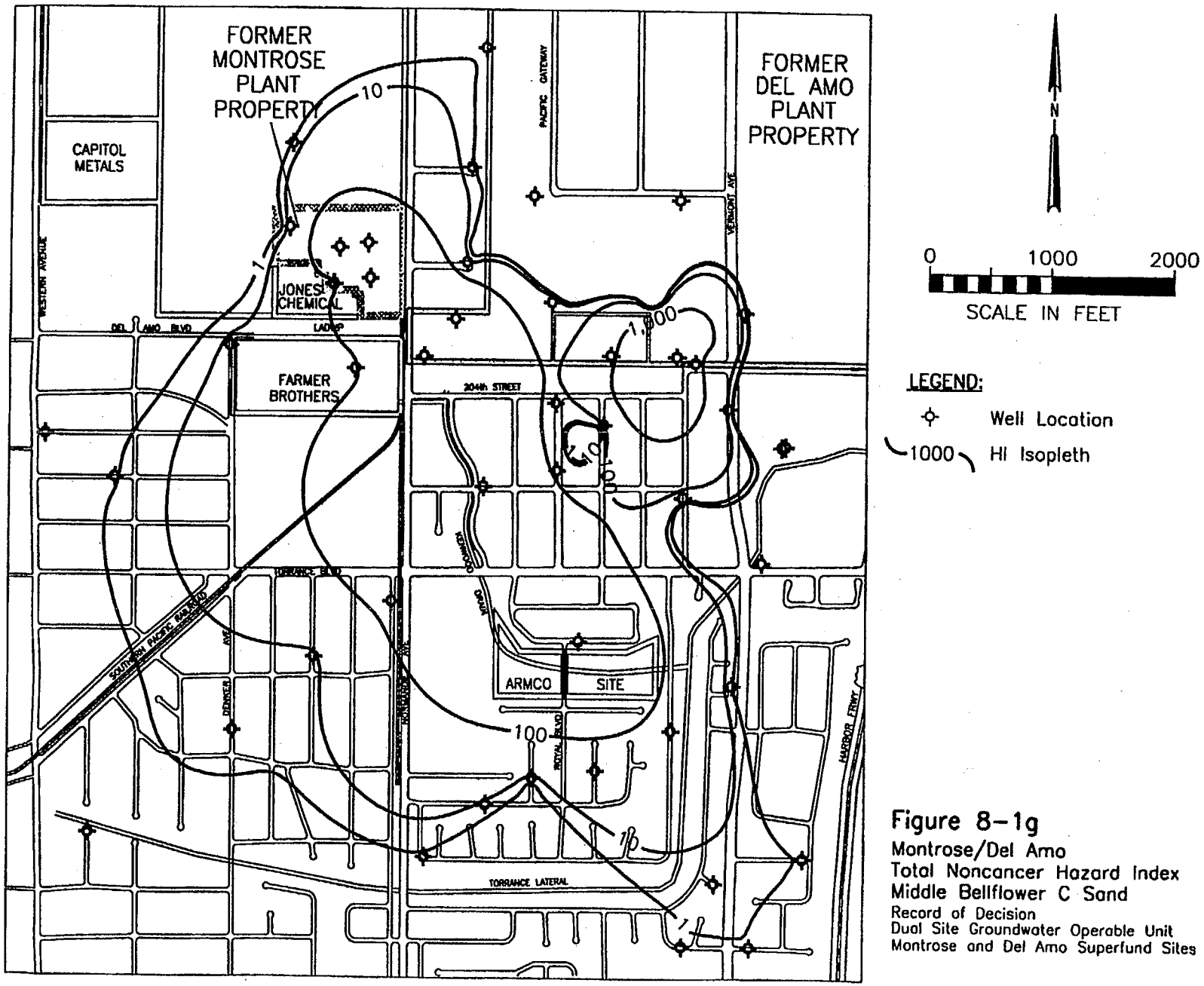
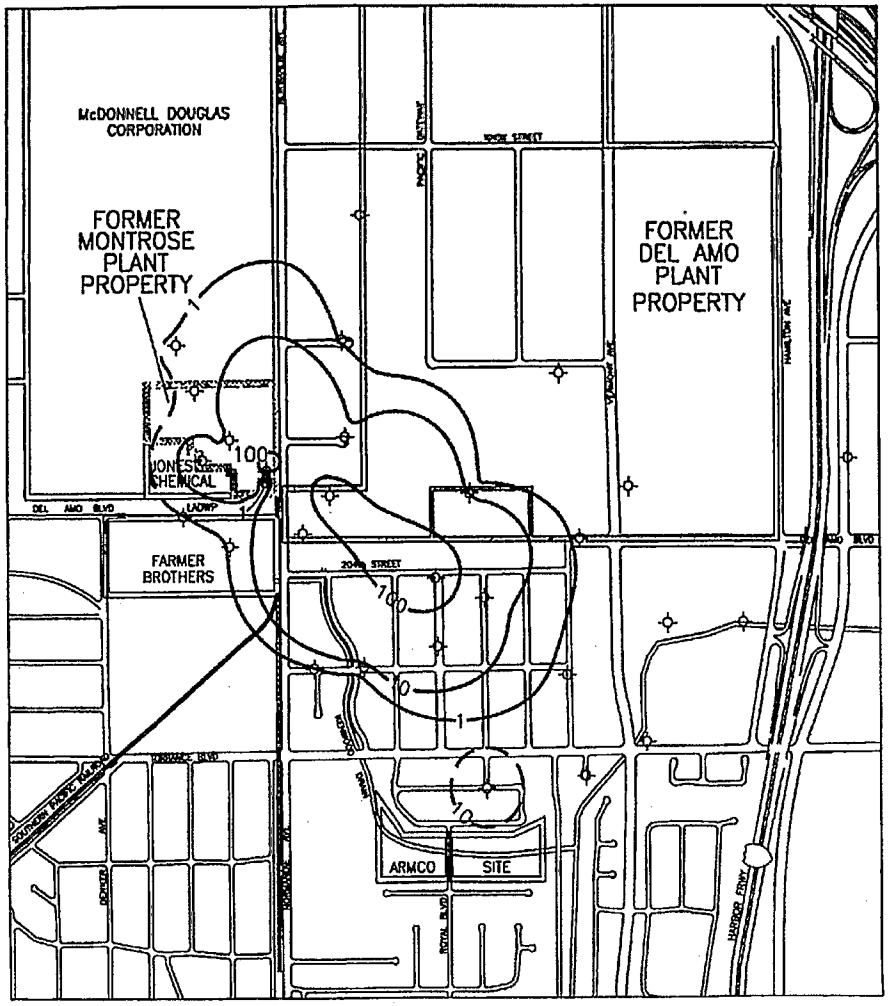
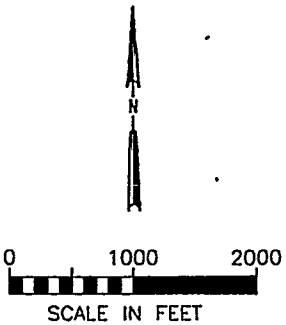


Figure 8-1g
Montrose/Del Amo
Total Noncancer Hazard Index
Middle Bellflower C Sand
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

CH2MHILL





LEGEND:

- Well Location
- 1000 HI Isopleth
- 10 Estimated HI Isopleth

Figure 8-1h

Montrose/Del Amo
Total Noncancer Hazard Index
Gage Aquifer
draft

Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

CH2MHILL

9. Remedial Action Objectives

The previous sections of this ROD have summarized the nature of the Joint Site, including the presence of NAPL, the distribution and types of contamination, the potential groundwater-related health risks posed by the Joint Site, and the basis for taking action at the Joint Site. This section briefly establishes the remedial action objectives given this information. Sections 10, 11, and 12 discuss and evaluate the basis for a TI waiver and the extent of the containment zone, discuss the factors necessary to understand the remedial alternatives, describe the alternatives, compare the alternatives, and justify the selected alternative. Section 13 presents the remedial action selected in provisional form.

The remedial action objectives for the action selected in this ROD are consistent with both CERCLA and the NCP. As set out in CERCLA, each selected remedial action must:

> "[A]ttain a degree of cleanup of hazardous substances, pollutants and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment..." [42 U.S.C. §9621(d)(1)]; and
>
> Comply with or attain the level of "any standard, requirement, criteria, or limitation under any Federal environmental law" or "any promulgated standard, requirement, criteria or limitation under a State environmental or facility siting law that is more stringent than any Federal standard, requirement, criteria or limitation" that is found to be applicable or relevant and appropriate [42 U.S.C. §9621(d)(2)(A)(i)&(ii)].

9.1 In-Situ Groundwater Standards

The particular in-situ concentration for a contaminant which this ROD requires be attained in groundwater at the conclusion of the remedial action shall be referred to by this ROD as the ***in-situ groundwater standard***, or ***ISGS.***

This ROD selects the following:

- The ISGS is the lower (i.e. more stringent) of the federal and State of California Maximum Contaminant Level, or MCL, the drinking water standards promulgated under the Safe Drinking Water Act;
- *Solely* for contaminants for which neither a federal nor a State MCL is promulgated, the ISGS is the EPA Region IX tap water Preliminary Risk Goal (PRG).

The ISGS levels that shall be applied in this remedial action are shown in Table 9-1. This table shows the chemicals detected at the Joint Site, the federal and State MCL where available, the PRG, and the resulting ISGS level[1]. To evaluate the prevalence of detection of most of the chemicals, other than the driving chemicals discussed in Section 7, the reader should consult the Montrose Remedial Investigation Report or the Del Amo Groundwater Remedial Investigation Report.

The selection of the ISGS for each contaminant is determined by applicable or relevant and appropriate requirements, and by the CERCLA requirement that remedies be protective of human health and the environment. This is discussed below.

All groundwater at the Joint Site has been designated by the State of California as having a potential potable beneficial use that would include drinking water [*Water Quality Control Plan, Los Angeles Basin*, California Regional Water Quality Control Board, Los Angeles Region, June 13, 1994; "the Basin Plan"]. When groundwater poses an actual or potential health risk and is a potential drinking water source or could affect a drinking water source, the NCP directs EPA to restore groundwater to federal and State drinking water standards, in a reasonable time frame. The NCP states, at 40 C.F.R. 300.430(a)(1)(iii)(F):

> EPA expects to return usable groundwaters to their beneficial uses whenever possible, within a time frame that is reasonable given the particular circumstances at the site. When restoration of groundwater to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction."

Drinking water standards are considered relevant and appropriate as cleanup standards in-situ in groundwater and are selected by this ROD as Applicable or Relevant and Appropriate Requirements (ARAR; see Appendix A of this ROD) for the remedial action selected by this ROD as per 42 U.S.C. §9621(d)(2)(A)(ii), 40 C.F.R. 300.430(e)(2)(i)(B) and 55 Fed. Reg. 8750-8754 (March 8, 1990). These ARARs are described in Appendix A. The NCP requires the in-situ attainment of the federal or State drinking water standard, whichever is lower. This standard is commonly known as the Maximum Contaminant Level, or MCL. The lower of these two standards for the three most-prevalent Joint Site groundwater contaminants is:

[1]Three sporadically-detected compounds did not have MCL or PRG values. In these cases, EPA has selected reasonable toxicological surrogate compounds (which have similar chemical properties and would be expected to have similar toxicological properties to the compound in question) and EPA has based the ISGS upon the PRG for the surrogate compound. These chemicals were not consistently detected, do not present in a discernable distribution, and provide an insignificant portion of mass and volume of groundwater contamination, as well as the risk posed by the Joint Site groundwater. These compounds are footnoted on Table 9-1.

- 70 parts per billion (ppb) for chlorobenzene;
- 1 ppb for benzene; and
- 5 ppb for TCE.

The value of the PRG is the concentration of the contaminant in groundwater that would pose the lower of a one-in-one-million cancer risk (10^{-6} risk) or a hazard index of unity, assuming standard risk assessment assumptions for residential water use. Solely for chemicals for which no federal or State MCL is promulgated, EPA is selecting the PRG as a remedial action standard to ensure protectiveness of human health and the environment. EPA does not consider PRGs as promulgated cleanup standards, and PRGs are not ARARs. However, it is reasonable to use the PRGs as standards to ensure protectiveness in cases where promulgated standards are not available, because such use is consistent with the NCP provision that 10^{-6} risk and hazard index of 1 should be the point of departure for determining remediation goals [40 C.F.R. 300.430(e)(2)(I)(A)(2)] and the fact that MCLs, when they are promulgated, are usually based on these same levels of risk.

There is an area of groundwater for which attainment of the ISGS is not technically practicable, and the requirement to attain ISGS levels for this groundwater is therefore waived. This is discussed in Section 10 of this ROD.

It is important to make a distinction between *in-situ* cleanup standards, as opposed to *discharge* standards. The former, *in-situ*, means "in place," and refers to the concentration of contaminants which must be attained in the water *in the ground* before the remedial action can be considered complete. The later refers to the concentration of contaminants which must be attained in *treated water* before the water can be discharged under the remedial action. These two are not always the same. ARARs which pertain to EPA's discharge of treated water as a result of this remedial action are identified in Appendix A and further discussed in Section 11 of this ROD.

9.2 Remedial Action Objectives

Remedial objectives apply in addition to the NCP and CERCLA requirement that remedial actions be protective of human health and the environment and attain ARARs in a reasonable time frame. The following remedial action objectives apply to this action.

1. Where technically practicable, reduce the concentrations of contaminants in Joint Site groundwater to ISGS levels;

2. In areas of groundwater where attainment of ISGS levels is not technically practicable, *contain* contaminants within their current lateral extent and depth;

3. Isolate NAPL by surrounding it with a zone of groundwater from which dissolved phase contaminants cannot escape;

4. Prevent lateral and vertical migration of dissolved phase contaminants at concentrations greater than ISGS levels to areas where currently they are not present or are below ISGS levels; and

5. Protect current and future users of groundwater from exposure to Joint Site groundwater contaminants at concentrations above ISGS levels.

In evaluating actions to meet these objectives, EPA has also sought to:

1. Reasonably limit the potential for adverse migration of dissolved phase contaminants and the potential for inducing accelerated movement of NAPL. This refers to the undesired movement of contamination in a manner that would violate or impede the objectives of the remedial action in the long term. This is discussed more fully in Section 11.1 of this ROD.

2. Account for and limit long-term uncertainties over the course of the remedial action. This is further discussed in Section 12 of this ROD.

Table 9-1
In Situ Groundwater Standards (ISGS)
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Compound	Federal MCL (µg/L)	State MCL (µg/L)	EPA 1998 Tap Water PRGs (µg/L) (Listed only when Federal or State MCLs do not exist)	ISGS [1] (µg/L)
Acetone	-	-	610	610
Acrolein	-	-	0.042	0.042
Acrylonitrile	-	-	3.7	3.7
Aldrin	-	-	0.004	0.004
Alpha-BHC	-	-	0.011	0.011
Benzene	5	1	-	1
Beta-BHC	-	-	0.037	0.037
Beta-Endosulfan	-	-	220	220
Bromoform	100	100	-	100
Bromomethane	-	-	8.7	8.7
Di-n-Butyl phthalate	-	-	3700	3700
sec-Butylbenzene	-	-	61	61
Carbon Disulfide	-	-	1,000	1,000
Carbon Tetrachloride	5	0.5	-	0.5
Chlorobenzene	100	70	-	70
Chloroethane	-	-	8600	8600
Chloroform	100	100	-	100
Chloromethane	-	-	1.5	1.5
2-Chlorophenol	-	-	38	38
Cyclohexane	-	-	-[2]	350 [2]
DDD(total)	-	-	0.28	0.28
DDE(total)	-	-	0.20	0.20
DDT(total)	-	-	0.20	0.20
1,2-Dichlorobenzene	600	600	-	600
1,3-Dichlorobenzene	-	-	17	17
1,4-Dicholorobenzene	75	5	-	5
Dichlorobromomethane	100	100	-	100
1,1-Dichloroethane	-	5	-	5
1,2-Dichloroethane	5	0.5	-	0.5
1,1-Dichloroethene	7	6	-	6
cis-1,2-Dichloroethene	70	6	-	6
trans-1,2-Dichloroethene	100	10	-	10
1,2-Dichloropropane	5	5	-	5
Diethylphthalate	-	-	29,000	29,000
Endrin	2	2	-	2
Ethylbenzene	700	700	-	700
Freon 11	-	150	-	150
Freon 12	-	-	390	390
Gamma-BHC	0.2	0.2	-	0.2
Heptachlor	0.4	0.01	-	0.01

Compound	Federal MCL (µg/L)	State MCL (µg/L)	EPA 1998 Tap Water PRGs (µg/L) (Listed only when Federal or State MCLs do not exist)	ISGS [1] (µg/L)
Heptachlor epoxide	0.2	0.01	-	0.01
2-Hexanone	-	-	1604	1604
Isopropylbenzene	-	-	61	61
Methyl Ethyl Ketone	-	-	1900	1900
4-Methyl-2-Pentanone	-	-	160	160
Methylene Chloride	5	5	-	5
2-Methylnaphthalene	-	-	-3	6.2 3
Naphthalene	-	-	6.2	6.2
Pentachlorophenol	1	1	-	1
Phenol	-	-	22,000	22,000
n-Propylbenzene	-	-	61	61
Styrene	100	100	-	100
1,1,2,2-Tetrachloroethane	-	1	-	1
Tetrachloroethene	5	5	-	5
Toluene	1,000	150	-	150
1,2,4-Trichlorobenzene	70	70	-	70
1,1,1-Trichloroethane	200	200	-	200
1,1,2-Trichloroethane	5	5	-	5
Trichloroethene	5	5	-	5
1,2,4-Trimethylbenzene	-	-	12	12
Vinyl Acetate	-	-	410	410
Vinyl Chloride	2	0.5	-	0.5
Xylenes (total)	10,000	1,750	-	1,750

Notes:

1- The In Situ Groundwater Standard for each chemical detected is the more stringent of the federal and state MCL where these exist. Solely for chemicals with no state or federal MCL promulgated, the ISGS is the EPA May 7, 1998 tap water PRG.

2- There is no MCL or PRG available for cyclohexane. The ISGS value is based on the PRG for n-Hexane, which is used as a surrogate compound for cyclohexane.

3- There is no MCL or PRG available for 2-Methylnaphthalene. The ISGS value is based on the PRG for Naphthalene, which is used as a surrogate compound for 2-Methylnapthalene.

4- There is no MCL or PRG available for 2-Hexanone. The ISGS value is based on the PRG for Methyl Isobutyl Ketone, which is used as a surrogate component for 2-Hexanone.

2-4: Toxicological surrogate compounds would be expected to have similar toxicological properties to the compounds in question. The three contaminants noted were not consistently detected, do not present in a discernable distribution, and provide an insignificant portion of mass and volume of groundwater contamination, as well as the risk posed by the Joint Site groundwater.

10. Technical Impracticability Waiver and Containment Zone

10.1 Introduction and Provisions

This ROD issues a waiver of the requirement to attain ISGS levels, and other ARARs identified in Appendix A of this ROD, based on the technical impracticability of cleaning groundwater to ISGS levels. This waiver is issued pursuant to 42 U.S.C. §9621(d)(4)(C) and 40 C.F.R.-300.430(f)(1)(ii)(C)(3). This waiver shall apply solely to a region of groundwater defined in this section, which is called the TI waiver zone and containment zone, depending on the context, as discussed below.

EPA has recognized that much of the groundwater at the Joint Site can be restored to ISGS levels. In order to do so, a zone of dissolved phase contamination in groundwater surrounding the NAPL must be contained, thereby isolating the NAPL. This zone is called the ***containment zone***[1]. If this is achieved, dissolved contamination from the NAPL cannot reach the water outside the containment zone, and so the outside groundwater can then be cleaned to ISGS levels. It is technically impracticable to attain ISGS levels *inside* the containment zone, because the NAPL continues to dissolve into groundwater there. By establishing a containment zone, the greatest possible extent of the groundwater can be restored to concentrations below ISGS levels, in keeping with the requirements of the NCP. As specified in Section 9, the objective for water inside the containment zone is containment; the objective for groundwater outside the containment zone is restoration to ISGS levels.

Because it is technically impracticable to attain ISGS levels *inside* the containment zone, this same physical space is also referred to as the ***TI waiver zone***. Groundwater outside the TI waiver zone is not subject to the waiver, and all ARARs identified in Appendix A remain in force there. Issuance of a TI waiver does not preclude that other standards or remedial actions apply to the contamination within the TI waiver zone in lieu of the particular requirements that are waived.

Figure 10-1 shows the TI waiver zone for the Joint Site in each hydrostratigraphic unit. In the chlorobenzene plume, the lateral extent of the proposed TI waiver zone is based on safely containing the DNAPL, and extends vertically through the Gage Aquifer. It does not include the Lynwood Aquifer or the Gage-Lynwood Aquitard. In the benzene and TCE plumes, the TI waiver zone extends vertically through the MBFC Sand. It does not include the Lower Bellflower

[1]The use of the term "containment zone" in this ROD does not reflect a formal establishment of a containment zone as that term is used in, and per the requirements of, California State Water Resources Control Board Resolution No. 92-49(III)(H).

Aquitard. The lateral extent of the TI waiver zone for the benzene and TCE plumes is based on differing factors, depending on the hydrostratigraphic unit. This is fully discussed below.

EPA has utilized, as appropriate, the *Guidance for Evaluating the Technical Impracticability of Groundwater Restoration*, (U.S. EPA OSWER Directive 9234.2-25, October 1993). The presence of NAPL alone generally is not sufficient to justify a TI waiver. EPA guidance directs that a TI waiver be justified based on site-specific conditions. The guidance directs that EPA's justification of a TI waiver include the following elements, among others:

- The specific ARARs or media cleanup standards for which TI determinations are being made;
- The spatial area over which the TI decision will apply;
- The conceptual model which describes site geology, hydrology, groundwater contamination sources, transport, and fate;
- An evaluation of the restoration potential of the area to be subject to the TI waiver, including data and analyses that support the assertion that attainment of ARARs or media cleanup standards is technically impracticable from an engineering perspective;
- Any additional information or analyses that EPA deems necessary for the TI evaluation.

Appendix E of the JGWFS provides such justification in detail for the Joint Site. The following section serves only to summarize and provide highlights. This section also summarizes EPA's basis for selecting the size and location of the TI waiver zone in each of the hydrostratigraphic units.

EPA has *not* made a determination that *no* NAPL can or shall be removed from either the Montrose or the Del Amo Superfund sites. This ROD, in issuing this TI waiver, determines solely that existing technologies will be incapable of practicably recovering enough NAPL (essentially all of it) to attain ISGS levels at *all* points in groundwater. Hence, a waiver of the requirement to attain the ISGS must be issued for a portion of the groundwater surrounding the NAPL. This determination leaves open the broader determination as to whether and to what degree NAPL recovery or immobilization will occur at the Montrose Chemical and Del Amo Superfund sites. As previously established by this ROD, a second phase of this groundwater operable unit shall address this matter. Future remedial actions to address NAPL recovery or immobilization will be addressed by amendment(s) to this ROD (See Declaration and Section 4 of this ROD). There are many technologies which would be capable of recovering some of the NAPL from the ground at

either site. It is noted that the TI waiver guidance cited above also directs EPA to demonstrate "that contamination sources [NAPL] have been identified and have been, or will be, removed and contained to the extent practicable." EPA's second phase of remedy selection addresses this guidance provision.

10.2 Summary of Why NAPL Areas Cannot Be Restored to Drinking Water Standards

NAPL is known as one of the most challenging and recalcitrant of all Superfund problems. As already discussed, while in most cases there are technologies that can remove some NAPL, it is often necessary to remove virtually all NAPL before concentrations in groundwater near the NAPL can approach concentrations commensurate with ISGS levels. Presently, there are no technologies, which have been proven to be capable of removing *all* NAPL from large sites where NAPL is widely distributed laterally and vertically, and where stratigraphy is highly heterogeneous and complex.

At the Montrose Chemical Site, the soils are highly heterogeneous. DNAPL has migrated downward to great depths, potentially exceeding 130 feet below land surface, which correspond to the bottom of the MBFC Sand and the Gage Aquifer. DNAPL beneath the Montrose Chemical Site occurs in discontinuous thin layers that likely reside atop the heterogeneously distributed fine-grained sediments. The majority of the DNAPL is below the water table. The DNAPL relative saturation distribution has not been determined, and it is impracticable to do this to a highly accurate degree. Montrose Chemical Company is continuing, under EPA oversight, to evaluate the properties and distribution of DNAPL, and evaluate options for removing some DNAPL. However, it will not be practicable to remove enough (virtually all) DNAPL so as to attain drinking water standards in the immediate vicinity of the DNAPL.

At the Del Amo Site, there is also substantial heterogeneity in the soils. Although NAPL at the former Del Amo plant property consists primarily of benzene, and therefore is lighter than water (LNAPL), beneath the site it is primarily smeared below the water table. This distribution of LNAPL beneath the former Del Amo plant property is the result of low water levels at the time of the LNAPL release and subsequent rise of the water table for about the past 30 years. The LNAPL that has been located and subjected to extensive testing appears to be present at low (below residual) saturations. Therefore, the studied NAPL appears to be present primarily in ganglia and droplets held in pore spaces by capillary forces. The former Del Amo plant site also presents an additional complication of having many multiple sources of LNAPL which are located relatively close to each other. A region of dissolved-phase contamination surrounds *each* of these sources, but because of their mutual proximity, these regions overlap in a largely contiguous distribution. Thus, removal of virtually all the LNAPL would have to occur in all of the multiple areas before drinking water standards could be achieved. There remain some locations where NAPL may be present at higher residual saturations. As with respect to the Montrose Chemical

Site, Shell and Dow are working under EPA oversight to further evaluate options for removing some of this LNAPL. However, it will not be practicable to remove enough of the LNAPL to attain drinking water standards.

The reduction in concentration of dissolved contaminants to ISGS levels is not practicable in the groundwater surrounding the multiple LNAPL sources located at the Del Amo Site because (1) removal of the NAPL sources is not technically practicable, (2) restoration could never be complete due to the continuing migration of benzene from the LNAPL sources; (3) extraction wells in the fine-grained UBF and MBFB would have extremely small radii of influence, which would necessitate impracticably large numbers of wells needed to capture and remove contaminated groundwater; and (4) the removal of the dissolved contamination in the MBFC, directly underneath the LNAPL is not practicable because it could cause adverse downward migration of contaminants from the overlying LNAPL sources, which will prevent the restoration this portion of the MBFC to ISGS (See Appendix E of the JGWFS).

Significantly more detail on this argument is provided in Appendix E of the JGWFS.

10.3 Non-NAPL Contaminants in the TI Waiver Zone

Where TI waivers are applied, the waiver is applied to *all* chemicals within the TI waiver zone, regardless of whether all of the chemicals served to base the original justification for the waiver. For example, if there is a TI waiver zone due to benzene as NAPL, all other contaminants in the same zone that are not present as NAPL would also be subject to the waiver.

Attempting to restore an incidental contaminant to ISGS levels that is present only in the dissolved phase within the TI waiver zone would impose the same remedial actions on the TI waiver zone that are otherwise waived due to the contaminant that is present in the NAPL phase. It would not be practicable, for instance, to apply hydraulic extraction and treatment to reduce dissolved naphthalene to ISGS levels, while the same water would also contain exceedingly high dissolved phase concentrations of benzene, which would not be reducible due to the presence of benzene NAPL. Such high concentrations of NAPL contaminant would dominate the capacity of the treatment technology, prohibiting reductions of dissolved naphthalene to ISGS levels. Second, such actions might induce adverse movements of high-concentration dissolved benzene or chlorobenzene contamination into areas where it is not currently present, and/or downward migration of DNAPL at the Montrose Chemical Site. Finally, it does not provide a significant environmental benefit, in this case, to attempt to remove the incidental dissolved phase contaminants, when the contaminants which serve as the primary risk drivers are also present as NAPL and will remain indefinitely within the TI waiver zone at exceedingly high concentrations.

10.4 Extent and Configuration of the TI Waiver Zone

In addition to establishing the need for a containment zone, this ROD also establishes the extent and configuration of the zone. The containment zone selected by this ROD differs in extent and configuration, depending on the plume and the hydrostratigraphic unit in question. EPA has based this selection on a set of consistent principles. EPA intended that the extent and configuration of the TI waiver zone should:

- Have a supportable technical basis;
- Be as small as reasonably possible while still meeting all objectives of the remedial action;
- Allow for limiting the potential for adverse migration of NAPL;
- Allow for limiting the potential for adverse migration of dissolved phase contamination;
- Allow for maximum efficiency in monitoring and assessing compliance with the requirement of containing contamination within the TI waiver zone;
- Avoid complicating the remedial action, its design, and implementation to the point that implementability is compromised or questionable; and
- Eliminate the potential for requiring remedial actions, which would provide no tangible environmental or protective benefit.

The first two principles arise from the fact that the TI waiver zone applies by definition to the groundwater for which it is truly impracticable to attain ISGS levels in a reasonable time frame. By corollary, in accordance with the NCP with EPA guidance on TI waivers, and with consideration to State of California Water Resources Control Board Resolution 92-49(H) [a.k.a. "Containment Zone Policy, which contains a provision that containment zones be kept as small as possible], it is EPA's intention to attain ISGS levels for the greatest practicable extent of groundwater. EPA did not extend the TI waiver zone beyond the reasonable technical basis for its existence.

EPA rejected assorted arguments informally suggested during the feasibility study process that the TI waiver zone should be extended to contain the entire contaminant distribution, more than a mile from the former plant properties and affecting six hydrostratigraphic units. This clearly would have been an inappropriate use of a TI waiver because, regardless of any relative difficulties or risks which might exist in attempting to restore groundwater in the downgradient portions of the plume, it *is* technically practicable to do so and to do so without compromising the objectives of the remedial action (e.g. inducing significant adverse downward movements of

NAPL). It is the NAPL which is the foundation of and gives rise to the TI waiver zone in this case; broad extension of the TI waiver zone outside the area of NAPL and potential influence on NAPL would not be appropriate.

At the same time, the second principle states that the TI waiver zone is to be as small as possible, *provided that all objectives of the remedial action can still be obtained.* This second phrase is also important to EPA's selection of the extent and configuration of the TI waiver zone. Most of the principles following the second principle arise from this consideration. In making this selection, EPA has placed "technically impracticable" within the context of all objectives of the remedial action, the attainment of which lead to the protection of human health and the environment. There are areas of groundwater within the Joint Site which, in the strictest sense, could potentially be restored to ISGS concentrations, at least temporarily. However, it would *not* be technically practicable to do so without compromising other basic objectives of the remedial action. Such areas are, therefore, included in the TI waiver zone. In keeping with the second principle, these areas have been kept as small as reasonably possible.

The evaluation of the lateral extent of the TI waiver zone and the means of containment of contaminants within this zone were made separately for each contaminant plume in each hydrostratigraphic unit. However, because the LNAPL and DNAPL TI waiver zones largely overlapped when evaluated separately EPA has established a single TI waiver zone for the Joint Site as the union of these two zones in each hydrostratigraphic unit. The technical factors accounted for by EPA in this evaluation include (1) physical processes affecting migration of contaminants, (2) the hydrostratigraphic conditions of the affected units, and (3) the amount and quality of data being used in any given hydrostratigraphic unit in the JGWFS groundwater model (See Section 11.1), and hence the degree of certainty/usability of the model on a case-specific basis. The basis for the TI waiver zone is discussed briefly below for the chlorobenzene, benzene, and TCE plumes.

Chlorobenzene Plume

The portion of the containment zone/TI waiver zone that lies within the chlorobenzene plume is larger than the extent of NAPL itself (i.e., includes portions of the dissolved plumes immediately adjacent to NAPL). The reason for this and the basis used to determine extent of this portion of the TI waiver zone is discussed below and in Appendix E of the JGWFS.

As determined in the JGWFS, and discussed in Section 11.1 of this ROD, active hydraulic extraction and treatment (pumping) is the sole effective means by which the dissolved contamination surrounding the DNAPL at the former Montrose plant property is contained (thereby isolating the DNAPL source). Therefore, EPA considered the implications of such pumping in determining the size of the part of the containment zone that lies in the chlorobenzene plume. The alternatives modeled for this remedial action were developed so as to ensure that

DNAPL would not be mobilized by the hydraulic extraction that creates the containment zone. The minimum necessary distance downgradient of the DNAPL at which to place containment wells so as safely limit drawdown in the DNAPL area was evaluated using a groundwater model (discussed in Section 11.1). Using this approach, the containment zone within the chlorobenzene plume is determined to be the minimum area that allows for hydraulic containment of DNAPL without adversely affecting DNAPL migration. This zone is larger than the area where DNAPL actually occurs. The containment zone must be subject to the TI waiver, because the DNAPL remaining inside the containment zone continuously contaminates any water that is within the zone.

Vertically, the TI waiver zone in the chlorobenzene plume extends to the Gage Aquifer. The best information available indicates this is the depth to which DNAPL may have migrated. It is noted that direct and certain identification of NAPL at the depth of the Gage Aquifer, and finding the greatest depth to which NAPL has migrated, are extremely difficult in this type of heterogeneous environment. However, dissolved and sorbed phase concentrations in both the MBFC Sand and the Gage Aquifer are high enough to be indicative of the likely presence of NAPL. It is important to note that the TI waiver zone does not extend to the Gage-Lynwood Aquitard and Lynwood Aquifer; the area of chlorobenzene contamination in the Lynwood Aquifer shall be restored to ISGS levels.

The majority of the chlorobenzene plume lies outside the TI waiver zone. (Section 2 and Appendix E of the JGWFS). The plume of dissolved contaminants extends more than 1.3 miles from the former Montrose plant in the MBFC Sand and as much as a mile in the Gage Aquifer, and vertically occurs as deep as in the Lynwood Aquifer. Based on the results of the JGWFS, it is feasible to restore the area of the chlorobenzene contamination to ISGS levels (e.g. drinking water standards) outside the TI waiver zone, and such a reduction would have an effect on concentration, mass, future contaminant migration, and risk reduction of the chlorobenzene plume.

Benzene Plume in the UBF and MBFB Sand

This discussion pertains only to the benzene plume in the first two units, the UBF and the MBFB Sand. The water table occurs in one of these units, depending on the location within the Joint Site. (See Section 7, "Summary of Site Characteristics," or the JGWFS, or the Remedial Investigation Reports). Again note the definition of plumes used by this ROD (See "Conventions for Dividing the Contamination into Plumes," in Section 7.2 of this ROD). As with the TI waiver zone in the chlorobenzene plume, the size of the TI waiver zone in the benzene and TCE plumes in these units is somewhat larger than the actual NAPL distribution. The basis for this is discussed in the course of the discussion below.

Basis for Not Establishing Multiple TI Waiver Zones in These Units

As previously discussed, the benzene plume in these units is characterized by a large number of multiple residual sources, each with associated dissolved phase contaminant distributions which have commingled into a single commingled distribution with steep or tight (i.e. large) concentration gradients; that is, the benzene concentrations fall off quickly with distance from the NAPL source. This observation is partially masked by the fact that there are very few places within the benzene plume where, as one moves downgradient from a given source, another source does not occur before end of the extent of contamination from the first source. Hence, at most points within the benzene plume, the benzene present is a result of a contribution from one or more NAPL sources. When observing the distribution as a whole, however, the concentration gradients are large (i.e. the concentrations taper off sharply with distance from the NAPL source) and the benzene plume appears to be stable. The primary reason for these observations is intrinsic biodegradation of benzene, although it also could be partially attributed to the small hydraulic gradient and groundwater flow velocity of these units.

EPA finds that it would not be practicable to restore water *between* the multiple NAPL sources at the former Del Amo plant, as they are so close together. In the course of attempting such restoration, contaminants likely would be pulled from surrounding sources. In addition, even if it were possible, such restoration of very small zones of clean water (on the order of a few hundred feet, at most, in size) in close proximity and in the midst of the multiple sources, essentially would provide no environmental benefit. Whether on the basis of contaminant mass, migration, or risk and concentration, the reduction of dissolved phase concentrations in these small areas would provide virtually no increase in the certainty of containing contaminants vertically or laterally, nor would the relative health risk be reduced in the event that the groundwater were used. It is noted that there would be no feasible use of groundwater from these localized "islands" of clean groundwater in the midst of the NAPL sources, because of their proximity to the NAPL sources. Finally, the long-term effectiveness and certainty of the groundwater remedy would be largely unaffected by such actions. For these reasons, EPA did not establish multiple small TI waiver zones within the benzene and TCE plumes in these units, but rather a single zone.

Basis for Establishing the TI Waiver Zone at the Boundary of the Existing Benzene Plume in These Units

In addition, based on the reasons discussed above and in Appendix E of the JGWFS, the ability of the available practicable remedial actions to decrease the extent of the dissolved benzene plume is at best highly limited. First, the size of the areas within the benzene plume that can be restored to MCL will be limited by the proximity of LNAPL sources and will not likely exceed several hundred feet. Second, the restoration of this limited area will never be complete due to the continuing dissolution of LNAPL into groundwater (See Appendix E of the JGWFS).

Accordingly, EPA has decided not to attempt to reduce the volume of, the benzene plume. *The TI waiver zone in the UBF and MBFB Sand is based on the area presently congruent with the existing benzene plume, as measured by the maximum contaminant level (MCL, the drinking water standard) for benzene (1 ppb).* The justification for this is discussed in detail in Appendix E of the JGWFS.

"Vertical Proximity" Basis for Extending the TI Waiver Zone into the MBFB Sand Under the Former Butadiene Plancor of the Del Amo Plant

Finally, there is an area of benzene contamination in the UBF (uppermost unit) in the former butadiene plancor of the Del Amo plant, near what is today called the "WRC building," and to the south of this building. Figure 7-2 shows this area as a scorpion-tail-shaped area on the easternmost portion of the UBF benzene distribution. In this location, there are two regions with direct observations of NAPL in the subsurface, and groundwater concentrations approach or equal the benzene solubility limit. EPA notes that wells were not installed in the MBFB Sand directly under this location. While wells with non-detect results located slightly downgradient provide a reasonable limit on the lateral extent of potential benzene contamination in both the MBFB Sand and the MBFC Sand, it has not conclusively been shown whether there is benzene in the MBFB Sand at this location. This ROD requires that this information be collected during the remedial design phase.

EPA has considered, if contamination does exist in the MBFB Sand directly under these NAPL sources, whether it would be practicable to restore the MBFB Sand at that location to ISGS levels. The MBFB Sand directly underlies the UBF with little to no separation to provide a significant barrier to the movement of contaminants. If the TI waiver does not extend to the MBFB Sand under this area of contamination in the UBF, it would be required that the benzene contamination in groundwater in the MBFC Sand be cleaned to ISGS levels. To achieve ISGS levels in this area, hydraulic extraction would be required directly under the benzene NAPL and the extremely high concentrations of dissolved benzene present in the UBF at this location. Such hydraulic extraction could increase vertical gradients between the UBF and MBFB Sand, which could cause the downward movement of dissolved benzene from the UBF to the directly underlying MBFB Sand. While gradient controls (such as limited counter-pumping in the UBF) could be applied, it would not be practicable to limit the contaminant movement from the UBF to the MBFB Sand to such a degree (virtually zero) that drinking water standards (1 ppb for benzene) could be achieved and maintained at this location in the MBFB Sand. The potential downward migration of high-concentration dissolved benzene caused by such pumping would more than offset benefits which might be derived from restoring water directly under the NAPL to ISGS levels. It is noted that there is no feasible use of groundwater directly under the NAPL in the UBF because of its proximity to the NAPL.

Therefore, while there may in fact be no contamination at all in the MBFB Sand at this location, it would not be practicable to restore this water to ISGS levels if contamination does exist. Based on this, EPA has extended the containment zone/TI waiver zone into the MBFB Sand directly under the LNAPL sources in the UBF. The extent of this portion of the TI waiver zone is based on the footprint of the contamination in the overlying UBF at this location. The TI waiver is extended to the MBFB Sand at this location due to its *vertical proximity* to the NAPL sources in the UBF. The argument for doing so is similar to the argument for extending the TI waiver zone laterally beyond the NAPL itself in any given unit due to *lateral proximity* to the NAPL.

EPA explicitly notes that the selected TI waiver zone for the benzene plume in the MBFB Sand is *not* based on the footprint of the benzene contamination in the overlying UBF at *all* locations in the MBFB Sand. This is only true in the area of the former butadiene plancor of the Del Amo plant. At other locations, the TI waiver zone in the benzene plume for the UBF and MBFB Sand are based on the present extent of benzene contamination in those units, respectively. This results in the TI waiver zone in the MBFB Sand being slightly smaller than in the UBF.

TCE Plume in the UBF and MBFB Sand

The TCE plume within the UBF and MBFB Sand is commingled with the benzene plume (see Figures 7-3 and 7-4). However, it does not extend as far downgradient as the benzene plume surrounding the waste pit area at the southern boundary of the former Del Amo plant property. The approach to the TCE plume is discussed further in Section 11 of this ROD.

Because the TCE plume in these units is *inside* the benzene plume, the TI waiver zone for the TCE plume in these units is the same as for the benzene plume, described above.

Benzene & TCE Plume in the MBFC Sand

The extent of the TI wavier zone in the MBFC Sand must be discussed in terms of both the benzene and TCE plumes at the same time. This is because the extent of the TI waiver zone in the MBFC Sand is not based on either the extent of the benzene plume or the TCE plume in that unit, but rather on the extent of the benzene plume in the MBFB Sand, the unit above. As discussed in Section 2 and Appendix E of the JGWFS, the presence of NAPL in the MBFC Sand, in either the benzene or TCE plumes, cannot be confirmed at this time with sufficient certainty upon which to base a TI waiver for the MBFC Sand.

Unlike the upper two units, the TCE and benzene plumes are not commingled in the MBFC Sand. The benzene plume in the MBFC Sand is limited to the area surrounding the Del Amo waste pits. There is no TCE at this location. The TCE plume is present to the north of the Del Amo Waste Pits, where the benzene plume is absent. Additional sampling will be conducted to determine the exact extent of the TCE plume, but its dimensions are bracketed by the existing sampling

locations. It is known that the extent of the TCE plume does not reach the Del Amo Waste Pits area, and its major source appears to be at or near several solvent-handling facilities just northwest of the MW-20 LNAPL area located at the northern end of the benzene distribution in the UBF/MBFB Sand.

"Vertical Proximity" Basis for Extending the TI Waiver Zone to the MBFC Sand

The benzene and TCE plumes in the MBFC Sand lie under and in vertical *proximity* to the LNAPL sources and the high-concentration dissolved benzene contamination in the UBF and MBFB Sand. Even though the presence of NAPL in the MBFC Sand in the benzene and TCE plumes has not been conclusively determined, EPA has extended the TI waiver zone to include the MBFC Sand in these plumes because of its location underneath the LNAPL sources. The rationale for this is as follows:

The MBFB and MBFC Sand are separated by a thin layer of mud, which exists only in the western portion of the Del Amo Site, and pinches out in the central portion (See Section 2 of the JGWFS). Without a TI waiver for the MBFC Sand, it would be required that the groundwater in the MBFC Sand be cleaned to ISGS for both TCE and benzene. To do so, hydraulic extraction would be required directly under the benzene NAPL and the extremely high concentrations of dissolved benzene present in the MBFB Sand. Such hydraulic extraction could induce vertical gradients, which in turn could cause the downward movement of dissolved benzene and TCE from the MBFB Sand to the MBFC Sand. The discontinuous layer of mud between these units will not likely serve as a sufficient barrier for such migration. While gradient controls (such as limited counter-pumping in the MBFB Sand) could be used to offset the increase in vertical gradients and limit the adverse downward movement of contaminants, it would not be practicable to limit the contaminant movement from the MBFB Sand to the MBFC Sand to such a degree (virtually zero) that drinking water standards (1 ppb for benzene) could be achieved and maintained in the MBFC Sand.

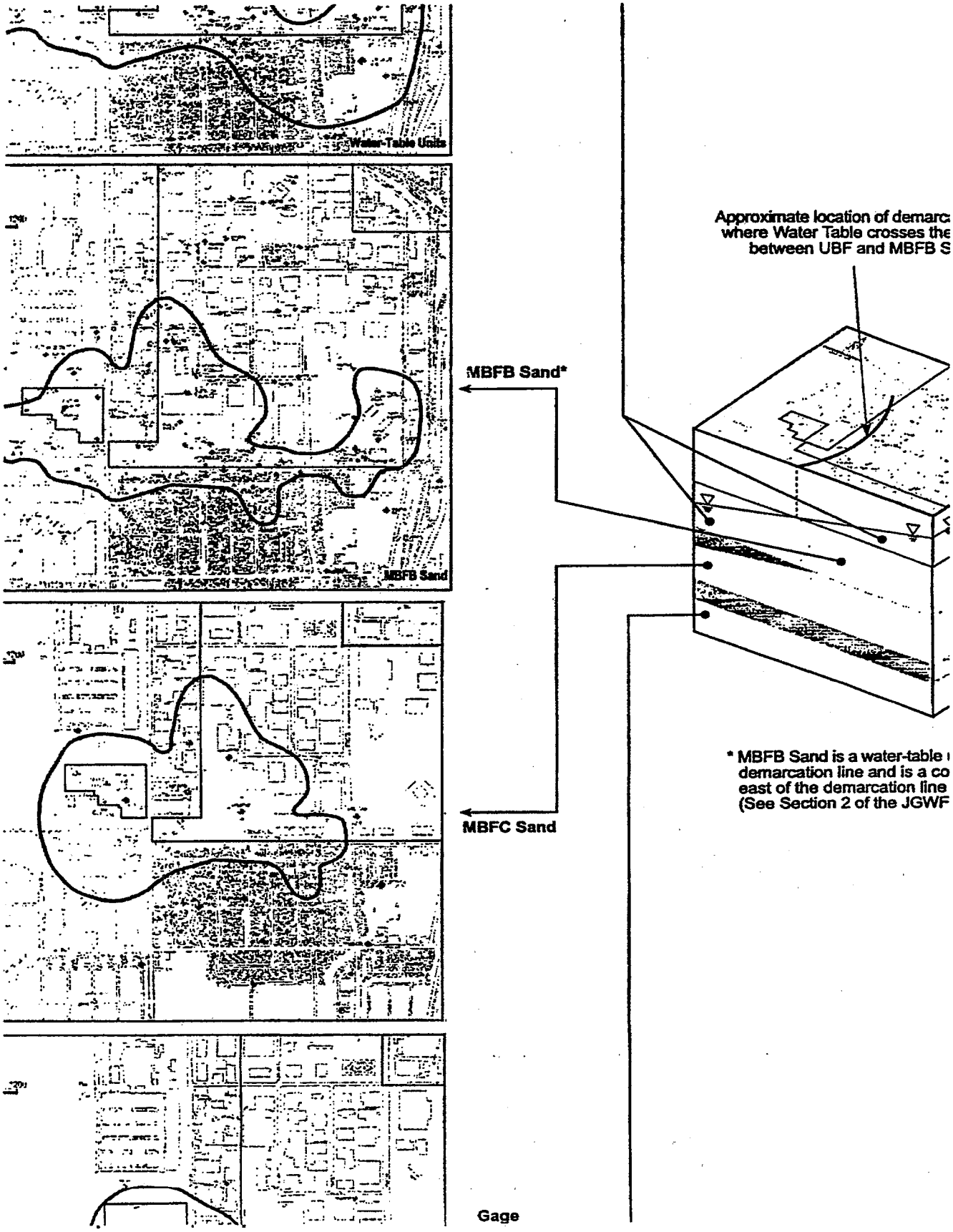
Basis for Establishing the Boundary of the TI Waiver Zone in the MBFC Sand as the Footprint of the Contamination in the Overlying MBFB Sand Benzene Plume

Based on the above discussion, the basis for extending the TI waiver zone to the MBFC Sand depends on vertical proximity of the contamination in the MBFC Sand to the LNAPL sources and high-concentration dissolved contamination in the MBFB Sand. Therefore, it is appropriate to define the boundary of the TI waiver zone in the MBFC Sand not in terms of the extent of the TCE and benzene plumes in the MBFC Sand but in terms of the footprint of the overlying MBFB Sand benzene LNAPL and high-concentration dissolved contamination (e.g. the projection of the lateral boundary of the benzene plume in the MBFB Sand onto the MBFC Sand). When the extent of the TI waiver zone in the MBFC Sand is defined in this way, it encompasses both the benzene and TCE plumes in the MBFC Sand. It is noted that the fine-grained LBF, which falls between the

MBFC Sand and the Gage Aquifer, would *not* be subject to a TI waiver outside the chlorobenzene plume.

10.5 Contaminants Moving Outside of TI Waiver Zone Become Subject to All ARARs

The TI waiver applies to the region of groundwater defined by Figure 10-1. The TI waiver does not apply outside the region. Contamination which may originate inside the TI waiver zone but over time come to be located outside the TI waiver zone are subject to all other applicable requirements of this ROD, including but not limited to the requirement that all ARARs be attained.


Water-Table Units
MBFB Sand
MBFB Sand*
MBFC Sand
Approximate location of demarc
where Water Table crosses the
between UBF and MBFB S
* MBFB Sand is a water-table
demarcation line and is a co
east of the demarcation line
(See Section 2 of the JGWF
Gage

11. Description and Characteristics of Alternatives

As part of the remedial action selection process leading to this ROD, EPA developed and evaluated five remedial alternatives. Each remedial alternative considered in the JGWFS, other than the No Action Alternative, contains: (1) a set of remedial actions for the chlorobenzene plume, (2) a set of remedial actions for the benzene plume, and (3) a set of remedial actions for the TCE plume. The JGWFS considered and evaluated potential interrelationships among the remedial actions for each plume in the process of assembling the alternatives. Alternatives and actions which would not be protective or would not attain applicable or relevant and appropriate requirements (ARARs) in a reasonable time frame were eliminated from further consideration prior to the detailed analysis of alternatives.

The JGWFS demonstrated that it is feasible to reduce and eliminate the volume of groundwater in the chlorobenzene plume outside the containment zone, while containing the contamination within the containment zone. The alternatives span three differing degrees of relative aggressiveness with respect to reducing the volume of the chlorobenzene plume outside the containment zone, in association with various combinations of means for containing the containment zone (recall that the chlorobenzene plume is the only plume with contamination *outside* the containment zone). This section describes the characteristics of these alternatives and Section 12 evaluates and compares them according to the nine NCP criteria.

Before the alternatives are described, several foundational aspects for the alternatives are documented. These evaluations provide a factual context for the alternatives that EPA considered in selecting this remedial action. Because this adds significant length to this section, the following outlines the section to assist the reader. Note that the actual description of elements within the alternatives does not begin until Section 11.3.

In Section 11.1, foundations and context for alternatives are discussed, including: (1) EPA's consideration of the potential for adverse contaminant migration, (2) critical aspects and limitations of the groundwater model that was used, (3) the potential and basis for reliance on intrinsic biodegradation as a remedial mechanism in alternatives, (4) situational aspects related to the TCE plume and why only one remedial option was appropriate for the TCE plume, (5) situational aspects related to the compound pCBSA, and (6) EPA's approach to alternatives. It is noted that alternatives and scenarios which EPA screened out in the JGWFS generally are *not* discussed in the ROD and the reader should consult the JGWFS for this information. Section 11.2 discusses factors related to measuring and addressing time frames for the remedial action, and the concepts of early time performance and pore volume flushing. Section 11.3 identifies the elements of the five alternatives which are common to all alternatives, other than the No-Action

alternative. Section 11.4 identifies the differentiating elements among the alternatives. Section 11.5 discusses treatment technologies and treated water discharge.

11.1 Foundation and Context for Alternatives

Consideration of Potential for Action Interrelationships and Adverse Migration

As discussed in Section 4, the various areas of groundwater contamination within the Joint Site are interrelated, and hence EPA has addressed it as a single operable unit. Factors evaluated in the development of remedial alternatives and the assessment of their feasibility during this remedial selection process included but were not limited to the potential for (1) remedial action interrelationships and (2) adverse migration of contaminants. The former refers to the movements of contaminants that might occur in other plumes in response to remedial actions that are designed and primarily targeted toward one plume. The latter refers to the undesired movement of contamination, including NAPL, in a manner that would violate the objectives of the remedial action. Before alternatives were ever constructed, the focus in defining, screening, and evaluating alternative prototypes in the JGWFS was to meet all remedial objectives for each plume while at the same time limiting or minimizing the potential for adverse migration of contaminants.

Migration of this type *could* include:

1. Movement of contaminants laterally or vertically in a manner which would make them more difficult to contain, or unacceptably increase the uncertainty associated with containing them within the containment zone;

2. Movement of contaminants in such a manner as would retard the attainment of remedial action standards set in this ROD (including but not limited to the attainment of drinking water standards for water outside the containment zone), or unacceptably increase the uncertainties associated with such attainment; or

3. Movement of contaminants that results in a spreading of the contamination to a larger area or to areas more likely to pose a risk from groundwater use.

Site-specific examples of potential remedial action interrelationships and adverse migration that EPA considered and accounted for in the remedial selection process include:

1. The potential for inducing NAPL to migrate downward or laterally in response to hydraulic extraction intended to contain the NAPL or reduce the plume outside the containment zone. Such movement, potentially caused by reducing interstitial pore

pressures or increasing vertical and lateral hydraulic gradients in the areas where NAPL occurs might: (1) threaten the ability of the remedial actions selected by this ROD to contain contaminants within the containment zone, (2) cause greater and more wide-spread migration of dissolved phase contamination associated with the NAPL, (3) lengthen and complicate the time necessary to achieve remedial objectives, and (4) potentially complicate the removal of NAPL by remedial actions being considered in the second phase of the groundwater remedy.

2. The potential for movement of the benzene plume downward or laterally in response to hydraulic extraction primarily focused on containing or reducing the chlorobenzene plume. This movement could result in the spreading of the benzene plume to areas of groundwater where it does not presently occur, including areas outside the containment zone and in the lower hydrostratigraphic units. In addition, more dissolved benzene could migrate into the chlorobenzene plume, in which biodegradation of benzene appears to be slower and less effective in reducing benzene mass.

3. The potential for movement of TCE downward or laterally in response to hydraulic extraction primarily targeting the chlorobenzene plume.

4. Potential for movement of contaminants from outside the Joint Site into the Joint Site in response to remedial actions being evaluated.

In the course of the remedy selection process, EPA has found that it is feasible to limit, control and even eliminate adverse migration of contaminants by a proper remedial design of the remedy. The JGWFS and the remedial selection process thoroughly evaluated the potential for adverse migration, considered the costs and benefits from the standpoint of the entire remedial action, and formulated remedial alternatives capable of controlling and limiting the impacts of such factors *while still meeting all other goals and objectives of the remedial action*, including but not limited to attaining ARARs in a reasonable time frame, and maintaining protectiveness of human health and the environment over the long term.

This does not mean that all the alternatives ultimately considered present the same risks with respect to adverse migration. In fact, some of the differences in such risks among the alternatives form a major basis for EPA's selection of one alternative over another. However, the alternatives have been constructed from the beginning of the JGWFS effort to take the potential for adverse migration into account, and the alternatives ultimately evaluated in detail by the JGWFS therefore encompass a reasonable range with respect to such potential. The appropriate alternative for selection therefore lies within that range.

EPA has not specified in this ROD that no adverse migration of contaminants shall occur at all, nor has it specified that the potential for such migration shall be completely eliminated. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of NAPL or dissolved phase contaminants and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. This ROD contains provisions for such a possibility, requiring that the remedial design be adjusted to reverse and contain the adverse migration. It is crucial to note that limiting adverse migration of contaminants shall not take preeminence over all other performance criteria and remedial action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone.

Therefore, for example, the remedial action shall be designed to reduce the chlorobenzene plume with the rate and efficiency required by this ROD. If, once the remedial action is implemented, adverse migration occurs at some location within the Joint Site, this ROD would require that additional wells or systems be implemented as required to minimize and contain that migration, as opposed to slowing the rate of cleanup by pumping less on the chlorobenzene plume. The former would represent adjusting to the migration within the context of continuing to meet ROD objectives. The latter would represent addressing migration at the expense of meeting ROD objectives.

Because potential remedial action interrelationships and adverse migration were considered intrinsically to the process of developing alternatives:

1. The remedial actions for each plume within each alternative are different than they would otherwise be if each plume had been considered independently and irrespective of the others. For instance, it is likely, though not certain, that EPA would have considered more aggressive cleanup rates for reducing the size of the chlorobenzene plume outside the containment zone, if the benzene plume did not exist. EPA did not do so because it had to keep the potential for adverse migration of the benzene plume, given potential influence from pumping on the chlorobenzene plume, within a reasonable range.

2. For each remedial alternative, the potential changes in drawdowns and gradients in the area of the DNAPL imposed by hydraulic extraction were evaluated, using the numerical model of the Joint Site groundwater discussed below. The locations and flow rates of wells in all considered alternatives were then adjusted to minimize the changes in gradients in the NAPL area. The results of modeling demonstrate the feasibility of limiting the inducement of NAPL migration under all remedial alternatives considered.

3. The JGWFS demonstrates that the goal of attaining ISGS levels in the aquifer outside the containment zone can be achieved without undue risks of adverse migration, if designed properly.

While it was appropriate for the JGWFS to evaluate the interrelationships among separate actions for each of three plumes, the remedial action as selected, designed, and implemented should not be considered a simple union of three disparate actions, but rather a unified whole addressing all requirements of the ROD. The various actions within the selected remedial action will be optimized together in the remedial design phase. To facilitate analysis, there is reference in the JGWFS and this ROD to separate wellfields [1] ("chlorobenzene wellfield," "benzene wellfield," etc.) but, in the final sense, the selected remedy will contain one optimized wellfield. Extraction and injection wells in the final design will generally serve a primary purpose with respect to one of the three plumes, yet may also have one or more purposes with respect to the other plumes, depending on the location of the wells. The description of alternatives in this section and the following section refer to actions for each plume separately to facilitate the documentation of the remedy selection process and to remain consistent with the feasibility study. But it should be remembered that remedial selection and design is not separable among the plumes.

The Joint Groundwater Model

A primary tool in the effort to evaluate (1) the performance of various remedial actions, (2) the potential for remedial action interrelationships, and (3) the potential for adverse migration of contaminants, was a computer-based groundwater flow and contaminant transport model. It is noted that the model was not the *only* tool used by EPA in these evaluations, and not all scenarios and types of movements were evaluated with the model (e.g., remedial actions focused on the TCE plume were not evaluated with the model). Also, the model (as with all models) has limitations which made it inappropriate for certain types of evaluations, as discussed in the JGWFS and briefly below. The model was used to the extent appropriate given its objectives, limitations, the data available, and the extent to which the model was necessary. An understanding of the modeling objectives and limitations is essential for the evaluation of alternatives and selection the remedial action in this ROD.

[1]Note: A "wellfield" refers to a particular configuration and number of hydraulic extraction and/or aquifer injection wells in physical space. Hydraulic extraction wells pull water toward themselves and create a cone of depression in the water table or in the head (pressure) distribution of the aquifer in which they operate. Injection wells push water away from themselves and create a "mounding" in the water table or an area of increased pressure in the head distribution of the aquifer in which they operate. In design, wellfields are generally varied until simulations of their operation produce the intended hydraulic effect on the aquifer system as a whole.

MODFLOW, a three-dimensional finite difference model, was used to simulate groundwater flow at the Joint Site. MODFLOW was linked to the transport model MT3D for the simulations of contaminant transport. The model domain was a rectangular area centered on, and extending beyond, the Joint Site, incorporating known and potential sources of contamination which lie in the vicinity of the Joint Site. The model grid consisted of 5,229 rectangular cells of 200- by 200-foot size in the primary area of interest, and 200- by 400-foot cells in the peripheral areas. Vertically, the model was divided into 13 layers of variable thickness to represent eight affected hydrostratigraphic units discussed in the JGWFS and in the previous sections of the ROD. Hydrogeologic properties were assigned to the model based on the results of remedial investigations performed at the Montrose and Del Amo Sites. In the peripheral portions of the model domain, hydraulic conductivities were interpolated based on a sequential gaussian protocol. The initial conditions for the contaminant plumes were assigned to the model based on contaminant distribution data collected during remedial investigations (See Section 2 of the JGWFS and the RI Reports; See Section 5 of this ROD). Fixed source term concentrations were used for areas of detected and suspected NAPL.

The model used for this analysis was a well-designed and highly useful tool for providing a basis for a comparative evaluation of remedial alternatives and an assessment of the approximate size and configuration of remedial systems required on a fairly large-scale. These are the purposes to which EPA has put the model in its analysis of alternatives for the Joint Site.

At the same time, the results of the groundwater model should only be seen in the context of, and as properly restricted by, the model's limitations. All models have uncertainties and limitations. EPA's intention in discussing them in this ROD is not to cast doubt on the quality or validity of the model or the modeling design effort used in this case. Rather, the intention is to establish that the model cannot be used for all purposes. Also, modeling results cannot be blindly trusted but must be accompanied by an assessment of the degree of certainty that can be attributed to them, given the nature of the input data and of the model itself. Some results provide greater certainty than others.

The modeling limitations applying to the model used for the JGWFS, and the reasons for them, are addressed in detail in Section 5 and Appendix B of the JGWFS. While the limitations do not diminish the valid uses of the model, they are critical to this remedy. Of particular note are the following:

- The model cannot be used to reliably simulate *absolute* cleanup time frames. Therefore, the evaluation of alternatives with respect to the cleanup time frame was focused on the relative rate of approaching complete cleanup (attaining remedial action objectives at all points in groundwater).

One of the reasons that the model cannot accurately estimate the total times to reach remedial objectives at all points in the Joint Site groundwater is that the model cannot account for sorption tailing effects, which mean that contaminant desorption from soils can occur at a slower rate than the rate at which sorption occurs (See Section 5 and Appendix B of the JGWFS). As a result, the simulated time frames from the modeling effort are likely to be shorter than the actual time required to complete the cleanup. While there are also other factors of which the model cannot account, such as potential unmeasurable intrinsic biodegradation, that may serve to lessen the actual cleanup times compared to simulated cleanup times, it is likely that the sorption tailing effects will dominate (See EPA's response to Montrose Chemical Corporation in the Response Summary to this ROD).

- The longer the time frame simulated, the greater the uncertainty associated with the modeling result. While the time to reach remedial objectives at all points in the Joint Site groundwater will likely be on the order of 100 years, simulations greater than the order of 50 years into the future are generally not reliable or useful. EPA has used simulations of 10-25 years for comparing remedial alternatives, even though the remedial action is not complete in that time frame under any of the alternatives. This provides a measure of each alternative's *relative* performance and progress at 25 years toward meeting the remedial objectives.

- The model cannot account for or simulate local small-scale heterogeneities and preferential flow paths, which could provide an explanation for some of the observed contaminant distributions. This is primarily for two reasons:

  1) The model has a limited resolution (cell size 200 by 200 feet), hence, the model cannot accurately estimate movements of water and contaminants along the potential preferential flow paths that are smaller than the size of one cell.

  2) Local heterogeneities and preferential flow paths may be only a few feet or tens of feet in size, yet still be able to affect contaminant fate, transport, and distribution. The data from the remedial investigations are not sufficient to define heterogeneities of such a size, nor would it be practicable to obtain such data in most cases.

- The modeling results for vertical transport from the MBFC Sand through the LBF to the Gage Aquifer, and for vertical transport from the Gage Aquifer through the Gage-Lynwood Aquitard to the Lynwood Aquifer, are associated with such high uncertainty as to be largely unreliable (See Section 5 and Appendix B of the JGWFS). EPA did not use the model for these purposes.

- The model cannot be used to simulate movement of the chlorobenzene plume in the MBFB Sand (water table units) near the former Montrose plant because of the high level of uncertainty associated with the hydrogeologic parameters of the MBFB Sand in this area (See Sections 2 and 5 of the JGWFS).

Key Findings of the Joint Groundwater FS

The model was not used as the exclusive determiner but rather as one tool in reaching these findings. The model was not used in reaching all of these findings. Among the key findings of the JGWFS are the following:

- Hydraulic containment (isolation) of the NAPL at the Joint Site feasibly can be achieved. The size of the containment zone must be somewhat larger than the actual physical dimensions of the DNAPL source to avoid the adverse impacts of hydraulic extraction on the migration of NAPL. The associated pump rates have been approximated with assistance from the model.

- Adverse downward migration of chlorobenzene DNAPL can be avoided by strategic placing of hydraulic extraction wells (pumping wells) in such a manner that hydraulic impact from these wells in the DNAPL zone is minimal (if any)

- Injection of treated water is considered a *necessary* component of the alternatives for the chlorobenzene plume, because it minimizes potential adverse migration of NAPL and the benzene and TCE plumes, minimizes the hydraulic impact on sources of contamination at the periphery of the Joint Site, and assists in preventing dewatering of the aquifers during extraction and treatment.

- Reducing the volume of the chlorobenzene outside the containment zone (i.e. restoration of the chlorobenzene plume) is feasible. Three different wellfields were examined which fall on a scale of increasing relative aggressiveness: a 350 gallon-per-minute (gpm) wellfield, a 700-gpm wellfield, and a 1400-gpm wellfield. The long and short-term performance of these wellfields has been evaluated and is described in the JGWFS, and is discussed and summarized in this ROD in Sections 11 and 12.

- It is feasible to minimize or eliminate adverse movements of the benzene plume and TCE plume were hydraulic extraction in the chlorobenzene plume to occur at any of the three degrees of relative aggressiveness (in terms of pumping rates) considered. Optimization of the wellfields would be necessary in remedial design, however.

- Hydraulic influences on contaminant sources outside the Montrose and Del Amo Sites and plumes, such as the Mobil Refinery to the west and the McDonnell Douglas facility to the north of the former Montrose plant, can be mitigated if treated water is injected in the aquifer (aquifer injection) as part of the remedial action.

- If no action is taken for the chlorobenzene plume, it will likely continue to migrate, as determined by the evaluation of the fate and transport of chlorobenzene including numerical modeling (See Montrose RI Report and Section 5 of the JGWFS).

- If no action is taken for the TCE plume, it will likely continue to migrate, as determined by the evaluation of fate and transport of TCE including numerical modeling (See Del Amo Groundwater RI Report and Section 5 of the JGWFS). The modeling results for the TCE plume are less certain than for the chlorobenzene plume.

- Little reduction in the volume of the benzene plume can be attained by pumping it, because of the presence of multiple LNAPL sources that cannot be isolated from the rest of the benzene plume. (See Appendix E of the JGWFS and Section 10 of this ROD). In addition, hydraulic containment of the benzene plume in the UBF and MBFB Sand provides little-to-no benefit compared to reliance on intrinsic biodegradation only (See Section 5 of the JGWFS). The benzene plume in the MBFC Sand feasibly can be contained by pumping, however, and there are reasonable benefits to be considered from such pumping. This is further discussed in Section 12 of this ROD and in Section 5 of the JGWFS.

Potential for Reliance on Monitored Intrinsic Biodegradation

Section 7.3 of this ROD briefly addressed the presence of intrinsic biodegradation of contaminants as a matter of site characteristics. As discussed there, intrinsic biodegradation is a form of natural attenuation which occurs when innate microorganisms metabolize site contaminants (See Section 7.3 and the JGWFS).

This section evaluates intrinsic biodegradation at the Joint Site from the standpoint of the potential to *rely* on it as a mechanism to meet remedial objectives. Intrinsic biodegradation can slow, halt, or reverse the outward migration of a dissolved phase contaminant in groundwater. Hence, EPA evaluated the potential for utilizing it as a means of containing all or portions of the containment zone. However, intrinsic biodegradation only occurs under certain conditions, and with certain contaminants. To rely on intrinsic biodegradation in a remedial context, it must not only be present but there must be enough confidence that it will reliably achieve the remedial objective for which it would be used. It is possible to have confidence in the presence of intrinsic biodegradation, but low certainty with respect to its ability to meet remedial objectives.

For the Joint Site, intrinsic biodegradation was considered potentially reliable for *containment* of the benzene plume, and is incorporated in the remedial alternatives as a containment mechanism to varying degrees for the benzene plume. However, intrinsic biodegradation was not considered potentially reliable for containment of the chlorobenzene and TCE plumes, and was not incorporated into alternatives for these plumes. Intrinsic biodegradation also was not considered potentially reliable for reducing the volume of contamination outside the containment zone, and was not incorporated into alternatives for this purpose. The basis for this is described further below.

Potential for Reliance on Intrinsic Biodegradation in the Benzene Plume

Recalling Sections 9 and 10, the remedial objectives for the benzene plume include only containment; there is no portion of the benzene plume, which lies *outside* the containment zone/TI waiver zone.

At the Joint Site, there is significant evidence of *reliable* intrinsic biodegradation of the benzene plume in the UBF and the MBFB Sand. The factors present with respect to the benzene plume that support the ability to rely on intrinsic biodegradation as a remedial mechanism for this portion of the benzene plume include several of those listed in Section 7.3:

- The concentration gradients at the leading edge of the benzene plume are steep;
- The lateral extent of the dissolved plume outside of the NAPL sources is small;
- The benzene plume is much smaller than what would be expected based on groundwater velocity and expected retardation in the absence of intrinsic biodegradation; benzene has not migrated far from the NAPL sources despite likely being in the ground 20-40 years;
- The plume appears to be stable and does not appear to be migrating laterally;
- In-situ measurements of geochemical parameters (e.g. dissolved oxygen, nitrate, sulfate, methane, etc.) indicate biological activity that is related to (varies spatially with) the benzene concentration in groundwater;
- Biodegrader organism counts in groundwater indicate greater biological activity inside the benzene plume than outside the benzene plume;
- Computer modeling runs could not be reasonably calibrated without assuming significant benzene biodegradation;

- An extensive body of research and literature is available to support that: a) the chemical pathways by which benzene degrades are well understood, b) benzene is known to biodegrade in a wide range of conditions in the laboratory, and c) benzene is known to biodegrade in a wide range of environmental conditions in the field, including those found at the Joint Site.

It is noted that any *one* of these factors, taken by itself, does not conclusively prove that intrinsic biodegradation of benzene is occurring in the benzene plume groundwater nor that it occurs reliably. However, when all lines of evidence are taken together, the case for reliable intrinsic biodegradation of benzene *in the benzene plume* is strong. These multiple factors not only indicate that biodegradation is occurring, but that it is occurring to an extent that the benzene plume in these units is being naturally contained by the intrinsic biodegradation process. Moreover, the extent of this naturally-contained plume essentially coincides with the TI waiver zone defined in Appendix E of the JGWFS and Section 10 of this ROD. It is therefore reasonable to conclude that intrinsic biodegradation can serve as a mechanism to meet the objectives for benzene plume containment for the UBF and MBFB Sand.

Reliance solely on monitored intrinsic biodegradation as a remedial mechanism for the benzene plume in the UBF and MBFB Sand is additionally appropriate for the following reasons:

- The UBF and the MBFB Sand have low permeability, which is 10 to 100 times less than the permeability of the MBFC Sand and the Gage and Lynwood Aquifers. Therefore, groundwater flow velocities, and consequently, rates of contaminant migration, are low in these units even in the absence of intrinsic biodegradation.

- These units are shallow and separated by several thick hydrostratigraphic units, including aquitards, from the units most likely to be used for drinking (although the State classifies all water under the site as having potential beneficial potable use). The result is that the risk associated with a failure of intrinsic biodegradation to contain the benzene plume in these two units would be low, provided containment is properly monitored.

Similar lines of evidence exist to support the presence of intrinsic biodegradation in the benzene plume in the MBFC Sand. Based on sampling conducted to date, it appears that the limited extent of the benzene plume in the MBFC Sand could be attributed to intrinsic biodegradation, which acts to contain the benzene in the UBF and MBFB Sand under the existing condition of the natural system. However, there is more uncertainty as to whether intrinsic biodegradation would be reliable to contain the benzene plume in the MBFC Sand, given the high permeability of the MBFC Sand, which could potentially result in higher contaminant migration velocities when hydraulic extraction is undertaken with the primary focus of reducing the chlorobenzene plume.

In addition, the MBFC Sand is separated from the Gage Aquifer only by one layer, the LBF, which creates a higher risk with respect to contaminating deeper aquifers, including those more likely to be used for drinking, should intrinsic biodegradation fail to contain the contamination, making reliance on it more dubious. This is thoroughly discussed in Section 5 of the JGWFS and Section 12 of this ROD. EPA included one alternative in which intrinsic biodegradation is relied upon for containing the MBFC Sand, and several other alternatives where it is not relied upon. The evaluation and comparison of alternatives in Section 12 discusses the benefits and drawbacks of each.

Potential for Reliance on Intrinsic Biodegradation for the Chlorobenzene Plume

Recalling Sections 9 and 10, the remedial objectives for the chlorobenzene plume include containment within the containment/TI waiver zone, and reduction of large volume of the plume outside the containment/TI waiver zone. EPA has determined that intrinsic biodegradation of chlorobenzene is not a *reliable* mechanism to attain either objective. The basis for this determination, and its relation to the determination made for the benzene plume, is advanced in the following discussion.

The lines of evidence just discussed for the benzene plume do *not* apply to the benzene that is commingled with the chlorobenzene plume (this benzene is, by definition, *in* the chlorobenzene plume). This benzene has migrated up to three-quarters of a mile in the MBFC Sand from the former Montrose Chemical and Del Amo plants with no known intervening sources. EPA has considered two possible explanations for the observation that the benzene commingled with chlorobenzene appears to have moved a significant distance from the benzene sources, in contrast to the benzene that is not commingled with chlorobenzene. The first, and most probable, explanation is that the presence of chlorinated organic contaminants, such as chlorobenzene, retards the rate of biodegradation of benzene, allowing it to migrate further in groundwater before it degrades. The second possible explanation is that chlorobenzene itself is degrading to benzene within the chlorobenzene plume. EPA believes it is not likely that this is occurring sufficiently to create the observed concentrations of benzene in the chlorobenzene plume; moreover, chlorobenzene degradation, if it occurs, is not sufficiently understood in the field to confirm reliably that benzene would be a byproduct. Further discussion ensues.

In contrast to the benzene plume, sufficient lines of support for the presence of reliable intrinsic biodegradation of *chlorobenzene* at the Joint Site are not present. While intrinsic biodegradation of chlorobenzene may be occurring to some degree,

- The state of the chlorobenzene plume, especially the fact that the plume has been able to expand to its large lateral and vertical size, is not supportive of the presence of significant and dependable intrinsic biodegradation of chlorobenzene and indicates that such

degradation is not likely to be substantial enough to rely upon as a remedial mechanism in remedy selection;

- The mechanisms by which chlorobenzene can be degraded in groundwater at the Joint Site, while outlined in theory, are only partially understood, are supported by a relative sparsity of laboratory studies, and are even less-well understood under field conditions, particularly in the conditions likely to exist at the Joint Site;

- Of the relatively few laboratory studies pertaining to biodegradation of chlorobenzene, those in which biodegradation occurred were performed under aerobic (oxygen present) conditions; other studies showed that biodegradation of chlorobenzene may be inhibited under anaerobic (oxygen absent) conditions; yet the conditions in the aquifers in which chlorobenzene contamination is extensive (in particular, the MBFC Sand and the Gage Aquifer) are likely to be anaerobic, not aerobic (for more information, see JGWFS).

The following two factors, in conjunction with the above observations, further imply that intrinsic biodegradation of chlorobenzene cannot be conclusively relied upon in a remedial context:

- The chlorobenzene is located in deeper aquifers with higher transmissivities. There is therefore greater potential for it to move more rapidly laterally and vertically, and it is closer to the aquifers most-likely to be readily used for drinking (it is noted that the State of California classifies all groundwater at the Joint Site as potential drinking water; the distinction made here is therefore one of the degree of likelihood of groundwater use, rather than of the classification of the aquifer). Moreover, because it becomes more difficult and expensive to characterize deeper aquifers fully, the deeper the contamination the more uncertainty associated with its long-term movement. These factors imply a greater risk associated with reliance on intrinsic biodegradation for the chlorobenzene plume, because the implications in the event that intrinsic biodegradation should fail are much more serious than for the shallower hydrostratigraphic units.

- It is unlikely that the biodegradation rate for chlorobenzene could be measured in the field with enough certainty that would allow for it to be used as a reliable remedial mechanism. The reasons for this were presented in detail in the JGWFS and in a letter from EPA to Montrose Chemical dated September 10, 1997. These reasons are also discussed in the Response Summary in this ROD, Response to Montrose Chemical Corporation, EPA Response ✍ 29.

Appendix B of this ROD provides explanations pertinent to the approach to characterization of intrinsic biodegradation for the benzene and chlorobenzene plumes.

Potential for Reliance on Intrinsic Biodegradation in the TCE Plume

The TCE plume, as defined in Section 7.2 of this ROD, is presently within the containment zone as defined in Section 10 of this ROD. There is no evidence to conclude that the TCE plume is subject to intrinsic biodegradation sufficient to keep it contained or to reduce its volume. As discussed in Section 7.3 of this ROD, (1) the range of rates of intrinsic biodegradation of TCE (and PCE) measured at other sites is much less (as much as 100 times slower) than the corresponding range for benzene, (2) limited modeling performed on TCE in the JGWFS, which assumed that TCE degrades at rates similar to those found at other sites, indicated significant migration of TCE would occur over time, particularly if hydraulic extraction is undertaken for the chlorobenzene plume, and (3) data from the remedial investigation indicate that TCE and PCE are migrating under existing conditions (that is, the TCE plume is not presently spatially stable with time). As with the chlorobenzene plume, intrinsic biodegradation may be occurring to some degree in the TCE plume. The significant rate of biodegradation of benzene in the benzene plume may be enhancing the rate of biodegradation of TCE in a process called co-degradation. This may, in fact, result in significant reductions in the field resident half-life of TCE at the Joint Site (and hence, the rate of its movement over time) compared to typical half-lives for TCE in the absence of benzene degradation. However, such processes cannot be *relied* upon with significant or sufficient certainty to the extent that they could be used as remedial mechanisms to contain or cleanup the TCE plume.

Basis for Using One Option for the TCE Plume in All Alternatives

All remedial alternatives that EPA considered in the remedial action selection process, other than Alternative 1, No Action, contained the same action for the TCE plume[2]. The rationale for including the same remedial action for TCE within the alternatives is presented below. The TCE action itself is discussed in Section 11.2. In general, there is both a need for a remedial action to contain the TCE plume, as well as significant limitations on the manner in which such an action can reasonably be implemented, due to the TCE plume's commingling and/or proximity to the benzene plume and benzene NAPL..

[2]The reader is reminded that in this ROD, unless otherwise noted, the term TCE refers to the family of chlorinated solvents including trichloroethylene (TCE), perchloroethylene (PCE), trichloroethane (TCA), and dichloroethylene (DCE). The term "TCE plume" refers only to the TCE that is *not* commingled with chlorobenzene presently. The TCE plume lies, primarily, under the former Del Amo plant. See Section 7, "Summary of Site Characteristics," for discussion on the distribution of TCE.

Why a TCE Action Can Be Selected Despite Data Limitations

As mentioned earlier, the amount of data available regarding the TCE plume is comparatively less than that for the benzene and chlorobenzene plumes. The extent of the TCE plume at the Joint Site is bracketed spatially in the downgradient direction, and there is evidence as to the presence of sources of TCE contamination along the western border of the former Del Amo plant. The former Del Amo plant as well could have been a source of TCE. Because of the lesser amount of characterization data, TCE remedial scenarios were not directly modeled, and the TCE plume was addressed on a conceptual, performance-based level. In order to complete remedial design, additional confirmatory data on the TCE plume, including its exact extent in each of the hydrostratigraphic units as well as information about sources of TCE, is necessary.

EPA did not collect this data during the RI phase in part because the need for it was not apparent until late in the RI process, but *primarily* because the necessary approach to the TCE plume, from a remedy selection standpoint, is evident and supportable from the existing data, in large part due to the TCE plume's proximity to the benzene plume. The specific situation in which the TCE plume occurs means that less information is needed about it to *select* a remedy for it. This would not be the case if the benzene plume and benzene NAPL were not also present. This is described in more detail below. EPA acknowledges, however, that additional data about the TCE plume will be necessary to complete the remedial design phase, and this ROD requires that such data be collected (See Section 13, "Specification of the Remedial Action"). EPA also has the authority to amend the ROD if necessary to address conditions revealed during this sampling.

Why a Remedial Action for the TCE Plume is Necessary

As discussed in the section above regarding reliance on biodegradation, the data and information available suggest that the TCE plume is likely to move adversely in response to changes in hydraulic conditions, such as would occur from pumping in the chlorobenzene plume. In fact, data suggest that the TCE plume is migrating under current conditions, even before such pumping takes place. Laboratory and field studies indicate that under most conditions TCE biodegrades at significantly lower rates in the field than does benzene, which is proven to be highly and robustly biodegradable. The TCE plume appears to have moved farther from the apparent sources compared to benzene, despite the fact that the TCE sources may be younger than the Del Amo benzene sources. This is owing to the fact that the presence of the TCE in part may be due to sources which have come into operation since the close of the former Del Amo plant.

Based on this higher potential to move in response to adding outside hydraulic influences to aquifers nearby the TCE, containment of the TCE will be necessary to prevent adverse movement of the TCE. Moreover, intrinsic biodegradation cannot be relied upon to obtain this containment (see previous section). Intrinsic biodegradation of TCE, to the extent it occurs, will enhance the

action selected by EPA for TCE and by assisting in keeping the TCE contained. However, active hydraulic containment, using hydraulic extraction with aquifer injection of treated water, will be necessary to keep the TCE contained.

Why Appropriate Versions of Active Hydraulic Containment for the TCE Plume are Limited

While it is necessary that hydraulic extraction be applied to the TCE plume, the manner in which it feasibly can be implemented is limited by its proximity to the high-concentration dissolved phase benzene and benzene NAPL. On this point, the following discussion addresses the MBFB Sand and MBFC Sand in turn.

In the MBFB Sand, the TCE plume is commingled with the dissolved phase benzene plume at high concentrations and the benzene NAPL in the benzene plume. Accordingly, using hydraulic extraction to remove the TCE from within the benzene plume would not a reasonable option, as it would require pumping the benzene plume in the fine grained upper units. This is a prospect which does not further the objective and requirement of containment, and, consequently, was screened from further consideration.

In the MBFC Sand, the TCE plume lies directly *under* the high-concentration dissolved phase benzene plume and NAPL in the MBFB Sand. Thus, either containing or reducing the concentrations of TCE in the MBFC Sand would require hydraulic extraction under the MBFB Sand contamination at the former Del Amo plant. Because of the thin stratigraphic separation between the MBFB Sand and the MBFC Sand, this would move some contamination downward from the MBFB Sand to the MBFC Sand. Such hydraulic extraction would impose significant risks and implementation problems because of the benzene NAPL lying directly above the MBFC Sand being pumped.

Based on existing data, EPA does not believe that hydraulic extraction directly under the benzene plume in the MBFB Sand is appropriate. If data collected in the remedial design phase indicates pumping of the MBFC Sand is necessary under the benzene plume and benzene plume NAPL in the MBFB Sand, EPA could modify the proposed remedy to include such a component to the remedial action. Instead, EPA's selected action for the TCE plume ensures that it remain contained within the containment zone, but does not require that pumping take place directly under the high concentrations of benzene in the MBFB Sand. This is consistent with other remedial action components in this ROD where the containment zone is affected by hydraulic pumping. In such cases, the extraction well or wells used to achieve the containment purposely have been located downgradient of the NAPL, rather than directly in the midst of or under the NAPL, so as to avoid inducing the movement of the NAPL (and associated high dissolved concentrations of contaminant) downward.

In summation, if remedial objectives were to be attained, EPA did not have multiple options as to whether the TCE plume would be contained, nor as to whether or how hydraulic extraction would be used. EPA has selected the option for the TCE plume presented in Section 11.3. This option was included as a component in all alternatives considered, other than the No-Action alternative. This alternative is largely performance-based, and insures that: (1) the immediate TCE sources are partially contained by localized pumping in the MBFB and MBFC Sand, and that (2) the TCE plume remains contained within the containment/TI waiver zone. The TCE action is described in Section 11.3.

11.2 Characterizing Time Frames and Efficiencies

As discussed, the two most fundamental elements of this remedial action are: (1) containing the containment zone, and (2) eliminating the dissolved phase groundwater contamination outside the containment zone with concentrations above ISGS levels. The containment zone must be contained indefinitely, and this containment is accomplished by a combination of hydraulic extraction and treatment (with assistance from aquifer injection of treated water), and reliance on intrinsic biodegradation. Eliminating the dissolved phase contamination outside the containment zone is accomplished in every alternative by hydraulic extraction and treatment of groundwater. The concepts in this subsection place the performance characteristics of the alternatives into context.

Long Time Frames and How Time To Achieve Objectives Is Characterized

The duration of the remedial action selected by this ROD is long in two three respects:

- The presence and manner of occurrence of NAPL at the Joint Site requires that the containment zone remain contained *indefinitely*.
- The attainment of ISGS levels at all points in the chlorobenzene plume outside the containment zone (the part of the plume subject to plume reduction) will take a long time due to:
    - The large size of the plume and the number of hydrostratigraphic units affected;
    - The complexity (heterogeneity) of the subsurface, including relatively low-permeable zones, where achievable extraction rates of wells, and consequently the flushing rates, will be low.

These introduce complexities in terms of characterizing and evaluating the time to reach objectives.

It is important to note that cleanup of the contamination *inside* the containment zone is *not* a remedial objective of this action. It is true that over an extremely long time, all of the NAPL will eventually dissolve into the groundwater in the containment zone. However, this will not occur in a reasonable time frame. The process of NAPL dissolution is too complex and its completion too far removed in time to obtain any reasonable estimate of the time interval, other than to say that it may be on the order of centuries. This ROD does *not* consider NAPL dissolution to be a remedial mechanism, and the action for the containment zone is characterized as "indefinite containment," not "cleanup by dissolution." As such, the alternatives are not characterized in terms of the time for NAPL dissolution to be complete.

In contrast, eliminating the contamination above ISGS levels *outside* the containment zone *is* a remedial objective for this action, and hence the time required to accomplish this objective, and the relative rate and efficiency with which this occurs, are pertinent and appropriate characteristics within which to frame alternatives. Because the benzene and TCE plumes lie entirely within the containment zone to begin with, this objective applies solely to the chlorobenzene plume outside the containment zone.

As discussed in Section 11.1, the time frame to reach ISGS levels at all points in the groundwater outside the containment zone was evaluated in terms of the progress in approaching this objective, rather than by obtaining a total time frame directly from the model. This is because modeling simulations of cleanup time frames can only be used on a relative, not absolute, basis, and because the total time to clean up is longer than the time the model can reliably simulate.

Instead of characterizing and comparing alternatives based on the simulated total time to reach objectives, EPA compared their simulated relative performance within a 25-year time frame. The uncertainties associated with 25-year simulations are lower and the model's results are more reliable. The total time to reach the objective of eliminating the chlorobenzene plume outside the containment zone is inferred on a relative basis from each alternative's performance at 25 years. This provides a reasonable basis for comparison among alternatives in terms of total cleanup time, even though a certain value for the total cleanup time is not available.

As will be discussed in Section 11.3, the four alternatives other than No Action differ in terms of the relative aggressiveness with which the chlorobenzene plume outside the containment zone is reduced. However, the time needed for the volume of the chlorobenzene plume outside the TI waiver zone to shrink to zero is long (in excess of 50 years) even in the fastest alternative considered. This consideration, and the consideration that the containment zone must remain effective indefinitely, form a primary context for the characteristics, comparison and selection of alternatives which takes place in this Section and Section 12 of this ROD.

Early Time Performance

When using hydraulic extraction, aquifer injection and treatment to reduce the size of a plume, plume reduction often does not occur at a constant rate. It is the last fraction of plume reduction of the chlorobenzene plume, closest to the containment zone, which may be the most difficult and take the longest to remove. Some of the alternatives considered are able to remove a large majority of the plume very quickly, leaving only a small percentage of the plume to be addressed over the relatively long remainder of the remedial action. Other alternatives remove very little of the plume until very late in the total cleanup time. As just discussed, the time frame required to reach remedial objectives at all points in the chlorobenzene plume outside the containment zone is extended so it becomes appropriate to consider to what *degree* the remedial objectives are achieved in the interim period during the remedial action but prior to actually attaining remedial objectives. In this ROD, EPA refers to this concept as ***early time performance.***

Pore Volume Flushing

For the groundwater contamination which lies outside the containment zone, this remedial action relies on hydraulic extraction and aquifer injection, as discussed above. These actions induce hydraulic (pressure) gradients in the ground which force water to move. ***Flushing*** is the process by which dissolved contaminants are mobilized and removed by the water movement induced by hydraulic extraction and/or aquifer injection. In this process, contaminants adsorbed to soils in the saturated zone are induced to desorb (this occurs at a limited rate) into the dissolved phase. In short, flushing is the means by which hydraulic extraction and aquifer injection accomplish the "cleaning" of the aquifer. ***Pore volume flushing*** is a measure of the number of times the volume of water in the interstitial pores in the soil will be exchanged per unit time through a hydraulic extraction/aquifer injection system.

Two factors of importance with respect to pore volume flushing are its magnitude and its distribution. Pore volume flushing is typically optimized during remedial design of the wellfield. However, this remedy selection process examined the issue of general overall pumping rate ("aggressiveness") in reducing the chlorobenzene plume, in light of potential adverse migration and plume interactions. Therefore, an evaluation is appropriate on a general level as to whether each alternative will (1) produce significant pore volume flushing and (2) whether given an approximate overall pump rate, pore volume flushing can be reasonably distributed to cover the entire portion of the chlorobenzene plume outside the containment zone. EPA has therefore characterized the alternatives in terms of pore volume flushing prior to making the formal comparison of alternatives.

Pore volume flushing rate magnitudes and distributions, simulated for each of the remedial alternatives, can be found in Appendix B of the JGWFS.

11.3 Elements Common to All Alternatives

Containment Zone and Restoration Outside the Containment Zone

As discussed in Sections 4 and 10 of this ROD, all alternatives considered by EPA in this remedial selection process (other than the No Action Alternative, Alternative 1) follow the approach of hydraulically containing a zone of groundwater around the NAPL, thereby isolating it from the remainder of the groundwater, which can then be cleaned. In keeping with this approach, all alternatives considered for this remedy other than No Action include a Technical Impracticability (TI) waiver for certain ARARs, to be applied to a zone of groundwater (shown in Figure 10-1), in which contaminants in groundwater are indefinitely contained. This was thoroughly discussed earlier in Section 10 of this ROD. The TI waiver zone and containment zone refer to the same physical space.

Contingent Actions

All of the alternatives except for No Action utilize hydraulic extraction and treatment as the means by which a substantial portion of the containment zone is contained. All alternatives except for No Action also rely upon monitored intrinsic biodegradation as the means by which the balance of the containment zone is contained. The basis for this reliance is discussed in a later subsection of this section. The degree to which monitored intrinsic biodegradation is relied upon varies in some of the alternatives, as discussed below. In general, under all alternatives other than No Action, all of the containment zone within the chlorobenzene plume is contained by hydraulic extraction, and some or all of the benzene plume is contained by reliance on monitored intrinsic biodegradation, depending on the alternative.

Because it is a passive and pre-existing natural condition, the efficacy of intrinsic biodegradation must be consistently monitored when it is applied. Moreover, it is not only appropriate but necessary that contingent and active measures be available should monitoring indicate that the remedial objective of containment is not being met by the passive process. Where it is applied by this ROD, monitored intrinsic biodegradation is relied upon solely to the extent that it successfully contains dissolved phase contamination within the containment zone. Should it fail to do so, hydraulic extraction and treatment shall be implemented as a contingent action, replacing monitored intrinsic biodegradation as the means of containment in such areas.

It is not possible at the time of issuing the ROD to specify exactly all aspects of the contingent action that would be taken if reliance on intrinsic biodegradation fails to contain the benzene plume where it is applied. This would be impractical because the number of possible types of failure is very large. The nature of any given containment transgression, including its vertical and lateral location, extent, and contributing causes, cannot be foreseen in advance but would largely

determine the detailed aspects of the contingent remedial action appropriate to correcting the transgression (e.g. where to apply extraction, injection, how to modify local pump rates, etc.) These aspects are largely a matter of design adjustments during the operation and maintenance phase of the remedial action. This ROD therefore specifies, on a performance basis, that contingent actions will be determined and undertaken in order to restore the condition of containment and that such actions will utilize active hydraulic extraction and treatment. Aquifer injection has the capability to alter aquifer hydraulics and assist in effecting or restoring containment. Where it is appropriate, and can be utilized in accordance with ARARs, aquifer injection can be used to supplement hydraulic extraction and treatment for such purposes.

Provisions for contingent actions are more fully detailed in Section 13.

Monitoring

All of the alternatives, except the No Action Alternative, include long-term and continual monitoring to confirm containment, remedial action performance, and other factors mentioned more specifically below and in Section 13. All of the alternatives also require periodic well surveys, both of private and public wells, to ensure that groundwater is not being used in a manner that would present an unacceptable health risk within the area of groundwater contamination that remains as the remedial action progresses.

Additional Data Acquisition

All of the alternatives, except the No Action alternative, would require that additional data be collected at the Joint Site, including but limited to:

- Data sufficient to further identify TCE sources within the Joint Site and to characterize the exact extent of its distribution;
- Data to further characterize the benzene plume in the MBFB Sand under the butadiene plancor of the former Del Amo plant; and
- Data to further characterize the downgradient extent of the pCBSA plume.

Institutional Controls

All alternatives other than No Action would include certain institutional controls.

Existing legal and regulatory requirements exist that may limit the use of groundwater in the contaminated area at the Joint Site. However, EPA is not in control of these requirements, in that EPA cannot ensure that (1) these authorities will remain "on the books" for the duration of this remedial action, and that (2) these requirements will be enforced in accordance with the requirements of this ROD. Among these requirements are the adjudication of the Los Angeles Groundwater Basin, as described in Section 7, as well as limitations and requirements on well installations imposed by the State Water Resources Control Board. As discussed in Section 7, these controls cannot be relied upon by EPA to be effective in the long term other than as an enhancement to the proposed remedy. This is particularly important given the long time frame over which this remedy must remain in place. Because the groundwater contamination covers literally thousands of separately-owned real property parcels, imposing direct institutional controls on real property throughout the entire distribution of groundwater contamination at the Joint Site would be impracticable.

Superfund regulations clearly state that, while institutional controls should be considered as a means for supplementing a remedy, they should not be relied upon as the sole remedy. The NCP, at §300.430(a)(1)(iii)(D), states,

> EPA expects to use institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants...The use of institutional controls shall not substitute for active response measures (e.g. treatment and/or containment of source material, restoration of groundwaters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of trade-offs among alternatives that is conducted during the selection of the remedy.

Similarly, EPA notes that the NCP preamble, at 55 Fed. Reg. No. 46, p.8706, notes that:

> "...institutional controls may be used as a supplement to engineering controls over time but should not substitute for active response measures as the sole remedy unless active response measures are not practicable..."

This remedial action contains certain institutional controls to supplement the primary actions selected in this ROD, which include both containment and restoration of groundwater resources through treatment as preferred by the NCP. All alternatives other than No Action include the following institutional controls:

1. EPA would coordinate with the appropriate agencies regarding the existing legal and regulatory prohibitions and restrictions on groundwater use for the affected groundwater at the Joint Site.

2. At its sole discretion, EPA may issue administrative non-interference orders within its authority to ensure that actions taken by outside parties do not interfere with the Joint Site remedial action. Non-interference orders are administrative orders issued by EPA pursuant to CERCLA which direct a party to cease or desist from taking an action that would interfere with EPA's remedy, and/or to take actions specified in the order to prevent or mitigate such an interference. As an example, if a facility outside the periphery of the Joint Site has groundwater contamination is moving or will move into the Joint Site during the remedial action, EPA may issue an order directing that party to take actions that will prevent such interference. Likewise, if such a party were implementing its own groundwater cleanup using hydraulic extraction, and such extraction threatened to create hydraulic changes that would threaten the effectiveness of the remedial action selected by this ROD, EPA could issue such an order directing that the party cease and desist or modify its remedial actions in such a way that such interference is avoided.

3. EPA would perform well surveys to monitor groundwater use within the area of groundwater affected by contamination at the Joint Site. If well users within the area are found, EPA would inform such persons directly of the substantial health risk and also inform the State and local agencies which have jurisdiction and/or authority with respect to groundwater wells and groundwater usage within the Joint Site. Also, EPA may issue non-interference orders, at its discretion, to prevent or limit operation of wells which may be found to exist within the contaminated groundwater at the Joint Site in the future.

With respect to potential interferences from outside sources of contamination, in addition to issuance of non-interference orders as discussed above, EPA may consider amending this ROD to select specific remedial actions for such sources as part of the Joint Site, if EPA should determine that such actions become necessary during the remedial design or implementation of the remedial action.

Common Elements for the *Chlorobenzene* Plume

All of the alternatives (except No Action, Alternative 1) contain the following aspects with respect to the *chlorobenzene plume*:

- The volume of the chlorobenzene plume *outside the containment zone/TI waiver zone* that contains contaminants at concentrations above ISGS levels is reduced to zero.[3]

- This reduction of volume of the chlorobenzene plume *outside the containment zone/TI waiver zone* is accomplished by hydraulic extraction, treatment, and aquifer injection.

- The volume of the chlorobenzene plume *inside the containment zone/TI waiver zone*, surrounding the NAPL, is contained indefinitely. The extent of the TI waiver zone was identified in Section 10.

- The containment zone/TI waiver zone is contained by means of hydraulic extraction, treatment, and aquifer injection. NAPL itself is not removed as part of this remedy (unless incidental). Rather, water into which the NAPL has dissolved is removed and treated within a zone of groundwater which surrounds the NAPL.

- The majority of the hydraulic extraction will take place, in roughly balanced amounts, in the MBFC Sand and the Gage Aquifer. Some extraction will also take place in the Lynwood Aquifer.

- Aquifer injection of treated water. As discussed earlier, this is necessary for hydraulic control and to ensure that the movement of NAPL is not unreasonably induced by the pumping, and so it is included in all alternatives.

- Monitoring sufficient to confirm and evaluate the plume reduction outside the containment zone, the containment of the containment zone, movements of contaminants within the plumes, groundwater levels, gradients, hydraulics, effects of pumping, and other factors.

- Contingent hydraulic extraction in the event that contamination leaves the containment zone (to which the TI waiver is applied).

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[3]Alternatives 2-5 differ in terms of the relative aggressiveness, or rate, that the cleanup of the chlorobenzene plume outside the containment zone would occur. These differences are discussed in Section 11.3, which discusses the differentiating aspects of the alternatives.

- A TI waiver applied to the MBFB Sand, MBFC Sand, Lower Bellflower, and Gage Aquifer. The Lynwood Aquifer is not included in the TI waiver and therefore Lynwood groundwater within the Joint Site will be restored to concentrations at or below ISGSs (See Section 10). The containment/TI waiver zone extends deeper within the chlorobenzene plume than within the benzene plume.

Common Elements for the *Benzene* Plume

The benzene plume lies entirely within the containment/TI waiver zone and so, under all alternatives considered other than the No Action Alternative, is not subject to volume reduction (e.g. shrinking the volume of water in the plume with contaminants at unacceptable concentrations), but rather containment. The basis for this was discussed in Section 10 of this ROD. The means used to contain the benzene plume varies among the alternatives, as is discussed in Section 11.4, following this section.

Under all alternatives except for No Action, this ROD sets a performance requirement that the benzene plume remain contained within the containment zone/TI waiver zone. Under all alternatives except No Action, if the benzene plume leaves the containment zone in the future, additional active hydraulic extraction and treatment of the benzene plume would be implemented to re-establish hydraulic containment of the benzene within the TI waiver zone.

The following are also components of all alternatives (except Alternative 1) for the ***benzene plume***:

- Monitoring sufficient to confirm and evaluate containment of the benzene plume, the movement of contaminants within the benzene plume, the continued effectiveness of intrinsic biodegradation within the benzene plume, groundwater levels, gradients, hydraulics, effects of pumping, and other factors.

- A TI waiver applied to the UBF, MBFB Sand and MBFC Sand, but not to the Gage or Lynwood Aquifers. See Section "Technical Impracticability ARAR Waivers" in this ROD. As described in that section, there is a single TI waiver zone for the Joint Site but it extends to a lesser depth for the benzene plume than for the chlorobenzene plume.

Common Elements for the *TCE* Plume

Under all alternatives, a performance-based approach is applied to the TCE plume, requiring that the TCE, like the benzene, remain contained within the containment zone (TI Waiver zone). Under this approach, as with benzene, if the TCE moves outside the containment zone, hydraulic extraction would be employed to re-establish containment. This contingent hydraulic extraction

would not take place under the benzene NAPL, but at the periphery of the containment zone; hence, risks of benzene movement would be minimized (See earlier discussion in Section 11.1).

The remedial action for the TCE plume in all alternatives, other than the No Action alternative, contains or addresses the following:

- The immediate sources of TCE contamination in the TCE plume (near solvent-using facilities upgradient of the MW-20 area) will be partially contained by pumping groundwater at low rates near these sources and treating it. This hydraulic extraction will not be directly under the benzene NAPL in the MBFB Sand, but will take place slightly upgradient of the NAPL. This hydraulic extraction will limit the highest concentrations of TCE, as well as TCE NAPL from migrating laterally and vertically, although it will not completely prevent the migration of the TCE.

- Treated water from this hydraulic extraction will be re-injected back into the aquifer to obtain the optimum flushing and ability to limit hydraulic influences on the neighboring benzene NAPL and/or chlorobenzene plume.

- Additional sampling during remedial design will confirm the exact size and nature of the TCE plume in the MBFC Sand for design purposes. If the data reveal unexpected information, adjustments to the remedy will be proposed and implemented by EPA, as necessary.

- On a performance basis, TCE that is currently within the containment zone (TI waiver zone, established as described earlier in this ROD) will not be allowed to leave the containment zone. While hydraulic extraction of the TCE in the MBFC Sand directly under the benzene NAPL in the MBFB Sand is not proposed, additional pumping wells downgradient of the TI waiver zone and/or under the MBFC Sand in the Gage Aquifer may be required to meet this performance requirement and such needs will be assessed during the remedial design phase.

As this action for the TCE plume does not further vary among the alternatives, it is not further described in the discussion differentiating the alternatives that follows.

Actions for the Contaminant pCBSA

All alternatives, except for the No Action alternative, contain the following actions with respect to the compound pCBSA. The rationale for taking these actions is presented in Section 12, however, as some of the information in the remainder of Section 11 provides part of the basis for this action. However, the actions for pCBSA are noted here so that all common-elements can be listed together.

pCBSA is being addressed separately from all other contaminants by this remedial action. Therefore, the requirements specified elsewhere in this ROD for the chlorobenzene, benzene, and TCE plumes do not apply to pCBSA. All alternatives other than the No-Action alternative contain the following actions for pCBSA. Section 12 provides much more detail on the rationale for this action.

- The concentration at which pCBSA is re-injected into the ground shall be limited to 25,000 ppb. The State of California holds that 25,000 µg/l can be considered a provisional health standard for pCBSA with respect to injected groundwater. This requirement is a non-promulgated standard of the State of California (See Section 8 of this ROD), however, it is selected by this ROD as a performance standard for injected groundwater.

- The full downgradient extent of pCBSA contamination shall be determined and the movement of pCBSA shall be routinely monitored.

- Sampling at potentially susceptible public production wells shall include analyses for pCBSA.

- Well surveys shall be routinely updated to identify any new wells which may lie within the pCBSA distribution.

- At the Superfund 5-year reviews required by law, EPA will re-evaluate whether additional toxicological studies have been performed for pCBSA, assess the extent of the pCBSA plume and make determinations as to whether the remedy remains protective with respect to pCBSA.

It should be noted that the 25,000 ppb limit on aquifer injection of treated water mentioned above is ***not*** an in-situ standard. Therefore, this value does not represent an ISGS value. This ROD standard applies to the action of aquifer injection after groundwater is withdrawn and treated; it does not imply that groundwater in the ground will be cleaned to this value.

11.4 Differentiating Description of Alternatives

A summary of major elements of alternatives is shown in Figure 11-1, and in Table 11-1. These figures greatly facilitate the discussion in this subsection as well as the previous subsection. Figure 11-1 is arranged visually by hydrostratigraphic unit. It provides a summary of both the common and differing elements of the alternatives in terms of how the containment zone is contained, and the means by which the contaminant concentrations in any portion of the plume outside the containment zone are reduced (the volume of the plume reduced) so as to attain ISGS concentration levels within the aquifer. Table 11-1 provides similar information in tabular format, but also shows information related to the TCE plume, aquifer discharge methods, and cost, which are not shown on Figure 11-1 for simplicity. It is noted that Table 11-2 contains more detailed cost information than Table 11-1.

A description of elements that are common among the alternatives was provided above. The following discussion provides a description of the differing elements of the alternatives that were considered as part of the remedial action selection process. The representative technologies and discharge options are also shown for each alternative. Further discussion of the treatment technologies and discharge options are discussed in the next section. Because the action for the TCE plume is common to all alternatives, it is not discussed in this section.

Detailed and overall cost information that is cited in the following discussion is summarized in Table 11-2 of this ROD.

Alternative 1

Alternative 1 is No Action. Under this alternative, no remedial action would be taken, and no monitoring would occur. It has no cost in terms of remedial actions, although there would clearly be a cost to society from the continued loss of the groundwater resource and the potential for human exposure to site contaminants. Contamination would continue to move unchecked and unmonitored. NAPL would continue to contaminate groundwater. Potential health risks, if realized, would not be abated. Existing groundwater contamination would remain indefinitely, on the order of several centuries, and would potentially continue to impact new areas.

Introduction to Alternatives 2 Through 5

The four active alternatives (2-5) differ in key respects with respect to the chlorobenzene plume and benzene plume, respectively.

Chlorobenzene Plume

Alternatives 2 through 5 differ in terms of the relative *aggressiveness,* or *rate,* with which the chlorobenzene plume *outside* the containment zone is reduced in volume. Three groundwater extraction rates for the chlorobenzene plume are reflected in alternatives 2-5: 350 gallons per minute (gpm), 700 gpm, and 1400 gpm. In the JGWFS, these pump rates represent the *Plume Reduction 1, Plume Reduction 2, and Plume Reduction 3 scenarios* for the chlorobenzene plume. In general, the higher the pump rate, the faster the cleanup would occur, and the greater the flushing of the pore spaces in the aquifer by the remedial action.

Each of these scenarios was modeled in the JGWFS using differing wellfields. While the basic structure of each of these wellfields was the same, the numbers of extraction and injection wells were increased as the overall target pumping rate being simulated was increased. *It should be noted that these wellfields are not selected by this ROD; wellfields will be adjusted during the remedial design phase.* Those wishing to see the wellfields used in the JGWFS should view Section 5 or Appendix B of the JGWFS.

Figure 11-2 shows the performance of each alternative at removing the chlorobenzene plume outside the containment zone at simulated time frames of 10, 25, and 50 years. The primary relative basis of comparison used in the text which follows is the 25 year simulation. It is noted that pore volume flushing rate magnitudes and distributions can be found in Section 5 of the JGWFS.

Benzene Plume

Alternatives 2 through 5 differ in terms of the means by which the benzene plume is contained (as discussed in Section 10, the entire benzene plume is within the containment zone). In Alternative 2, the benzene plume is contained in all units by reliance on monitored intrinsic biodegradation. In Alternatives 3, 4 and 5, the benzene plume is contained in the UBF and MBFB sand by reliance on monitored intrinsic biodegradation, but is contained in the MBFC Sand by active hydraulic extraction and treatment. This was called ***hybrid containment*** in the JGWFS because both methods were used to contain the benzene plume, depending on the hydrostratigraphic unit.

EPA eliminated from further consideration alternatives that would have relied on intrinsic biodegradation for the MBFC Sand in the benzene plume while the chlorobenzene plume was

pumped at the higher 700-gpm and 1400-gpm pump rates. This was because there was too much uncertainty that intrinsic biodegradation could keep the benzene plume contained in the MBFC Sand if the chlorobenzene plume is pumped at these rates.

Alternative 2
350 gpm for Chlorobenzene / Containment by Intrinsic Biodegradation for Benzene

Under Alternative 2, the chlorobenzene plume outside the containment zone would be reduced using hydraulic extraction, treatment, and aquifer injection, at a rate of approximately **350 gpm**. Because of this low pump rate, the time to complete the remedy is the longest of any of the alternatives (excluding No Action, in which a cleanup is not undertaken). After 25 years, the model predicts that somewhat less than one third of the volume of the chlorobenzene plume (with concentrations above drinking water standards) would be removed. From Figure 11-2, it can be seen that Alternative 2 removes very little of its contamination in the early years of operation. Thus, Alternative 2 exhibits relatively poor early time performance.

The area with measurable and significant pore volume flushing under Alternative 2 is limited to about one half the size of the chlorobenzene plume and the spatial coverage of significant pore volume flushing is sporadic. Significant areas of the chlorobenzene plume, therefore, will be flushed at low rates and other areas will virtually not be flushed at all.

Under alternative 2, the benzene plume would be contained in the UBF, the MBFB Sand, and the MBFC Sand through reliance on monitored intrinsic biodegradation.

The cost of Alternative 2 would be $21,353,000.[4]

Alternative 3
350 gpm for Chlorobenzene / Hybrid Containment for Benzene

Under Alternative 3, as with Alternative 2, the chlorobenzene plume outside the containment zone would be reduced using hydraulic extraction, treatment, and aquifer injection, at a rate of approximately **350 gpm**. As with Alternative 2, after 25 years, the model predicts that somewhat less than one third of the volume of the chlorobenzene plume with concentrations above ISGS

[4] Cost values given below differ slightly from those in the JGWFS because they have been corrected after a spreadsheet error was discovered in the JGWFS during the public comment period. The cost estimates change by the following amounts due to this error: Alternative 2, 2.4 percent; Alternative 3, 2.0 percent; Alternative 4, 1.7; and Alternative 5, 1.6 percent. These amounts are not considered significant relative to the -30%/+50% cost estimating used for feasibility study purposes. For more information on this error, see Response Summary.

levels would be removed. Alternative 3 has the same characteristics as Alternative 2 with respect to total relative time to meet objectives, early time performance, and pore volume flushing.

Under alternative 3, the benzene plume would be contained in the UBF, and the MBFB Sand through reliance on monitored intrinsic biodegradation. The benzene plume in the MBFC Sand would be contained by active hydraulic extraction and treatment. This is called *hybrid containment.*

The cost of Alternative 3 would be $26,481,000.

Alternative 4
700 gpm for Chlorobenzene / Hybrid Containment for Benzene

Under Alternative 4, the chlorobenzene plume outside the containment zone would be reduced using hydraulic extraction, treatment, and aquifer injection, at a rate of approximately **700 gpm**, as opposed to 350 gpm in Alternatives 2 and 3. Alternative 4 would stop the chlorobenzene plume from spreading almost immediately and begin to reduce its size. The higher 700 gpm pump rate provides for excellent early time performance (a large percentage of the plume is removed in early years of operation), and a shorter overall cleanup time, compared to Alternatives 2 and 3. At 25 years, the model predicts that slightly more than two-thirds of the chlorobenzene plume with concentrations above ISGS levels would be removed. The pore volume flushing by this Alternative is greater in magnitude (flushing rates of 1 pore volume per year and higher are achieved in the chlorobenzene plume, and pore volume flushing covers the entire plume).

Under alternative 4, as with Alternative 3, the benzene plume would be contained in the UBF, the MBFB Sand only through reliance on monitored intrinsic biodegradation. The benzene plume in the MBFC Sand would be contained by active hydraulic extraction and treatment. This is called *hybrid containment.*

The cost of Alternative 4 would be $30,490,000.

Alternative 5
1400 gpm for Chlorobenzene / Hybrid Containment for Benzene

Under Alternative 5, the chlorobenzene plume outside the containment zone would be reduced using hydraulic extraction, treatment, and aquifer injection, at a rate of approximately **1400 gpm**. After 25 years, the model predicts that about 90 percent (varies between MBFC Sand and Gage Aquifer) of the volume of the chlorobenzene plume with concentrations above ISGS levels would be removed. Based on these estimates, the total time to reach remedial objectives would be the least among the alternatives. The early time performance of Alternative 5 is excellent and is the

best of any of the alternatives. The pore volume flushing under Alternative 5 is greater in magnitude and in extent than Alternative 4; in fact, it was simulated to create appreciable pore volume flushing over an area larger than the chlorobenzene plume (this excess, however, would be removed during the remedial design process if Alternative 5 were designed and implemented).

Under alternative 5, as with Alternatives 3 and 4, the benzene plume would be contained in the UBF, the MBFB Sand only through reliance on monitored intrinsic biodegradation. The benzene plume in the MBFC Sand would be contained by active hydraulic extraction and treatment. This is called *hybrid containment.*

The cost of Alternative 5 would be $40,514,000.

11.5 Treatment Technologies and Treated Water Discharge

Each of the alternatives considered by EPA in the JGWFS, except for Alternative 1, No Action, employs treatment of extracted groundwater for one or more areas of groundwater. The treated groundwater must be discharged in some manner.

Locations of Treatment and Number of Treatment Plants

The JGWFS makes reasonable assumptions as to the number and locations of groundwater treatment plants so as to make reasonable estimates of costs associated with the alternatives. Three treatment plants were assumed, one for each plume, for alternatives 3, 4 and 5. For Alternative 2, in which no active hydraulic containment is assumed for the benzene plume in the MBFC Sand, only two plants are assumed. For Alternative 1, No Action, no plants are assumed. However, this ROD does not select the number of treatment plants, wellfields, nor pump rates at individual wells, and these will be set in remedial design.

Primary Treatment Technologies

The primary differences among the remedial alternatives considered by EPA lie in what each alternative is able to accomplish in the ground rather than which technology is used to accomplish treatment of the extracted water. Treatment technologies were thoroughly evaluated as part of this remedy selection process, taking into account each of the plumes from which water would be extracted. However, this ROD selects several possible technologies to be available in remedial design.

Primary treatment technologies were those which were deemed capable of attaining ISGS levels in the groundwater outside the containment zone with respect to the contaminants in groundwater. Such technologies would also be capable of treating water drawn from *inside* the

containment zone (in the process of containment of the containment zone) to discharge standards. Additional *ancillary treatment technologies* were evaluated subsequently in order to ensure compliance with treated water discharge requirements (ancillary technologies are discussed following this subsection). The primary technologies identified in the JGWFS, after screening, to address the Joint Site contaminants are (1) liquid phase and vapor phase carbon adsorption, (2) air stripping, and (3) fluidized bed reactor. These are shown on Figure 11-3. With **liquid phase adsorption**, the water coming into the treatment plant is run through a bed of activated carbon, which adsorb the contaminants out of the water. When the carbon can no longer adsorb more contaminants, the carbon is said to be saturated. The saturated carbon can be sent offsite and reactivated, or regenerated, which allows the contaminants to be safely recovered and destroyed, and the carbon beads can be reused. Alternatively, the carbon can be sent to a landfill designed and approved to receive hazardous waste. **Liquid phase granular activated carbon** is the form of liquid phase adsorption most likely to be cost-effective at the Joint Site. With **air stripping**, the water is contacted with air and the volatile contaminants are transferred into the air. The air is then passed through a **vapor phase carbon adsorption** system that transfers the contaminants from the air to the carbon, similar to what occurs in liquid phase adsorption. The clean air is then discharged back into the atmosphere. With **fluidized bed reactor**, the contaminated water is passed through a agitated bed which has carbon with a biological film , or biofilm, on it. The bacteria in the biofilm metabolize and degrade most of the contaminants into carbon dioxide, water, and hydrochloric acid. There is the need to dispose of a portion of the biological mass that grows in the biofilm. When necessary, the biological mass is concentrated, dewatered, and disposed offsite in accordance with independently applicable laws and requirements.

Treatment Trains

The JGWFS did a screening and evaluation of these technologies, taking into account the water quality, approximate pumping locations and pump rates, and discharge options to be applied. Primary treatment technologies were assembled into treatment trains.

From the three primary technologies, EPA considered three treatment trains for the chlorobenzene plume, three treatment trains for the benzene plume, and two treatment trains for the TCE plume. These are:

- Chlorobenzene Plume:

  Carbon adsorption alone
  Air stripping followed by carbon adsorption polishing and vapor phase adsorption
  Fluidized bed reactor followed by carbon adsorption polishing

- Benzene Plume:

  Carbon adsorption alone
  Air stripping followed by carbon adsorption polishing and vapor phase adsorption
  Fluidized bed reactor followed by carbon adsorption polishing

- TCE Plume:

  Carbon adsorption alone
  Air Stripping followed by vapor phase carbon adsorption

These basic treatment trains were further enhanced by ancillary technologies shown in Table 11-3 and discussed below, to form the complete treatment trains, as shown in Table 11-4.

Ancillary Technologies

Ancillary technologies are those required to treat extracted groundwater to reduce the concentration of naturally-occurring species in the water to meet regulatory standards and engineering requirements associated with the discharge of the water. The JGWFS identified the major such ancillary technologies anticipated to be necessary in the alternatives, and incorporated them in the treatment trains evaluated for each plume in the JGWFS. As an example, the natural level of copper in the benzene plume is slightly too high to meet standards for discharge to a storm channel, the discharge option for water treated from the benzene plume in the MBFC Sand. Ancillary technologies identified in the JGWFS include those that may be necessary to reduce ambient copper levels in groundwater prior to injection into a storm water system, reduce total dissolved solids prior to re-injection, or prevent scaling or fouling of injection wells. These are shown in Table 11-3. These technologies shall be used in the remedial action where necessary and shall be considered available in remedial design. Ancillary technologies shall be used only to the extent that the remedial design requires them.

Cost-representative Treatment Train versus Selection of Multiple Technologies

For each plume, a ***cost-representative treatment train*** was identified in the JGWFS. In each case, the cost-representative treatment train was the least costly option using the assumptions used by the JGWFS and after determining largely equal ability of all the treatment trains to meet regulatory requirements, including ARARs. For purposes of estimating costs, the cost-representative treatment train was assumed to be used for each plume. In this way, the costs of all alternatives could be compared on an even basis.

For all three plumes, the JGWFS identified Carbon Adsorption Alone (with ancillary treatments as necessary) as the *cost-representative treatment.* Accordingly, the cost estimates of alternatives in the JGWFS assumed that Carbon Adsorption Alone was the treatment. EPA's calculations indicate that Carbon Adsorption Alone is likely to be the most cost-effective option for each plume once the remedy is designed. However, the JGWFS does provide sufficient information to determine the cost of an alternative primary treatment technology in the event that a different treatment train were used.

By identifying a cost-representative treatment, this ROD does not intend to limit the remedial design to this one treatment method. Rather than selecting a single treatment technology or treatment train for each plume, this ROD selects the entire range of treatment trains, and the primary technologies which passed screening, as available in remedial design to address each plume. This is to allow for maximum flexibility in the design. This ROD identifies all ARARs that shall apply to these technologies, in Appendix A to this ROD.

Supplemental Technologies

In addition to the primary treatment trains, and ancillary technologies, the JGWFS identified other technologies which survived screening and could be added to the treatment trains in modular fashion, if determined necessary in remedial design or during the course of the remedial action. It is not intended that these additional technologies be available as wholesale alternatives (replacements) to the primary treatment trains identified above. Switching the entire treatment to one of these additional technologies could imply a dramatic change in the cost of the remedial action which was not evaluated as part of the Feasibility Study or remedial action selection process. However, such ***supplemental technologies*** could be added to the remedial action for certain portions of groundwater, for certain times during the remedial action, to address problems or issues with might arise, or to increase the efficiency of the remedial system already in place. These supplemental technologies should be considered available in remedial design as determined necessary by the remedial design. The supplemental technologies considered in the JGWFS include ***liquid-gravity separation*** and ***advanced oxidation processes.***

Discharge Options

As discussed earlier in this section, aquifer injection is considered the essential disposal option for the treated water for the chlorobenzene plume and the TCE plume. This is to provide hydraulic control and limit the potential for NAPL movement. Therefore, no other discharge options were evaluated in detail by EPA for the chlorobenzene and TCE plumes. However, three discharge options were evaluated for the benzene plume, for alternatives where the benzene plume is subject to hydraulic extraction. These are: (1) aquifer injection, (2) discharge to the storm drain, and (3) disposal to the sanitary sewer. Discharge to the Storm Drain was the representative discharge

option used in the remedial alternatives for the benzene plume. The basis for this is described in the JGWFS, Section 7.

As with the primary technologies and treatment trains just discussed, by selecting a representative discharge option, this ROD does not intend to restrict the discharge options for the benzene plume to only storm water discharge. Any of the three discharge options identified shall be available in the remedial design, provided all discharge ARARs and other requirements are met by the implemented remedial action.

The ISGS levels established in Section 9 of this ROD apply to the in-situ groundwater. However, in order to ensure protectiveness of human health and the environment, and ensure progress toward meeting ISGS levels in-situ in groundwater, treated groundwater shall not be injected into aquifers at the Joint Site as part of this remedial action at concentrations which exceed the ISGS levels.

Table 11-1
Description of Alternatives
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

	Alternative 1 "No Action"	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			Faster Cleanup →	→	→
CHLOROBENZENE PLUME					
Approximate Rate of Hydraulic Extraction	No action	350 gallons per minute	350 gallons per minute	700 gallons per minute	1,400 gallons per minute
Method of Hydraulically Isolating NAPL Area	No containment of the NAPL area	Extracting and treating the groundwater	Extracting and treating the groundwater	Extracting and treating the groundwater	Extracting and treating the groundwater
Where is the Treated Water Discharged?	No action, thus no discharge	Aquifer injection	Aquifer injection	Aquifer injection	Aquifer injection
BENZENE PLUME					
Approximate Rate of Hydraulic Extraction	No action	No hydraulic extraction for benzene plume	Approximately 40 gallons per minute	Approximately 40 gallons per minute	Approximately 40 gallons per minute
Method of Hydraulically Containing Benzene Plume	No containment of the benzene plume	Contain benzene plume in all units with intrinsic biodegradation	Contain the UBF and MBFB Sand with intrinsic biodegradation	Contain the UBF and MBFB Sand with intrinsic biodegradation	Contain the UBF and MBFB Sand with intrinsic biodegradation
			Contain the MBFC Sand with extracting and treating the groundwater	Contain the MBFC Sand with extracting and treating the groundwater	Contain the MBFC Sand with extracting and treating the groundwater
Where is the Treated Water Discharged?	No action, so no discharge	No treated water to discharge	Storm Drain	Storm Drain	Storm Drain
TCE PLUME					
What is Done? (Same in all alternatives except No. 1)	No action	Extracting and treating groundwater to partially contain the sources; TCE is not allowed to spread beyond TI waiver zone	Extracting and treating groundwater to partially contain the sources; TCE is not allowed to spread beyond TI waiver zone	Extracting and treating groundwater to partially contain the sources; TCE is not allowed to spread beyond TI waiver zone	Extracting and treating groundwater to partially contain the sources; TCE is not allowed to spread beyond TI waiver zone

Table 11-1 - CONTINUED
Description of Alternatives
Record of Decision for Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

			Faster Cleanup →	→	→
	Alternative 1 "No Action"	Alternative 2	Alternative 3	Alternative 4	Alternative 5
COSTS OF THE ALTERNATIVES					
Total 30-Year Present Worth*:	$0	$21,353,000	$26,481,000	$30,490,000	$40,514,000
Capital Cost:	$0	$12,402,000	$13,976,000	$16,028,000	$22,049,000

☐ EPA's Preferred Alternative

*Costs are calculated as 30-year present worth, even though the true duration of the remedy is likely to be greater than 30 years. This is reasonable because the present worth value of the dollar after 30 years is small under a reasonable depreciation rate. For instance, EPA ran calculations which showed that if the cost basis were extended to 100 years, instead of 30 years, the total present worth value would increase by only about 12 percent, assuming a 5-percent depreciation rate. Because the true total time to clean up cannot be known exactly (time frames for alternatives are compared on a relative, not absolute, basis) EPA believes that the 30-year present worth value is an acceptable estimate and basis for comparison of the total costs of the alternatives in this case.

Table 11-2
Costs of Alternatives
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Alternative	Cost Summary	Monitoring	Benzene Hybrid Containment	Chlorobenzene Plume Reduction	TCE Plume Reduction	Total Cost Summary
2	Capital	$806,000	$0	$8,989,000	$2,607,000	$12,402,000
	Present Worth O&M	$2,057,000	$0	$4,338,000	$2,180,000	$8,575,000
	Present Worth Equipment Replacement	97,000	0	155,000	124,000	376,000
	Total Present Worth	**$2,960,000**	**$0**	**$13,482,000**	**$4,911,000**	**$21,353,000**
3	Capital	$806,000	$1,574,000	$8,989,000	$2,607,000	$13,976,000
	Present Worth O&M	$2,057,000	$3,381,000	$4,338,000	$2,180,000	$11,956,000
	Present Worth Equipment Replacement	97,000	173,000	155,000	124,000	549,000
	Total Present Worth	**$2,960,000**	**$5,128,000**	**$13,482,000**	**$4,911,000**	**$26,481,000**
4	Capital	$806,000	$1,574,000	$11,041,000	$2,607,000	$16,028,000
	Present Worth O&M	$2,057,000	$3,381,000	$6,237,000	$2,180,000	$13,855,000
	Present Worth Equipment Replacement	97,000	173,000	213,000	124,000	607,000
	Total Present Worth	**$2,960,000**	**$5,128,000**	**$17,491,000**	**$4,911,000**	**$30,490,000**
5	Capital	$806,000	$1,574,000	$17,062,000	$2,607,000	$22,049,000
	Present Worth O&M	$2,057,000	$3,381,000	$10,141,000	$2,180,000	$17,759,000
	Present Worth Equipment Replacement	97,000	173,000	312,000	124,000	706,000
	Total Present Worth	**$2,960,000**	**$5,128,000**	**$27,517,000**	**$4,911,000**	**$40,514,000**

Notes: Present worth operations & maintenance (O&M) costs calculated at 5-percent discount rate for 30 years.
Costs are calculated as 30-year present worth, even though the true duration of the remedy is likely to be greater than 30 years. This is reasonable because the present worth value of the dollar after 30 years is small under a reasonable depreciation rate. For instance, EPA ran calculations which showed that if the cost basis were extended to 100 years, instead of 30 years, the total present worth value would increase by only about 12 percent, assuming a 5-percent depreciation rate. Because the true total time to clean up cannot be known exactly (time frames for alternatives are compared on a relative, not absolute, basis) EPA believes that the 30-year present worth value is an acceptable estimate and basis for comparison of the total costs of the alternatives in this case.

Table 11-3
Ancillary Treatment Technologies
Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Control Requirement	Treatment Technologies
Heavy Metals Removal	– Iron Coprecipitation: (benzene plume storm drain discharge)
Mineral Scale Control	– pH Adjustment – Lime Softening: (benzene plume injection) – Antiscalent (sequestering agent) Addition: (all plumes, all discharge options)
pH Control	– Carbon Dioxide Addition (all plumes following air stripping) – Mineral Acid Addition (Benzene plume storm drain discharge following iron coprecipitation)
Biological Slime Control	– Bleach Addition (all plumes, all discharge options)
Suspended Solids Control	– Clarifiers (where applicable) – Media Filtration (where applicable) – Fine Filtration (all plumes, all discharge options)

Table 11-4
Treatment Trains

Record of Decision for Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

Chlorobenzene Plume

Air Stripping Followed by LGAC Adsorption and VGAC for Offgas Treatment

LGAC Adsorption

Fluidized-Bed Reactor Followed by LGAC Adsorption

Benzene Plume

Air Stripping Followed by Iron Coprecipitation, LGAC Adsorption, and VGAC for Offgas Treatment

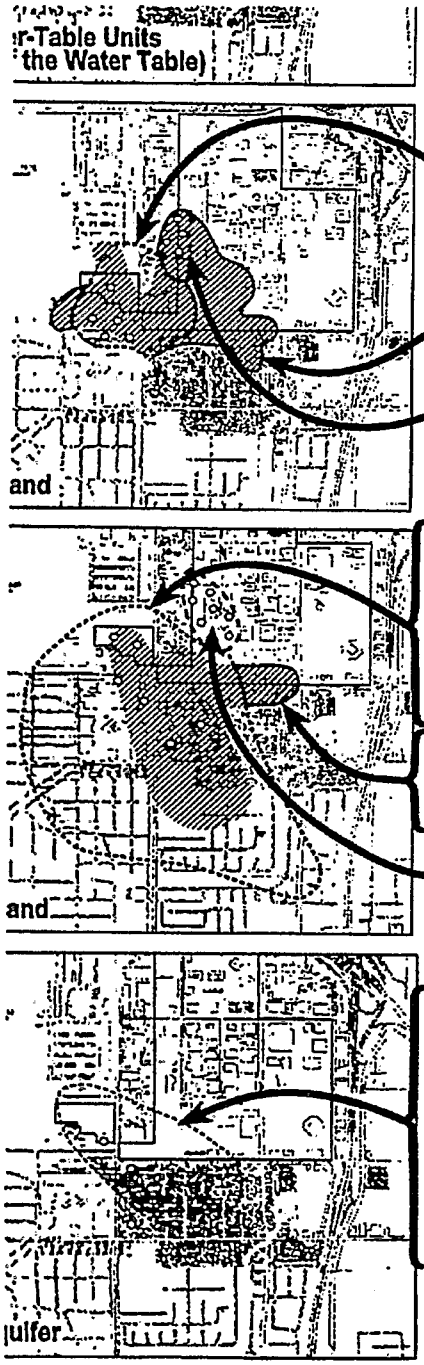
LGAC Adsorption with Iron Coprecipitation

Fluidized-Bed Reactor Followed by Iron Coprecipitation and LGAC Adsorption

TCE Plume

Air Stripping Followed by LGAC Adsorption and VGAC for Offgas Treatment

LGAC Adsorption

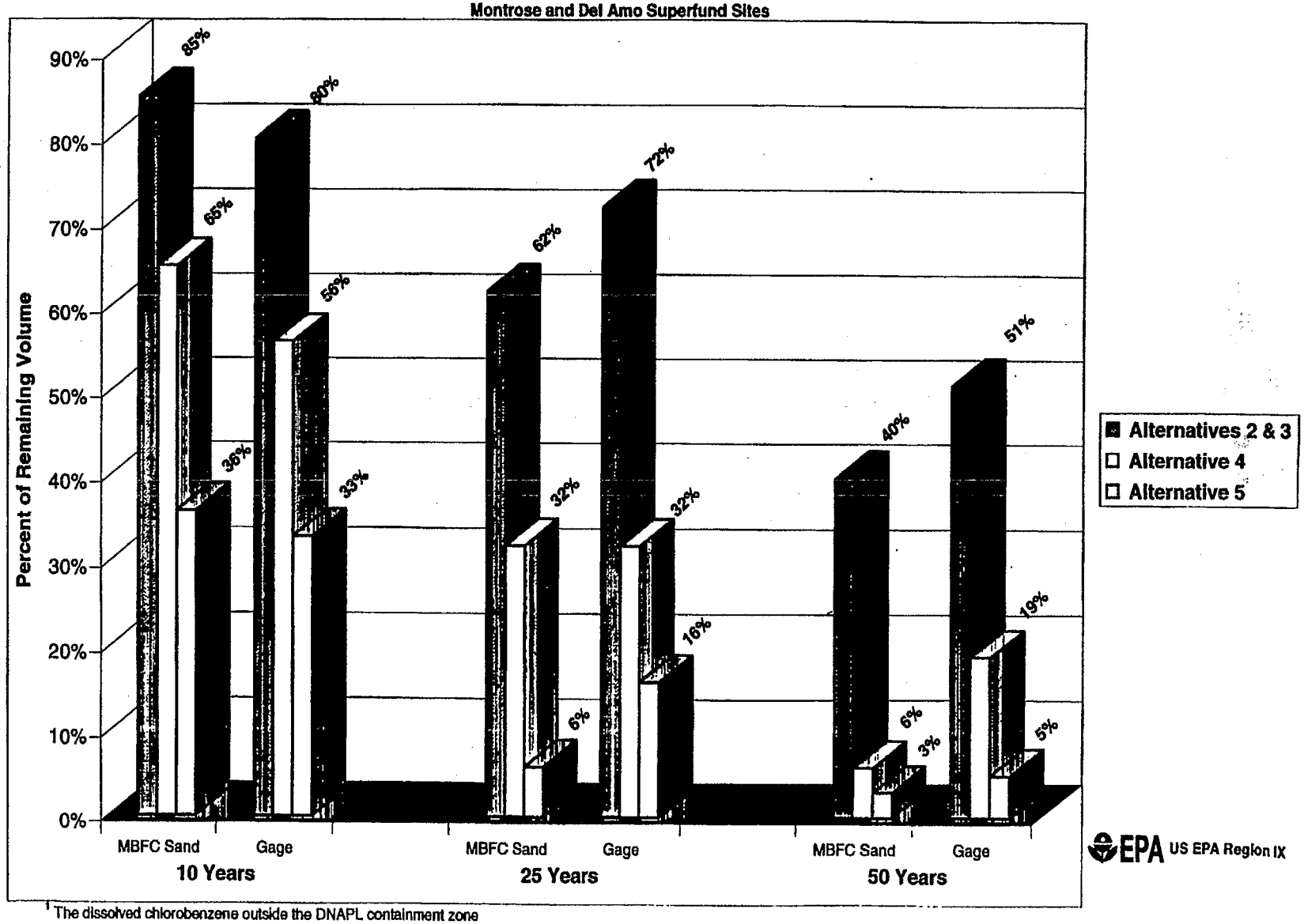


[redacted]				
Chlorobenzene plume†	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Con hyd extr inje
Benzene plume††	Contain with monitored intrinsic biodegradation	Contain with monitored intrinsic biodegradation	Contain with monitored intrinsic biodegradation	Cont moni biod
TCE plume†	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Cont the T Zone
[redacted]				
Chlorobenzene plume† (within the containment zone)	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Cont hydr extra inje
Chlorobenzene plume† (outside the containment zone)	Reduction at 350 gpm using hydraulic extraction and injection*	Reduction at 350 gpm using hydraulic extraction and injection*	Reduction at 700 gpm using hydraulic extraction and injection*	Redu 1,40 hydr and
Benzene plume††	Contain with monitored intrinsic biodegradation	Contain with hydraulic extraction and injection+	Contain with hydraulic extraction and injection+	Cont hydr and
TCE plume†	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Contained within the TI Waiver Zone	Cont the T Zone
[redacted]				
Chlorobenzene plume† (within the containment zone)	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Contain with hydraulic extraction and injection	Cont hydr extra inje
Chlorobenzene plume† (outside the Containment Zone)	Reduction at 350 gpm using hydraulic extraction and injection*	Reduction at 350 gpm using hydraulic extraction and injection*	Reduction at 700 gpm using hydraulic extraction and injection*	Redu 1,400 hydr and

= Principal Differing Elements of Alternatives

e 1, No Action, implies no actions and is not shown.
"plume" has a meaning specifically defined by convention in this ROD; see Sections 5 and 7 of this ROD.
ne plume in all units, and the chlorobenzene plume in the MDFD Gand, are entirely within the NAPL containment zone.
that water withdrawn from the benzene plume itself may not be suitable for discharge by aquifer injection depending on the well locati
l remedial design. However, aquifer injection of water drawn from other locations (e.g. the chlorobenzene plume) may be used to assis

Figure 11-2
Percent of Remaining Volume of the Chlorobenzene Plume[1]
by Alternative in 10, 25, and 50 Years
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites



[1] The dissolved chlorobenzene outside the DNAPL containment zone

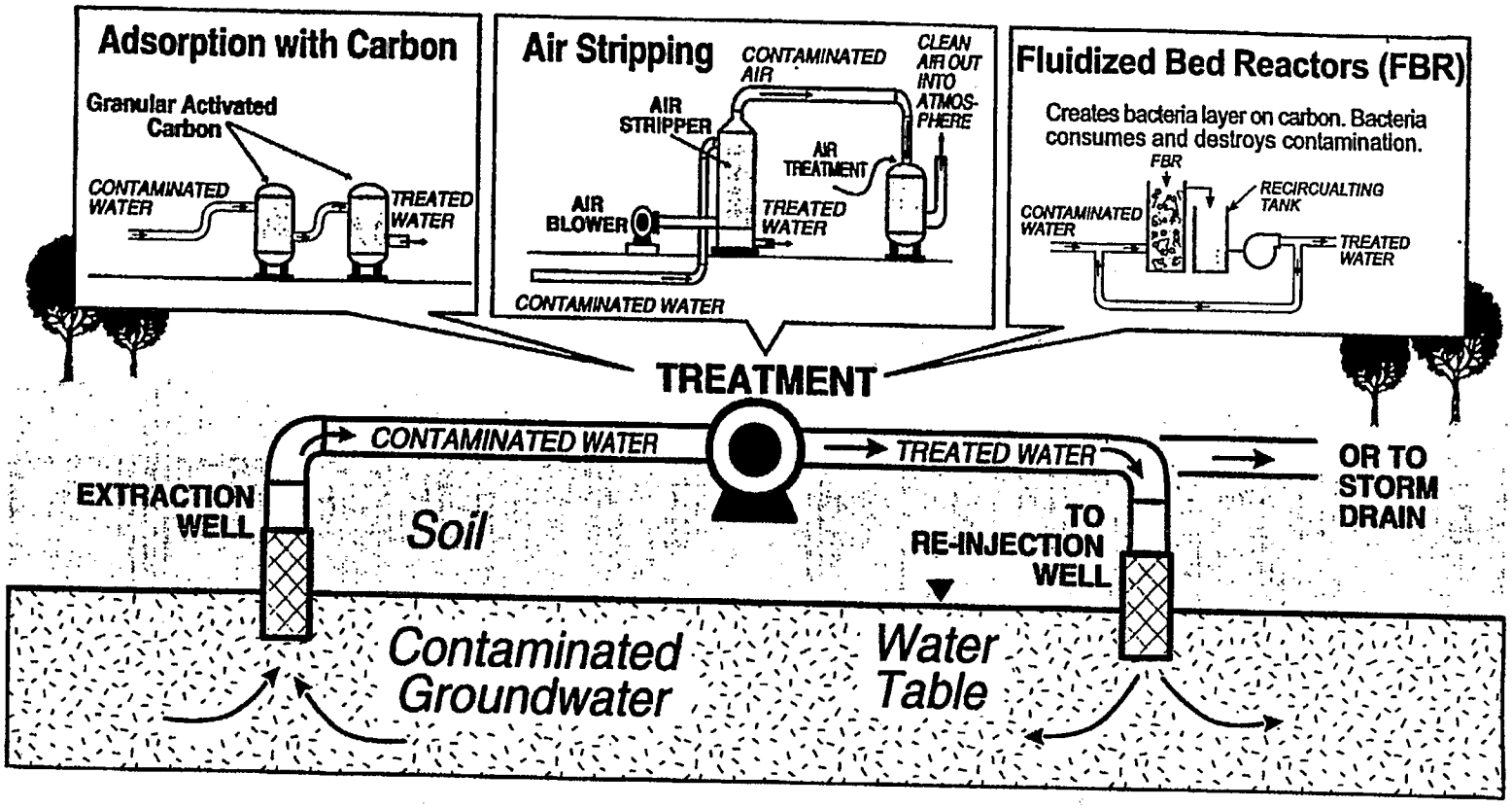


Figure 11-3
Treatment Technologies
Record of Decision
Dual Site Groundwater Operable Unit
Montrose and Del Amo Superfund Sites

EPA US EPA Region IX

12. Summary of Comparative Analysis of Alternatives & Rationale for Selected Alternative

This section of the ROD presents EPA's comparison of alternatives, and documents the rationale for other elements of EPA's decision. The reader should also consult the Response Summary of this ROD for further documentation of how EPA addressed issues related to the selection of the remedial action.

The NCP requires that EPA utilize nine criteria in comparing and selecting remedial alternatives. These are:

- Protectiveness of Human Health and the Environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long Term Effectiveness
- Short-Term Effectiveness
- Reduction of Mobility, Toxicity and Volume of Contaminants Through Treatment
- Implementability
- Cost
- State Acceptance
- Community Acceptance

[40 C.F.R. §300.430(f)(1)(i)]

The first two criteria are usually referred to as threshold criteria; the next five criteria are usually referred to as balancing criteria; and the last two are referred to as modifying criteria. The following evaluates the five alternatives discussed in Section 11 of this ROD in terms of these criteria.

As with the previous section, the following discussion does not focus on elements that are

common to all alternatives. The cost estimates in the following discussion are based on the JGWFS and are approximate values intended to be within +50%/-30% of the actual values.[1] We note that this section does not repeat analyses included in previous sections of this ROD, including but not limited to the basis for using a dual-site approach and the context of this remedial action, the rationale for imposing a containment zone, rationale for the size and extent of the TI waiver zone, etc. Discussions of these matters can be found in the earlier sections.

12.1 Protectiveness of Human Health and the Environment

Protectiveness of Human Health and the Environment is generally considered a threshold criterion [40 C.F.R. §300.430(f)(1)(i)(A)]. EPA has addressed this criterion in two ways. Presently, and as a matter of threshold, all alternatives other than the No Action Alternative would be protective of human health and the environment. However, while each of the alternatives, except for the No Action Alternative, has the potential to attain remedial action objectives, it would be misleading to represent that the alternatives are certain to attain, or have equal certainty of attaining, the objectives of (1) reducing the concentrations of contaminants to ISGS levels at all points outside the containment zone, and of (2) maintaining the containment or contaminants within the containment zone. Because the time frame of the remedy is so long, there cannot be absolute certainty that these objectives will be met in the long term. The degree of certainty varies with the length of time the remedial action will take, the degree of early time performance, and the magnitude and distribution of pore volume flushing rates . Therefore, in addition making a threshold statement, EPA also compared the alternatives in balancing fashion with respect to the *degree* of certainty that, at the conclusion of the remedial action, all remedial action objectives will have been attained, and that the remedial action will remain protective over the long term.

In general, in dealing with extensive time frames, the longer the time required for a remedial alternative to meet remedial action objectives, the greater is the uncertainty that it will ultimately and fully meet those objectives at all. This is true because of the enormous degree of change that can occur in human (e.g. social, demographic, resource use, etc.) and natural (e.g. groundwater gradients, flow, water levels) conditions over the course of such time periods. As an example, demographic and in turn, water use patterns and distributions may change. The demand for water and the nature of water use may shift with social, economic, or political factors. It is not possible to reliably predict the manner in and degree to which these factors will change over the course of

[1] Cost values given below differ slightly from those in the JGWFS because they have been corrected after a spreadsheet error was discovered in the JGWFS during the public comment period. The cost estimates change by the following amounts due to this error: Alternative 2, 2.4 percent; Alternative 3, 2.0 percent; Alternative 4, 1.7 percent; and Alternative 5, 1.6 percent. These amounts are not considered significant relative to the -30%/+50% cost estimating used for feasibility study purposes. For more information on this error, see the Response Summary.

a century or more. This point can be illustrated by considering a comparison of 1999 to 1899 with respect to population and resource use patterns, or considering the capability of a person in 1899 to predict such patterns as they exist today. The assumptions of the analyses of a feasibility study, both written and implicit, assume generally greater uncertainty as the intervening time frame becomes very long. Accordingly, in this case, EPA considered alternatives likely to have shorter cleanup times to be characterized by greater certainty of meeting long-term remedial action objectives, and hence greater certainty of long term protectiveness of human health and the environment.

Likewise, because uncertainty in meeting remedial objectives increases as time to cleanup increases, an alternative with good early time performance achieves most of its progress in the early period that is associated with relatively high certainty. When more of the plume is removed relatively early in the remedial action process, the majority of the plume is removed within the range of time in which the model is a reasonable predictive tool, and this also affords greater certainty that the remedial objectives ultimately will be attained. In contrast, alternatives with poor early time performance do most of the removal of contamination late, when uncertainties as to future conditions are larger, and at points in time which cannot be simulated accurately by the model.

An additional benefit of early time performance is that more of the restored groundwater resource is usable sooner. The larger the area of groundwater that has been restored to drinking water standards, and the sooner this area grows in size, the less opportunity there is over time for use to be made of water that would pose an unacceptable health risk. Early time performance therefore affords greater certainty of long-term protectiveness.

Finally, alternatives which produce greater flushing rates, and have an even and complete, rather than sporadic and/or incomplete, coverage of the plume in terms of pore volume flushing, provide better long-term certainty of protectiveness than alternatives which do not. Such alternatives have better ability to remove contaminants throughout the plume, and hence provide (1) faster cleanup rates, (2) higher certainty that ARARs and remedial objectives will ultimately be achieved at all points in the plume, and in turn superior protection of human health in the long term.

In light of the foregoing discussion, the No Action Alternative would not be protective of human health and the environment either presently or in the long term.[2] Alternative 2 has the least degree of certainty as to long-term protectiveness, followed by Alternative 3, Alternative 4, and

[2]EPA finds the basis for action sufficiently compelling in this case, and also finds it feasible based on the JGWFS to take action in a manner which will not pose unacceptable short-term problems, to reject the No Action Alternative. However, EPA did evaluate it fully in the JGWFS as required by the NCP as a benchmark of comparison.

Alternative 5, in that order. Issues related to certainty of long-term protectiveness fall largely in two categories: (1) regarding reduction of the chlorobenzene plume outside the containment zone, and (2) regarding certainty of long-term containment of the benzene plume, which lies entirely within the containment zone. Clearly, the greater the uncertainty that ISGS levels will ultimately be attained at all points in the chlorobenzene plume outside the containment zone, the greater the uncertainty in the long term protectiveness of the remedial action. Similarly, the greater the uncertainty that long-term containment of the benzene plume can be maintained, the greater is the chance that contaminants will escape the zone, thwarting efforts to clean groundwater outside the containment zone to ISGS levels. This also would result in greater uncertainty of long-term protectiveness.

It is noted that all alternatives (other than No Action) perform similarly with respect to long term containment of the portion of the *chlorobenzene* plume that lies within the containment zone.

Long Term Certainty of Protectiveness in Relation to Reduction of the Chlorobenzene Plume Outside the Containment Zone

Because of its relatively low total groundwater extraction rate and lower number of extraction wells, Alternative 2 would take the longest of all the alternatives to reach cleanup standards. This long time frame results in the least certainty that ISGS levels ultimately will be attained at all points in the plume. Alternative 2's performance (percent of plume removed) at 25 years is the poorest of the alternatives. In addition, in simulations of Alternative 2, the magnitude of the increase in pore volume flushing is very small, and the area where increased pore volume flushing occurs covers only about 50 percent of the chlorobenzene plume. This greatly decreases the certainty that ISGS levels would be attained at all points in the plume in the long term. Alternative 2 has poor early time performance, again resulting in lower certainty of long-term protectiveness. Very little of the plume is removed during the time in which the model is an acceptable predictive tool. In addition, much more of the plume remains over the course of the remedial action, implying a larger contaminated area as time progresses, which in turn increases the chance that contaminated groundwater could be used over a long time frame. Alternative 3 has the same characteristics as Alternative 2 with respect to the characteristics just discussed.

Alternative 4, and to a greater extent, Alternative 5, because of their higher groundwater extraction rates and greater numbers of wells, imply much shorter cleanup times. Performance in terms of percent of the plume removed at 25 years for Alternative 4 more than double that for Alternatives 2 and 3. In simulations of Alternatives 4 and 5, pore volume flushing rates are much higher, more consistent, and more evenly- and completely-distributed over the chlorobenzene plume than for Alternatives 2 and 3. The early-time performance of Alternative 4 is much better than Alternatives 2 and 3, and still better in Alternative 5. These aspects lend much greater certainty that ISGS levels will be attained throughout the plume outside the containment zone,

end hence, greater certainty of protectiveness in the long-term. Moreover, because more of the groundwater is restored sooner, users see a smaller area of contamination over time and there is less chance of exposure to contaminated groundwater. The certainty of protectiveness in the long term is therefore greater with Alternative 4 and greatest with Alternative 5, in this regard.

Long Term Certainty of Protectiveness in Relation to Certainty of Long-Term Containment of the Benzene Plume

Alternative 2 relies on intrinsic biodegradation entirely to contain the benzene plume. Hydraulic extraction is not used under Alternative 2 to contain the benzene in the MBFC Sand. There is significant uncertainty as to whether intrinsic biodegradation will reliably contain the benzene plume in the MBFC Sand, once the pumping of the chlorobenzene plume starts. This is because pumping the chlorobenzene plume may pull on the benzene and may move it. In relying solely on intrinsic biodegradation, the risk of this movement is greater for a number of reasons discussed further below in this section in more detail. Therefore, once again in this respect, Alternative 2 provides the least certainty of long-term protectiveness.

Rather than relying on intrinsic biodegradation to contain the entire benzene plume, Alternatives 3, 4 and 5 alike use active hydraulic extraction and treatment to contain the benzene plume in the MBFC Sand. Because intrinsic biodegradation is merely a pre-existing condition in the soil, it cannot be controlled. However, hydraulic extraction and treatment can be designed and controlled directly to provide better, adjustable, and more reliable control of the possible movement of benzene in the MBFC Sand. The risks and implications of adverse benzene plume movement in the MBFC Sand (particularly movement into the Gage Aquifer) during the course of the remedial action, if the benzene plume is not actively contained, are substantial. Of particular concern are: (1) the higher permeability of the MBFC Sand compared to the UBF and MBFB Sand, (2) uncertainties related to the sources of benzene and preferential flow paths in the MBFC Sand, and (3) uncertainties in contaminant migration pathways within the LBF. These factors are due to a number of factors including uncertainties and limitations of the model, inability to effectively monitor the LBF, which separates the MBFC Sand from the Gage Aquifer, and the inability to effectively characterize small-scale contaminant migration pathways within the MBFC Sand and LBF. These and other issues related to benzene movement in the MBFC Sand are further discussed later in this section under EPA's Rationale for the Selected Alternative and Section 5 of the JGWFS.

The active hydraulic containment of the benzene plume in the MBFC Sand, found in Alternatives 3, 4, and 5 increases the certainty that the benzene plume will remain contained and will not move downward or sideways in response to hydraulic extraction (pumping) that is primarily targeted to containment and reduction of the chlorobenzene plume. Lack of reliable benzene containment could result in benzene migration outside the containment zone, which could

slow the progress in restoring groundwater outside the containment zone to drinking water standards in either the short or the long term. The JGWFS concluded that it is feasible to adequately contain the benzene plume in the MBFC Sand under Alternatives 3, 4 or 5 provided active hydraulic containment is used.

Alternatives 3, 4 and 5 provide more certainty with respect to long-term containment of the benzene plume than does Alternative 2, and hence, more certainty of long-term protectiveness in this regard.

12.2 Compliance with ARARs

As a matter of comparison, it is attaining ISGS levels (which embody in-situ groundwater chemical-specific ARARs) at all points in the groundwater outside the containment zone that is of concern. All other ARARs can be attained by any of the alternatives, with the exception of the No Action Alternative. The No-Action alternative would not attain ARARs.

As with protectiveness of human health and the environment, compliance with ARARs is considered as a threshold criterion [40 C.F.R. §300.430(f)(1)(i)(A)]. All of the alternatives, except for No Action, meet a threshold in that they have an reasonable potential to ultimately attain ISGS levels throughout the groundwater outside of the containment zone. Nonetheless, because of the long time frames associated with this remedial action, the alternatives differ widely in terms of the *certainty* of this over the long term. Therefore, for purposes of comparison, EPA also has discussed the alternatives in terms of degrees of this certainty.

Long-term certainty with respect to compliance with ARARs, in terms of attaining ISGS levels for all groundwater outside the containment zone, varies among the alternatives in exactly the same way and for the same reasons provided in the discussion of long-term certainty of *Protectiveness of Human Health and the Environment.* As discussed under Section 12.1, the shorter the cleanup time, the greater is the potential that the cleanup will ultimately attain ARARs in the long-term, as anticipated.

The National Contingency Plan (NCP), the regulations for Superfund, requires that remedial actions attain ARARs (in this case, drinking water standards in-situ) in a reasonable time frame. In the case of the Joint Site groundwater, EPA believes that an alternative should be considered more "reasonable" with respect to time frame if it restores a major portion of the aquifer to drinking water standards in a relatively more certain and short time frame, as compared to an alternative that restores very little of the aquifer until late in the long remedial action. As previously discussed, in this ROD EPA refers to this concept as early time performance of the alternative. Because uncertainty in meeting remedial objectives increases as time to cleanup increases, an alternative with good early time performance achieves most of its progress in the

early period associated with relatively high certainty. When more of the plume is removed relatively early in the remedial action process, there is greater certainty that the remedial objectives ultimately will be attained, particularly if the majority of the plume is removed within the range of time in which the model is a reasonable predictive tool.

Also as with certainty of long-term protectiveness, alternatives which produce greater flushing rates, and have an even and complete, rather than sporadic and/or incomplete, coverage of the plume in terms of the increase in pore volume flushing, provide greater certainty of attaining ARARs in the long term, than alternatives which do not. Such alternatives have better ability to remove contaminants throughout the plume, and hence provide higher certainty that ARARs and remedial objectives will ultimately be achieved at all points in the plume outside the containment zone.

Overall, Alternative 2 provides the least certainty of long term compliance with ARARs, followed by Alternative 3, Alternative 4, and Alternative 5, in that order.

With respect to ultimately complying with ARARs (i.e.attaining ISGS levels at all points in the chlorobenzene plume outside the containment zone), Alternatives 2 and 3 are the poorest (and about the same relative to each other) with respect to certainty of attaining ARARs in the long term. Alternative 4 ranks above Alternatives 2 and 3, and Alternative 5 ranks above Alternative 4. The reasons for this are the same as those discussed above in Section 12.1 with respect to long term certainty of protectiveness with respect to attaining ISGS levels at all points in the chlorobenzene plume.

Alternatives which provide a lower certainty of containing the benzene plume also have a lower potential for attaining ISGS levels in the long term, because there is a greater chance that benzene contamination may move outside the containment zone, thwarting or lengthening the efforts to attain the concentration reductions necessary to attain ISGS levels there. With respect to this aspect, Alternatives 3, 4 and 5 are about the same, and superior to Alternative 2.

12.3 Long-Term Effectiveness

In the case of the Joint Site and the nature of the alternatives being considered, most of the arguments and factors related to long-term effectiveness parallel those related to certainty of protectiveness in the long-term, presented in Section 12.1. To some extent, these are repeated here for maximum clarity, although some of the discussion also differs.

In general, in dealing with extensive time frames, the longer the time required for a remedial alternative to meet remedial action objectives, the greater is the uncertainty that it will ultimately and fully meet those objectives at all. This is true because of the enormous degree of change that

can occur in human (e.g. social, demographic, resource use, etc.) and natural (e.g. groundwater gradients, flow, water levels) conditions over the course of such time periods. As an example, demographic and in turn, water use patterns and distributions may change. The demand for water and the nature of water use may shift with social, economic, or political factors. It is not possible to reliably predict the manner in and degree to which these factors will change over the course of a century or more. This point can be illustrated by considering a comparison of 1999 to 1899 with respect to population and resource use patterns, or considering the capability of a person in 1899 to predict such patterns as they exist today. The assumptions of the analyses of a feasibility study, both written and implicit, assume generally greater uncertainty as the intervening time frame becomes very long. Accordingly, in this case, EPA considered alternatives likely to have shorter cleanup times to be characterized by greater certainty of meeting long-term remedial action objectives, and hence greater long-term effectiveness.

Likewise, because uncertainty in meeting remedial objectives increases as time to cleanup increases, an alternative with good early time performance achieves most of its progress in the early period that is associated with relatively high certainty. When more of the plume is removed relatively early in the remedial action process, the majority of the plume is removed within the range of time in which the model is a reasonable predictive tool, and this also affords greater certainty that the remedial objectives ultimately will be attained. In contrast, alternatives with poor early time performance do most of the removal of contamination late, when uncertainties as to future conditions are larger, and at times which cannot be predicted accurately by the model.

An additional benefit of early time performance is that more of the restored groundwater resource is usable sooner. The larger the area of groundwater that has been restored to drinking water standards, and the sooner this area grows in size, the less opportunity there is over time for use to be made of water that would pose an unacceptable health risk. Early time performance therefore affords greater long-term effectiveness.

Finally, alternatives which produce greater flushing rates, and have an even and complete, rather than sporadic and/or incomplete, coverage of the plume in terms of pore volume flushing, provide better long-term effectiveness than alternatives which do not. Such alternatives have better ability to remove contaminants throughout the plume, and hence provide faster cleanup rates and a greater chance that all contamination throughout the plume will be addressed. Because contaminants will have been more evenly and completely flushed from the aquifer system, there is less chance that contaminant levels will rebound above ISGS levels and therefore greater chance in the long term that the remedy will remain permanent; hence, greater long-term effectiveness.

In light of the foregoing discussion, the No Action Alternative would not be effective or long-term effective. Alternative 2 has the least degree of certainty as to long-term protectiveness, followed by Alternative 3, Alternative 4, and Alternative 5, in that order. Issues related to long-

term effectiveness fall largely in two categories: (1) regarding reduction of the chlorobenzene plume outside the containment zone and the permanence of that action, and (2) regarding the certainty of long-term containment of the benzene plume, which lies entirely within the containment zone. Clearly, the greater the uncertainty that ISGS levels will ultimately be attained at all points in the chlorobenzene plume outside the containment zone, and the greater that this action is permanent, the greater the uncertainty in the long term protectiveness of the remedial action. Also, the greater the uncertainty that long-term containment of the benzene plume can be maintained, the greater is the chance that contaminants will escape the zone, thwarting efforts to clean groundwater outside the containment zone to ISGS levels. This would result in less long-term protectiveness.

It is noted that all alternatives (other than No Action) perform similarly with respect to long term containment of the portion of the *chlorobenzene* plume that lies within the containment zone.

Long-Term Effectiveness in Relation to Reduction of the Chlorobenzene Plume Outside the Containment Zone

Because of its relatively low total groundwater extraction rate and lower number of extraction wells, Alternative 2 would take the longest of all the alternatives to reach cleanup standards. This long time frame results in the least certainty that ISGS levels ultimately will be attained at all points in the plume. Alternative 2's performance (percent of plume removed) at 25 years is the poorest of the alternatives. In addition, in simulations of Alternative 2, the magnitude of the increase in pore volume flushing is very small, and the area where increased pore volume flushing occurs covers only about 50 percent of the chlorobenzene plume. This greatly decreases the certainty that ISGS levels would be attained at all points in the plume in the long term.. Alternative 2 has poor early time performance, again resulting in lower long-term effectiveness. Very little of the plume is removed during the time in which the model is an acceptable predictive tool. In addition, much more of the plume remains over the course of the remedial action, implying a larger contaminated area as time progresses, which in turn increases the chance that contaminated groundwater could be used over a long time frame. Alternative 3 has the same characteristics as Alternative 2 with respect to the characteristics just discussed.

Alternative 4, and to a greater extent, Alternative 5, because of their higher pumping rates, imply much shorter cleanup times. Performance in terms of percent of the plume removed at 25 years for Alternative 4 more than double that for Alternatives 2 and 3. Pore volume flushing rates are much higher, more consistent, and well-distributed than for Alternatives 2 and 3. The early-time performance of Alternative 4 is much better than Alternatives 2 and 3, and still better in Alternative 5. These aspects lend much greater certainty that ISGS levels will be attained throughout the plume outside the containment zone, end hence, greater long-term effectiveness. Because the plume is more efficiently and completely addressed by the remedial action under

Alternative 4 and 5, there is greater chance it will be permanent and therefore long-term effective. Moreover, because more of the groundwater is restored sooner, users see a smaller area of contamination over time and there is less chance of exposure to contaminated groundwater. The certainty of protectiveness in the long term is therefore greater with Alternative 4 and greatest with Alternative 5, in this regard. While the pore volume flushing of Alternative 5 is greater in magnitude than that of Alternative 4, both Alternative 4 and Alternative 5 provide complete and well-distributed coverage of the plume with respect to pore-volume flushing.

Long-Term Effectiveness in Relation to Certainty of Long-Term Containment of the Benzene Plume

Alternative 2 relies on intrinsic biodegradation entirely to contain the benzene plume. Hydraulic extraction is not used under Alternative 2 to contain the benzene in the MBFC Sand. There is significant uncertainty as to whether intrinsic biodegradation will reliably contain the benzene plume in the MBFC Sand, once the pumping of the chlorobenzene plume starts. This is because pumping the chlorobenzene plume may pull on the benzene and may move it. In relying solely on intrinsic biodegradation, the risk of this movement is greater for a number of reasons discussed further below in this section in more detail. Therefore, in this respect, Alternative 2 provides the least long-term protectiveness.

Rather than relying on intrinsic biodegradation to contain the entire benzene plume, Alternatives 3, 4 and 5 alike use active hydraulic extraction and treatment to contain the benzene plume in the MBFC Sand. Because intrinsic biodegradation is merely a pre-existing condition in the soil, it cannot be controlled. However, hydraulic extraction and treatment can be designed and controlled directly to provide better, adjustable, and more reliable control of the possible movement of benzene in the MBFC Sand. The risks and implications of adverse benzene plume movement in the MBFC Sand during the course of the remedial action, if the benzene plume is not actively contained, are substantial. Of particular concern are: (1) the higher permeability of the MBFC Sand compared to the UBF and MBFB Sand, (2) uncertainties related to the sources of benzene and preferential flow paths in the MBFC Sand, and (3) uncertainties in contaminant migration pathways within the LBF. These factors are due to a number of factors including uncertainties and limitations of the model, inability to effectively monitor the LBF, which separates the MBFC Sand from the Gage Aquifer, and the inability to effectively characterize small-scale contaminant migration pathways within the MBFC Sand and LBF. These and other issues related to benzene movement in the MBFC Sand are further discussed later in this section under EPA's Rationale for the Selected Alternative.

The active hydraulic containment of the benzene plume in the MBFC Sand, found in Alternatives 3, 4, and 5 increases the certainty that the benzene plume will remain contained and will not move downward or sideways in response to pumping primarily targeted to the

chlorobenzene plume. Lack of reliable benzene containment could result in benzene migration outside the containment zone, which could slow the progress in restoring groundwater outside the containment zone to drinking water standards in either the short or the long term. The JGWFS concluded that it is feasible to adequately contain the benzene plume in the MBFC Sand under Alternatives 3, 4 or 5 provided active hydraulic containment is used.

Alternatives 3, 4 and 5 provide more certainty with respect to long-term containment of the benzene plume than does Alternative 2, and hence, more long-term effectiveness in this regard.

12.4 Short-Term Effectiveness

Short-term effectiveness is generally attributed to the time during which the remedial action is ongoing but has not yet attained remedial action objectives. In the case of the Joint Site, this time period is greatly extended, and so this characterization of "short term" is actually long-term in its implications, and therefore is somewhat blended in nature with long-term effectiveness. Therefore, the same aspects noted for long-term effectiveness and with respect to certainty of long-term protectiveness are, in this sense, applicable to short-term effectiveness. Alternatives 2 and 3 provide relatively poor short-term effectiveness compared to Alternative 4, and in turn, Alternative 5, in relation to removing the chlorobenzene plume outside the containment zone during the course of the remedial action. Alternatives 3, 4, and 5 provide superior (and roughly equal) short-term effectiveness in terms of containing the benzene plume during the course of the remedial action.

It is noted that all alternatives, other than the No Action Alternative, the condition of containment of the containment zone is attained relatively quickly. In addition, all of the alternatives, other than the No Action Alternative, would arrest the outward migration of the chlorobenzene plume soon after implementation, although the certainty of containment is higher with for Alternatives 4, and 5, sequentially, than for Alternatives 2 and 3, which espouse the lower 350 gpm pump rate.

Alternatives which provide better early-time performance clearly provide short-term effectiveness; that is, over the course of the remedial action, a greater portion of the contamination is removed in a shorter time frame. The public also thereby realizes the benefit of clean groundwater over a larger area sooner under such alternatives. In this regard, Alternatives 2 and 3 provide the poorest short-term performance, Alternative 4 much better short-term performance, and Alternative 5 the greatest short-term performance.

The alternatives do not differ much in terms of short-term issues such as dangers that may exist to the public or workers during construction. There is little risk in this regard and standard, excepted engineering practices are available to mitigate such risks. Any of the alternatives could be implemented safely with respect to the public and to workers.

12.5 Reduction of Mobility, Toxicity and Volume of Contaminants Through Treatment

Alternative 1, No Action, would not reduce the mobility, toxicity, or volume of contaminants through treatment.

In all alternatives other than No Action, treatment is employed in the form of hydraulic extraction and treatment of contaminants, to the majority of the groundwater, as presented in Section 11 of this ROD. The efficiency and rate at which the alternatives reduce the mobility, toxicity, and volume of contaminants, differs widely by alternative, however.

Reduction in Volume of Contaminants In-Situ

Because the volume of the containment zone will remain fixed indefinitely, the primary factor for comparison with respect to volume in-situ is the ability of the alternative to reduce the volume of contaminated groundwater outside the containment zone. At the end of the remedial action, assuming all remedial objectives have been achieved, all of the alternatives other than No Action would result in the same reduction in the volume of contamination. However, the efficiency of the alternative in producing this reduction increases as: (1) the pump rate of the chlorobenzene plume outside the containment zone increases, (2) the early-time performance increases, and the pore volume flushing increases or becomes more completely- and evenly-distributed under an alternative. Alternatives with superior pore volume flushing and early time performance result in greater volume reduction, and a greater percentage of the groundwater resource becoming usable, sooner.

Alternatives 2 and 3 have the least pump rate, early time performance, and poorest poor volume flushing, and therefore are the least effective at reducing the volume of contamination over time, followed in order by Alternatives 4 and 5.

Reduction in Mobility of Contaminants In-Situ

All alternatives would be roughly equally effective in containing the DNAPL at the Montrose Chemical Site. Likewise, all alternatives would be effective at stopping the outward expansion of the chlorobenzene plume.

However, Alternatives 3, 4, and 5 are more effective at containing the benzene plume over the long term, and hence are more effective at limiting the mobility of the benzene plume. This is because these alternatives employ active hydraulic extraction and treatment to contain the benzene plume in the MBFC Sand. Alternative 2, in contrast, relies on intrinsic

biodegradation for this purpose. With the hydraulic effects of pumping the chlorobenzene plume, reliance on intrinsic biodegradation provides less control and less certainty of containing the benzene plume in the MBFC Sand, and hence less control on benzene mobility.

Reduction in Toxicity of Contaminants In-Situ

At the conclusion of the remedial action, if all remedial objectives have been met, the total reduction toxicity in-situ would be the same for all alternatives. However, as discussed, Alterative 2 and 3 are the poorest in terms of the efficiency with which they would reduce the toxicity of groundwater and the size of the area of groundwater which would pose a toxicity. Alternative 4 is superior to Alternatives 2 and 3 in this regard, and Alternative 5 is superior to Alternative 4.

Reduction in Toxicity, Mobility and Volume of Contaminants That Are Removed From Ground

In terms of mobility, toxicity, and volume of contaminants *that are removed from the ground*, all alternatives would be similar in that the volume of contaminants would be greatly reduced, from the great extent of contaminated groundwater to a treatment stream of much smaller volume. With any of the technologies or treatment trains used, the contaminant is ultimately destroyed (either off site, as in regeneration of activated carbon, or directly in the treatment process, such as in fluidized bed reactor). Hence, the mobility, toxicity, and volume of the contaminant is reduced ultimately to zero.

12.6 Implementability

Alternative 2 is the easiest to implement of the alternatives. This is in part because it implies the least number of extraction wells and injection wells, and the smallest injection rate. Injection presents more engineering challenges as the required injection rates increase, although these challenges typically do not make injection infeasible at any of the pumping rates considered for this remedial selection. Alternative 2 would imply the smallest number of properties which would have to be accessed for purposes of installing wells and water conveyance lines for the treatment system. Alternative 2 would require a smaller treatment system, which may provide some implementability benefits, but these are not expected to be highly significant.

Alternative 3 presents a few more implementability issues than does Alternative 2, because a separate system must be built and designed to implement the pumping and treatment of the MBFC Sand. Because the water quality near the benzene plume is different than in the chlorobenzene plume in terms of parameters such as total dissolved solids (TDS), the need to extract and

discharge treated water from this plume forces additional design and engineering considerations. However, Alternative 3 is still highly implementable.

Alternative 4 would be somewhat more difficult to implement compared to Alternative 3 due to the greater number of extraction wells and equipment required. Alternative 4 will require access to more properties to install wells and conveyance lines. The treatment systems would have to be larger and more sophisticated under Alternative 4 than under Alternative 3. Alternative 4 also would likely pose additional engineering challenges associated with aquifer injection. As aquifer injection rates increase, the potential for well plugging and fouling also tends to increase. However, at the 700 gpm pump rate considered, these issues should not be inordinately difficult nor insurmountable. Alternative 4 is highly implementable.

Alternative 5 is somewhat more difficult to implement than Alternative 4 due to the greater number of extraction wells and equipment required. Alternative 5 also would likely pose greater engineering challenges associated with the doubled rate of aquifer injection over Alternative 4. As aquifer injection rates increase, the potential for well plugging and fouling also tends to increase. Alternative 5 would require access to the greatest number of properties for installation of wells and conveyances. The treatment systems would have to be larger and more sophisticated under Alternative 5 than under Alternative 4. At the 1400 gpm pump rate considered, these issues would not be insurmountable, however, they become much more significant than with Alternative 4. Alternative 5 is still implementable.

12.7 Cost

The costs of the remedial alternatives were presented in Section 11. Tables 11-2 shows the capital, operation and maintenance (O&M), and out-year O&M costs on a 30-year present worth basis. While it is recognized that the remedial action will take considerably in excess of 30 years, because of the depreciation rate in the value of future dollars when measured in present worth, the costs associated with time beyond 30 years is negligible. Approximate calculations performed during the JGWFS revealed that, if 100 years were used instead of 30 years, the present worth cost estimates would be only approximately 10 percent higher. Likewise, if 200 years were used instead of 100 years, the present worth cost estimates would be only 1 percent higher.

It is useful to examine what each increase among the alternatives cost "buys," starting from the minimal Alternative 2, which addresses the chlorobenzene plume with hydraulic extraction at 350 gpm and uses intrinsic biodegradation to contain the entire benzene plume.

Alternative 3 has hybrid containment of the MBFC Sand benzene plume, whereas Alternative 2 does not. The cost of obtaining this is approximately $5 million.

Alternative 4 has hybrid containment of the benzene plume and also addresses the chlorobenzene plume with hydraulic extraction at 700 gpm, double the rate of Alternative 3. It removes double the volume of the contaminated chlorobenzene plume at 25 years as does Alternative 3. Alternative 4 costs $4 million more than alternative 3, and $9 million more than Alternative 2.

Alternative 5 has hybrid containment of the benzene plume and also addresses the chlorobenzene plume with hydraulic extraction at 1400 gpm, double the rate of Alternative 5 and approximately 4 times the rate of Alternative 3. It removes about 1.5 times the volume of the contaminated chlorobenzene plume at 25 years as does Alternative 4, and about 3 times as much as Alternative 3. Alternative 5 costs $10 million more than Alternative 4, $15 million more than Alternative 3, and $19 million more than Alternative 2.

From this, it can be seen that while Alternative 5 offers superior performance in all respects (long and short term effectiveness, early time performance, pore volume flushing), the doubling of the extraction rate from Alternative 4 to Alternative 5 does not provide a doubling of the effectiveness as it does from Alternative 3 to Alternative 4. At the same time, the cost difference between Alternative 4 and 5 is more than double the cost difference between Alternative 3 and 4.

12.8 State Acceptance

The State of California has provided EPA with its written concurrence and acceptance of the remedy selected by this ROD.

12.9 Community Acceptance

Having held a public comment period and hearing and responded to all pertinent comments as required by law, EPA believes that the degree of community acceptance of the selected alternative is high.

12.10 Rationale for EPA's Selected Alternative

After consideration of the comments received during the public comment period and based on the administrative record, EPA is selecting ***Alternative 4,*** referred to in the JGWFS as *Benzene Hybrid Containment / Chlorobenzene Plume Reduction 2 (700 gpm).*

As discussed in earlier sections, the groundwater, should it ever be used, would present an unacceptable risk. Because the groundwater continues to move, new portions of the resource can become impacted by contamination in the future. The NAPL itself serves as a principal threat which continues to contaminate groundwater. The regulations direct EPA to restore this groundwater to drinking water standards in a reasonable time frame where it is practicable to do so (i.e. these standards are ARARs where not waived). The alternative EPA is selecting to remedy the groundwater contamination at the Joint Site eliminates the dissolved phase contamination outside the containment zone, meets ARARs where practicable, contains the principal threat, and safely contains contamination with a significant degree of certainty where it is not practicable to meet ARARs. ***Alternative 4*** represents an appropriate balance between performance and practicability, and also between long-term certainty of effectiveness and cost.

This section discusses EPA's rationale for this selection. It is noted that the rationale for the aspects of the proposed TI Waiver Zone were provided in Section 10. Also, the rationale for the approach to the TCE plume was provided in Section 11.

In April 1997, EPA's National Remedy Review Board (NRRB) reviewed EPA's intended proposed remedial action for the Joint Site groundwater and supported it.

All of the alternatives considered, except for Alternative 1, No Action, imply the presence of a hydraulic containment zone for NAPL for an indefinite duration, perhaps centuries. Such time frames are far beyond our present capabilities to model or anticipate. While not losing sight of cost effectiveness, EPA has placed a premium of value on actions that will reduce the long-term uncertainty in the remedy. It is difficult to assess whether, for instance, EPA or the responsible parties will exist in 500 years to ensure the remedy remains effective and protective. It is true that presently it is not possible to clean all groundwater at the Joint Site to drinking water standards. While this must be accepted, it is for the same reason appropriate to deal with long-term uncertainties conservatively. In many ways which are discussed in the JGWFS, the duration of this remedial action is directly related to the uncertainty as to its long-term success. Therefore, when more of the plume is removed early, less of the plume remains subject to large long-term uncertainties. This means it is appropriate to value the alternatives which provide early time performance and take less time to implement. Likewise, alternatives with more certainty of

maintaining reliable containment of the NAPL zones are favored by EPA over those providing less certainty, because the containment must be in place and effective for such a long time.

Alternative 4 (as Alternatives 2, 3 and 5) hydraulically isolates the NAPL so that the largest reasonable portion of the contaminated groundwater can be restored to drinking water standards and to limit the potential for human exposure to contaminated groundwater. The selected action also arrests the further lateral and vertical movement of all plumes.

While addressing NAPL isolation (both by hydraulic containment and by intrinsic biodegradation), Alternative 4 (as well as 2, 3, and 5) also mitigates drawdowns and reduction in interstitial pore pressures near the NAPL, factors which could otherwise induce NAPL to migrate downward. EPA has soundly and consistently considered the issues of adverse migration and plume interactions (NAPL movement and the inducement of movement of one plume due to actions focused on another plume). The potential for such factors has been addressed and modeled in detail by the feasibility study. EPA's evaluation and consideration of potential adverse migration and plume interactions is manifest in the very design of the alternatives (e.g. the pump rates considered), is a principal factor in the selection among the alternatives, and plays a prominent role among the ROD requirements in Section 13 of this ROD. Alternative 4 strikes a good balance between (1) reducing the size of the plume outside the containment zone at an acceptable rate, with significant early time performance and substantial and well-distributed pore volume flushing, on the one hand, and (2) avoiding movements of contaminants and other situations which might make the contamination worse or cause net delays in the cleanup effort.

Finally, as discussed, EPA assumes for the purposes of this analysis that NAPL is recovered (removed) from, and/or immobilized at, these sites to the extent determined appropriate by a separate remedial action selection process. This NAPL removal has the potential to limit the degree to which the NAPL can move, increasing the long-term certainty of effectiveness of this proposed groundwater remedy.

Rationale With Respect To The Chlorobenzene Plume

As discussed, with respect to the chlorobenzene plume, Alternative 4 provides greater and better-distributed pore volume flushing, stronger early time performance, and a shorter overall cleanup time as compared to Alternatives 2 and 3. This means overall uncertainties of long-term remedy performance and of meeting the remedial action objectives are lower, including ultimate attainment of drinking water standards. While the performance of Alternative 4 is markedly superior to that of Alternatives 2 and 3, the cost of Alternative 4 is only $4 million more than the cost of Alternative 3. EPA therefore favors Alternative 4 over Alternatives 2 and 3 for the reasons discussed at the beginning of this section.

EPA does not believe that the low rate of cleanup provided by Alternatives 2 and 3 provides for too much uncertainty that remedial objectives, including ARARs, will ultimately be achieved and that the remedial action will be fully protective of human health for the long term. The poor and sporadic pore volume flushing adds to this conclusion. Also, because these alternatives provide poor early-time performance with respect to the chlorobenzene plume, it would take much longer under these alternatives to realize any environmental gains (in terms of usability of the aquifer resource) and it is much less certain that the cleanup time frame can be considered "reasonable."

Based on the findings in the JGWFS, there is no reason to accept the low degree of aggressiveness and cleanup rate posed by Alternatives 2 and 3, as it is feasible to design the remedy at the higher pump rates posed by Alternative 4 without incurring significant additional risk of adverse contaminant migration or plume interaction. It is noted that this ROD requires that the remedial action be designed in such a way that such adverse migration is limited and that containment of the containment zone is accomplished. Hence, the wellfields used in the JGWFS can be adjusted in the remedial design as necessary to accomplish this objective. At the same time, as discussed in Section 11.1, this ROD requires that limiting of adverse migration take place within the context of meeting all other remedial action objectives and requirements in this ROD, rather than take preeminence over these.

The performance of Alternative 5 is clearly superior to that of Alternative 4. In fact, the model predicts that almost all of the chlorobenzene plume is removed in 25 years. Alternative 5 provides higher, but roughly as-well-distributed pore volume flushing rates compared to Alternative 4. However, Alternative 5 costs $10 million more than Alternative 4, and the relative increase in performance is less than the increase of Alternative 4 over Alternative 3. In addition, Alternative 5 poses some issues with implementability which would likely be of lesser prominence than with Alternative 4. While EPA does not believe these issues would be insurmountable, it is possible that the true costs of Alternative 5 could be higher in dealing with such issues (e.g. plugging of re-injection wells at higher injection rates).

In this ROD, EPA has specified other performance criteria in addition to the approximate pumping rate to be used with respect to reduction of the chlorobenzene plume outside the containment zone. While the pumping rate was the primary basis for distinguishing among wellfields and alternatives in the JGWFS, it was chosen because of its ability to produce an expected result. Hence, this ROD specifies not only that the remedial action primarily targeting the chlorobenzene plume be constructed and operated at approximately 700 gpm, but that it be designed to remove 33 percent of the plume in 15 years, 66 percent of the plume in 25 years, and 99 percent of the plume in 50 years, as measured by a refined computer model during the remedial design phase of the remedial action, and that progress toward these targets be monitored during the course of the remedial action. It is recognized that the model will not predict actual cleanup times, but progress can be tracked on a relative basis. The ROD also requires that a basic

minimum average pore volume flushing rate be achieved by the remedial system. These requirements are provided in Section 13 of this ROD.

Rationale With Respect To The Benzene Plume

Alternative 4 (as do Alternatives 3 and 5) contains hybrid containment for the benzene plume, which means that biodegradation is relied upon for the UBF and the MBFB Sand, but that the benzene in the MBFC Sand is contained by active hydraulic extraction. This is an appropriate balance between cost and long-term certainty of containing the benzene plume.

The UBF and the MBFB Sand are fine-grained units in which the groundwater flow velocities are very low. While they are classified as drinking water units, their relatively low ambient water quality, low water-producing potential, and small aquifer thickness make them less-likely candidates for actual groundwater use. There is strong evidence for intrinsic biodegradation and a relatively stable benzene plume in these units under natural conditions. The risk of a failure of intrinsic biodegradation to contain the benzene plume in these units is relatively low. It is appropriate to rely on intrinsic biodegradation in this case, so long as contingent active hydraulic extraction is also required in the event that intrinsic biodegradation fails to keep the benzene plume contained. This ROD applies contingencies as part of the selected remedial action for the benzene plume.

However, the considerations for the benzene plume in the MBFC Sand are different. EPA's evaluation led to the conclusion that the risks of relying solely on intrinsic biodegradation for the benzene plume in the MBFC Sand are not acceptable if a sufficient cleanup rate is to be achieved for the chlorobenzene plume. Such risks include not only the potential for benzene movement but the implications if benzene does move. Using hydraulic extraction and injection to contain the benzene plume in the MBFC Sand, assuming such containment is properly designed and optimized, is safer and more reliable.

EPA's conclusion accounts for several other factors other than the modeling results themselves, including:

- The MBFC Sand and Gage Aquifers are thicker, more permeable, and deeper, than the UBF and MBFB Sand, and are characterized by higher groundwater flow velocities, and therefore deviations between simulations and reality are more critical (contamination is closer to water actually being used for drinking, has more production potential, and the water has the potential to move more quickly);

- The Gage Aquifer is the first significantly-water bearing unit in which the benzene plume does not occur; at the same time, it is much more likely to be used as a drinking water

source than is the MBFC Sand (noting that the State of California designates all units at the Joint Site as having potential potable beneficial use);

- Vertical migration into the Gage Aquifer is of paramount concern and protection of the Gage Aquifer critical;

- The LBF separating the MBFC Sand and the Gage Aquifer is very fine-grained and cannot be effectively monitored;

- The sources of benzene in the benzene plume of the MBFC Sand are not well understood; this was discussed earlier in this ROD in Section 7, "Summary of Site Characteristics;"

- The movements of contaminants from the MBFC Sand through the LBF into the Gage Aquifer are likely to be heavily influenced by localized phenomena such as preferential flow paths;

- The model used in the JGWFS is not appropriate for modeling vertical contaminant *transport* from the MBFC Sand through the LBF into the Gage Aquifer (See Section 7 and the Response Summary of this ROD for more discussion on this issue);

- Additional modeling optimization is unlikely to overcome the uncertainties posed by the above conditions of the hydrostratigraphic units and modeling limitations;

- The vertical transport of benzene into the Gage Aquifer can only be monitored with wells placed in the Gage Aquifer; however, if benzene arrives there, it is "too late" in that benzene has already loaded the LBF and contamination of the Gage has occurred.

The modeling simulations resulted in small movements of benzene toward the chlorobenzene plume under the various pumping rates for chlorobenzene which were simulated. This simulated movement was small, however it is precisely in the area least desirable for benzene movement. Benzene at this location would be entering the chlorobenzene plume and possibly moving downward into the Gage Aquifer.

EPA stresses that the modeling used in the JGWFS is unreliable for predicting the movement of benzene from the MBFC Sand into the Gage Aquifer. This is discussed earlier in Section 7, "Summary of Site Characteristics" as well as in detail in the Response Summary. The fact that this limitation exists does not in any way impugn the model's validity. All models have limitations. Models should be used only for the purposes which lie within their identified limitations, and should not be extended to purposes beyond.

In this case, the model is highly useful for a wide variety of JGWFS uses, but not in particular for predicting the movement of benzene from the MBFC Sand into the Gage Aquifer. Therefore, while the model predicts no vertical migration into the Gage Aquifer, EPA does not consider this result reliable, and the risks of benzene movement in response to pumping primarily targeting the chlorobenzene plume are greater than the model would imply. EPA believes that the modeling uncertainties and the higher risk factors associated with the MBFC Sand combine to make reliance on intrinsic biodegradation to contain the benzene plume for the MBFC Sand risky. It is for this reason that EPA screened out alternatives which relied on intrinsic biodegradation for the MBFC Sand at the higher 700 and 1400 gpm pump rates for chlorobenzene. For the same reasons, EPA believes that Alternative 2 presents a risk which is not warranted given the relatively small additional cost of active hydraulic containment of the MBFC Sand and therefore prefers Alternatives 3, 4 and 5 to Alternative 2 with respect to this issue.

Alternative 4 contains active hydraulic containment of the MBFC Sand, which can be designed and manipulated to provide the maximum hydraulic control and therefore the maximum certainty in the long term that the benzene plume will remain contained. It is noted that it is much easier and far less costly to establish containment by hydraulic extraction in the MBFC Sand, than in the fine-grained MBFB Sand or the UBF.

Rationale for Remedial Actions for pCBSA

Section 7, "Summary of Site Characteristics" outlined the distribution of the chemical para-chlorobenzene sulfonic acid (pCBSA) and Section 8, "Summary of Groundwater-Related Risks" discussed its toxicological status. pCBSA is a byproduct of the manufacture of DDT, created when sulfuric acid sulfonates monochlorobenzene, one of the raw materials for making DDT. The compound is highly water soluble which reduces its retardation coefficient and has resulted in its moving a greater distance in groundwater than chlorobenzene (See earlier sections). There are no promulgated standards or reliable toxicological reference values for pCBSA. While some studies have been completed with respect to pCBSA, no chronic (long-term) studies have been performed and the studies are insufficient to allow EPA to set toxicological reference values or establish health-based standards. No studies of pCBSA are planned or underway at this time.

The JGWFS has shown that treatment of pCBSA will not occur coincidentally with the treatment of the other groundwater contaminants, if the most cost-effective technology for the other contaminants is employed. An explanation follows. The JGWFS did show that concentrations of pCBSA in the extracted groundwater effluent stream could be dramatically reduced by the treatment train which includes Fluidized Bed Reactor (FBR) plus liquid-phase carbon adsorption polishing. Tests indicate that FBR would be effective at destroying 95-99 percent of the pCBSA. This treatment train is one of three that this ROD selects as available in remedial design. However, in the absence of a promulgated health-based standard for pCBSA, and in turn, an

ISGS under this ROD, there is not an established concentration to which pCBSA concentrations in-situ (concentration remaining in the ground) must be reduced that can numerically drive the analysis of the technology used. Therefore, the-situ concentration of pCBSA will be reduced only if this reduction occurs coincidentally with the treatment used to achieve ISGS levels in groundwater for all other contaminants at the Joint Site.

While FBR plus carbon adsorption polishing is available and effective at treating the other contaminants as well as pCBSA, it was determined that liquid phase carbon adsorption acting alone, rather than FBR, would be the most cost-effective treatment train for attaining the health-based standards of all other contaminants. Unfortunately, liquid phase carbon adsorption performs rather poorly at removing pCBSA from groundwater. While this technology does remove some pCBSA, impractically large amounts of carbon are needed to achieve significant removal over extended periods of time.

The JGWFS evaluated the additional cost of using FBR plus carbon adsorption to address the Joint Site groundwater in the case where significant active treatment of pCBSA is required. As stated earlier, no health-based value was available for pCBSA to assume as a target cleanup concentration, so 99 percent removal of pCBSA was assumed for this analysis. This is the demonstrated removal efficiency/capability of FBR. The additional cost of using FBR, with all other parameters and assumptions constant, was on the order of $5 million.

This figure, however, represents only the additional cost of treating the pCBSA that lies *within* the chlorobenzene plume. The alternatives in the JGWFS assumed capture and mass/volume reduction for the chlorobenzene plume, and treatment and discharge of the resulting extracted groundwater. But the pCBSA distribution is *larger* than the chlorobenzene plume in all directions. Hence, as the JGWFS notes, the costs of capturing and reducing the much larger pCBSA distribution (over what would be a longer time period) and treating all of the water using FBR, would be far greater than this $5 million. To obtain an accurate estimate of the full additional cost of addressing all pCBSA ***in-situ***, a wide-ranging expansion of the feasibility study and its modeling would have been necessary. While this was not performed, the JGWFS reasonably concludes that the costs for such an endeavor could be in the many tens of millions of dollars and could double the cost of the remedial action.

If carbon adsorption acting alone is used, the pCBSA will, for the most part, not be removed from the extracted groundwater, which will then be re-injected into the aquifers. The result of this aquifer injection is that in-situ concentrations of pCBSA will decrease and become more evenly-distributed overall due to dilution. However, the pCBSA will cover a somewhat larger area of groundwater in the process. Modeling suggests that after 50 years under Alternative 4, concentrations of pCBSA will average 1000-5000 ppb over the entire distribution of pCBSA.

Having found no *in-situ* standards which might apply to pCBSA, EPA evaluated whether there were other requirements that might apply to *injection* of pCBSA into the aquifer. As discussed earlier in this ROD, aquifer injection is a necessary component of this remedy in order to achieve the hydraulic control necessary to prevent adverse migration of contaminants and NAPL, and to limit the effect of the remedial action on contamination sites outside the Joint Site. While the State of California did not identify any such injection standards to EPA, the State did request that EPA consider a non-promulgated To-Be-Considered criterion (TBC) of 25,000 ppb as a limit on the concentration at which pCBSA could be injected into the aquifer. Upon consideration of this TBC, EPA has decided to make it a ROD standard for this remedial action.

In April 1997, EPA's National Remedy Review Board (NRRB) reviewed EPA's intended proposed remedial action for the Joint Site groundwater and supported it. While the NRRB had no direct recommendations, they did issue a statement that they assume that EPA can seek to address costs associated with pCBSA by various elements of the remedial design. EPA will address this in the remedial design phase. It was noted, also, that the NRRB was in accordance with EPA's proposal not to actively capture or treat the pCBSA plume at this time.

In light of the above analysis and information, EPA has selected a set of remedial actions for pCBSA separately from the other groundwater contaminants at the Joint Site. Based on the extent of knowledge at this time, *these remedial actions are protective of human health and the environment.* These actions do not require that the area of groundwater affected by pCBSA be captured or reduced in volume. We note that no one is presently drinking water contaminated by pCBSA, though as with the other contaminants at the Joint Site, the potential for future use of the groundwater resource, either from the existing contaminant distribution of after that distribution has spread to a larger area, is possible. Future toxicological studies may reveal data or results which would allow for setting a health-based standard for pCBSA, in which case the continued protectiveness of the remedial action with respect to pCBSA would have to be reassessed by EPA. While EPA does not have direct control over which chemicals are studied, EPA is informing those with influence in this regard about the pCBSA at the Joint Site so that they can prioritize it properly among all other chemicals awaiting study.

As discussed in Section 11, the following remedial actions are selected by this ROD for pCBSA:

- The concentration at which pCBSA is re-injected into the ground shall be limited to 25,000 ppb. The State of California holds that 25,000 µg/l can be considered a provisional health standard for pCBSA with respect to injected groundwater. This requirement is a non-promulgated standard of the State of California (See Section 8 of this ROD), however, it is selected by this ROD as a performance standard for injected groundwater.

- The full downgradient extent of pCBSA contamination shall be determined and the movement of pCBSA shall be routinely monitored.

- Sampling at potentially susceptible public production wells shall include analyses for pCBSA.

- Well surveys shall be routinely updated to identify any new wells which may lie within the pCBSA distribution.

- At the Superfund 5-year reviews required by law, EPA will re-evaluate whether additional toxicological studies have been performed for pCBSA, assess the extent of the pCBSA plume and make determinations as to whether the remedy remains protective with respect to pCBSA

Finalizing of the Del Amo Waste Pits ROD

On September 5, 1997, EPA issued a ROD for the Del Amo Waste pits. This ROD specified that the remedial (cleanup) standards for soils under the Waste Pits were to be considered interim pending a decision by EPA on the groundwater. This was because it was not known at that time what the joint groundwater ROD would select as groundwater standards under the Waste Pits. This ROD establishes a TI waiver zone which includes the groundwater under the Waste Pits. This means that the water under the Waste Pits will not be restored to drinking water standards by the remedial action. EPA believes, therefore, that the currently-existing soil standards in the Del Amo Waste Pits ROD will be sufficient to prevent significant additional contamination from entering the groundwater at that location, and will allow for groundwater remedial action objectives to be satisfied.

The interim soil standards in the Waste Pits ROD were not based on cleaning soil under the Waste Pits so as to achieve drinking water standards in groundwater. Rather, the goal of the interim standards was to ensure that any additional contamination coming from the Waste Pits in the future would be small relative to the existing contamination already in the groundwater. In effect, this was to control the Waste Pits as a major source of additional contamination.

While the remedy selected by this ROD places the Waste Pits in a TI waiver zone, EPA believes it is still prudent to limit the amount of additional contamination that can be added by the Waste Pits to the groundwater system. The TI waiver waives the requirement to clean groundwater to drinking water standards, but it does not preclude reasonable and appropriate source control measures to ensure that large quantities of additional contamination, NAPL or otherwise, do not arrive in the groundwater. The interim standards were set based on this goal. Accordingly, EPA

makes final the soil standards for the Del Amo Waste Pits as they currently exist in the Waste Pits ROD.

13. Specification of the Selected Remedial Action: Standards, Requirements, and Specifications

The remedial action implemented as selected by this ROD shall meet the standards, requirements, specifications, and provisions (hereafter, "provisions" unless otherwise noted) contained in this section. The remedial action shall be designed with the express purpose and intention of meeting these provisions. Discretion and latitude shall be preserved in designing the remedy within the range of possible designs meeting the requirements of this section. There are provisions which are established in other sections of this ROD. The provisions in this section apply *in addition* to, and not in lieu of, provisions which appear before or after this section of the ROD.

As previously established, this ROD selects differing remedial actions and objectives to apply to various areas of the groundwater at the Joint Site that are defined in this ROD. Some of the provisions vary depending on the hydrostratigraphic unit that is the subject of the provision. The reasons for this were established and discussed previously.

As discussed in Section 7.2 of this ROD, the term "plume" has a specialized use in this ROD. The formal definition of each plume is provided in this Section. "Plume" does not always refer to the entire distribution of a contaminant in groundwater, but rather refers to a particular portion of the distribution which espouses a certain set of physical characteristics and will respond to one set of remedial actions and objectives (See Section 7). The term "plume" applies to all hydrostratigraphic units within which a referenced plume occurs unless otherwise stated.

The following hydrostratigraphic units are referenced and addressed by this ROD:
Upper Bellflower, Middle Bellflower B Sand (MBFB Sand), Middle Bellflower C Sand (MBFC Sand), Lower Bellflower Aquitard, Gage Aquifer, Gage-Lynwood Aquitard, Lynwood Aquifer, Lynwood-Silverado Aquitard, and Silverado Aquifer.

For convenience and clarity, the provisions in this ROD are numbered and are segregated into subsections with headings.

PROVISIONS

1 Provisions Apply to the Joint Site.

All provisions below apply to the Joint Site. The term *Joint Site* was defined in Section 6 of this ROD. It is noted that the Joint Site includes any physical space within the groundwater to which contaminants may move, either vertically or laterally, during the course of the remedial action.

2 In-Situ Groundwater Standards (ISGS).

The particular in-situ concentration for each contaminant which this ROD requires be attained in groundwater at the conclusion of the remedial action is referred to by this ROD as the ***in-situ groundwater standard***, or ***ISGS***. This ROD establishes the ISGS for the Joint Site groundwater as the lower of the State or federal Maximum Contaminant Level (MCL) as established under the Safe Drinking Water Act. In cases of contaminants where MCLs do not exist, the ISGS shall be EPA's Tap Water Preliminary Remediation Goals, which are based on the lower of a 10^{-6} cancer risk or a non-cancer hazard index of unity for residential exposure assumptions. The ISGS levels were shown in Table 9-1, and discussed in Section 9 of this ROD.

3 Definition of Plumes.

This remedy assigns differing provisions, remedial actions, and objectives to various areas of groundwater. Each such area is referred to as a "plume" by this ROD. Section 7.2 of this ROD, "Convention for Dividing the Contamination into Plumes," provides the basis for dividing the overall distribution of contamination in this fashion. Unless otherwise noted, the term *plume* as used in this section shall be defined under this provision. Provisions not specifying applicability to a specific plume shall apply to all groundwater at the Joint Site, unless otherwise noted in the provision.

3.01 **Chlorobenzene Plume.** The *chlorobenzene plume* shall include the entire distribution of chlorobenzene in groundwater at the Joint Site, *and* all other contaminants that are commingled with the chlorobenzene. Benzene, trichloroethylene (TCE), perchloroethylene (PCE), and a variety of other contaminants are present within the chlorobenzene plume. The chlorobenzene plume is present in the MBFB Sand (the UBF is unsaturated in the area where the chlorobenzene plume occurs), the MBFC Sand, the Lower Bellflower Aquitard (LBF), the Gage Aquifer, the Gage-Lynwood Aquitard, and the Lynwood Aquifer, based on data collected in the remedial investigation.

3.02 **Benzene plume.** The *benzene plume* shall include the portion of the distribution of benzene in groundwater at the Joint Site *that is not commingled* with chlorobenzene. Put another way, the benzene plume is that benzene within the Joint Site that lies outside the chlorobenzene plume. The benzene plume occurs in the UBF, the MBFB Sand, and the MBFC Sand, based on data collected in the remedial investigation. Benzene that is commingled with chlorobenzene is not considered to be part of the benzene plume, but is instead part of the chlorobenzene plume. The benzene plume includes ethyl benzene and naphthalene, among other contaminants.

3.03 **TCE.** The term *TCE,* unless otherwise noted, when used in reference to a plume or contaminant distribution in groundwater, shall represent a series of chlorinated aliphatic VOCs, including but not limited to TCE, PCE, dichloroethylene (DCE), trichloroethane (TCA), and any isomers of these compounds in groundwater at the Joint Site. The term does not include chlorobenzene or polychlorinated benzenes.

3.04 **TCE Plume.** The *TCE plume* shall include the portions of the distributions of any such contaminants in groundwater at the Joint Site *that are not commingled* with the chlorobenzene plume. The TCE plume occurs in the UBF, the MBFB Sand, and the MBFC Sand, based on data collected during the remedial investigation. The TCE plume in the UBF and MBFB Sand is commingled with the benzene plume. The downgradient extent of the TCE plume in these units does not exceed the extent of the benzene plume. The TCE plume in the MBFC Sand lies *under* the benzene plume in the MBFB Sand and north of the benzene plume in the MBFC Sand (See Figures 7-2 and 7-4). TCE (chlorinated solvent) contamination outside the chlorobenzene plume which may exist in the Gage Aquifer is not considered to be part of the TCE plume and will be addressed separately. TCE that is commingled with chlorobenzene is not considered part of the TCE plume but is part of the chlorobenzene plume.

4 Additional Data Acquisition

4.01 **TCE Plume.** The current downgradient extent of the TCE plume is bracketed by several downgradient wells that have non-detect values for TCE concentration. This, combined with its location relative to the benzene NAPL, allows for this remedy to address the TCE (See Section 11). However, additional data is necessary in order to complete remedial design for the remedy. It is noted that portions of the remedial design could be completed without this data. Sufficient monitoring wells shall be installed and sampled in the UBF, the MBFB Sand, MBFC Sand, and the Gage Aquifer to:

(1) identify and characterize the sources of chlorinated solvents in the TCE plume, including their location and the possible presence of NAPL associated with these sources, and

(2) define the distribution sufficiently to allow for a remedial design of the remedial action selected by this ROD.

4.02 **Benzene Plume in the MBFC Sand.** In the remedial investigation, monitoring wells were never installed in the MBFC Sand under or near-downgradient to the high concentrations of benzene which were eventually discovered in the MBFB Sand near what is today called the "WRC building" in the eastern portion of the benzene contaminant distribution. These wells shall be installed and sampled under this remedy during the remedial design phase. The number of wells, their location and construction design shall be established in the monitoring plan for the remedial action and shall be subject to the approval of EPA.

4.03 **Well Survey.** The well survey for the Joint Site shall be updated. Wells existing within one-half mile of the area of groundwater contamination at the Joint Site (including pCBSA contamination), shall be identified and mapped. The well survey shall be a document of public record on file with EPA Region IX. Well surveys shall be further updated as described in later subsections, below.

4.04 **pCBSA.** The extent of the contaminant para-chlorobenzene sulfonic acid, or pCBSA, downgradient and side-gradient from the Montrose property shall be determined by installation and sampling of additional wells. The extent shall be determined to a non-detectable concentration as determined and approved by EPA in its Monitoring Plan for the Joint Site remedy, which is required by this ROD. Production wells within 1 mile of the terminus (downgradient extent) of the pCBSA distribution and within one-half mile cross-gradient as determined by the midline of the pCBSA distribution shall be tested for pCBSA and the results shall be made available to the public. Additional monitoring requirements after the initial sampling are addressed below under Monitoring. Provisions for finding pCBSA in production wells are provided below under "Ensuring Protection of Human Health During the Course of the Remedial Action."

5 Containment Zone

5.01 Dissolved phase contamination in a specific zone of groundwater, defined in the provisions which follow, shall be contained and isolated indefinitely such that the contamination cannot escape the zone. This zone is referred to by this ROD as the ***containment zone***[1]. There shall be a single containment zone for the Joint Site. The basis for the size and configuration of the containment zone (and TI waiver zone) was discussed in Section 10, "Technical Impracticability Waiver and Containment Zone" in this ROD.

5.02 The containment zone shall surround the NAPL in a region of groundwater, defined in this ROD, to which remedial actions selected by this ROD shall be applied to prevent the escape of dissolved-phase contaminants. The containment zone shall be implemented such that dissolved phase contaminants within the containment zone, and contaminants dissolving from NAPL within the containment zone, shall be prevented from escaping the containment zone and from entering the groundwater outside the containment zone. The NAPL, and all contaminants within the containment zone, shall thereby be *isolated* from the groundwater outside the containment zone.

5.03 Dissolved phase contamination within the containment zone shall be considered contained when it is reliably prevented from moving outside the containment zone by the remedial actions selected by this ROD, in accordance with the specifications, requirements, and standards established by this ROD.

5.04 **Geographical Definition.** The technical basis for the size and shape of the containment zone was discussed in Section 10. Although its shape, size and extent were determined by EPA using a scientific basis, the containment zone is established by this ROD *geographically*. That is, the extent of the containment zone is not conditional but represents a fixed volume in space, defined by the boundaries herein described.

5.05 **Specification of Lateral Extent of the Containment Zone.** The lateral extent of the containment zone in the various hydrostratigraphic units shall be as depicted in Figure 10-1. The lateral extent of the containment zone differs by hydrostratigraphic unit, and is based on the various arguments provided in Section 10 of this ROD.

5.06 **Lateral Extent of Containment Zone in the Lower Bellflower Aquitard (LBF).** The containment zone shall have the same lateral shape, size and extent in the LBF as in the

[1]The use of the term "containment zone" in this ROD does not reflect a formal establishment of a containment zone as that term is used in, and per the requirements of, California State Water Resources Control Board Resolution No. 92-49(III)(H).

MBFC Sand, *within the chlorobenzene plume*. The containment zone shall have no extent in the LBF outside the chlorobenzene plume.

5.07 **Depth of the Containment Zone Within the Chlorobenzene Plume.** The containment zone shall extend through the Gage Aquifer and all shallower hydrostratigraphic units *within the chlorobenzene plume*. The containment zone shall not include any extent in the Gage-Lynwood Aquitard or the Lynwood Aquifer.

5.08 **Depth of the Containment Zone Within the Benzene and TCE Plumes.** The containment zone shall extend through the MBFC Sand and all shallower hydrostratigraphic units *in the TCE and benzene plumes*. The containment zone shall exclude the Lower Bellflower Aquitard, the Gage Aquifer, and the Lynwood Aquifer in these plumes.

6 Technical impracticability ARAR waiver

6.01 Specific applicable or relevant and appropriate requirements (ARARs), which EPA has determined would otherwise apply to this remedy, shall be waived due to technical impracticability as provided by CERCLA at 42 U.S.C. §9621(d)(4)(C) and 40 C.F.R.-300.430(f)(1)(ii)(C)(3). This waiver shall apply solely and specifically to a zone of groundwater referred to in this ROD as the ***TI waiver zone***. Because the TI waiver is being applied exclusively to the containment zone defined in Provision 5 above, the terms *TI waiver zone* and *containment zone* are congruent and refer to the same physical space with respect to this remedy for the Joint Site. This waiver shall not apply to any other groundwater within the Joint Site. The basis for this waiver is discussed earlier in this ROD in Section 10 and is provided in detail as Appendix E of the JGWFS.

6.02 The ARARs to be waived based on technical impracticability for the TI waiver zone are identified in Appendix A of this ROD. The primary ARARs being waived under the TI waiver, where it applies, is the requirement that concentrations of contaminants in groundwater be reduced to at or below the MCL (promulgated drinking water standards), as discussed in Section 9 of this ROD.

6.03 The TI waiver is necessary because it will not be practicable to restore groundwater within the TI waiver zone to MCLs within a reasonable time frame as required by the National Contingency Plan (NCP). This is discussed in Section 10 of this ROD and in Appendix E of the JGWFS. This is due to the presence of NAPL under the specific site conditions it occurs at the Joint Site.

6.04 The TI waiver shall apply to all contaminants within the TI waiver zone, regardless of whether a particular contaminant provided the original basis for the waiver. This was discussed in the JGWFS and in Section 10 of this ROD.

7 Containment of the Overall Contaminant Distribution.

In addition to meeting all other provisions in this ROD (including but not limited to requirements to reduce the volume of the chlorobenzene plume that has concentrations exceeding the ISGSs for any contaminant), the remedy shall achieve containment of the overall contaminant distribution in that the physical size of the union of the chlorobenzene, benzene, and TCE plumes shall not increase from such point in time as the remedial action is initiated. As a corollary, the lateral extent of the overall contaminant distribution in each of the contaminated hydrostratigraphic units shall not increase, and the vertical extent of the overall contaminant distribution shall not increase. The chemical pCBSA shall not be subject to this provision for reasons discussed in Section 12 of this ROD.

8 Containment Within the Containment Zone.

8.01 Dissolved phase contaminants within the containment zone shall remain contained to the zone and shall not escape the zone. This condition shall be preserved indefinitely by this remedial action. Contaminants shall not leave the containment zone either laterally or vertically at any point along the three-dimensional boundary of the containment zone.

8.02 **Means by Which Containment Shall Be Achieved Within the Containment Zone**

8.02.01 **Chlorobenzene Plume.** Containment of the chlorobenzene plume within the containment zone shall be affected by hydraulic extraction of groundwater from one or more extraction wells, followed by treatment of extracted water, followed by aquifer injection of the treated water through one or more injection wells. Provisions for aquifer injection under the "Plume Reduction" section of provisions below shall apply to this injection. Hydraulic extraction and aquifer injection of water shall be optimized in remedial design to ensure that containment is achieved and that the other provisions in this ROD are attained.

8.02.02 **Benzene Plume in the UBF and MBFB Sand.** Containment of the benzene plume within the containment zone shall be effected by reliance on monitored intrinsic biodegradation. It is recognized that other natural processes may aid in the containment of the benzene in these units. However, it is the process of intrinsic biodegradation which makes the reliance on natural processes for these units feasible from a remedial standpoint. The continued stability and containment

of the benzene plume in the UBF and MBFB Sand shall be monitored as specified below, and if transgressions of containment occur, contingencies shall be implemented, as specified below.

8.02.03 **Benzene Plume in the MBFC Sand.** Containment of the benzene plume within the containment zone in the MBFC Sand shall be effected by hydraulic extraction of groundwater from one or more extraction wells, followed by treatment of extracted water, followed by discharge of the treated water. Discharge provisions are given below. Such hydraulic extraction shall independently establish the capture of the benzene plume within the MBFB Sand.

Other actions such as the adjustment of the locations and flow rates of injection and extraction wells being used for other elements of the remedy may be employed during the optimization of the remedial design to assist the hydraulic extraction in achieving containment of the benzene plume in the MBFC Sand. However, these actions shall not be taken *in lieu* of hydraulic extraction required under this provision.

It is recognized that intrinsic biodegradation is also occurring to the benzene in the MBFC Sand, and that this naturally-occurring process will, to a significant extent, assist the active processes to be implemented by this provision in containing the benzene plume in the MBFC Sand. However, by virtue of the analyses put forth in the JGWFS and earlier in this ROD, this ROD is explicitly selecting *active* hydraulic containment, as the remedial action for the benzene plume in the MBFC Sand. The optimization of aquifer injection being performed for the chlorobenzene plume shall also be performed during remedial design to limit the potential for transgressions of benzene containment.

8.02.04 **TCE Plume.** Containment of the TCE in the NAPL containment zone shall be partially accomplished by hydraulic extraction of groundwater from one or more extraction wells, followed by treatment of extracted water, followed by discharge of the treated water. Specifically, this groundwater extraction shall be undertaken at low pump rates close to the TCE sources which are indicated by existing data to lie within the containment zone but upgradient of the benzene NAPL. Additional data on TCE sources shall be collected as provided above prior to executing this response action. This action shall occur at low pump rates sufficient solely to:

1. Contain the immediate TCE source locations, and
2. Provide a control on the amount of mass leaving the sources and entering the greater TCE plume.

This action will not actively contain the entire TCE plume. Containment of the remainder of the TCE plume shall be accomplished by the contingencies provided below. Such contingencies shall be activated if the extent of the TCE plume currently within the containment zone/TI waiver zone comes to exceed the containment zone/TI waiver zone.

During remedial design, the overall remedial system shall be designed to take advantage of injection and other hydraulic controls so as to limit the movement of the TCE in response to hydraulic extraction being undertaken under this remedy for the chlorobenzene and benzene plumes.

8.02.05 **Optimization.** In the remedial design phase of the remedy, the remedial wellfield and relative pump rates among wells in the wellfield shall be optimized so as to limit the lateral and vertical movement of TCE. Such optimization in design shall also be performed so as to maximize the certainty of containment of contamination within the containment zone. However, such optimization shall not counter or override meeting any of the other requirements and provisions in this ROD.

8.03 Monitoring and Monitoring Plan for Containment

A monitoring plan shall be developed and approved by EPA for matters related to the containment of the dissolved phase contaminants surrounding NAPL in the containment zone. At a minimum, this plan shall provide for sampling of monitoring wells sufficient to meet the objectives stated below in this provision and any additional goals identified in the approved monitoring plan. Additional monitoring wells shall be installed, as necessary, to achieve the objectives of the monitoring plan. Continual monitoring shall be conducted as part of this remedy in accordance with the EPA-approved Monitoring Plan for as long as the containment zone is in effect as part of the remedy.

8.03.01 **Minimum Objectives of the Monitoring Plan with Respect to Containment Zone.** The monitoring plan shall provide for, at a minimum:

- Confirmation that contaminants within the containment zone have not left the zone;
- Data sufficient to reliably evaluate compliance with any and all requirements, standards, and provisions in this ROD;

- Reliable evaluation of the lateral and vertical movements of all contaminants of concern within the containment zone;

- Reliable evaluation of the lateral and vertical movements of benzene, TCE, and chlorobenzene in response to hydraulic extraction in the overall system;

- Evaluation of the effectiveness of partial containment of the TCE plume by hydraulic extraction and the degree of movement of TCE toward the boundary of the containment zone;

- Data sufficient to determine groundwater levels, hydraulic gradients, reliable groundwater elevation contour maps, effects of any local pumping both on and off the Joint Site, and groundwater flow velocities within all of the affected hydrostratigraphic units at the Joint Site;

- Verification and evaluation of the zones of capture of extraction wells and the radii of influence of extraction and injection wells;

- Reliable evaluation of gradient control measures;

- Data sufficient to measure and verify drawdowns in the immediate vicinity of the NAPL sources due to pumping;

- Evaluation of efforts to optimize the wellfields and pump rates associated with hydraulic extraction and aquifer injection of treated water so as to provide the greatest certainty of long-term containment, and reduce the potential for plume interactions and adverse migration of NAPL and dissolved contaminants;

- Reliable concentrations of contaminants in treatment system influent and effluent, and treatment streams so as to assess the effectiveness and performance of the treatment system; and

- Additional aquifer tests including but not limited to aquifer stress, pumping, and recovery tests, such as to provide estimates of local or general parameters such as hydraulic conductivity, storativity, specific yield, as determined necessary in the monitoring plan.

8.03.02 **Monitoring Wells..** The approved Monitoring Plan shall establish the monitoring objectives, which shall include but not be limited to the objectives specified in this

ROD, and shall list the monitoring wells serving each objective. During the remedial design phase of the remedy, the wells necessary to meet each objective shall be identified, taking into account the location, construction, and other circumstances associated with all existing wells. Should EPA determine that additional wells are necessary to meet the objectives in the approved Monitoring Plan, such wells shall be installed and sampled.

8.03.03 **Monitoring Wells in Regard to Containment.** Sufficient monitoring wells shall be placed around the periphery of the containment zone in each hydrostratigraphic unit where the containment zone occurs to ensure that failures of the remedial actions to contain contaminants to the containment zone (transgressions of containment) will be promptly detected. Sufficient numbers of monitoring wells also shall be placed in the hydrostratigraphic units below the containment zone to determine that contaminants have not migrated vertically out of the containment zone. Monitoring well construction and locations shall be approved by EPA as part of the remedial design and additional wells may be added as determined necessary by EPA during the remedial action and operation and maintenance (O&M) phase. This may include wells in either aquifers or aquitards.

8.03.04 **Monitoring frequency.** The frequency of monitoring for all wells in the monitoring network shall be specified and justified in the approved Monitoring Plan, in accordance with the ability to attain the stated monitoring objectives. Any changes to the monitoring frequency for one or more wells shall be approved by EPA by means of an amendment to the Monitoring Plan which states the justification for the changes.

8.03.05 **Monitoring Analytes, Sampling Protocols, and Methods.** EPA shall approve one or more field sampling plans (FSPs) and Quality Assurance Project Plans (QAPPs) which shall establish the sampling protocols, analytical protocols, quality assurance and quality control parameters and protocols, data quality objectives, and sample rotation. Such plans shall be in accordance with all applicable EPA regulations, policy, and guidance. The FSP(s) and QAPP(s) may be incorporated into or attached to the Monitoring Plan as approved by EPA. Modifications to the sampling and analytical protocols shall be accompanied by the appropriate modification to the FSP or QAPP.

8.03.06 **Direct Monitoring of Intrinsic Biodegradation.** The continued reliability of intrinsic biodegradation to contain the benzene plume in the UBF and the MBFB Sand shall be verified by actual periodic confirmation of the biological activity in the benzene plume. The degree, frequency, types of testing, etc. of such

monitoring shall be established in the approved Monitoring Plan. The frequency may be modified as approved by EPA in amendments to the Monitoring Plan. The monitoring shall include, but shall not be limited to, one or more of the following:

- Analysis of samples from monitoring wells along a transects running from the center to the outside of the benzene plume for dissolved oxygen, nitrate, sulfate, and methane, to be followed by evaluation of the degree of biodegradation in the context of electron donor-acceptor pairs and benzene biodegradation mechanisms.

- Analysis of groundwater or saturated zone soil samples to establish biodegrader counts.

- Analysis of groundwater samples for biodegradation interim by-products.

- Systematic measurements of benzene intrinsic biodegradation rate.

The frequencies of any such tests may vary according to the approved Monitoring Plan.

8.04 Contingent Actions

In the event that EPA determines that the actions selected by this ROD have not contained contaminants within the containment zone contingent actions shall be taken to (1) restore the condition of containment, (2) meet all remedial action objectives and ROD standards, and (3) meet ARARs where not waived, including attaining ISGS levels in groundwater. Contamination which leaves the containment zone also leaves the TI waiver zone; such contamination is not subject to the TI waiver and is subject to cleanup to ISGS levels as is all contamination outside the TI waiver zone.

It is not possible in advance to specify in detail the design particulars of all contingent actions, because the number of possible types of transgressions is large. Therefore, contingent actions are specified on a conceptual basis. "Transgressions of Containment" in this subsection refers to the condition upon which EPA has determined that contaminants within the containment zone have not been contained as required by this ROD. "Rectifying" transgressions of containment in this subsection refers to restoring the condition of containment after the transgression, meeting all remedial action objectives and ROD standards, and meeting all ARARs after a transgression.

8.04.01 **Chlorobenzene Plume.** Under this ROD, containment of the containment zone in the chlorobenzene plume is accomplished by active hydraulic extraction. Transgressions of containment in the chlorobenzene plume shall be rectified by adjustments to this active hydraulic means, which shall include (1) adjusting the pumping rates of one or more extraction and injection wells, and/or (2) installation of additional extraction and/or injection wells.

8.04.02 **Benzene Plume in the MBFC Sand.** Under this ROD, containment of the benzene plume in the MBFC Sand is accomplished by active hydraulic extraction. Transgressions of containment in the benzene plume in the MBFC Sand shall be rectified by adjustments to this active hydraulic means, which shall include (1) changing the pumping rates of one or more extraction and injection wells, and/or (2) installation of additional extraction and/or injection wells.

8.04.03 **Benzene Plume in the UBF and MBFC Sand.** Under this ROD, containment of the benzene plume in these units is contained by reliance on monitored intrinsic biodegradation with a contingency for active hydraulic extraction. Transgressions of containment shall be rectified by active hydraulic means, which shall include (1) changing the pumping rates of one or more existing extraction and injection wells, and/or the installation of extraction wells and initiation of hydraulic extraction specifically to rectify the transgression.

8.04.04 **Limitations on Contingent Actions.** Unless there is no other option, activation of a contingent action:

- Shall not reduce the rate of cleanup of the chlorobenzene plume;
- Shall not reduce the certainty of the containment of chlorobenzene, benzene, or TCE within the containment zone;
- Shall be effective in rectifying the transgression in a timely manner.

8.04.05 **Rectifying the Transgression.** Contingent actions shall reduce the concentrations of contaminants in the groundwater affected by the transgression to the levels which existed prior to the transgression. If no detectable contamination existed at the point of the transgression outside the containment zone, then the contingent action shall reduce the concentrations at that point to below detectable levels. Contingent actions shall also reduce contaminant migrations within the containment zone such that the transgression will not continue.

9 Plume Reduction

9.01 Basic Requirement.

The volume of groundwater within the Joint Site that is *outside* the containment zone at concentrations that exceed ISGS levels for any contaminant as identified by this ROD shall be reduced to zero in a reasonable time frame. This process shall be referred to as "plume reduction." The concentrations of contaminants in all groundwater at the Joint Site outside the containment zone shall be reduced to concentrations below the ISGS for each contaminant present in groundwater. ISGS values are specified on a contaminant-specific basis.

9.02 Means of Plume Reduction and Requirement of Aquifer Injection for the Chlorobenzene Plume

Plume reduction shall be achieved by hydraulic extraction and treatment. This shall include a series of hydraulic extraction wells from which water will be pumped to a treatment unit or units for treatment, followed by treated water discharge. For the chlorobenzene plume that is outside the containment zone, aquifer injection shall be implemented as the treated water discharge option. Feasibility Studies have shown that aquifer injection is necessary in conjunction with the plume reduction of the chlorobenzene plume to achieve the gradient control necessary to (1) reduce the potential for induction of movement of NAPL, and (2) limit the possibility of adverse migration of contaminants both within and from outside the Joint Site, within the context of meeting all remedial action objectives of this ROD. Accordingly, aquifer injection of treated water shall be applied in such a way as to achieve these goals and in accordance with the provisions in this Section of the ROD. Aquifer injection shall be accomplished by a series of aquifer injection wells.

9.03 Performance Criteria for Plume Reduction of the Chlorobenzene Plume

The following performance criteria with respect to plume reduction of the chlorobenzene plume shall be met by this remedial action. The reduction of the concentration of contaminants in groundwater outside the containment zone to levels below in-situ groundwater standards shall occur in a reasonable time frame.

9.03.01 **All of the Provisions Shall Be Met.** No one of these provisions is merely a focus for attaining one or more of the other provisions. All provisions shall be met, even if doing so will result in one or more provisions not only being met, but exceeded. As an example, provisions below require a certain pump rate, a certain pore volume flushing rate, and a certain minimum overall rate of reduction of the plume. These provisions independently apply. Thus, even if the minimum rate of reduction of the plume would be exceeded by attaining the pump rate and pore volume flushing rate specified, these shall still be attained.

9.03.02 **Pump Rate.** Hydraulic extraction shall be occur at a combined pump rate of approximately 700 gpm, mostly in the MBFC Sand and the Gage Aquifer. This ROD recognizes that pilot testing, design adjustments, and optimization modeling will occur during the remedial design phase, and the intent of this provision is not to overly limit design. However, it is intended that hydraulic extraction take place at a rate as close as feasible to the 700 gpm rate shown effective in the feasibility study for Alternative 4, and that this rate be departed from only if shown necessary and if approved by EPA.

9.03.03 **Hydrostratigraphic Units Affected by Hydraulic Extraction.** The MBFC Sand, the Gage Aquifer, and the Lynwood Aquifer shall be subject to direct hydraulic extraction. The MBFB Sand, the LBF, and the Gage-Lynwood Aquitard shall be subject to hydraulic extraction only to the extent shown necessary in remedial design to meet all other provisions, standards, goals and requirements of this ROD.

9.03.04 **Plume Reduction Rate Design and Early Time Performance.** The remedy shall be designed such that, at a minimum, the rate of plume reduction achieves the following performance criteria ***when modeled*** by a remedial design model approved by EPA (Provision 11):

The following performance standards shall apply:

- 33% of the volume of the chlorobenzene plume outside the containment zone with concentrations above ISGS levels plume shall be removed in 15 years;

- 66% of the volume of the chlorobenzene plume outside the containment zone with concentrations above ISGS levels plume shall be removed in 25 years;

- 99% of the volume of the chlorobenzene plume outside the containment zone with concentrations above ISGS levels plume shall be removed in 50 years.

The simulations of the rate of plume reduction to evaluate compliance with this reduction rate at the time of design shall be based on the modeling done during the remedial design effort. The model and its construction shall be approved by EPA and run using the specific well fields and pump rates in the design. It is recognized that actual cleanup times may be longer than those simulated by the model and that the model may not be able to correct for such deviations. Where practical, however, the design shall minimize the influence of those factors which lead to such modeling deviations.

9.03.05 **Early Time Performance Principle.** The total time frames envisioned as part of this remedy are quite long (50 to100 years), by necessity. In order to ensure that the remedy achieves the standards of this ROD in a reasonable time frame, it is an explicit objective of this remedy that it achieve significant reductions in the volume of contaminated groundwater outside the containment zone in the early time period (first 25 years). It is typically the last 25 percent of contamination which takes the longest to remove; hence, if a remedial system is properly designed, a large percentage of the volume of contaminated groundwater can be removed early in the implementation of the remedial action even if the total time to reach compliance with all objectives is long. The design of this remedy shall not be compromised in such a way that little cleanup is achieved in the first 25 years.

9.03.06 **Pore Volume Flushing Rates.** Flushing is the process by which contaminants are pushed from the ground during hydraulic extraction. The remedial action shall be designed in such a way that (1) in the MBFC Sand and Lynwood Aquifer, *at least* 1 net pore volume of water per year; and (2) in the Gage Aquifer, *at least* 0.5 net pore volumes of water per year; be exchanged throughout the area of groundwater remaining that has concentrations of any contaminant in excess of ISGS levels. This minimum annual net pore volume flushing rate may not be sufficient to meet the other provisions in this ROD and the pore volume flushing rate may need to be adjusted upward either at specific locations or all locations within the plume during the remedial design or remedial action phases of this remedial action.

9.03.07 **Well Replacement.** As the volume of water that is contaminated above ISGS concentrations shrinks during plume reduction, it may occur that the downgradient portion of the plume is eliminated before the portion of the plume located more proximally to the NAPL sources. The most downgradient hydraulic extraction

wells may then come to be located beyond the toe of the plume. If this occurs, extraction from these wells will be discontinued. These wells shall be replaced with new hydraulic extraction wells inside the remaining plume, if EPA determines this is possible without compromising any other objectives of the remedial action as required by this ROD. The pump rate and locations for the replaced wells shall be established in adjustments to the remedial design, and shall be subject to EPA approval. In this manner, the capacity of the remedial system will be utilized to its maximum capacity and cleanup rates will be maintained.

9.04 Monitoring and Monitoring Plan for Plume Reduction

9.04.01 **Monitoring and Monitoring Plan.** A monitoring plan shall be developed and approved by EPA for matters related to plume reduction. This may be done in the same physical plan as the monitoring plan for the containment zone. At a minimum, this plan shall provide for sampling of monitoring wells sufficient to meet the objectives stated below in this provision and any additional goals identified in the approved monitoring plan. Additional monitoring wells shall be installed, as necessary, to achieve the objectives of the monitoring plan. Continual monitoring shall be conducted as part of this remedy in accordance with the EPA-approved Monitoring Plan until such time as the remedial action for plume reduction is determined complete by EPA.

9.04.02 **Minimum Objectives of the Monitoring Plan with Respect to Plume Reduction.** The monitoring plan shall provide for, at a minimum:

- Data sufficient to reliably evaluate compliance with any and all requirements, standards, and provisions in this ROD;
- Reliable estimates of the rate that the volume of contaminated groundwater with concentrations of contaminants above ISGS levels is being reduced;
- Reliable estimates of the rate that mass of contaminants is being removed from the groundwater;
- Reliable estimates of the pore volume flushing rates throughout the remaining plume that is contaminated with concentrations of contaminants in excess of ISGS levels;
- Reliable evaluation of the lateral and vertical movements of all contaminants of concern within the plume reduction zone;

- Reliable evaluation of the lateral and vertical movements of benzene, TCE, and chlorobenzene in response to hydraulic extraction in all hydrostratigraphic units;

- Data sufficient to determine groundwater levels, hydraulic gradients, reliable groundwater elevation contour maps, effects of any local pumping both on and off the Joint Site, drawdowns, and groundwater flow velocities within all of the affected hydrostratigraphic units at the Joint Site;

- Verification and evaluation of the zones of capture of extraction wells and the radii of influence of extraction and injection wells;

- Reliable evaluation of the effectiveness of vertical and horizontal gradient control measures;

- Data sufficient to measure and verify drawdowns in the immediate vicinity of the NAPL sources due to pumping;

- Evaluation of efforts to optimize the wellfields and pump rates associated with hydraulic extraction and aquifer injection so as to provide the greatest certainty of long-term containment, and reduce the potential for plume interactions and adverse migration of NAPL and dissolved contaminants;

- Reliable concentrations of contaminants in treatment system influent and effluent, and treatment streams so as to assess the effectiveness and performance of the treatment system; and

- Additional aquifer tests including but not limited to aquifer stress, pumping, and recovery tests, such as to provide estimates of local or general parameters such as hydraulic conductivity, storativity, specific yield, as determined necessary in the monitoring plan.

9.04.03 **Monitoring Wells..** The approved Monitoring Plan shall establish the monitoring objectives, which shall include but not be limited to the objectives specified in this ROD, and shall list the monitoring wells serving each objective. During the remedial design phase of the remedy, the wells necessary to meet each objective shall be identified, taking into account the location, construction, and other circumstances associated with all existing wells. Should EPA determine that

additional wells are necessary to meet the objectives in the approved Monitoring Plan, such wells shall be installed and sampled.

9.04.04 **Monitoring Frequency.** The frequency of monitoring for all wells in the monitoring network shall be specified and justified in the approved Monitoring Plan, in accordance with the ability to attain the stated monitoring objectives. Any changes to the monitoring frequency for one or more wells shall be approved by EPA by means of an amendment to the Monitoring Plan which states the justification for the changes.

9.04.05 **Monitoring analytes, sampling protocols, and methods.** EPA shall approve one or more field sampling plans (FSPs) and Quality Assurance Project Plans (QAPPs) which shall establish the sampling protocols, analytical protocols, quality assurance and quality control parameters and protocols, data quality objectives, and sample rotation. Such plans shall be in accordance with all applicable EPA regulations, policy, and guidance. The FSP(s) and QAPP(s) may be incorporated into or attached to the Monitoring Plan as approved by EPA. Modifications to the sampling and analytical protocols shall be accompanied by the appropriate modification to the FSP or QAPP.

10 Limiting Adverse Migration of Contaminants Within Context of Remedial Objectives

10.01 **Limit Adverse Migration of NAPL.** This remedial action shall limit the *induction*[2] of NAPL migration by limiting hydraulic drawdowns and changes in vertical gradients in the physical space where the NAPL occurs. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of NAPL or dissolved phase contaminants and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. In the event this occurs, the remedial design shall be adjusted to reverse and contain the adverse migration. Limiting adverse migration of NAPL shall not take preeminence over the other performance criteria and remedial action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone. Further discussion of this matter occurs in Section 11.1, including the definition of adverse migration.

[2]The migration of NAPL that occurs naturally is not eliminated by this remedial action; this action does limit inducing further such movement, however. See Section 4 of this ROD.

10.02 **Limit Adverse Migration of Dissolved Phase Contamination.** The concept of adverse migration of contaminants was discussed in Section 11.1 of this ROD. The remedial action shall be designed to limit adverse migration of dissolved phase contaminants within the context of meeting all other provisions of this ROD. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of dissolved contaminants and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. In the event this occurs, the remedial design shall be adjusted to reverse and contain the adverse migration. Limiting adverse migration of contaminants shall not take preeminence over the other performance criteria and remedial action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone. The objective to limit adverse migration of dissolved phase contamination shall not supercede or take preeminence over the other performance provisions of this ROD. Further discussion on this matter appears in Section 11.1, including the definition of adverse migration. At a minimum, adverse migration of dissolved phase contaminants in the following forms shall be limited as part of the design of this remedial action:

- Adverse movement of chlorobenzene to areas not presently affected by chlorobenzene;

- Adverse movement of chlorobenzene, or TCE in the chlorobenzene plume, from shallower to deeper hydrostratigraphic units, including but not limited to (1) from the MBFC Sand into the LBF and the Gage Aquifer, (2) from the Gage Aquifer to Gage-Lynwood Aquitard and into the Lynwood Aquifer;

- Adverse movement of benzene from the MBFB Sand into the MBFC Sand in the benzene plume;

- Adverse movement of benzene in the benzene plume from the MBFC Sand into the LBF and the Gage Aquifer;

- Adverse movement of benzene currently in the chlorobenzene plume into lower hydrostratigraphic units, especially from the MBFC Sand into the LBF and the Gage Aquifer;

- Adverse movement of benzene currently in the benzene plume in the MBFC Sand toward the interface of the benzene and chlorobenzene plumes, and subsequently into the chlorobenzene plume;

- Adverse movement of the TCE (and related chlorinated solvents) in the MBFB Sand and MBFC Sand of the benzene plume laterally toward to south or west and hence closer to the containment zone (TI waiver zone) boundary;

- Adverse movement of TCE (and related chlorinated solvents) from the MBFB Sand of the TCE plume into the MBFC Sand;

- Adverse movement of TCE (and related chlorinated solvents) from the MBFC Sand of the TCE plume into the LBF and into the Gage Aquifer;

- Adverse movement of TCE (and related chlorinated solvents) from sources off the Joint Site to the north and to the west toward the Joint Site.

10.03 **Vertical Gradient Control Wells.** Where necessary to offset the vertical gradient imposed by pumping in a lower hydrostratigraphic unit, hydraulic extraction shall take place in the hydrostratigraphic unit overlying that unit, in order to prevent or minimize the movement of contaminants from the upper to the lower unit in response to the induced vertical gradient. As an example, even though pumping is not required in the MBFB Sand of the benzene plume to contain the benzene plume in that unit because intrinsic biodegradation is being relied upon for that purpose, some limited pumping may have to take place in the MBFB Sand in order to offset vertical gradients induced by pumping in the MBFC Sand. The need for and placement of such wells shall be determined in remedial design.

10.04 **Non-Interference.** The remedial design shall be optimized to the extent possible to minimize potential interference from sources of contamination not presently being addressed as part of the Joint Site. The design objective to limit such interference shall not supercede or take preeminence over the other performance provisions of this ROD. Rather, limiting the potential for such interference shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone.

While it has not been determined necessary at the time this ROD is issued, it may be found, either during remedial design or in the course of the remedial action, that additional remedial actions are necessary at the locations of such off-site sources in order to prevent

interference from those sources. As determined necessary by EPA, EPA may either (1) issue administrative non-interference orders (see Provision 15, below) to parties associated with such sources requiring that such they cease and/or desist from interfering with the remedy, or (2) amend this ROD to select specific remedial actions for such sources as part of the Joint Site.

11 Flow and Transport Modeling and Optimization of the Remedial Action

11.01 **Computer Model.** A computer-based groundwater flow and contaminant transport model shall be developed, as necessary, and used during the remedial design, and also used as needed during the remedial action and O&M phases of the remedy for the purposes of (1) assisting in evaluating the potential for adverse migration of NAPL and dissolved phase contaminants, (2) assisting in verifying the compliance with performance requirements, (3) *assisting* in optimizing the remedial design to maximize the effectiveness of the remedial action, and (4) any other purposes determined necessary during the remedial design effort. The computer model developed during the feasibility study shall be utilized as appropriate in developing the remedial design model. EPA shall review and approve the model used and all aspects of the development and site-specific construction of the model prior to its use. The model shall be used only as appropriate, given its limitations and uncertainties, to complete the remedial design.

11.02 **Optimization during Remedial Design and During Remedial Implementation.** The wellfield used in the remedial action, including the location of hydraulic extraction wells and aquifer injection wells, and the relative pumping rates among the wells and hydrostratigraphic units, shall be determined and optimized in the remedial design phase. Optimization shall be performed as determined necessary by EPA, in the remedial design. Optimization shall also be performed as determined necessary by EPA during the remedial action, whenever (1) extraction or injection wells are being added or removed, (2) pump rates are being adjusted, (3) adjustments are necessary to rectify a transgression of the containment zone, or (4) other times as required by EPA.

The computer-based groundwater flow and contaminant transport model discussed in Provision 11.01 shall not be the exclusive means of optimizing the remedial design or remedial action. Rather, pilot testing, and adjustments and hydraulic response tests using actual hydraulic extraction and injection systems, shall be employed in conjunction with modeling simulations to optimize and adjust the remedial action. (See EPA Response #344 in the Response Summary; Response to Del Amo Respondents for further discussion).

Optimization is a process by which the remedial design and action is adjusted to attain maximum effectiveness with respect to meeting the requirements of this ROD; optimization does not represent an evaluation of *whether* to meet such requirements.

The remedial design and action shall be optimized:

- For the efficiency and rate of removal of contaminants;
- For pore volume flushing;
- For the rate of reduction of the volume of groundwater with concentrations of contaminants in excess of ISGSs;
- For early time performance (See Sections 11 and 12 of this ROD);
- For meeting all performance provisions above with respect to reduction of the plume outside the containment zone;
- For the certainty of containment of contaminants in the containment zone and the overall chlorobenzene plume; and
- To limit the potential for adverse migration of contaminants and NAPL during the course of the remedial action;

while meeting all provisions and objectives of this ROD.

12 Provisions for para-Chlorobenzene Sulfonic Acid (pCBSA)

The following provisions shall apply to pCBSA. A detailed discussion of this contaminant is provided in several sections earlier in this ROD. There are no promulgated health-based standards and there are insufficient toxicological data to determine provisional standards for this contaminant. pCBSA is not a hazardous substance under CERCLA, but is a "pollutant or contaminant" (See CERCLA Section 101). pCBSA shall be subject to the monitoring plan requirements 9.04.01, 9.04.03, 9.04.05 and 9.04.06, as well as all provisions in this subsection. pCBSA shall not be subject to the other provisions in this Section. The following provisions shall apply to pCBSA:

12.01 **pCBSA Injection Limits.** No water containing pCBSA at concentrations exceeding 25,000 micrograms per liter (µg/L) shall be injected into the ground in the course of this remedial action. Micrograms per liter is the equivalent of parts per billion (ppb) for water.

The State of California holds that 25,000 µg/L can be considered a provisional health standard for pCBSA with respect to injected groundwater. This requirement is a non-promulgated standard of the State of California (See Section 8 of this ROD), however, it is selected by this ROD as a performance standard for injected groundwater.

pCBSA shall not be injected into the Gage-Lynwood Aquitard, the Lynwood Aquifer, nor any point at lower elevation than these hydrostratigraphic units during the course of this remedial action.

12.02 **Additional Monitoring Requirements for pCBSA.** Provisions given above for additional data acquisition require that the toe and sides of the pCBSA plume be identified during the remedial design phase. The following additional monitoring shall be performed for pCBSA as part of this remedial action.

- Continued monitoring of the downgradient extent of the pCBSA distribution in all hydrostratigraphic units in which it occurs so that EPA can evaluate its proximity to production wells;
- Continued monitoring of the side-gradient extent of the pCBSA distribution in all hydrostratigraphic units where it occurs so that EPA can evaluate the effect of aquifer injection of treated water which still contains some pCBSA.
- Periodic measurements of pCBSA concentrations within the core of the pCBSA distribution to assess the effects of redistribution and dilution that occur as a result of aquifer injection of treated water which still contains some pCBSA.
- Monitoring of water from the production wells in nearest proximity to the downgradient toe of the pCBSA distribution as identified in the approved monitoring plan.

13 Treatment for Extracted Groundwater

The following provides the requirements for treating water removed as part of the hydraulic extraction systems described in this remedial action. Groundwater shall be treated according to ARARs identified in Appendix A of this ROD prior to discharge. This ROD does not limit the treatment of extracted groundwater to a single technology. This ROD selects several technologies which are hereby considered "available" to the remedial design. ARARs applicable to each of these technologies have been identified in Appendix A.

Provision 13.01 and 13.02 pertain to primary treatment technologies which are designed to address the primary contaminants at the Joint Site. Provision 13.03 pertains to ancillary technologies, which reduce concentrations of ambient substances in groundwater to allow treated water to meet discharge standards, when the primary technologies are insufficient to do so. Provision 13.04 pertains to supplementary technologies, which can be used in modular fashion as necessary to assist in meeting remedial goals.

Primary, ancillary, and supplemental treatment technologies, and treatment trains, were discussed at the end of Section 11.4 of the Decision Summary of this ROD.

13.01 **Primary Treatment Technologies for the Chlorobenzene and Benzene Plumes.** The following primary technologies shall be considered available for the remedial design for treatment of the chlorobenzene and benzene plumes:

- Adsorption including liquid phase granular activated carbon (LGAC);
- Air Stripping plus LGAC polishing;
- Circulating Fluidized Bed Reactor (FBR) plus LGAC polishing

The JGWFS demonstrated that, based on data from the Remedial Investigation Reports, adsorption operating alone would be the most cost-effective primary technology for treatment of extracted groundwater. Air Stripping and FBR, if utilized, requires an LGAC polishing step to be effective in attaining all discharge requirements, as well as to ensure efficient progress in attaining ISGS levels in-situ for the Joint Site.

13.02 **Primary Treatment Technologies for the TCE Plume.** The following primary technologies shall be considered available for the remedial design for treatment of the water from the partial containment of the TCE plume (near the TCE sources near the upgradient end of the former Del Amo plant):

- Adsorption including liquid phase granular activated carbon (LGAC);
- Air Stripping plus LGAC polishing.

The JGWFS demonstrated that, based on data from the Remedial Investigation Reports, adsorption operating alone would be the most cost-effective primary technology for treatment of extracted groundwater. Air Stripping, if utilized, requires an LGAC polishing step to be effective in attaining all discharge requirements, as well as to ensure efficient progress in attaining ISGS levels in-situ for the Joint Site.

13.03 **Ancillary Technologies.** Ancillary technologies are those required to treat extracted groundwater to reduce the concentration of naturally-occurring species in the water to

meet regulatory standards and engineering requirements associated with the discharge of the water. Such technologies shall be applied, when necessary, in addition to the primary treatment technologies. It is anticipated by the JGWFS, based on water quality data, that the ancillary technologies may be necessary. For example, naturally occurring copper must be reduced to meet surface water discharge standards if the wellfields assumed in the JGWFS are utilized. These ancillary technologies shall be utilized, to the extent that EPA determines them necessary during the remedial design phase. Ancillary technologies are listed in Table 11-3, in Section 11 of the Decision Summary of this ROD.

13.04 **Treatment Trains.** The JGWFS considered a set of treatment trains that were identified in Section 11.4 of this ROD, as listed in Table 11-4 of the Decision Summary of this ROD and in the JGWFS. However, treatment trains composed of any combination of available primary and ancillary technologies, as specified above, may be designed and utilized for this remedial action.

13.05 **Supplemental Technologies.** Liquid Gravity Separation, and Advanced Oxidation Processes, may be used, in supplemental fashion, as part of the remedial action as determined necessary in remedial design. It is not intended that these technologies wholesale replace those selected as available for the remedial action as specified above; however, they may be added or used at appropriate times or in appropriate places as necessary. This was discussed in Section 11 of the Decision Summary of this ROD.

13.06 **Number of Treatment Plants.** The JGWFS evaluated the situation where there were three treatment plants, one for each plume. Provided all provisions and ARARs specified in this ROD are met, however, the number of treatment plants is not specified by this ROD and shall be determined in remedial design. All ARARs identified in this ROD, and all independently applicable requirements, if any, which pertain to the discharge of treated water shall be attained by the treatment plants prior to discharge. The number of treatment plants shall be determined by the needs of the design in attaining these requirements.

13.07 **Treatment Plant Locations and Access.** The precise treatment plant locations are not specified by this ROD; however, the remedial design shall provide security measures designed to prevent public access.

13.08 **Conveyances.** Necessary easements, agreements or other actions shall be obtained as necessary to maintain the conveyances (pipelines) which carry water from the extraction wells to the treatment plant(s) and from the treatment plant(s) to discharge points such as aquifer injection wells.

14 Treated Water Discharge and Ancillary Technologies

Treated groundwater shall be discharged as follows.

14.01 **Chlorobenzene Plume.** Groundwater shall be re-injected into the aquifers from which it was withdrawn, in such a way as to limit adverse migration of contaminants and plume interactions as per the provisions already given. Aquifer injection shall be accomplished by aquifer injection wells. The hydraulic control afforded by this injection is required to meet the objectives of this remedial action.

14.02 **Benzene Plume.** Treated groundwater from the benzene plume shall be discharged by one of two methods:

- Discharge to the storm drain, and
- Aquifer injection.

Discharge by aquifer injection shall be allowed only if, upon remedial design, the concentrations of total dissolved solids in the extracted water will be low enough to meet regulatory and engineering requirements for aquifer injection. If this is not the case, then the treated groundwater shall be discharged to the storm drain.

14.03 **TCE Plume**. Treated water from the TCE plume shall be discharged by aquifer injection, with the express purpose of creating hydraulic control and gradients to limit the migration of the TCE.

14.04 **Discharge Requirements**. The discharge requirements that shall be attained prior to discharge by any of the applicable discharge methods are identified in Appendix A of this ROD. All ARARs and independently applicable standards pertaining to groundwater discharge shall be attained.

The ISGS levels established in Section 9 of this ROD apply to the in-situ groundwater. However, in order to ensure protectiveness of human health and the environment, and ensure progress toward meeting ISGS levels in-situ in groundwater, treated groundwater shall not be injected into aquifers at the Joint Site as part of this remedial action at concentrations which exceed the ISGS levels.

15 Operation and Maintenance Plan and Remedial Action

15.01 **Operation and Maintenance (O&M) Plan.** An Operation and Maintenance Plan (O&M Plan) shall be written and approved by EPA prior to initiation of the remedial action. The O&M plan shall establish, at a minimum, all operating aspects, maintenance requirements, schedules, efficiency checks and tests, contingencies, monitoring requirements, performance verification, and compliance verification testing required for the implementation of the remedial action. The remedial action shall be implemented in accordance with the EPA-approved O&M Plan.

15.02 **O&M Plan Contents.** The O&M Plan shall address, at a minimum, the following. "System" refers to the treatment plant, conveyances, extraction wells, aquifer injection wells, monitoring wells, and all related equipment, unless otherwise noted.

- System operating procedures and contingencies
- System maintenance requirements
- System maintenance schedule
- Minimum qualifications of system operating and maintenance personnel
- Frequency, procedures, and protocols for testing treatment plant influent, effluent, and mid-treatment streams including specification of all analytes
- Frequency, procedures and protocols for testing, handling and disposing of all waste streams from the System, including specification of all analytes
- Standard shutdown procedures
- Alarms, notification schedule, and emergency shut-down procedures
- All environmental measurements, including but not limited to ambient air and noise levels within and near the System, the procedures, frequency, schedule, and personnel required for such measurements
- Extraction well maintenance, inspection and sampling schedule and protocols, with specification of all analytes

- Injection well maintenance, inspection, and sampling protocols and methods of assessing and increasing efficiency of injection, with specification of all analytes
- Management of all easements necessary for conveyance lines
- Maintenance and inspection of all conveyance lines
- All tests and procedures related to verification of the efficiency of the System
- All tests and procedures related to verification of compliance with ARARs and all other provisions of the ROD
- All tests and procedures related to evaluation of System performance in attaining cleanup standards.

The O&M Plan need not have a structure corresponding directly to these contents.

15.03 **Additional Engineering Documentation**. The following additional documentation shall be required. These plans may be issued separately or as content/sections within the O&M Plan as approved by EPA. The remedial design shall address, detail, and fully identify the contents of these plans. Plans shall meet any applicable EPA guidances and directives for the development of such documents, unless otherwise approved by EPA. All such plans shall be subject to EPA approval.

- *Site Management Plan,* describing the management of the grounds and area in which the system will operate;
- *Health and Safety Plan* in accordance with all regulations of the Occupational Safety and Health Administration (OSHA), including but not limited to standards found at 29 C.F.R.1910.120;
- *Quality and Assurance Plan* and *Field Sampling Plan* for all samples of water collected for purposes of monitoring, effluent or influent testing, or assessment of system design or performance;
- *Pollution Control and Management Plan* for any and all wastes or waste streams associated with the system; this plan shall ensure compliance with all requirements and ARARs in this ROD as well as any independently applicable standards, if any.
- *Construction Quality Assurance Plan*, for construction of the system;

- *Pilot Test Plan*, outlining all procedures evaluations, reports, and activities related to pilot tests which may be necessary during remedial design or remedial action;

- *Start-up Monitoring Plan*, outlining procedures to start up the system and determine that it is fully functional and operational.

The remedial design shall identify other planning documents and elements, as necessary for the successful design of the system.

15.04 **Completion of the Plume Reduction Portion of the Remedial Action.**

The containment of the containment zone will continue indefinitely and this ROD does not envision its shutdown. However, the chlorobenzene plume with concentrations above ISGS levels outside the containment zone will be eliminated. The following shall apply to the determination that the remedial action has attained ISGS levels and is complete. The following provisions apply *only* to the remedial action operating outside the containment zone.

15.04.01 **Engineering Practices, Rebound, and Minimum Compliance Period.** The O&M Plan shall establish a plan for utilizing appropriate engineering practices to ensure that concentrations of contaminants to not rebound above ISGS levels at any point in the plume after shutdown of the hydraulic extraction and treatment system effecting plume reduction. After the shutdown of the system, concentrations of contaminants shall not again rise above ISGS levels for a period of time to be specified in the O&M Plan and approved by EPA. During this time period, the remedial system, including wells, conveyances, treatment, and discharge systems, shall be maintained and ready to be reactivated in the event that concentrations of contaminants rebound to levels above ISGS levels.

15.04.02 **Additional Requirements.** EPA shall establish any additional requirements and conditions as may be necessary to confirm the completion of the remedial action, in addition to those listed here, in the approved O&M Plan.

16 Institutional Controls and Ensuring Short Term Protection

Institutional controls are discussed in Section 11.3. Only the actions selected are stated here. As part of this action, EPA will:

16.01 **Continue Existing Restrictions.** EPA will coordinate with the appropriate agencies regarding the existing legal and regulatory prohibitions and restrictions on groundwater use for the affected groundwater at the Joint Site.

16.02 **Non-Interference Orders.** At EPA's sole discretion and within its authority, EPA will issue administrative non-interference orders to appropriate parties to prevent contaminant sources presently outside the Joint Site from interfering with the remedial action (discussed in Section 11.3);

16.03 **Well Surveys.** Well surveys will be performed to monitor groundwater use within the area of groundwater affected by contamination at the Joint Site. As part of each statutorily-required 5-year review of the remedial action, and at other times as determined necessary by EPA, a well survey shall be performed for (1) the area within which groundwater contamination exists at concentrations exceeding ISGS levels, (2) the area in which pCBSA concentrations exist at detected concentrations, and (3) the area within one-quarter mile of the areas previously identified. Such well surveys shall identify public or private wells which exist, whether or not they are in operation. The well survey shall be a public record on file with EPA Region IX.

16.03.01 **Sampling of Wells.** For each previously-unidentified well identified in each periodic well survey, the well shall be sampled upon EPA's receipt of permission of access to the real property. Results of sampling shall be made available to the well owner as well as to any property owner who requests such results. Analytes for this sampling shall include the contaminants of concern for the Joint Site, including pCBSA.

16.03.02 **Actions If Contamination Is Found.** For each new well sampled as identified by the well survey, if contaminants of concern are found at concentrations exceeding ISGS levels, or if pCBSA is found at any concentration, the following shall occur:

- EPA shall inform the users and owners of the well of the findings, the health risks that may be associated with use of the water and, if appropriate, provide recommendations to the user as to how to avoid or eliminate those risks.

- EPA shall inform the State Department of Health Services, the State Department of Toxic Substances Control, the Regional Water Quality Control Board, and the Office of the Watermaster of the finding and ask that these agencies review the case of the well to see whether action under their own authorities can be used to prevent further exposure to contaminated water.

- EPA may issue non-interference orders, at its discretion, to prevent or limit operation of wells which may be found to exist within the contaminated groundwater at the Joint Site in the future.

14. Statutory Determinations

The following statutory determinations apply to the remedial action selected by this ROD for the dual-site groundwater operable unit for the Joint Site. Previous sections provide much of the detail often expected in this section. For brevity, those sections are referenced as appropriate.

14.1 Protection of Human Health and the Environment

The remedial action selected by this ROD is protective of human health and the environment. The groundwater at the Joint Site, should it ever be used, would present an unacceptable risk. Because the groundwater continues to move, new portions of the resource can become impacted by contamination in the future. The NAPL itself serves as a principal threat which continues to contaminate groundwater. Regulations direct EPA to restore this groundwater to drinking water standards where it is practicable to do so (i.e. these standards are ARARs where not waived). The remedial action EPA is selecting to for the groundwater contamination at the Joint Site eliminates the health threats from contaminated groundwater, restores the maximum practical extent of the groundwater resource to usability, meets ARARs where technically practicable, contains the principal threat, and safely contains contamination with a significant degree of certainty where it is not practicable to meet ARARs.

The remedial action selected by this ROD hydraulically isolates the NAPL so that the largest reasonable portion of the contaminated groundwater can be restored to drinking water standards and to limit the potential for human exposure to contaminated groundwater. The remedial action arrests the further lateral and vertical movement of all dissolved phase plumes. NAPL recovery actions, as selected by subsequent amendment(s) to this ROD, may reduce and limit the potential for NAPL mobility, enhance the long-term effectiveness, and reduce uncertainties in the ability of the actions selected in this ROD to maintain protectiveness of human health and the environment over the long term.

This remedial action restores the groundwater outside the NAPL isolation zone to levels that would be safe to drink or use for any potable purpose. In doing so, it protects the human health of any persons who might come to use groundwater, either now or in the future, and eliminates the dissolved phase contamination in groundwater outside the containment zone. As discussed at length in Section 12 of this ROD, "Summary of Comparative Analysis of Alternatives and Rationale for Selected Alternative," the remedial action to restore groundwater (i.e. achieve plume reduction) outside the NAPL isolation zone will extend over a long time frame. Because of this, all alternatives considered in the remedy selection process provided a threshold level of protection of human health and the environment, but also provided a range of protectiveness in

terms of long-term certainty of attaining ISGS levels (drinking water standards) at all points in the groundwater that are subject to restoration. The remedial action selected by this ROD provides a highly significant certainty of ultimately attaining ISGS levels within groundwater outside the NAPL isolation zone. In addition, it provides significant early time performance, meaning to extent practicable, significant reductions in the size of the plume are achieved early in the remedial time frame. This both increases the certainty of long-term protectiveness, and provides the benefits of the remedial action to the greatest possible area, sooner. Because a significant portion of the groundwater resource is usable in a relatively short time frame, there is, over the course of the remedial action, a smaller area of groundwater that continues to pose unacceptable health risks. This means there is less opportunity for anyone over time to make use of water which poses an unacceptable health threat. This provides additional protectiveness to this remedial action. At the conclusion of the remedial action, groundwater at all points outside of the NAPL isolation zone will not pose a risk outside of EPA's 10^{-4} to 10^{-6} excess cancer risk range, nor a non-cancer risk which exceeds a hazard index of 1. Water inside the NAPL isolation zone will be contained, subject to contingent actions if transgressions of containment occur.

The remedial action was selected by considering the potential for interactions and adverse movements among the various distributions of contamination at the Joint Site. The various elements of the remedial action have been selected such that all objectives of the remedial action can be met. In addition to reducing and eliminating the contamination outside of the NAPL isolation zone, this includes safely and reliably containing the NAPL isolation zone and limiting the induction of movement of contaminants which may threaten the objectives of the remedial action. The size and configuration of the NAPL isolation zone, the aggressiveness of cleanup performance and approximate pump rates to be used, and the actions selected (e.g. reliance on intrinsic biodegradation for some areas, active hydraulic extraction for others) have all been selected to strike an appropriate balance among all of these remedial objectives.

As the remedial action progresses, but prior to its completion, there will remain an area of groundwater that would pose a health risk were it used. This remedial action requires periodic well surveys to identify any new groundwater use within the water contaminated by the Joint Site, requires sampling of such wells, and requires that alternative means of water be provided to persons using such water. This, in conjunction with the institutional controls EPA will seek to implement as part of this remedy, will ensure short-term protectiveness as the remedial action is being implemented.

This remedial action is not expected to present any other unacceptable short-term risks or cross-media impacts. All water will be treated to meet ARARs and/or independently applicable standards prior to discharge.

14.2 Compliance with ARARs

This remedial action will comply with all ARARs, except for those ARARs which are being waived as established by this ROD based on technical impracticability. The specific ARARs that shall apply to this remedial action, and the ARARs which are subject to TI waiver, are listed and discussed in Appendix A of this ROD. The TI waiver applies only to groundwater within the TI waiver zone as defined by this ROD.

As discussed at length in Section 12 of this ROD, "Summary of Comparative Analysis of Alternatives and Rationale for Selected Alternative," the remedial action to restore groundwater (i.e. achieve plume reduction) outside the NAPL isolation zone will extend over a long time frame. All alternatives considered in the remedy selection process met the threshold of compliance with ARARs, yet with long remedial time frames, ARAR compliance must be treated in terms of degrees of long-term certainty, rather than absolute certainty. Accordingly, alternative considered provided a range of long-term certainty of attaining in-situ ARARs (e.g. MCLs) at all points in the groundwater that is subject to restoration. The remedial action selected by this ROD provides a highly significant certainty of ultimately attaining in-situ ARARs within groundwater outside the NAPL isolation zone. The degree of aggressiveness, performance, pore volume flushing rate, and early time performance of this remedial action enhance the certainty of meeting ARARs in the long term.

As discussed in Sections 8 and 11 of this ROD, there are no ARARs, promulgated or provisional standards, or reliable toxicological surrogate compounds for pCBSA. However, this remedy adopts a ROD standard for injection of groundwater for the contaminant pCBSA, as discussed in Sections 11 and 12 of this ROD.

14.3 Cost Effectiveness

The remedy selected by this ROD is cost-effective. It uses sufficiently aggressive, but not overly aggressive actions given the conditions, acknowledges the impracticability of complete NAPL removal and contains cost-effective means for addressing it, utilizes intrinsic biodegradation to the extent it can be relied upon, and properly configures the TI waiver zone.

In general, in present worth terms, the alternatives which are more aggressive in terms of plume reduction for the chlorobenzene plume cost more. EPA noted that Alternative 3 presented would cost on the order of $26 million, but it provided unacceptable long-term performance, early time performance, insufficient and sporadic pore volume flushing rates, a low degree of certainty of ultimately attaining ARARs, and an extremely long cleanup time. For an additional $5 million (on the order of $31 million), Alternative 4 provides significant long-term and early time performance, significant and well-distributed pore volume flushing, a substantial degree of certainty of

ultimately attaining ARARs, and an much shorter cleanup time. Alternative 5 would cost an additional $10 million, as compared with Alternative 4. Alternative 5 would provide superior performance to Alternative 4 in all ways just discussed. However, the relative improvement in performance from Alternative 4 to Alternative 5 would not be as great as the improvement from Alternative 3 to Alternative 4; while the increase in cost from Alternative 4 to Alternative 5 would be twice as much as the increase in cost from Alternative 3 to Alternative 4. The JGWFS performed an analysis which showed that, solely on the basis of percent of plume removed per dollar spent, Alternative 4 was superior to the other alternatives. Of course, this simple calculation does not take into account all of the more intangible societal benefits of removing the contamination faster, which Alternative 5 would do. EPA believes, however, that Alternative 4 is an appropriate balance in terms of cost-effectiveness among the alternatives.

The remedial action selected by this ROD strikes a reasonable and appropriate balance between cost and meeting remedial objectives. It acknowledges the fact that, on the one hand, the groundwater within the Joint Site is not being presently withdrawn and used by people. At the same time, it recognizes that future groundwater use is possible, that further expansion of the contamination is possible, and that the groundwater is classified by the State of California as having potential beneficial potable use. The health risks posed by the Joint Site groundwater, should it be used in the future, are unacceptable and could be extreme. Action is warranted.

Accordingly, while not requiring that an exceedingly fast, highly aggressive, and costly remedy be implemented, this remedial action achieves a cleanup in a reasonable time frame, achieves substantial early time performance, and provides for substantial pore volume flushing with good coverage. The remedial action meets the ARAR of attaining the MCLs in all groundwater outside the TI waiver zone and does so with substantial certainty of ultimate success.

This remedial action does not unreasonably impose requirements that all groundwater, including that in the NAPL areas, be restored to drinking water standards. EPA has recognized up-front that doing so would not be practicable, and it would prove extremely costly to attempt to do it, only to empirically "prove" that a TI waiver is justified. Rather, EPA has issued the TI waiver in advance, and developed a prudent and cost-effective approach of isolating the NAPL hydraulically. This approach allows the greatest amount of groundwater to be restored to drinking water standards, while not requiring that the impracticable be achieved in the NAPL areas.

This remedial action properly relies upon the existence of natural intrinsic biodegradation in the benzene plume to achieve remedial goals. This greatly lowers the cost of the remedial action compared to an effort in which active remediation of the benzene plume in all units were required. To the extent that intrinsic biodegradation fulfills the purposes for which it is being relied upon, this greatly enhances the cost effectiveness of this remedy.

EPA also has not unreasonably limited the size and characteristics of the NAPL isolation zone. Had EPA not done so, complicated remedial efforts may have been required that would have greatly increased the costs of the remedial action. While costs were not the primary basis for making these adjustments and delineations to the TI waiver zone, the end result is a remedial action that is more cost-effective. EPA has allowed a reasonable NAPL isolation zone to ensure that pumping does not induce NAPL movement. Also, EPA has not imposed multiple tiny NAPL isolation zones separated by areas that theoretically must be "cleaned," when, in all likelihood, the potential for doing so would be minimal or nonexistent.

The costs of containing and reducing the size of the plume in the case of this remedial action are not inordinate compared to other sites where similar actions have been applied. The cost of this remedial action is reasonable in light of the very substantial protection of human health and long-term effectiveness that is afforded by the action.

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

The remedial action selected by this ROD meets the statutory preference to utilize permanent solutions, and apply treatment to the maximum extent practicable. It is not practicable at this time to remove all NAPL from the site; hence the highest degree of permanence, namely, removal of all contamination from the site cannot be attained. However, the NAPL isolation zone has been kept to the smallest reasonable size that is considered safe, and hence the maximum practicable portion of groundwater is subject to treatment. The alternative selected by this remedial action provides a substantial certainty of attaining ISGS standards outside the NAPL isolation zone in the long term. The remedial action would be permanent with respect to any groundwater areas which are restored to ISGS standards. Accordingly, the maximum practicable area of groundwater is subject to a significant degree of permanence.

While treatment is being employed to remove contaminants from the ground, it is true that groundwater hydraulic extraction and treatment is not, technically, an "alternative treatment technology." However, the size of the contaminant distribution at the Joint Site, and its significant depth across so many hydrostratigraphic units, precludes the use of the more highly innovative technologies now emerging for groundwater cleanup. Likewise, recovery of the contaminant for reuse is not practicable. The groundwater resource, as a whole, is being recovered for use to the greatest practicable extent by this remedial action, however.

It is noted that, in the second phase of remedy selection which will focus on NAPL recovery, both innovative or "alternative" technologies will not only be considered but will be essential; likewise,

recovery of NAPL from the ground, and potential reuse of the NAPL in some way, can be more practicably considered.

14.5 Preference for Treatment as a Principal Element

This remedial action satisfies the statutory preference for treatment as a principal element. Treatment of contamination, which physically removes the contaminant from the site both in terms of mass and volume of water affected, is employed by this remedial action. The principal NAPL threat is isolated and contained by means of hydraulic extraction, treatment, and injection (or discharge). The dissolved phase contamination outside the containment zone is likewise eliminated by means of hydraulic extraction, treatment, and injection (or discharge).

Natural intrinsic biodegradation is relied upon for meeting some of the remedial objectives of this remedial action. While intrinsic biodegradation is not a form of active treatment, it is, in a sense, a treatment in that bacteria are degrading and eliminating contaminant mass just as surely as if EPA had actively applied a man-made treatment. In *relying* on intrinsic biodegradation, EPA is using it as a monitored remedial mechanism. Should this mechanism fail to meet its objective, the ROD calls for active treatment to replace it. Hence, it can be said that the preference for treatment is met by reliance on intrinsic biodegradation, as well.

15. Documentation of Significant Changes

EPA does not consider any changes imposed between the proposed plan and this ROD to be highly significant. For the information of the reader, EPA mentions the following differences, however:

1. The proposed plan identified that one of the performance criteria for the reduction of the chlorobenzene plume would be that the remedial action "remove 50 percent of the plume in 15 years, 70 percent of the plume in 25 years, and 99 percent of the plume in 50 years, as measured by a refined computer model during the remedial design phase of the remedial action, and that progress toward these targets be monitored during the course of the remedial action."

   In the ROD, this requirement was modified to be 33 percent of the plume in 15 years, 66 percent of the plume in 25 years, and 99 percent of the plume in 50 years. These values more closely track the performance that was attributed to the 700-gpm system in the JGWFS.

2. The ROD contains provisions for conducting well surveys during the course of the remedial action. This was not specified in the proposed plan, although as noted by the proposed plan, the ROD does contain many details not listed in the proposed plan, which is intended to be a more general indication to the public as to EPA's intentions with respect to remedy selection.

Appendix A

Identification of Applicable or Relevant and Appropriate Requirements

A.1. Groundwater ARARs

The following legal requirements are determined by this ROD to be applicable or relevant and appropriate requirements (ARARs) for the selected remedial action pursuant to CERCLA Section 121 (d)(2), 42 U.S.C. Section 9621 (d)(2). Only substantive portions of the requirements in the cited provisions below are designated as ARARs for this Record of Decision (as contrasted with administrative requirements, including permitting requirements, which are not ARARs). Where all of an ARAR, or some of the provisions of an ARAR, is/are waived as a result of the technical impracticability waiver of ARARs discussed in Section 10 of the Decision Summary this ROD, it is discussed within the text below in context.

1. DTSC Hazardous Waste Regulations, Title 22 Ch. 14 Article 6 as discussed and specified below.

The DTSC Hazardous Waste Regulations, Title 22, Ch. 14, Article 6 as discussed and specified below. (Implementing relevant portions of the California Hazardous Waste Control Act, California Health and Safety Code Section 2500 et seq. and the Solid Waste Disposal Act, 42 U.S.C. Section 6901 et seq. under EPA authorization pursuant to 42 U.S.C. Section 6926).

The provisions of California Code of Regulations (C.C.R.) Title 22, Chapter 14, Article 6 set out below are relevant and appropriate ARARs for the response actions selected in this Record of Decision. See U.S. EPA, CERCLA Compliance with Other Laws Manual: Interim Final, at 2-4 to 2-7 (EPA 540/G-89/006)(August 1988).

Pursuant to 22 C.C.R. Section 66264.94(c),(d) and (e)(1) and the supporting analysis contained in Appendix F of the Joint Groundwater Feasibility Study, concentration limits for the Joint Site are set at the ISGS levels established in Section 9 of the ROD, except where waived below with regard to the Technical Impracticability Waiver Zone. See e.g., Table 9-1.

A. 22 C.C.R. Section 66264.92(a) Water Quality Protection Standard.

This ARAR is waived within the Technical Impracticability Waiver Zone established in this ROD. This waiver is granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4)(C). The technical justification for the waiver is contained in Section 10 of this ROD.

B. 22 C.C.R. Section 66264.93 Constituents of Concern and Section 66264.94(a)(3), (c),(d),(e)(1) Concentration Limits.

These sections are waived within the Technical Impracticability Waiver Zone established in this ROD. This waiver is granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4(C). The technical justification for these waivers is contained in Section 10 of this ROD.

In that this ROD finalizes portions of the Del Amo Site Waste Pit Operable Unit ROD, this ROD also selects these sections as ARARs for the unsaturated zone at the Del Amo Site Waste Pit Operable Unit. However, this ROD waives these two ARARs for the unsaturated zone at the Del Amo Site Waste Pit Operable Unit based on the authority and analysis cited above.

These sections are not designated by this ROD as ARARs for the unsaturated zone at the Montrose Site or Del Amo Site outside the Waste Pit Operable Unit. With the exception of the Del Amo Site Waste Pit Operable Unit, the selection of any vadose zone response actions is beyond the scope of this ROD.

C. 22 C.C.R. Section 66264.95(a)(first two sentences only) Monitoring Point and Point of Compliance.

These sections are waived within the Technical Impracticability Waiver Zone established in this ROD. These waivers are granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4)(C). The technical justification for these waivers is contained in Section 10 of this ROD.

As a result, the point of compliance is established at the outer boundaries of the Technical Impracticability Waiver Zone as established in this ROD.

D. 22 C.C.R. Section 66264.97(b)(1)(A), (b)(1)(D), (b)(3-7), (d)(2)(A), (d)(2)(D) General Water Quality Monitoring and System Requirements.

Section 66264.97(d)(2)(A) + (d)(2)(D) are selected as ARARs solely for the purpose of establishing unsaturated zone monitoring requirements for the Waste Pit Operable Unit. As noted above, selection of response actions with respect to the unsaturated zone at the other areas of the Del Amo and at the entirety of the Montrose Site is beyond the scope of this ROD.

E. 22 C.C.R. Section 66264.100(b)(first sentence only), (c)(first sentence), (c)(second sentence- for the Del Amo Waste Pits Operable Unit, as explained below), (d).

Section 66264.100(b)(first sentence) and (c)(first and second sentence) are waived within the Technical Impracticability Waiver Zone established in this ROD. These waivers are granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4)(C). The technical justification for these waivers is contained in Section 10 of this ROD.

Section 66264.100(c) (second sentence) is selected as an ARAR for the Waste Pit Operable Unit. This ROD also determines that response actions, including but not limited to soil and vadose zone cleanup standards, selected in the Waste Pit ROD comply with this ARAR.

Regarding the application of Section 66264.100(d), EPA will base the monitoring program on EPA guidance rather than employ an evaluation monitoring program as set out in Section 66264.99. EPA believes that the EPA guidance is more relevant and appropriate to the circumstances of the Joint Site than are the requirements of Section 66264.99.

2. Other DTSC Hazardous Waste Regulations, 22 C.C.R., as discussed and specified below.

Other DTSC Hazardous Waste Regulations, 22 C.C.R., as discussed and specified below. (Implementing relevant portions of the California Hazardous Waste Control Act, California Health and Safety Code Section 2500 et seq. and the Solid Waste Disposal Act, 42 U.S.C. Section 6901 et seq. under EPA authorization pursuant to 42 U.S.C. Section 6926).

The following provisions of Title 22 of the California Code of Regulations are applicable ARARs for the response actions selected in this ROD[1]. Once it is extracted for treatment, groundwater contaminated with hazardous substances at the Joint Site is classified as hazardous waste, and must be managed accordingly. Once the extracted groundwater is treated to ISGS levels, the groundwater is no longer classified as hazardous waste[2].

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[1]See U.S. EPA, CERCLA Compliance with Other Laws Manual: Interim Final, at 2-4 to 2-7 (EPA 540/G-89/006) (August 1988). The determination that contaminated groundwater, once it is extracted for treatment, must be managed as state and federal hazardous waste is based on site specific information contained in the Administrative Record for this ROD. See e.g., Section 2 of this ROD and Section 1.3 of the Final Remedial Investigation Report for the Montrose Site (May 1998) (Montrose Site RI Report) regarding the use and releases of hazardous substances at and from the Montrose Plant Property, the Del Amo Plant Property and other nearby properties. See also Montrose RI Report, Chapter 5 and Dames & Moore, Final Remedial Investigation Report; Del Amo Study Area Chapter 5 (May 1998) regarding the concentrations of hazardous substances found at the Joint Site. EPA finds that groundwater which is extracted from the Joint Site for management and treatment in accordance with this ROD is classified as hazardous waste because the groundwater:

- may contain levels of hazardous substances that meet or exceed state and federal hazardous waste toxicity criteria for specific hazardous wastes (including but not limited to RCRA waste # D021 chlorobenzene, D018 benzene, D022 chloroform, D0271,4 dichlorobenzene, and D040 trichloroethylene) and for specific California wastes (including but not limited to DDT and its isomers DDE and DDD). 40 C.F.R. Section 261.24 and 22 C.C.R. Section 66261.24; and

- will contain one or more of the following RCRA listed hazardous wastes-F002 (spent solvents including chlorobenzene), F003 (spent solvents including benzene and xylene), F005 (spent solvents including toluene), and U-listed commercial chemical products, intermediates or off specification products - U019 benzene, U037 chlorobenzene, U061 DDT, U239 xylene, U165 naphthalene, U220 toluene, U228 trichloroethylene, and U056 cyclohexane.

[2]See Memorandum "Status of Contaminated Groundwater and Limitations on Disposal and Reuse" from Sylvia Lowrance, Director Office of Solid Waste, U.S. EPA, to Jeff Zelikson, Director Toxics and Waste Management Division, U.S. EPA Region IX (dated January 24, 1989).

A. 22 C.C.R. Part 261 Criteria for Identifying Hazardous Waste.

B. 22 C.C.R. Section 66262.11 Hazardous Waste Determination by Generators.

C. 22 C.C.R. Section 66262.34 Accumulation Time.

D. 22 C.C.R. Section 66264.13(a)(1), (b) General Waste Analysis.

E. 22 C.C.R. Section 66264.14(a), (b) Hazardous Waste Facility General Security Requirements.

F. 22 C.C.R. Section 66264.15 General Facility Inspection Requirements.

G. 22 C.C.R. Section 66264.17 Hazardous Waste Facility General Requirements for Ignitable Reactive or Incompatible Wastes.

H. 22 C.C.R. Section 66264.18 Location Standards.

I. 22 C.C.R. Section 66264.25 Hazardous Waste Facility Seismic and Precipitation Standards.

J. 22 C.C.R. Section 66264.31 Preparedness & Prevention-Design and Operation of Facility.

K. 22 C.C.R. Section 66264.32 Preparedness & Prevention-Required Equipment.

L. 22 C.C.R. Section 66264.33 Preparedness & Prevention-Testing and Maintenance.

M. 22 C.C.R. Section 66264.34 Preparedness & Prevention-Access to Communications or Alarm System.

N. 22 C.C.R. Section 66264.35 Preparedness & Prevention-Required Aisle Space.

O. 22 C.C.R Section 66264.37 Preparedness & Prevention-Arrangements With Local Authorities.

P. 22 C.C.R. Section 66264.51 Contingency Plan-Purpose and Implementation.

Q. 22 C.C.R. Section 66264.52 Contingency Plan-Content.

R. 22 C.C.R. Section 66264.53(a) Contingency Plan-Copies of Plan.

S. 22 C.C.R. Section 66264.54 Contingency Plan-Amendment.

T. 22 C.C.R. Section 66264.55 Contingency Plan-Emergency Coordinator.

U. 22 C.C.R. Section 66264.56 Contingency Plan-Emergency Procedures.

V. 22 C.C.R. Section 66264.111 Hazardous Waste Facility Closure Performance Standard.

W. 22 C.C.R. Section 66264.112 (a)(1), (b) Closure Plan.

X. 22 C.C.R. Section 66264.114 Hazardous Waste Facility Closure-Disposal and Decontamination of Equipment, Structures and Soils.

Y. 22 C.C.R. Section 66264.117(a)(b)(1) and (d) Hazardous Waste Facility Postclosure Care and Use of Property.

Z. 22 C.C.R. Section 66264.119(a) (regarding notice to the local zoning authority) and (b)(1) Hazardous Waste Facility Post Closure Notices.

AA. 22 C.C.R. Sections 66264.171-178 Use and Management of Containers.

BB. 22 C.C.R. Section 66264.192 New Tanks.

CC. 22 C.C.R. Section 66264.193(b),(c), (d), (e) and (f) Containment and Detection of Releases.

DD. 22 C.C.R. Section 66264.194 General Operating Requirements.

EE. 22 C.C.R. Section 66264.195 Inspections.

FF. 22 C.C.R. Section 66264.196 Response to Leaks or Spills and Disposition of Leaking Or Unfit-for Use Tank Systems.

GG. 22 C.C.R. Section 66264.197 Closure and Post Closure Care.

HH. 22 C.C.R. Section 66264.1052 Standards-Pumps in Light Liquid Service.

II. 22 C.C.R. Section 66264.1053 Compressors.

JJ. 22 C.C.R. Section 66264.1057 Standards-Valves in Gas Vapor Service or Light Liquid Service.

KK. 22 C.C.R. Section 66264.1058 Standards-Pumps and Valves in Heavy Liquid Service.

LL. 22 C.C.R. Sections 66264.1061 and 66264.1062 Alternate Standards.

MM. 22 C.C.R. Section 66264.1063 Test Methods and Procedures.

NN. 22 C.C.R. Section 66264.1101 Containment Buildings-Design and Operating Standards.

OO. 22 C.C.R. Section 66264.1102 Closure and Post Closure Care.

PP. 22 C.C.R. Section 66268.3 Hazardous Waste Dilution Prohibition as a Substitute for Treatment.

This provision is established as an ARAR for any onsite activity that generates a hazardous waste that will be sent offsite for disposal and/or treatment.

3. South Coast Air Quality Management District (SCMD) Rules and Regulations, as specified below

South Coast Air Quality Management District (SCAQMD) Rules and Regulations, as specified below (Implementing relevant portions of Division 26 of the California Health and Safety Code and the Clean Air Act, 42 U.S.C. Section 7401 et seq.).

A. Regulation XIII New Source Review (including but not limited to Rule 1303).

B. Regulation IV, Prohibitions -

i. Rule 401 Visible Emissions,
ii. Rule 402 Nuisance,
iii. Rule 403 Fugitive Dust, and
iv. Rule 473 Disposal of Solid and Liquid Waste.

C. Regulation X NESHAP (Benzene).

D. Rule 1401 New Source Review of Carcinogenic Air Contaminants.

4. Other ARARs, as discussed and specified below

A. State and Federal Maximum Contaminant Levels

As discussed in the ROD, state and federal maximum contaminant levels (MCLs) for hazardous substances found in the groundwater at the Joint Site are established as relevant and appropriate ARARs for the remedial actions selected in this ROD. These ARARs establish both in-situ groundwater cleanup standards and treated groundwater reinjection standards. CERCLA Section 121(d)(2)(A), 42 U.S.C. Section 9621(d)(2)(A) requires that a remedial action attain MCLs where MCLs are determined to be relevant and appropriate. EPA guidance states that MCLs are relevant and appropriate ARARs in situations where the groundwater is or may be used for drinking water. See U.S. EPA, CERCLA Compliance with Other Laws Manual: Interim Final, at 4-8 (EPA/540/G-89/006) (August 1988). Although contaminated groundwater at the Joint Site is not currently being used to supply drinking water, the State of California has designated the groundwater bearing units at the Joint Site as potential sources of drinking water. See California Regional Water Quality Control Board, Los Angeles Region, Water Quality Control Plan - Los Angeles Region - Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, Chapter 2 (1994) (implementing S.W.R.C.B. Res. 88-63). Accordingly, EPA in this ROD is selecting the state and federal MCLs set out in Table 9-1 of this ROD as appropriate and relevant ARARs for the remedial actions selected in this ROD. State MCLs are derived from the R.W.Q.C.B Basin Plan which applies specified State standards for chemical constituents to groundwaters that are designated by the Basin Plan as potential sources of drinking water. See California Regional Water Quality Control Board, Los Angeles Region, Water Quality Control Plan - Los Angeles Region at 3-18 (1994).

These MCL ARARs, as in-situ groundwater treatment standards, are waived within the Technical Impracticability Waiver Zone established in this ROD. These waivers are granted based on the authority contained in 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3) and 42 U.S.C. Section 9621(d)(4)(C). The technical justification for these waivers is contained in Section 10 of this ROD. However, state and federal MCLs, as ARARs for reinjecting treated groundwater, are not waived inside the Technical Impracticability Waiver Zone. EPA finds that there is no acceptable basis for waiving these ARARs as reinjection standards - given that it is technically feasible to treat the hazardous substances found in groundwater at

the Joint Site to state and federal MCLs and that the lowering, to MCLs, contaminant levels in treated groundwater that is reinjected in the containment zone will not hinder, compromise or complicate the containment measures selected as remedial actions in this ROD.

B. S.W.R.C.B. Resolution 68-16.

State Water Control Board Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California", is an applicable ARAR with respect to the reinjection of groundwater that has been extracted from the Joint Site as the result of remedial actions required by this ROD.

C. S.W.R.C.B. Regulation, 22 C.C.R. Chapter 15, Article 5, Section 2550.7(b)(5) General Water Quality Monitoring and System Requirements.

D. S.W.R.C.B. Resolution 92-49 Section III. (H).

This Record of Decision does not identify California State Water Resources Control Board Resolution Section III (H) (regarding the establishment of containment zones) as an ARAR for the remedial actions selected in this ROD nor does this ROD rely on this provision as authority for issuing the technical impracticability ARAR waivers previously identified above. However, EPA believes that the Technical Impracticability Waiver Zone for the Joint Site established by this ROD is consistent with S.W.R.C.B Resolution 92-49 Section III (H).

5. Guidance and Advisories To Be Considered

Certain non-promulgated advisories or guidance that are otherwise not legally binding may be identified in a Record of Decision as guidance or advisories "to be considered" (TBC) particularly to aid the design and implementation of the selected remedial actions. See U.S. EPA, CERCLA Compliance with Other Laws Manual: Interim Final, at 1-76 (EPA 540/G-89/006) (August 1988). For this Record of Decision the following guidance or advisory is determined to be a TBC for the selected remedy:

South Coast Air Quality Management District, Best Available Control Technology Guidelines Document

A.2. Other Legal Requirements of Independent Legal Applicability

The remedial actions selected in this ROD may trigger additional legal requirements. These requirements are not identified as ARARs in this ROD either because such requirements do not meet the definitional prerequisites (as established by CERCLA Section 121(d)(2)) to be identified as an ARAR for onsite activities or because such requirements are triggered by offsite activities. See generally 42 U.S.C. Section 9621(d)(2). The legal requirements identified below are presented for informational purposes only. Any determination of the legal applicability of such requirements (as well as any implementing regulations) ultimately rests with the governmental entity charged with implementing and enforcing compliance with such requirements.

- CERCLA Section 121 (d)(3), 42 U.S.C. Section 9621(d)(3) requirements regarding offsite disposal of material contaminated with hazardous substances.

- CERCLA Section 103, 42 U.S.C. Section 9603 notification requirements and comparable provisions of California law.

- Provisions of Title 22 of the California Code of Regulations and parallel provisions of federal RCRA regulations relating to offsite shipments of hazardous waste, including but not limited to manifest requirements, pretransport requirements, transportation requirements, and offsite disposal, treatment and land ban prohibitions and requirements.

- Provisions of the California Porter Cologne Act (implementing both state law and the federal Clean Water Act NPDES program) concerning the issuance of waste discharge requirements for point source discharges of treated groundwater water to offsite storm sewer conveyances.

- Federal and State Occupation Health and Safety Act requirements.

- Los Angeles County Sanitation District Wastewater Ordinance, as amended, concerning offsite discharges of treated groundwater to the LACSD sanitary sewer system.

Appendix B

Explanations Pertinent to the Approach to Characterization of Intrinsic Biodegradation for the Benzene and Chlorobenzene Plumes

The following discussion summarizes why (1) EPA did not pursue detailed studies of intrinsic biodegradation rates of the chlorobenzene plume, and (2) EPA did not require highly rigorous direct field measurements of the biodegradation rate for the *benzene* plume. It is important to note that EPA evaluated the potential value of performing extended field studies on chlorobenzene biodegradation, not as to whether such studies could produce useful information, but as to whether the information would be sufficient and accompanied by sufficient certainty to allow for selecting and relying upon intrinsic biodegradation of chlorobenzene in lieu of some other remedial action.

It is noted that showing that a compound can be made to biodegrade in the laboratory under specific conditions does not demonstrate that it is biodegrading in the field at any given location. In principle, field studies could be designed with the intention of evaluating the presence of intrinsic biodegradation of chlorobenzene at the Joint Site. However, the mere presence of intrinsic biodegradation is not a sufficient foundation upon which to base a remedy; rather, it must be shown to be reliable as a remedial mechanism for the long term, in the context of remedial decisionmaking.

In light of the specific characteristics discussed above pertaining to chlorobenzene and the chlorobenzene plume, such studies would have to demonstrate, at a minimum:

1. That intrinsic biodegradation of chlorobenzene is possible and, with significant certainty, by what chemical pathways it occurs;

2. That it is actually occurring in the chlorobenzene plume in all locations in the chlorobenzene plume;

3. That the *rate* of intrinsic biodegradation is sufficient, at all locations throughout the extensive groundwater contamination in the chlorobenzene plume, to attain the remedial objectives of the remedy; and

4. That the rate of intrinsic biodegradation would be reliable for the very long term over

which the remedy will need to be effective, to achieve all remedial objectives.

To accomplish these with a study of chlorobenzene biodegradation, the certainty in the direct field measurements of the rate of intrinsic biodegradation of chlorobenzene at all points in the chlorobenzene plume would have to be extraordinarily high to overcome the fact that most observations about the chlorobenzene plume not only fail to provide support for reliable intrinsic biodegradation of chlorobenzene, but discount it.

Counterposed with this need for high certainty is the fact that studies of the field rate of the intrinsic biodegradation of chlorobenzene at the Joint Site would almost certainly be associated with extraordinarily high *un*certainty. Methods for performing direct field measurements of biodegradation rate require determining the water quality and aquifer characteristics at a (potentially large) number of locations, and measuring how the concentrations change with time between one point and the next. These tests require numerous assumptions and are associated with significant uncertainties. Primary uncertainties among these are associated with (1) attributing the concentration difference from one point to the next as being due to intrinsic biodegradation as opposed to other potential mechanisms, (2) differentiating measured degradation of the target chemical with degradation of another degrading chemical, (3) heterogeneities in aquifer and hydraulic properties, (4) spatial variability in the distribution of geochemical and water quality parameters, (5) temporal variability in the same parameters. The uncertainties in direct field measurements of intrinsic biodegradation rate increase dramatically as:

1. The size of the affected groundwater contaminant distribution increases;

2. The degree of heterogeneity in aquifer parameters and hydraulic parameters increases;

3. The complexity of chemistry in the aquifer (e.g. number of chemicals, etc.) increases;

In large aquifer systems, such studies require significant periods of time (on the order of years) in order to resolve actual concentration changes due to degradation. The time and number of sampling points necessary to run an adequate study of this type increases as the size of the affected groundwater concentration increases. Such studies are more typically run for relatively small groundwater plumes with simple chemistry which can be relatively well-characterized by a reasonable number of sampling points. In most systems, the costs of large numbers of wells in deep hydrostratigraphic units becomes prohibitive.

The extent of the chlorobenzene plume both laterally and vertically, is very large, covering several square miles, extending 1.3 miles from the source and through six hydrostratigraphic units to depths exceeding 200 feet. The aquifers exhibit relatively large heterogeneities and the chlorobenzene plume contains several potentially degradable compounds. All of these factors

imply that relatively high uncertainty would be associated with direct field measurements of intrinsic biodegradation rate in the chlorobenzene plume.

Because multiple and independent lines of evidence support the presence of reliable intrinsic biodegradation in the *benzene* plume, the importance of any single line of evidence, such as direct field measurements of biodegradation rate, is correspondingly less than if it were the *only* line of evidence. In contrast, because there are no independent lines of evidence supporting reliable biodegradation of *chlorobenzene*, direct field measurements would be the *only* means available to provide evidence of such biodegradation. The degree of certainty required to rely on such measurements would therefore be higher, at the very same time that, if such studies were to be performed, the degree of certainty would be much lower for the reasons already discussed.

Given this situation, EPA concluded that, while such studies for the chlorobenzene could produce results which would be of interest, they could not provide a basis for selecting a remedial action that relied on intrinsic biodegradation for the chlorobenzene plume. EPA therefore did not require their performance prior to remedy selection.

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United States
Environmental Protection Agency
Region IX

Record of Decision

for

Dual Site
Groundwater Operable Unit

Montrose Chemical and Del Amo Superfund Sites

Volume II:
Response Summary

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March 1999

Record of Decision: Dual Site Groundwater Operable Unit
Montrose Chemical and Del Amo Superfund Sites

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Acronyms

AOC	Administrative Order on Consent
ARARs	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BHC	benzene hexachloride
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Act Information System
C.F.R.	Code of Federal Regulations
CIC	community involvement coordinator
CPA	Central Process Area of the former Montrose Plant
CPF	cancer potency factor
DCA	dichloroethane
**See below*	
DCE	dichloroethylene
DDT	dichlorodiphenyl-trichloroethane
DNAPL	dense nonaqueous phase liquid
Dow	Dow Chemical Corporation
DTSC	California Department of Toxic Substances Control
FBR	Fluidized Bed Reactor
FSP	field sampling plan
FTC	focused transport calibration
gpm	gallons per minute
GSA	United States General Services Administration
ISGS	in-situ groundwater standards
JGWFS	Joint Groundwater Feasibility Study
JGWRA	Joint Groundwater Risk Assessment
LBF	Lower Bellflower Aquitard
LGAC	liquid-phase granular activated carbon
LNAPL	light nonaqueous phase liquid
MBFB Sand	Middle Bellflower "B" Sand
MBFC Sand	Middle Bellflower "C" Sand
MBFM	Middle Bellflower Muds
MCL	maximum contaminant level (promulgated drinking water standard)
µg/L	micrograms per liter
mg/kg/day	milligrams per kilogram per day
mg/L	milligrams per liter
NAPL	nonaqueous phase liquid

NCEA	National Center for Exposure Assessment
NCP	National Contingency Plan
NOEL	No Observed Adverse Effect Level
NRRB	National Remedy Review Board
O&M	operations & maintenance
OSHA	Occupational Safety and Health Administration
pCBSA	para-chlorobenzene sulfonic acid
PCE	perchloroethylene
ppb	parts per billion
PRG	Preliminary Risk Goal
PRP	potentially responsible party
QAPP	Quality Assurance Project Plan
RCRA	Resource, Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RME	reasonable maximum exposure
RMS	root mean square
ROD	Record of Decision
ROST™	Rapid Optical Screening Tool
RPM	remedial project manager
Shell	Shell Oil Company
SVE	soil vapor extraction
TBC	To-Be-Considered Criterion
TCA	trichloroethane
TCE	trichloroethylene
TDS	total dissolved solids
TI	technical impracticability
UBF	Upper Bellflower
U.S.C.	United States Code
VOCs	volatile organic compounds

*Note: The term "Del Amo Respondents" refers to Shell Oil Company and Dow Chemical Company, collectively.

III. Response Summary

The purpose of the Response Summary is to provide a summary of EPA's response to the comments EPA received from the public on EPA's proposed plan and administrative record for the Dual-Site Groundwater Operable Unit, Montrose Chemical and Del Amo Superfund Sites, Los Angeles, California. This comment period was announced on June 26, 1998 and began July 2, 1998. The comment period was originally scheduled to end on July 31, 1998, a duration of 30 days. However, in response to a request from the public, the comment period was extended by EPA for all commenters to August 30, 1998, a duration of 60 days. Because August 30 was a Sunday, EPA did consider comments received on August 31, 1998. EPA held a formal public meeting on Saturday, July 25, 1998 from 1:00 PM to 5:00 PM at the Torrance Holiday Inn. The meeting was divided into two parts. In the first part, EPA explained its proposed remedial action and answered questions. In the second part of the meeting, EPA received formal public comments to be addressed in this response summary. The entire proceedings of the meeting were transcribed by court reporter and are being included in the final administrative record.

EPA received two kinds of comments: 1) written comments received during the public comment period, and 2) formal oral comments received at EPA's public meeting. EPA is required by law to consider and address only those comments that are pertinent and significant to the remedial action being selected. EPA is not required to address comments which pertain to the allocation of liability for the remedial action, nor potential enforcement actions to implement the remedial action, as these are independent of the selection of the remedial action and EPA's proposed plan. EPA does have the discretion to address comments with limited pertinence if doing so would nonetheless address the concerns of a significant segment of the public.

EPA is not required to re-print the comments of the commenters verbatim and may paraphrase where appropriate. In many cases in this response summary, EPA has included large segments of the original comments. However, persons wishing to see the full text of all comments should refer to the commenter's submittal to EPA which has been included in the administrative record.

Specific responses by EPA are indexed for convenient reference. These indices run consecutively through the entire Response Summary, regardless of the section or commenter. Index numbers are listed after the symbol ✍. Comments are shown in normal text, and EPA's responses are shown in **shaded boxes in boldface text.** In some cases, a certain portion of the commenter's text is boldfaced in order to highlight the portion of the commenter's text being addressed.

1. Responses to Oral Comments Received During The Public Meeting

As required by law, EPA held a formal public meeting on its proposed plan for this remedy on Saturday, July 25, 1998, from 1:00 PM to 5:00 PM at the Torrance Holiday Inn on Vermont Street. During this meeting, EPA gave a presentation explaining its proposal during which it answered questions, followed by a question-and-answer period, and concluded with a period in which formal comments were received into the record. The entire meeting was recorded by a court-recorder, and the transcript of the meeting, including all of EPA's and the community's statements, and EPA's responses to the community, are reflected in the transcript. The transcript is entered into the Administrative Record for this remedy with the Record of Decision.

EPA here provides responses to the comments made by the community in the public meeting during the formal comment portion of the meeting. It should be noted that during this portion of the meeting, some persons raised additional questions to EPA and requested a direct oral response, which EPA provided. Only those statements formally identified by persons as formal comments for the record are addressed here. EPA's oral responses to questions raised during this and other periods of the meeting can be found in the meeting transcript.

Comment:

...my name is Clare Adams. I'm a resident, homeowner...there has been nothing said by the EPA that this area is dangerous to occupy for business purposes. It wasn't what I planned to talk about, but I want that to be clearly stated: This is safe. We can come here to the hotel, to businesses. And none of the research that the EPA has published or anybody has asserted has said that any of this area from Del Amo to 190th Street), from Normandie to the freeway, is not safe for businesses such as take place here now.

1 EPA Response:

EPA provides a response to this issue in another response. See EPA's response to the written comments from Clare F. Adams. EPA does note with respect to this particular comment that the commenter is correct that there is no evidence nor plausible reason to believe that Superfund contaminants affect the hotel at which the public meeting was held, despite its being within the Del Amo Site, and EPA considers attendance at that meeting to have been completely safe.

Comment [Cynthia Babich, director, Del Amo Action Committee]:

[Is it true that] there is no health-based level for toxicity been determined yet [for pCBSA]? So it could be potentially worse than some of the other chemicals that we're talking about today, the benzene and the monochlorobenzene? And you said a little earlier that when you were talking about cleaning up all those other chemicals while you were doing the benzene and monochlorobenzene, that it would take care of all of those except for this particular chemical. I would like to know what kind of work the EPA is planning to do to pressure other agencies, such as the ATSDR, Agency for Toxic Substances and Disease Registry, to come up with some kind of a guideline for you guys as you go through that. We'd hate to have you come up and do all this cleanup for one thing and find out it's a dioxin situation and it's something that would be much worse.

2 EPA Response:

It is true that no health-based toxicity level has been established for pCBSA. Not only is there no formal standard (such as a drinking water standard), there are no accepted values that would allow EPA to quantify the toxicity of pCBSA. Based on what we do know, EPA's remedy is protective of human health. We note that no one is drinking water today that is contaminated with pCBSA, and EPA's remedy will be monitoring for pCBSA to ensure that this remains true. We could find aspects of toxicity for pCBSA in the future of which we are not aware today.

This does not mean that we have no information about pCBSA. A few studies have been done. Several of these were screening indicator tests which did not show mutagenicity (tendency to cause mutations) or teratogenicity (tendency to cause birth defects). Another acute (short-term) study did not cause health effects when very high dosages of pCBSA were used. We also know that pCBSA is highly water soluble, and one study suggested that the body may convert certain compounds into pCBSA in order to excrete them. These characteristics, taken alone, would suggest 1) a low acute (short-term) toxicity for pCBSA, and 2) the time that pCBSA stays in the body, if it is ingested, may be short. Because of these factors, it is unlikely, though admittedly not impossible, that pCBSA has a higher human toxicity than do chlorobenzene and benzene. Benzene, for instance, is one of only a handful of compounds that is proven to be a carcinogen not only through animal studies but directly in humans.

The problems are that (1) the design of these studies was inadequate to establish toxicity values, (2) an insufficient number of studies has been performed, and (3) no chronic (long-term) studies have been performed. This means that the data on pCBSA must be considered preliminary and that no direct quantification of its toxicity is supportable by the existing data at this time.

The priorities for performing toxicological studies on chemicals are influenced by a wide variety of persons and institutions, and are not completely within the control of the EPA or agencies such as ATSDR. EPA is sending a memorandum to those persons within EPA who have such influence and who discuss priorities with other agencies and institutions, informing them of the pCBSA situation at the Montrose Chemical Site. Readers should understand that there are far more chemicals awaiting study than can be studied at any given time, and so studies are usually done first on chemicals to which people are already being exposed, or for which the indicator tests show immediate signs of toxicity. Because pCBSA meets neither condition currently, it is not likely to be studied as soon as many other chemicals. On the other hand, its presence in the groundwater over a large area at the Montrose and Del Amo Sites does give it a certain degree of priority. Presently, no studies are planned or underway on the toxic effects of pCBSA. Such studies typically take on the order of 1-4 years to complete, once started.

EPA will review the remedy as necessary to address any new knowledge about pCBSA.

Comment [Cynthia Babich, Director, Del Amo Action Committee]:

We can clearly see from your presentation that the groundwater contamination extends into the residential areas of the community. Soil gas is a concern...I think that when we start trying to separate some of the issues aside from the groundwater, there's confusion that if you clean up this one little thing, that everything's going to be pristine again and we can go about our way. That's not what's going on in these communities...there's a lot of different things affecting it...people have a right to know.

3 EPA Response:

EPA does not intend to imply that if its cleanup for groundwater is implemented, then all issues with respect to contamination at these sites are resolved. That is why EPA is continuing with its investigations and studies, and, as necessary, will select additional cleanup actions for other areas, including but not limited to soils. In addition, EPA acknowledges that there may be issues not involving the Superfund sites but related to possible exposures to chemicals from other sources which the community may face.

Part of the comment refers to the concept of "offgassing" from the groundwater. In concept, this can occur when contaminants leave the groundwater and move up through soils a limited distance as a vapor. As explained in the meeting, EPA does not believe that persons in residences are exposed to soil gas contamination that has come off the water table for several reasons:

1) The vast majority of the groundwater contamination that is under residences is not in the water table aquifer (layer), but in the aquifers below it. In these areas, the water table is clean. To understand this, one can picture clean water layers near the surface lying over contaminated layers deeper down. In order for contamination to offgas into the soils above the water table, the water table must be contaminated. Because the water table under virtually all the residences is clean, there are no contaminants to offgas into the soils above the water table at these locations.

2) Even in the very limited areas where contamination exists in the water table under residences, the water table is more than 50 feet under the ground, and the effects of significant offgassing typically do not extend more than 10-15 feet. This is especially true in this case, because benzene has been shown to readily biodegrade in the soils above the water table over time; this greatly impedes the movement of offgassed vapors toward the ground surface, and

3) Soil gas samples taken in soils in residential yards directly over the groundwater contamination nearest the Del Amo waste pits did not indicate the presence of offgassed contaminants.

Comment:

My name is John Carpenter, and I'm a resident of Carson. You seem to see where a 50-year timetable is being brought up for remediation of this site, and my only question is, what is EPA's commitment or the involved parties' commitment going to be if there are any technological changes which would allow different processes of different remediation technologies to be used?

4 EPA Response:

This comment was addressed in response to another set of comments. See response to written comment of John Carpenter, in this response summary. EPA also responded to this comment orally during the public meeting at the request of the commenter.

Comment:

Ms. Bassist suggested that with EPA's toll-free number, we publish a menu of the steps that you can take to get through to the people quickly if its during working hours, and also the extensions of people working on the project.

5 EPA Response:

EPA will take this comment under advisement and see what we can do. We note that EPA does have an automated locator at 415-744-1305, which will allow you to spell a person's name on your phone and it will connect you without having to know the person's phone number. We note that this is a toll call, however. Please also note that, if persons are away from their desk, you will reach their voice mail, but EPA staff is generally diligent about returning phone calls. For reference, the persons working on the project can be reached at the following numbers:

Jeff Dhont, Remedial Project Manager 415-744-2399

Dante Rodriguez, Remedial Project Manager 415-744-2239

Bruni Davila, Remedial Project Manager 415-744-2364

Michael Montgomery, Chief, Arizona/California Site Cleanup Section 415-744-2362

Andrew Bain, Community Involvement Coordinator 415-744-2186

Comment:

Chris Stoker, who identified himself as a concerned citizen, asked several questions about how contamination could be found upgradient of the NAPL sources, or cross-gradient of the NAPL sources, and wanted EPA's input as to how it might occur.

6 EPA Response:

First, EPA must stress that the graphics used in the public meeting were primarily for conceptual purposes, and the notion of up- or cross-gradient spreading of NAPL or dissolved phase plumes is quite technical and beyond the general scope being conveyed in the meeting. Therefore, the conceptual figures were not designed to be read with the kind of precision that the commenter may have supposed. If interpreted in this way, the figures may over-represent the degree to which NAPL has moved "upgradient" of the source. Instead, the commenter should refer to the remedial investigation and feasibility study reports and to other documents in the administrative record documenting NAPL investigations for more precise descriptions of the position of NAPL.

It is not clear whether the commenter was primarily interested in the movement of NAPL in an "up-" or "cross-gradient" direction, or the movement of the dissolved plume in these directions. EPA will give a brief response to both.

It is true that the NAPL at the Montrose Chemical Site has been found in a distribution that extends both north and south of the Central Process Area to some extent. However, the movement of DNAPL in the subsurface is not strongly influenced by hydraulic gradients in many instances. Much more important are the NAPL residual saturations and head distributions, as well as the highly local variations in the hydrostratigraphic environment (such as porosity, residual conductivity, composition and character of the stratigraphic material, and alignment of stratigraphy). These local factors, and general dispersion, will cause the NAPL to spread out to some degree laterally as it "fingers" and moves downward.

At the Del Amo Site, the NAPL likely originally floated on the water table (LNAPL). Again, hydraulic gradients would not necessarily be the prevailing factor in the movement of the material on the water table, the local pressure distribution of the NAPL arriving at the water table, as well as the factors already discussed above for DNAPL being more predominant.

Dissolved plumes also typically extend upgradient and side-gradient of the source. Factors which may have influenced this movement at the Montrose and Del Amo Sites include dispersion and diffusion, and also variations in the groundwater flow gradient in the past.

2. Responses to Short Written Comments Received by EPA

The following written comments were received by EPA during the public comment period and are relatively short. It is therefore most efficient to respond to them in a single section. From certain other commenters, EPA received written comments of considerable length. For presentational clarity, EPA provided responses to these lengthy comments in the sections which follow this section, one section to each commenter.

John Joseph Carpenter, Jr. of Carson, CA

Comment:
My name is John J. Carpenter Jr. My academic background is in chemical and mechanical engineering. My interest is as a citizen of the area...Upon analysis of the presented data I feel that the plan presented on July 25, 1998 is ill contrived and doomed to failure. My thesis is based on the following:

- The study does not address the pCBSA plume and its effects.

#7 EPA Response:

EPA's studies of the Montrose and Del Amo Sites have addressed pCBSA significantly in that (1) we are aware of the extent of pCBSA in the aquifer system, either to non-detect or in the case of the downgradient extent, to a concentration of about 200 parts per billion, and (2) the feasibility study thoroughly assessed technologies which would remove pCBSA from water and the costs for doing so, and (3) EPA's proposed plan does include actions for monitoring and for ensuring that groundwater contaminated by pCBSA is not consumed or used by people. Most importantly, EPA's proposal is protective of human health with respect to pCBSA as well as the other compounds in groundwater.

- The largest plume in the study is pCBSA and it was stated that no health and toxicological data exists for this material. Unless a risk can be factored in for this contaminant the overall risk is at this time unknown for the largest known contaminant plume.

68 EPA Response:

EPA did not state that there are *no* health and toxicological data for pCBSA. There are a limited number of studies, which if relied upon, would indicate a low toxicity for pCBSA, and indicator tests performed did not give indications of mutagenicity (causing mutations) or teratogenicity (causing birth defects) in laboratory animals. However, these studies were highly preliminary. The conclusions that can be drawn from these studies, and the number of studies, are insufficient for EPA to promulgate health-based standards for pCBSA. It is true that (1) the pCBSA distribution covers the largest area of any contaminant associated with the Joint Site and (2) the hypothetical risk should someone drink the pCBSA in the water is unknown in that it cannot be quantified. However, no one is drinking the water in the contaminated area. Therefore, while we have not set a cleanup number, EPA's groundwater remedy focuses on monitoring and ensuring that water from wells that are being used for drinking do not contain pCBSA.

- Why are there no defined data or health/toxicity figures available or proposed?

69 EPA Response:

Again, there are limited health data available, but they are not sufficient to allow EPA to determine health-based levels for pCBSA. Additional studies, especially chronic, or long-term, studies, will be needed to propose or set these values.

A refinement of your question would ask why these additional studies have not been or are not being done. The priorities for which toxicological studies are started and completed are not set directly by EPA's Superfund program but are set nationally by many organizations based on a wide number of factors. There are far more chemicals awaiting study nationally than can possibly be studied at any given time given resources available, both public and private. Hence, priorities for initiating studies are usually set higher for chemicals where (1) people are known to actually be consuming the chemical, and (2) preliminary studies have shown a high probability of toxicity, even if the toxicity is not yet quantified. There are many unstudied chemicals with these characteristics that take high priority for study. In the case of pCBSA, (1) no one is currently using the contaminated groundwater for drinking or other purposes, and (2) the preliminary and screening tests done on pCBSA would indicate a low toxicity. These two factors combine to place studies for pCBSA at a lower relative priority for initiation of studies. On the other hand, pCBSA would have a higher priority than chemicals that are not already present in the environment, as pCBSA is. EPA has informed the parties within EPA with influence on these priorities about the pCBSA at the Montrose and Del Amo Sites and has requested that studies be initiated when priorities will permit.

It is important to note that, once studies are performed which are sufficient to quantify the hypothetical risk from pCBSA if someone drank it, EPA will re-evaluate this remedy to determine whether it is still protective of human health and, if it is not, EPA will amend the remedy to make it protective. Such an amendment may include additional or different cleanup actions. Presently, however, such studies are not yet being performed for the reasons discussed above.

Comment:

There is a statement that pCBSA is associated with DDT production which conflicts with a statement that pCBSA is widely distributed. There were not a large number of DDT manufacturing facilities. Is this material being seen just a long-lived contaminant which was in DDT used for agricultural uses which is now "background noise" everywhere?

10 EPA Response:

pCBSA was in fact associated solely with DDT production which occurred solely at the Montrose Chemical plant. The reason that pCBSA is widely distributed in groundwater is not that it has come from a large number of sources. Rather, this is because pCBSA is highly soluble in water, especially when compared to the other major contaminants at the Joint Site such as chlorobenzene and benzene. In general, as groundwater moves, the chemicals that are most soluble in water will move the most readily (fastest) with the groundwater. The chemicals that are less soluble will move more slowly than chemicals of higher solubility. EPA believes that the chlorobenzene and the pCBSA arrived in the groundwater at about the same time and continued to arrive in groundwater together under the former Montrose plant during its operations. However, once in the groundwater, the pCBSA moved faster than the chlorobenzene; hence we see a larger distribution of the pCBSA in the groundwater.

As to your question about agricultural uses, please note that after 15 years of investigation, EPA does not have information indicating that pCBSA was present in the DDT product from the Montrose plant. However, during DDT production at the Montrose plant, liquid waste streams were formed which contained pCBSA, which subsequently entered the ground. The point of origin was the Montrose plant itself. There is no reason to believe that pCBSA entered groundwater via agricultural application of DDT.

Comment:

Has any of the studies considered the proximity of the pCBSA plume to Dominguez Water Company wells along Carson Street?

#11 EPA Response:

EPA did a well survey and compared the location of the plume to all water supply wells in the area. Under this remedy, this survey will be updated periodically and all production wells which remain in use and are within range of the pCBSA plume will be required to be tested for pCBSA.

Comment:

This Plan is fatally flawed in that a commitment is being made to use current technology for the 50-year cleanup duration. This is my primary objection. Since it will take 25 years to effect approximately a 50 percent volume reduction, why is it not mandatory to re-open the case every 5 years to assure that the best, most cost-effective technology is being applied? Every month there are new environmental cleanup protocols developed and I feel technological options must be open ended.

#12 EPA Response:

EPA is required to perform a review of the protectiveness of all Superfund cleanups where hazardous substances remain on site at least every five years. Such reviews may be performed more often as necessary or appropriate. However, such reviews do not involve a "reopening" of the remedy selection process except in certain conditions. You are right that technologies are continually emerging. However, while small-scale technological improvements can be incorporated into the design, it is not practical and would be cost-prohibitive to change the entire remedial approach and/or technology each time a "better" technology arises. Consider, for instance, EPA or responsible parties implementing a $40 million cleanup action, only to operate that action for 5 years before changing to an entirely different action, technology, and/or remedial approach. With such an approach, over the course of the remedy, the total cost could run into the many hundreds of millions, if not billions, of dollars. Also consider that each new technology requires a design phase and may also require negotiation of legal agreements, a process that can require 1-3 years. Given this, it is doubtful that any actual cleanup would take place before the "next" technology came along five years later.

EPA must therefore use a different standard for requiring that the remedy selection be reopened to consider new major technologies and/or remedial approaches. During the 5-year review, a determination is made as to whether the remedy remains effective and

protective of human health and the environment. If the remedy remains protective, then in general, EPA does not require that the remedy switch to "better" technologies which may have emerged in the interim. If the remedy does not remain protective of human health and the environment, EPA in most cases would reopen the remedy selection process to incorporate new technologies or actions as necessary to make the remedy protective.

Comment:

My third objection is to that of equipment, maintenance, and life. ...

Most of the "environmental" equipment I see at remediation sites is poorly constructed with no well thought-out engineering. It is just a bunch of pieces from catalogs connected together. Most of the systems for vapor extraction at gas stations are unreliable and do not work 25 percent of the time.

13 EPA Response:

EPA cannot comment on your previous experience with remedial systems nor the state of the engineering you have experienced. However, with respect to the remedy EPA is selecting for groundwater at the Joint Site, EPA will require a comprehensive design, subject to EPA approval, and that the design be performed to accomplish the goals and requirements of the remedial action both over the short and long-term. Operation and maintenance, including replacement of equipment, will be planned for and enforced. EPA will continue to oversee, or directly perform, all aspects of the execution of this remedial action so that the scenarios which you say you have experienced elsewhere will not occur here.

Comment:

Nowhere in the Plan do I see any provisions for an equipment life/replacement schedule. Since the duration of this project is a 50-year window, how have equipment lives been determined? Over 50 years in a refinery or chemical plant generally over 5 to 8 major change-outs of pumps and equipment are the norm.

14 EPA Response:

The proposed plan is by its nature a summary document designed to assist the reader in commenting on all of the studies and documents related to EPA's proposal. While it did not specifically reference equipment life/replacement times, such aspects have been accounted for in the Joint Groundwater Feasibility Study, where cost estimates and feasibility are evaluated. Also note that when EPA selects a remedy, it is not designing a

remedy. Remedial design occurs in a phase after remedy selection. Thus, while replacement times, schedules, and costs are estimated for feasibility study purposes, these things are determined in much more detail, and made enforceable, during the remedial design process after the selection of the remedy.

Comment:

The logical extension of [the above comments] are that the most effective way to consider this project would be to start it up for 10 years with the assumption that at the end of 7 years the technology would be assessed and that assessment would drive the equipment selection for the next 10-year increment. This is because the plant equipment life is probably only going to be 10-12 years.

15 EPA Response:

This comment was largely addressed above. However, we wish to point out a possible difference in the interpretation of the terms "equipment" and "technology" as you have used them in your comments. As you suggest, as equipment wears out, it will be replaced, and in a small-scale sense (for instance, this type of pump versus that type of pump, using this new type of sensor or alarm, incorporating a new manifold) improvements to the equipment and the design will be incorporated through time and over replacement lifetime cycles. In a large-scale sense however, the technologies used in the remedy and the approach to cleanup most-likely would not change unless the remedy were determined not to remain protective of human health and the environment.

Comment:

The second great flaw to this program is that there is no up-front attack on the high concentration NAPL zone. Due to concentration driving forces, the area of the NAPL plume with high concentrations should share an equal priority for cleanup. This material with high concentrations is the most easily treated. To recover 25 pounds of contaminant at 5 ppm concentration (weight), 25 million pounds of contaminated solution must be treated. Conversely, at a concentration of 0.01 percent by weight only 2500 lbs. Of contaminated NAPL would have to be handled. This consideration does not appear to have been made for prioritizing NAPL cleanup.

16 EPA Response:

EPA will respond to the concepts implied by your comment rather than whether the actual numerical values you have provided are correct. Your comment, while containing some correct assertions, reveals several misunderstandings. First, you are referring specifically to the efficiency of removing dissolved phase contaminants from water. However, you fail

to make a distinction between the water with high dissolved phase concentrations on the one hand, and NAPL, on the other. The two are not the same. NAPL by definition is not contamination in the dissolved phase; rather, it represents a separate phase (NAPL stands for Non-Aqueous Phase Liquid). In the absence of NAPL, you are correct that it can be more efficient, on the basis of pounds of contaminant removed per volume of water treated, to remove contaminants from water where the contaminant concentration is higher.

However, with a NAPL phase present, the NAPL continues to dissolve into the water surrounding it, which very effectively re-contaminates the water. Thus, despite efficiencies that might otherwise exist in trying to clean the water with high concentrations, the concentrations of the contaminants in the water in the immediate proximity to the NAPL will not be reduced regardless of how much one pumps and treats this surrounding water. Said another way, the pounds of contaminant removed per gallon of water removed might be substantial, but no cleanup of the water in the ground would be occurring for the effort!

Contrary to your statements, removing the NAPL itself from the ground is far more complicated than removing water, especially in cases where it is necessary to remove virtually all NAPL. NAPL recovery to such a degree is often exceedingly difficult and fraught with a host of technical complications not typically associated with simple pumping of water.

EPA has not placed NAPL recovery on a lower priority than cleanup of the dissolved phase. Rather, EPA will have a second phase of remedy selection to address whether and to what degree NAPL recovery will occur. It will take longer to complete the studies needed to select this portion of the remedy. In the meantime, however, EPA has determined that not enough of the NAPL can be removed to obtain drinking water standards in the water surrounding the NAPL. Therefore, EPA's approach is to isolate both the NAPL and the water surrounding it, and contain it. The water outside this containment area will then be cleaned up. However, it will not be possible to clean the groundwater in the areas near the NAPL which have the very highest contaminant concentrations. In summation, EPA is not failing to "attack" the NAPL at all; in fact addressing the NAPL is the primary prerequisite for this remedy and the basis of the second phase of the remedy to be selected later.

For the reasons discussed above, EPA does not agree that the remedy we have proposed is doomed or flawed as you have proposed. Rather, the remedy will be effective in cleaning up as much of the groundwater as we can, containing the portions of groundwater we cannot clean up, and protecting human health and the environment both in the short and the long term.

Clare F. Adams of Torrance, CA and

Joeann Valle, Harbor City/Harbor City Gateway

Chamber of Commerce

EPA is responding to these two commenters together as several of the comments they presented are related. EPA has noted the actual commenter associated with a given comment.

Comment [Clare F. Adams]:

I am writing you concerning the Remedy Proposed Plan for the Dual Site referred to as Montrose and Del Amo Superfund Sites for the clean up of the water table.

17 EPA Clarification:

For clarity, we note that "water table" normally refers to the depth at which the first groundwater occurs, or the first aquifer (layer) in which groundwater occurs. EPA's proposed remedy addresses not only the water table but the other layers, known as hydrostratigrahpic units, under the water table, as well.

[Comment resumes] This letter is in regard to the site from the south east corner of the intersection of Vermont and Del Amo Blvd. At the intersection of the City of Los Angeles and the County of Los Angeles. The property to which I refer extends south to Torrance Blvd. also in the County of Los Angeles. The postal addresses for this property, known as the Ponderosa Pines, is Torrance, 90502. This property is just south of the land labeled a Superfund site, but it is in the water cleanup area, MBFB.

18 EPA Clarification:

The definition of a Superfund site includes all physical locations where contamination has come to be located. Therefore, the area you reference is within the area targeted for groundwater cleanup, and within the Del Amo Superfund site as well, although it is not within the original Del Amo Synthetic Rubber Plant property.

Comment [Clare F. Adams]:

Having attended your presentation on July 25, 1998, I have the following concerns:

[EPA should ensure that] ...actions taken to remediate the contaminated water table do not destabilize the ground or cause a subsidence under the buildings which run along the east side of Vermont between Del Amo Blvd. and Torrance Blvds. in the County portion known as Torrance.

19 EPA Response:

EPA appreciates your concern about ground subsidence or destablization, which can occur in certain cases where groundwater is shallow and a very large quantity of water is being withdrawn in a small area. Such occurrences are exceedingly rare with respect to groundwater cleanup actions. In this case:

1. **The groundwater is more than 50 feet under the surface, which is deep compared to the usual depths to groundwater at which such problems might occur;**
2. **The vast majority of the groundwater to be withdrawn for the cleanup remedy is not from the water table at 50 feet but from aquifers (layers) much deeper under the ground; in fact, in the area of Ponderosa Pines, the cleanup remedy would imply no withdrawal of water from the water table unless natural biodegradation fails to keep the benzene in that area contained; and**
3. **The withdrawal of water will be spread within the area of contamination, not concentrated in a single area; the amount of water being withdrawn for EPA's remedy is not significant enough to cause subsidence problems.**

Therefore, EPA does not believe that subsidence or destabilization will be an issue with respect to the groundwater remedy proposed.

We note that subsidence may occur within the Ponderosa Pines property you have mentioned for other reasons. Historical information indicates that these properties lie at least in part above former landfills. The land surface over a former landfill can subside over time if the landfill is not properly compacted and prepared prior to development for housing. EPA has no knowledge or information as to the manner in which the landfills were prepared prior to construction of the Ponderosa Pines development. Should property owners have concerns in this regard, EPA recommends they contact local authorities with jurisdictions in this area, or the property developers.

Comment [Clare F. Adams]:

...actions should be taken by the EPA to make it clear to the public that the property listed as the Superfund site is safe for uses involved with business and normal commerce. Further that the EPA make it clear to the public that most of the land is clean and safe and may be deemed so for purchase and development.

Comment [Joeann Valle, Harbor City/Harbor City Gateway Chamber of Commerce]:

[The Harbor City/Harbor Gateway Chamber of Commerce is concerned about] the false perception of the community that this area is dangerous. This perception has resulted not only from the labeling of this area as a Superfund site (although many properties have been deemed clean by the EPA), but also from the information released regarding the water table correction activities. Existing businesses have already experienced significant economic losses due to the misperception of this valuable and viable economic area as being unsafe.

This area generates considerable economic benefit to the voters of the 37th U.S. Congressional District and the 15th Councilmanic District of the City of Los Angeles, as well as the 2nd and the 4th Supervisorial Districts of the County of Los Angeles. The declaration of this area as a Superfund site has proved devastating enough. Now to have individuals and business groups fearful of working or using this area as a result of the misperceptions resulting from the water table improvements is intolerable.

We expect that the EPA does not wish to be, nor appear to be, the source of unwarranted financial losses due to the nature of information released. For example, water table contamination has nothing to do with surface land safety and that point should be made clear to the lay folks who hear or read of EPA's activities.

Frightening comments made on the record at the July 25th meeting clearly showed the misunderstanding by the public even to the statements from the public that the surface area used by business was unsafe. This perception must be corrected.

In order to lessen the economic impact to this critical source of businesses and jobs, the EPA owes the business community every effort to correct the misperception regarding this area. This is particularly so since the incorrect ideas about this area result from the EPA's communications with the press and others. We expect that the EPA must take a pro-active position to maintain the economic viability of this area. To clean up an area while leaving economically destroyed is pointless.

520 – EPA Response:

EPA is aware of and sensitive to the economic issues faced by businesses by virtue of being on a Superfund site. The commenters are correct that many of these issues arise from independent perceptions among businesses, lenders, and individuals about Superfund and what it means to be on a Superfund site. Please understand that EPA focuses on cleaning up sites and protecting human health as the law requires. We also do the best job we can to educate communities, including businesses, about known risks at Superfund sites. It is our goal to encourage the economic vitality of the business community by demonstrating progress in the progress of cleanup.

EPA has endeavored, and will continue to endeavor, to explain to the public completely and clearly what we know about site-related health risks. Should the press or other individuals harbor or promote misperceptions about the site, EPA can continue to provide correct information but cannot guarantee that those perceptions will change.

It is important to note that EPA's activities at the Del Amo Superfund Site would not be necessary had pollution not been released into the ground historically from the Del Amo Plant. And, certainly, EPA would not be expending the time, effort and costs to investigate and develop cleanup actions for the Del Amo site if the potential for certain health threats did not exist, either now or in the future. EPA therefore believes it would be misleading to state that there are no actual or potential health threats associated with the Del Amo Site. The issues posed by the site contaminants are serious and we would not label all concerns about them as "misperceptions."

That said, the comment is still well-taken in that sometimes perceptions of health threats can develop which are not realistic. During the time that EPA's investigation is underway but not yet complete, EPA lacks the data it needs to make final statements about site contamination. As already stated, EPA will try to address misperceptions that may arise during this period of time.

The Del Amo Superfund Site encompasses the areas where contamination has come to be located. However, there are a vast majority of locations within the Superfund Site that would not present a chemical exposure to persons at the ground surface. For example, in some parts of the site there is groundwater contamination far underground but no soil contamination between the groundwater and the ground surface. In these areas, so long as the groundwater is not pumped to the surface and used, there is no health threat to persons at the ground surface and routine surface activities are safe with respect to Superfund contaminants (we point out that the safety of, and possible chemical exposures from, ongoing industrial activities and practices are not part of EPA's Superfund investigations and are typically addressed by other laws and agencies such as the Occupational Safety and Health Administration (OSHA)). This conclusion carries more certainty because the groundwater portion of EPA's investigation is largely complete (additional investigation will be conducted to be able to design the groundwater remedial action).

Also, based on the partial soils sampling done to date within the former Del Amo plant property, EPA has not identified an unacceptable health threat to persons living or working at the ground surface from Superfund contamination in soils. EPA has discovered contamination in some soils at depth; however indoor air sampling has not shown that this contamination has entered buildings. Because of the distribution of the contamination, the commenter is most-likely correct that the vast majority of buildings within the Del Amo Site are safe to occupy with respect to Superfund contaminants. EPA's sampling is not complete, however, and EPA may later discover sporadic locations where health threats

from soils do exist. For this reason, it would be inappropriate for EPA to make the broad conclusions called for by the first commenter. For specific information about the results of existing sampling and plans for additional sampling, persons may contact the Del Amo project manager at EPA.

Finally, we wish to note that it is not possible or practical for EPA to sample in every location within the Del Amo Superfund Site, even at the conclusion of its investigation. For this reason, EPA cannot and does not make parcel-by-parcel determinations of "clean" or "not clean." Our mandate under Superfund is to define the nature and extent of the Del Amo contamination and develop cleanup actions as necessary to protect human health and the environment; it is not to make parcel-specific evaluations of all properties within the site. Thus, there will be some parcels with many samples, some with few samples, and some with no samples at all, depending on the degree of characterization needed with respect to the contamination released from the former Del Amo plant. Even on parcels we do sample, we cannot eliminate the potential (which of course we try to minimize) that some contamination could be missed by the sampling. On the other hand, we can and will always tell a landowner or business owner what was found and what is known about contamination on their property. Also, EPA can explain why it did not sample in certain locations and why additional contamination may not be expected in those locations.

In conclusion, EPA does understand the issues raised in these comments and will endeavor to provide the most accurate information within the framework of what we know. It is our hope that our communications with the public will assist it in understanding the concerns of EPA, as well as the types of health effects that are not likely to exist, in relation to the Del Amo Site.

Comment Synopsis:

Both the Clare F. Adams and The Harbor City/Harbor Gateway Chamber of Commerce requested that EPA documents in the future correctly identify the properties in or near the site as being either the City of Los Angeles or the County of Los Angeles with a mailing address of Torrance or Gardena.

#21 EPA Response:

EPA understands this comment to refer to the matter of the Montrose Superfund Site, in particular, but also potentially the Del Amo Superfund Site, being referred to in EPA documents as being within the City of Torrance. Technically, the commenters are correct that the former Montrose plant, and in fact, the former Del Amo plant, are within the Harbor Gateway, a narrow strip of the City of Los Angeles which provides it with a jurisdictional pathway to the Los Angeles Harbor (under California law, cities must be contiguous). Historically, during the operations of the former Montrose plant, it was

referred to by Montrose as well as the City agencies regulating it as "the Torrance plant." Also, because the Montrose plant was much closer to Torrance than to Los Angeles proper, the historical "Torrance" label continued to be used when EPA began investigating the site and placed it on the National Priorities List (the formal register of Superfund sites).

Within the last few years, EPA has, in fact, endeavored and been largely successful in being careful to refer to the Montrose and Del Amo Sites as being within Los Angeles, near Torrance. We will continue to endeavor to make this clear in documents (both for Montrose and Del Amo) that we produce today; however, because of the historical factors discussed above, you may continue to find older documents which refer to the Montrose Chemical Site as being in Torrance.

3M Corporation and Goodyear Tire and Rubber Company

EPA received written comments from 3M Corporation and Goodyear Tire and Rubber Company. The comments received from each company were identical in that one issued a letter incorporating the other's comments by reference.

Upon review of these comments, EPA has determined that they are not pertinent to EPA's proposed plan and selection of alternatives for groundwater for the Joint Site. EPA finds that these comments are focused on allocation of liability and/or responsibility among responsible parties, and on establishing these companies' position with respect to such matters. In making this determination, EPA does not wish to minimize the concern these companies may have for these issues, nor dismiss their positions. However, the remedial selection process (culminating in the ROD) does not address or establish liability allocation, and hence such issues are not pertinent to the selection of alternatives and this is not the proper forum for addressing them. Because these comments are extensive, were EPA to address them here, it would fill this response summary with lengthy discussion not related to, and distracting from, the matter at hand. As stated in the NCP, EPA is only required to address pertinent comments in the response summary [40 C.F.R. §300.430(f)(3)(C) and (F). Because the 3M and Goodyear comments are not relevant to the issue of remedy selection, EPA has chosen not to address these comments here.

3. Responses to Written Comments Received From Montrose Chemical Corporation of California

Preface by EPA:
In this section, EPA summarizes its responses to written comments provided by the Montrose Chemical Corporation of California (Montrose). To a large extent, the original comments are cited verbatim for convenience. Where appropriate, responses are given both within the body of a comment as an issue arises, and at the end of an overall comment. Responses are provided first to the General Comments, 1 through 18. Responses are then provided to the "exhibits" where more detailed comments are made by Montrose, in the same order as the original comment document. The response format is the same as used in the remainder of the response summary, except that, because the comments are largely repeated verbatim, the **Comment:** heading is generally omitted unless needed for clarity. The commenter's text is shown in normal text.

Many of the comments made by the commenter are not pertinent to groundwater or groundwater remedy selection. Some of these have been identified in the course of EPA responses, some have not. In most cases, because the comments pertain to the RI Report, EPA has provided a response, even though such comments do not relate to the remedy selection. This applies largely to comments applying to soils issues.

General Comments

General Comment 1. "Theoretical" Health Risk and Strong Institutional Controls on the West Coast Basin Favor Plume Containment Only.

A. Hypothetical Risk

EPA cites high risk factors for cancer and other heath symptoms associated with the theoretical human consumption of contaminated groundwater as support for the proposed 700 gpm groundwater extraction remedy. See generally Joint Groundwater Risk Assessment and Supplement; Proposed Plan, p. 42. However, the risk data are misapplied by EPA for remedy selection purposes because there is no actual human exposure to any chemicals of concern, and none is expected, proposed or reasonably foreseeable. In short, there is no present or future pathway for human consumption of the impacted groundwater, and reliance upon a hypothetical risk as justification for EPA's proposed remedy is both erroneous and inconsistent with the National Contingency Plan. The current cancer and health risk relating to actual human consumption of the affected groundwater is, by definition, zero because no groundwater pathways exist (and none will be created).

EPA purports to overcome this analytical obstacle by assuming hypothetical future well installation and human consumption in the impacted area in order to justify a highly expensive remedy. The risk reports, however, more persuasively support the proposition that existing legal restrictions on regional groundwater for the Bellflower Sand and Gage Aquifers should be maintained, and impacted zones should not used for potable water. Even after implementation of EPA's proposed 50-year, $30 million remedy, groundwater at and in the vicinity of the Joint Site will not be used for drinking water because of naturally occurring contaminants and regional sources of volatile organic compounds ("VOCs") and petroleum constituents (e.g., benzene, toluene, ethylbenzene, xylene, or "BTEX" compounds).

In short, EPA is justifying remediation of the Montrose monochlorobenzene ("MCB") plume based on the reduction of an exposure risk that will never actually exist. Yet at the same time, EPA is willing (and correctly so) to allow benzene at the Del Amo Superfund Site (Del Amo Site) to attenuate naturally over hundreds of years, even though the hypothetical risk associated with that adjoining plume is many times greater (if based on "maximum contaminant levels" or "MCLs") than that associated with the MCB plume. The fact of the matter is that neither risk will ever materialize and therefore should not be used as a basis for decisionmaking at either site.

22 EPA Response:

EPA disagrees with the commenter's interpretations. The commenter is correct, as EPA has stated in several places in the ROD and proposed plan, that persons are not currently exposed to the contaminated water within the Joint Site. However, in this case, EPA would be remiss to neglect to take action based solely on this fact. Both the NCP and CERCLA require cleanup of groundwater resources when potential risk exists and when the groundwater is designated as a potential source of drinking water. Also, the preamble to the NCP, at Fed. Reg. 55 No. 46, p. 8733, states "It is EPA policy to consider the beneficial use of the water and to protect against current and future exposures. Ground water is a valuable resource and should be protected and restored if necessary and practicable. Ground water that is not currently used may be a drinking water supply in the future." While we add the following extended discussion in response to the comment, we do not wish the comment or the discussion to distract from the overriding fact that the NCP requires restoration of groundwater at the Joint Site because the State of California has designated the groundwater as a potential source of drinking water.

Both the Joint Risk Assessment, and EPA's Supplement to the Joint Risk Assessment made it clear that the risk calculations reflect risks that would exist in the event someone did use the groundwater, rather than risks presently being incurred. However, it is appropriate to calculate such hypothetical future risks in this situation and EPA would be remiss to fail to do so.

The fact that the actual contaminated groundwater within the Joint Site presently is not being used for potable purposes is not tantamount to saying that the groundwater in the

area of the Joint Site is in widespread disuse. To the contrary, there is groundwater use in the area for a variety of purposes. The State of California classifies *all* water at the Joint Site as having potential potable beneficial use, and it is the intention of the State in making this classification to protect this water both as a present as well as a future potential resource. Moreover, it is at least in part because of the presence of the contamination itself that more use presently is not being made of the groundwater within the Joint Site itself.

The contaminated Joint Site groundwater covers a very large area both laterally (covering several square miles) and vertically (covering six hydrostratigraphic units to depths exceeding 200 feet). The contaminated groundwater can continue to move, both laterally and vertically. Over time, the contamination may reach wider areas outside those presently affected, as well as deeper aquifers which are already much more-readily and regularly used for drinking water. The deeper Silverado Aquifer, below the Lynwood Aquifer, has high groundwater velocities and is widely used as a major source of drinking water within the Los Angeles Basin. The contamination may reach wells that are presently used, as well as wells that eventually may be installed and used, for potable water. As the overall area and depth of affected groundwater increases, so does the chance that some groundwater will be used within the area affected by contamination, either presently or in the future. The ability to effect a cleanup of the contamination later in the future decreases as the extent of the contamination becomes larger and deeper.

Additionally, while the tendency may be to focus solely on patterns of water use by purveyors and major municipal supply systems, it also should be recognized that private wells can be drilled and used. Such wells may not be drilled to the depths or in the manner that commercial purveyors would install water production wells. It is true that, while there are regulations that prohibit or require certain standards for individual well installations, compliance with these regulations may vary. Again, the larger the distribution of contamination from the Joint Site over time, the greater the possibility that the health of a private well user may be jeopardized by private water use. Such water use could be particularly pernicious because, unlike most major water purveyor systems which tend to blend water from multiple locations, private well use is made from a well at a single location. If the contaminant concentrations at that single location are high, the well user could incur a very high health risk.

The commenter states that the existing risk is zero because no one is drinking the water. While this is true in the most immediate sense, it is appropriate to consider what would happen should the groundwater be used in the future, particularly in light of the potential for groundwater use. The Joint Risk Assessment, as amended, showed that the risk from use of the groundwater could be extremely high, and may exceed a 10^{-2} cancer risk and a hazard index of ten thousand. These levels are on the order of ten thousand times more risk than EPA typically considers acceptable at Superfund sites. It is not inconsistent with the National Contingency Plan (NCP), as the commenter suggests, to consider the potential

for future risks. On the contrary, the NCP requires that EPA consider the potential for future risks, and it is considered prudent and appropriate to take actions to prevent those risks, especially if they are reasonably likely over a long period of time. A corollary to the commenter's suggestion would be that, until someone actually drinks the contaminated water, little or no action is justified. Given the fact the groundwater contamination is widespread, may continue to move, and lies in an area with extensive and increasing urban population, EPA does not think this would be appropriate. EPA disagrees with the commenter's statement that there is no potential for future health risks from groundwater.

The commenter implies that existing laws will be sufficient to prohibit the use of groundwater at the Joint Site in the future. EPA disagrees. While adjudication of groundwater, which was designed to limit upland salt water intrusion into the groundwater system, may limit groundwater use, it does not preclude it.

The commenter mentions that there are other sources of contamination (i.e. VOCs) near the Joint Site, and suggests that minimal action (containment only) should be taken for all of the groundwater at the Joint Site because of the presence of these other sources. It is true that there are sources of contamination in groundwater in areas surrounding the Joint Site. Primarily, these are under investigation and may be subject to cleanup actions under the jurisdiction of environmental agencies of the State of California. The argument for minimal action because of the presence of other neighboring contaminant sources is circular in that all contaminant sources could make this argument, resulting in no action among any of them. EPA does not accept the implication that remedial action at the Joint Site should be performed only after remedial actions are completed at any neighboring sites. The State of California will be taking actions in the areas surrounding the Joint Site as the remedial action selected for this ROD is also being implemented. EPA will continue to coordinate with the State on an ongoing basis with respect to these actions.

The comment implies that EPA is being more lenient with the benzene plume near the Del Amo Site, allowing it to "naturally degrade for hundreds of years," while at the same time requiring that the chlorobenzene plume be actively cleaned up. In fact, the remedial action in this ROD treats the chlorobenzene and benzene plumes consistently and without bias.

The comment does not reflect an understanding of the fact that the benzene plume being "allowed to degrade" is inside the containment zone, whereas the majority of the chlorobenzene plume is not. There are physical differences in the nature and extent the benzene and chlorobenzene plumes. The benzene plume extends a relatively short distance from its original NAPL sources, and does not extend outside the containment zone. The chlorobenzene plume, on the other hand, extends more than 1.3 miles from the former Montrose property in the MBFC Sand, and almost a mile in the Gage Aquifer, far outside the containment zone. In addition to this, intrinsic biodegradation is more reliable as a remedial mechanism for benzene than for chlorobenzene. These are the reasons for the

differences in the type of actions required for the benzene and chlorobenzene plumes, which are explained in the body of the ROD. However, for benzene and chlorobenzene plumes alike, (1) contamination within the containment zone is contained, and (2) contamination outside the containment zone is reduced in concentrations to drinking water standards.

As the commenter suggests, it is correct that, under this remedial action, the containment zone will indefinitely contain water which would pose a health threat *if* it were used. The containment zone cannot be cleaned to drinking water standards. However, this zone is kept as small as possible; the large extent of the chlorobenzene plume that lies outside of the containment zone will no longer pose such a potential risk at the conclusion of this remedial action. Potential risks must be viewed not solely in terms of contaminant concentrations, but also in terms of the extent of the groundwater that is contaminated.

Finally, the commenter suggests that a remedial action imposing only containment of all of the contaminated groundwater, coupled with existing regulatory controls, should be implemented, in lieu of the remedial action that was proposed by EPA. EPA notes that applicable or relevant and appropriate requirements (ARARs) apply to all remedial actions that EPA selects for the Joint Site. ARARs identified for this ROD require that the in-situ concentrations of groundwater contaminants be reduced to at or below drinking water standards. These ARARs apply to all Joint Site groundwater other than that groundwater for which the ARAR can be waived based on technical impracticability; namely, inside the containment zone. The ARARs must be attained in a reasonable time frame. The commenter's proposal of indefinitely containing the overall groundwater contamination at the Joint Site, but not reducing its concentrations, would not meet these ARARs and hence would not be consistent with the NCP nor the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Hence, while EPA believes the commenter's proposed action would not adequately protect human health for other reasons, it can be rejected initially simply on the grounds it does not meet the most basic regulatory requirements.

B. Institutional Controls

In its reports, EPA appropriately acknowledges that legal controls have long existed regarding water usage in the West Coast Basin, which includes the water-bearing zones in the vicinity of the Joint Site. JGWFS Report, Section 2.3.4, at p. 2-102. West Coast Basin water rights were adjudicated over 35 years ago in 1962, and regional groundwater has since been managed by the California Department of Water Resources ("CDWR") as the court-appointed "Watermaster." Persons who have no basin water rights are prohibited from extracting water. According to the Deputy Watermaster, Mr. Chris Nagler, the adjudicated "maximum sustainable yield" for the

water basin has consistently been 64,000 acre-feet per year. Telephone conference with Deputy Watermaster, CDWR, Aug. 27, 1998.

Despite three decades of legal control over the resources of the West Coast Basin by the State of California, which has already prohibited the construction of wells in the vicinity of the Joint Site, EPA assumes that existing legal controls may be repealed or seriously weakened, thereby allowing water users to install water supply wells in or around the Joint Site. Such a hypothesis is extremely farfetched, particularly since the same concerns that led to the basin adjudication in the 1960s are only going to become more compelling with time. A repeal of the current legal restrictions on basin use would be tantamount to the abandonment of basin resources by the State for water supply purposes. The basin would quickly be overused and degraded through seawater intrusion. Telephone conference with Deputy Watermaster, CDWR, Aug. 27, 1998.

23 EPA Response:

EPA's nonreliance on existing regulatory programs to be a component of the remedial action for the Joint Site is not farfetched, and the rationale for EPA's position is clearly stated on pages 2-102 through 2-105 of the Joint Groundwater Feasibility Study (JGWFS). EPA's position is also clearly supported by the NCP, as discussed below.

Superfund regulations clearly state that, while institutional controls should be considered as means for supplementing a remedy, they should not be relied upon as the sole remedy. The NCP, at §300.430(a)(1)(iii)(D), states,

> **EPA expects to use institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants...The use of institutional controls shall not substitute for active response measures (e.g. treatment and/or containment of source material, restoration of groundwaters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of trade-offs among alternatives that is conducted during the selection of the remedy.**

Similarly, EPA notes that the NCP preamble, at 55 Fed. Reg. No. 46, p.8706, notes that:

> **"...Institutional controls may be used as a supplement to engineering controls over time but should not substitute for active response measures as the sole remedy unless active response measures are not practicable..."**

EPA's concerns about institutional controls also stem from the required duration any of the alternatives developed in the JGWFS. Each alternative, including the preferred remedy, would result in contamination remaining in the groundwater for periods on the order of 100 years or more. It is reasonable to assume that over this time frame the local demand for groundwater could increase and the legal and administrative requirements for groundwater withdrawals could change. The lengthy duration of the proposed remedy, including the component of indefinite non-aqueous phase liquid (NAPL) containment, is

too long to rely exclusively on the current legal and administrative groundwater management tools to protect human health over the long term.

As discussed in the JGWFS, the adjudication of the groundwater basin does not preclude the installation of new wells in the vicinity of the Joint Site. In fact, the Water Replenishment District of Southern California is currently evaluating the feasibility of desalter wells, pumping at several thousands gallons per minute, in the Torrance area.

Those entities which do possess allocated West Coast Basin water rights are subject to strict reporting requirements to prevent overuse, further decline in groundwater levels and seawater intrusion. One of the inherent limitations in determining the maximum sustainable yield is potential seawater intrusion. Reinjection is already used within the basin to maintain a hydrologic barrier. The Water Replenishment District of Southern California also funds an "in lieu replenishment" program that compensates holders of water rights if they agree to forego pumping in certain years to maintain basin water levels through dry cycles. Accordingly, actual annual pumping in the basin may be less than 64,000 acre-feet in order to preserve basin levels.

24 EPA Response:

In fact, the average extraction in the West Coast Basin in the last several years is considerably less than the legal maximum basinwide withdrawals. Specifically, the average is roughly 50,000 acre feet per year, or about 77 percent of the adjudicated extraction of 64,468 acre feet per year. As a result, more water can potentially be extracted from the basin, including in the vicinity of the Joint Site. This additional extraction could cause significant changes in hydraulic gradients and velocities of regional groundwater flow.

The Watermaster monitors the water levels carefully and will continue to do so indefinitely. *Id.* CDWR regulations also prohibit installation of water supply wells in basin areas with contamination. *See JGWFS Report* at p. 2-103.

Although annual water extractions may fluctuate to preserve basin resources, total annual yield in the West Coast Basin has since 1965 remained steady. Telephone interview with Deputy Watermaster, CDWR, Aug. 27, 1998. According to the Watermaster, even assuming seawater intrusion could be managed, there is no anticipated increase in the adjudicated maximum sustainable yield. *Id.*

EPA's risk analysis suggests, however, that future water resource development in the West Coast Basin will occur in a haphazard fashion, despite decades of carefully planned study of this water supply. CDWR studies in fact indicate that the shallow groundwater in the basin cannot be pumped in sufficient quantity to make extraction economical, and that the Gage Aquifer is not an important source of groundwater production except in Gardena. *See Planned Utilization of the*

Ground Water Basins of the Coastal Plain of Los Angeles County (CDWR, June 1961) ("CDWR Study"). Any future water supply development is likely to occur in the vicinity of the Los Angeles and Montebello forebay areas, where deep groundwater can be replenished by spreading water on the surface of the ground, and at locations where it is convenient to pump water into the Silverado Aquifer for temporary storage. Neither of these forebays is located near the Montrose Chemical Superfund Site, and the Silverado Aquifer is not impacted by the Montrose Chemical Site.

CDWR also considers the first zone underlying the Montrose Chemical Site to be within an aquiclude, which means that water cannot be economically extracted. Studies by CDWR in 1952, 1957 and 1958 refer to this zone as a "clay cap," indicating its inability to transmit water. *See* CDWR Study at p. 42. While a number of wells have been drilled into the Gage Aquifer in the vicinity of Gardena, CDWR considers it "unimportant as a producing aquifer in other areas." *See id.* at p. 61. The Gage Aquifer "exhibits moderate to low permeability and therefore is of secondary importance as a groundwater producer in the West Coast Basin." *See id.* at p. 132. As of 1961, "few wells extracting from this aquifer supply water for domestic and irrigation purposes." *Id.* Because municipal water has become available throughout the basin, and since area agricultural usage has been diminished, it is reasonable to conclude that reliance upon the Gage Aquifer has declined with time and will not, as EPA suggests, dramatically increase.

25 EPA Response:

The response is divided into four major points:

1. Once again, we point out that the preamble to the NCP, at Fed. Reg. 55 No. 46, p. 8733, states "It is EPA policy to consider the beneficial use of the water and to protect against current and future exposures. Ground water is a valuable resource and should be protected and restored if necessary and practicable. Ground water that is not currently used may be a drinking water supply in the future." We also note that the State of California classifies *all* water at the Joint Site as having potential potable beneficial use, and it is the intention of the State in making this classification to protect this water both as a present as well as a future potential resource.

2. The contamination in Joint Site groundwater, even if the remedial action selected by this ROD is implemented, will remain to some extent on the order of 50 years to a century outside the containment zone, and for perhaps centuries inside the containment zone. As discussed, it is appropriate to consider the potential for groundwater use, over a large plume, in the far future as well as in the near term. (See earlier responses)

EPA does not discount that the authorities of the Watermaster as established in the adjudication of the basin presently limit the use of groundwater at a lower withdrawal rate, on a large-scale basis, than might otherwise exist. It is also likely that if water is used, there is more potential for the use to occur in the Lynwood Aquifer than the Gage Aquifer, and

more potential for use of the Gage Aquifer than the MBFC Sand. (We again note, however, that the State of California classifies *all* groundwater at the Joint Site as having potential potable beneficial use.) Yet, the CDWR report quoted by the comment, as well as the telephone conversation quote of the Deputy Watermaster stating that no increase in sustainable yield is presently planned, represent contemporary findings of near-term water use on a large scale. Such plans and statements cannot (and we would submit, are likely not intended to) reflect water use centuries or more into the future.

3. Perhaps more importantly, the comment focuses primarily on increases in sustainable yield of the entire adjudicated groundwater system, and/or certain aquifers within the entire system. This overly large focus obscures a more critical consideration: the maximum sustainable yield of the system can stay the same, but the use of the water can be redistributed. Accordingly, water within the Joint Site may come into use if extraction of water is discontinued at other points within the adjudicated basin and moved within the Joint Site. Such redistribution is not prohibited even under existing adjudication. This could occur for a large variety of reasons, including but not limited to shifts in local water needs within the basin, contamination in other locations, or depletion or overdraft of groundwater in a localized area (as opposed to the entire basin as a whole discussed in the comment).

4. EPA notes that, whether local or over the whole basin, the groundwater use at the Joint Site would not have to increase by a large amount, when viewed from the standpoint of the volume of water extracted basin-wide, for a significant health risk to occur. Future groundwater use may be insignificant from the standpoint of the basin-wide CDWR report, and the Watermaster may consider a small perturbation in use essentially to be "stable" groundwater withdrawal. Yet, individual persons using such well water could face a health risk considered unacceptable by EPA.

Of note, all current water supply wells are upgradient or removed (laterally and at depth) from the Montrose Chemical Site and the impacted area. This is because wells have already been located where aquifer conditions allow optimal yield. Having achieved maximum sustainable yield in the West Coast Basin for the last several decades at current well locations, all of which are located sufficiently far away from the Montrose Chemical Site and any impacted groundwater, it is highly unlikely that new wells will be installed closer to the impacted area for "improved yield." Alternate locations of higher transmissivity exist elsewhere in the basin outside any zone of influence.

[1] Provided the MCB, trichloroethylenene ("TCE") and benzene plumes are contained, maximum sustainable yields could be maintained indefinitely without any impact from the Joint Site. Thus, EPA's arguments of a potential future adjudication of higher yields and new water supply wells around the impacted area are not well supported by the history and characteristics of the basin, and the law already prohibits the fictional risk upon which EPA justifies its proposed remedy.

26 EPA Response:

First, EPA states again that permanent containment of the groundwater is not an option which is consistent with the NCP or CERCLA. These require that ARARs be attained in a reasonable time frame; permanent containment of the groundwater would not achieve this objective.

Future adjudication to allow for higher overall yields, when considering remedial action time frames on the order of centuries, is possible regardless of historical trends that may exist. Again, EPA disagrees with the commenter's implication that water use patters over centuries into the future can be reliably predicted and reliably based on shorter-term historical patterns.

That point aside, focusing on "higher yield" from a basin-standpoint obscures the concern of redistribution (e.g., consolidation) of water rights and pumping patterns. EPA does not state in the JGWFS nor in the proposed plan that new wells would be installed closer to the affected area specifically for the purpose of "improved yield." See response to the last comment with respect to water use redistribution.

The comment implies that it should be acceptable to leave the groundwater at the Joint Site contained but permanently contaminated so long as there are other locations where wells can be placed to obtain "optimum yield." This again ignores how the water rights and pumping patterns may change in the future. Optimum efficiency for water use is not based solely on the yield of a well, but also depends on where the water needs are, the costs of conveying the water from the wells to the point of need, and the degree of use of the water already in the areas being considered for pumping. All of these factors may change over time as water resources become more scarce and population and demographic patterns change. EPA disagrees with the commenter that wells are presently placed in the only optimum locations for water withdrawal, and that no future redistribution of wells is

[1] EPA's hypothetical risk analysis ignores the basic reality that water supply purveyors have made significant investments in infrastructure to enable groundwater extraction from the West Coast Basin. There is no indication that such purveyors will abandon these investments and move wells within the affected zone in the vicinity of the Montrose Chemical Site. Because groundwater resources in Southern California in general (and certainly in the West Coast Basin) are utilized to sustainable capacity, the locations of further well development, if any, are likely to be located near points where imported groundwater is used to replenish the deeper aquifers. Such replenishment can occur at the Los Angeles and Montebello forebays, which are several miles from the site, or may occur at deep well injection points in the Silverado Aquifer, which is not a resource affected by the Montrose Chemical Site.

possible. Regardless, EPA does not agree that it is appropriate to allow the entire affected resource to remain permanently compromised simply because there are other well locations where more yield may be possible, if this is even the case.

Nonetheless, as stated in the last response, it may not require a large increase in the use of the groundwater within the Joint Site to create a large health risk.

Since it is inconceivable that the State and those who possess water rights would abandon basin resources, existing legal controls represent the most certain of available long-term institutional protections, irrespective of EPA's conclusion that such controls are irrelevant for purposes of remedy selection. *See JGWFS Report,* at p. 2-102. Accordingly, EPA's risk assessment hypothesis that California may (1) repeal or seriously weaken current legal restrictions on the West Coast Basin over the next century, (2) degrade basin resources by allowing accedence of the maximum sustainable yield, and (3) allow potential human consumption of impacted water through the movement of extraction points considerably closer to the Joint Site, completely lacks foundation and is contrary to well-established basin practices. EPA's conclusion that only plume reduction and an aggressive 700 gpm (or higher) system can protect the basin over the next century is incorrect. In short, the basin's yield can be maintained indefinitely and safely through plume containment.

27 EPA Response:

See the collective responses presented above to this general comment.

Montrose-Related Groundwater Contamination Presents No Significant Increased Human Health or Environmental Risk.

Chemicals of concern associated with the Montrose Chemical Site have not contaminated drinking water wells, and none is threatened now or in the foreseeable future. All domestic, commercial and industrial water in the Torrance, California area is supplied by water purveyors who obtain water from outside of the impacted area. Municipal water standards prevent water purveyors from delivering water that exceeds state drinking water standards (*i.e.*, "maximum concentration limits" or "MCLs").

Despite the absence of any significant human health risk, EPA is proposing a "subregional" groundwater remedy for the Montrose Chemical Site, effectively creating at considerable expense an island of cleaner groundwater within an area of regional groundwater contamination that will not be remediated for hundreds of years, if ever. As shown in Figure 2-14 of the JGWFS Report, contamination appears to originate from at least the following ten industrial facilities, all of which are located within 1.5 miles of the Montrose Chemical Site.

1. McDonnell Douglas (VOCs)
2. Jones Chemical (benzene and VOCs)
3. Landfills (BTEX and VOCs)
4. Golden Eagle Refinery (BTEX and VOCs)
5. Allied Signal (benzene and VOCs)
6. ILM (VOCs)
7. Mobil refinery (BTEX)
8. Armco (BTEX and VOC)
9. Pipelines to the south (BTEX)
10. Azko (toluene)

For Del Amo, EPA is proposing natural attenuation of dissolved phase benzene and LNAPL [2] over the next several hundred years. Given the numerous, disparate sources, the wide-spread presence of LNAPL and DNAPL in the regional groundwater, the inability to remediate many of the sources, and the interconnection or interrelationship of the regional groundwater contaminant plumes, there is no reason why the subregional MCB groundwater plume in the Torrance area (above the Silverado Aquifer) should be restored to drinking water standards within 50 years. Imposing such standards on only a subset of the region would produce no meaningful human health risk reduction or other environmental benefit, and thus could never be cost-effective.

28 EPA Response:

Much of the above comment is addressed in earlier responses and the reader is referred to earlier comments on water use and risk.

EPA disagrees that no wells could be affected in the future for reasons previously discussed. EPA disagrees that the potential health risk from future exposure to contaminants should be ignored for reasons previously discussed.

The comment states that water purveyors are prevented from serving water above MCLs. The existence of the MCL requirement is not an acceptable argument for allowing the continued compromise of the groundwater resource. Such an argument is tantamount to placing the liability and responsibility for groundwater contamination on water purveyors, who must either clean the groundwater themselves before serving it, or continually find sources of groundwater that are not contaminated and are becoming increasingly scarce. CERCLA placed the responsibility for such actions on the parties who released the contamination into the groundwater.

Once again, EPA is aware of the other source of contamination (i.e. VOCs) near and surrounding the Joint Site. Primarily, these are under investigation and may be subject to cleanup actions under the jurisdiction of environmental agencies of the State of California. (See earlier comment response regarding VOC sources). The remedial action selected by

[2] LNAPL is defined as lighter than water "light non-aqueous phase liquid," and DNAPL is defined as heavier than water "dense non-aqueous phase liquid."

this ROD has considered these other sources and directs the means by which their influence on the remedial action for the Joint Site be minimized.

EPA does not agree with the statement that cleanup within the Joint Site (the "subregion" identified by the comment) provides no benefit and no reduction of risk unless the entire "region" is cleaned with it. The comment is not clear as to how it envisions "the region." EPA would strongly disagree with the implication that any and all groundwater contamination within the Los Angeles groundwater basin, or some such extensive area, be subject to cleanup before any cleanup of the Joint Site would have a benefit. The Joint Site is quite large (several square miles) and so, when it is cleaned, will not represent an insignificant island in a sea of contamination. The remedial action selected by this ROD will create a large volume of groundwater that will no longer pose a health threat if used and hence, would be usable as a resource. The greater region will be subject to investigations and cleanup actions taken by the State of California and/or EPA, while the remedial action selected by this ROD is implemented. However, benefits from the remedial action for the Joint Site will accrue independent of such actions.

The commenter mentions the fact that benzene NAPL at the former Del Amo plant property (along with high concentrations of dissolved benzene) will remain indefinitely under the remedial action. It is also true that chlorobenzene NAPL and high concentrations of chlorobenzene near the NAPL at the *Montrose* property will remain indefinitely. We again note that this ROD addresses the benzene and chlorobenzene plumes consistently and without technical bias; moreover, the ROD does not address the sites (e.g. Montrose Chemical, and Del Amo) individually with respect to remedial actions, as implied in this comment.

The presence of the containment zone does not imply that there would be no benefit to eliminating the extensive chlorobenzene plume that extends 1.3 miles from the former Montrose plant. To the contrary, this significant portion of groundwater would no longer pose a health threat and would be usable as a resource. The commenter also implies that cleanup of the chlorobenzene plume within 50 years is too aggressive given the fact that the containment zone will remain indefinitely. EPA disagrees with this assertion. The environmental benefits accrue for the area being cleaned; from this standpoint, the sooner drinking water standards are achieved in that area, the better. From any reasonable perspective, fifty years is quite a long time and does not represent a highly aggressive cleanup approach for groundwater in this case. This is also true when viewed in terms of aquifer flushing rates. See later comment responses also which address this point.

General Comment 3. EPA Has Not Adhered to Its 1997 Natural Attenuation Policy and JGWFS Conclusions Regarding the Benefits of Field Studies.

EPA states that it considers the commingled groundwater plume underlying both the Del Amo and Montrose Chemical Sites to be "a single technical problem," but it has evaluated natural attenuation seriously at only one site—the Del Amo Site. There, EPA proposes that dissolved phase benzene in the groundwater be allowed to attenuate naturally for centuries. As to the immediately adjacent Montrose Chemical Site, however, EPA proposes a 50-year cleanup, even though the Del Amo situation will continue to exist. In so doing, EPA has failed to comply with its own Interim Final Policy entitled, *"Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites,"* 62 *Fed. Reg.* 64588-01 (Dec. 8, 1997), and the guidelines set forth for further field study as articulated in the JGWFS Report, Section 2.2.5.1.

Although EPA has acknowledged in the JGWFS Report that bioattenuation of the MCB plume is indeed possible, albeit imperfectly understood, it has refrained from further assessment and has actively discouraged any additional investigation recommended by Montrose. EPA's 1997 policy on natural attenuation requires technical analyses that have not been performed in their entirety at the Montrose Chemical Site. In fact, the agency criticized Montrose sharply for seeking to undertake such an evaluation.

[3] EPA's objection to further investigation in anticipation of final remedy selection is inconsistent with its conclusion that the mechanisms of MCB biodegradation are "only partially understood, and are supported by a relative paucity of laboratory studies, and are even less-well understood under in-situ (field) conditions." *JGWFS Report*, Section 2.2.5.3 at p. 2-85. EPA fails to follow through with its own conclusion that only additional field studies could conclusively resolve the issue of MCB natural attenuation. *See JGWFS Report*, pp. 2-85 to 2-88.

Under EPA's policy, natural attenuation may very well be an appropriate remedy for soil or groundwater contamination, whether implemented as a stand-alone remedy or in conjunction with other remediation measures. Indeed, EPA has emphasized repeatedly that its interest lies in the "certainty" of the selected groundwater program. Yet it ignores the benefit of a full evaluation of natural attenuation which, being a natural phenomena, only increases the certainty that an effective remedy can be implemented. The natural attenuation policy sets forth nine criteria,[4] few

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[3] In a September 10, 1997 letter to Montrose, EPA states that Montrose's various proposals for a study of intrinsic biodegradation of MCB "were not requested or sanctioned by EPA," chastising "Montrose's intentions and timing for conducting these studies" and finding it "unlikely that Montrose was suddenly stricken with a desire to run an academic study on MCB intrinsic biodegradation." *See* Letter from J. Dhont, dated Sept. 10, 1997, pp. 1-2.

[4] According to EPA policy, the following natural attenuation criteria should be evaluated by EPA and compared to other remediation methods.
1. Whether the contaminants present in soil or groundwater can be effectively remediated by natural attenuation processes.
2. Whether the resulting transformation products present a greater risk than do the parent contaminants.

of which have been given serious consideration by EPA for the MCB plume before proposing a $30 million, 50-year groundwater remedy that may mobilize DNAPL and benzene, and exacerbate the lateral and vertical extent of contamination.

In the JGWFS Report, EPA outlines three factors that may shed sufficient light on the extent of intrinsic biodegradation to avoid heavy investment in field studies. The relevant factors to consider are "(1) observational characteristics (e.g., spatial characteristics of the plume), (2) geochemical/microbial indicators, and (3) an understanding of degradation mechanisms for a given contaminant." *JGWFS Report*, Section 2.2.5.1. In the event insufficient information is available to assess these factors, as here, "then direct field measurements of the biodegradation rate must be solely relied upon, and a much higher level of certainty must be achieved with such measurements before it can be reasonably concluded that significant (i.e., measurable) biodegradation of a contaminant is occurring." *Id.* at p. 2-82 and 2-83.

While plainly recognizing the merit and appropriateness of field studies for biodegradation at the Montrose Chemical Site, EPA rejects such an evaluation and is otherwise highly critical of efforts to undertake such field work. EPA's position is arbitrary and potentially excludes from consideration a much more efficient and cost-effective remedy (or partial remedy) for the Montrose Chemical Site. EPA acknowledges that existing published laboratory data suggest that MCB is biodegradable and such studies "indicate the need for further assessment." *JGWFS Report*, Section 2.2.5.3, at p. 2-86. Montrose has advised EPA that it is prepared to conduct such field studies, and it has even funded a preliminary study.

A recently completed 1997 Zeneca preliminary study of the MCB plume indicates that conditions are favorable in the MCB plume for biodegradation. In September 1997, EPA criticized this study as self-serving, despite the absence of any site-specific, independent analysis. More importantly, EPA has been supportive of no further analysis in advance of issuing a Record of Decision. EPA has declined repeated requests to participate in Montrose's studies or otherwise facilitate the design of future studies. Notwithstanding EPA's non-compliance with its own policy and disinterest in natural attenuation studies at this site, Montrose will continue to move forward in conducting a MCB field study consistent with the principles outlined in the 1997 EPA policy and 1998 JGWFS Report. Until this study is completed, EPA's remedy for the MCB plume discussed in the *Proposed Plan* is premature.

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3. The nature and distribution of sources of contamination and whether these sources have been adequately controlled.
4. Whether the plume is relatively stable or is still migrating and the potential for environmental conditions change over time.
5. The impact of existing and proposed active remediation measures upon the monitored natural attenuation component of the remedy.
6. Whether drinking water supplies, other groundwaters, surface waters, ecosystems, sediments, air, or other environmental resources could be adversely impacted as a consequence of selecting monitored natural attenuation
7. Whether the estimated time frame for remediation is reasonable compared to time frames required for other more active methods.
8. Current and projected demand for the affected aquifer over the time period that the remedy will remain in effect.
9. Whether reliable site-specific vehicles for implementing institutional controls (*i.e.*, zoning ordinances) are available.

29 EPA Response:

At the outset, EPA notes that the commenter (Montrose Chemical Corporation of California) recently chose to initiate independent long-term field studies of intrinsic biodegradation of monochlorobenzene, after more than 14 years of remedial investigations during which Montrose did not perform or suggest such studies, and indeed even after the original date planned for completion of the JGWFS. Montrose provided EPA no supportable objective for performing such studies. EPA strongly disagrees with the Montrose's timing for such studies. For the reasons presented throughout this response, and in Section 7.3, 11.1, and Appendix B of this ROD, EPA believes that (1) such studies will not provide information of sufficient certainty to alter remedial decisionmaking, and that (2) delaying the remedial selection on groundwater to allow Montrose to perform such studies is unwarranted, inappropriate, and would unnecessarily threaten human health and the environment.

The commenter makes a very large number of points in this comment. EPA has considered this comment and will attempt to summarize its response in a reasonably complete yet concise manner. To do so requires the visitation of numerous points and some extended discussion, however. EPA addresses these generally in the order in which they were made within the comment. EPA also notes that EPA addresses many of the issues raised in the comment in Section 11.1 and in Appendix B of the Decision Summary of the ROD.

We start with a substantive semantic clarification. Without making a distinction, the commenter uses the term "natural attenuation" in two different ways, as: 1) the process by which contaminants in the ground are metabolized by bacteria intrinsic to the ground, and 2) a remedial action that *relies* on this and related processes to achieve remedial action objectives. There is a critical difference between these, and they should not be confused, as we shall discuss. The possibility or presence of the processes associated with natural attenuation, does not necessarily imply that natural attenuation can be *relied upon* as a remedial action.

For clarity, we note that, as was discussed in the Decision Summary, in this ROD EPA uses the term *intrinsic biodegradation* in lieu of *natural attenuation* (See Decision Summary Section 7.3). Intrinsic biodegradation is a specific form of natural attenuation, and refers to the degradation of a compound through microbial metabolism of innate organisms. However, the terms "monitored natural attenuation" and "monitored intrinsic biodegradation" are consistent with respect to EPA's policy, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (EPA OSWER Directive 9200.4-17, December 1997), which is the policy referred to by the commenter in its *Federal Register* citation.

In the case of the Joint Site, potential remedial actions not relying on monitored natural attenuation (intrinsic biodegradation) require an active means, generally extracting and

treating groundwater, to effect containment or reduction of concentrations of groundwater. Relying on monitored natural attenuation is, in general, less expensive than active hydraulic extraction. However, typically EPA relies on natural attenuation in a remedial selection context only when it can be relied upon with sufficient certainty to attain remedial objectives, and when it can be reliably monitored.

Contrary to the characterization in the commenter's comment, EPA's approach to the Joint Site groundwater as a "single technical problem" did not address the Joint Site groundwater in terms of the Montrose Chemical Site versus the Del Amo Site. Rather, it divided the distribution of contamination in Joint Site groundwater into areas called "plumes," based on the physical and chemical characteristics of the contaminants in groundwater. The commenter's site-based distinctions are not logically congruent with this approach. For instance, the commenter states that "EPA proposes that the dissolved phase benzene be allowed to attenuate for centuries," implying that EPA's remedy does not include active measures to address dissolved phase benzene. This is, however, not correct. EPA's remedial action relies on intrinsic biodegradation only with respect to dissolved benzene that is *outside* the chlorobenzene plume. There is benzene *inside* the chlorobenzene plume for which EPA does not rely on intrinsic biodegradation, because degradation does not appear to be a reliable remedial mechanism for that benzene and because that benzene's extent is so large. There is a sound technical basis for these distinctions; and they are not based on one site versus the other.

Along similar lines, the commenter states that "...EPA proposes a 50-year cleanup [presumably referring to the Montrose Chemical Site] even though the Del Amo situation will continue to persist." However, what will "persist" is not "the Del Amo situation" but the containment zone, within which groundwater contaminants will be contained rather than restored to drinking water standards. This zone contains extensive NAPL and highly-contaminated groundwater not only at the Del Amo Site but *also at the Montrose Chemical Site*. EPA used consistent and technically based principles to define the containment zone, the benzene plume, and the chlorobenzene plume. The chemical and physical nature of the NAPL and contamination at *both* sites was considered in the analysis. The reason that the chlorobenzene plume outside the containment zone is subject to a remedial action that is more expensive than that for the benzene plume inside the containment zone is that (1) the chlorobenzene has contaminated a far greater extent of groundwater, (2) it does not exhibit signs of intrinsic biodegradation sufficient to rely on for remedial selection purposes, (3) it does not appear to be stable, and perhaps most-importantly, (4) it is not near NAPL, does not provide the basis for a technical impracticability waiver to ARARs, and therefore is reasonably subject to cleanup to drinking water standards as required by ARARs.

EPA did consider intrinsic biodegradation, and the potential for relying upon it as a component of the selected remedial action, for *both* the benzene and chlorobenzene plumes. The commenter's statement, therefore, that "EPA considered natural attenuation seriously

at only one site–the Del Amo Site" is not accurate. See Sections 7.3, 11.1, and Appendix B of the Decision Summary of the ROD. Contrary to the statements in the comment, the 1997 natural attenuation guidelines cited by the comment do not suggest that EPA perform the same degree of field investigation of intrinsic biodegradation in all cases. EPA's selection of a remedial action for the chlorobenzene plume other than monitored natural attenuation (in this case, intrinsic biodegradation) does conform to established policies for remedy selection.

While EPA properly *considered* intrinsic biodegradation in all portions of the Joint Site, it is true that *field studies* of intrinsic biodegradation in the chlorobenzene plume were not performed to the same degree as in the benzene plume (this is discussed in detail in Appendix B of the Decision Summary of the ROD). However, there was a sound technical basis for this difference. EPA has *not* found that additional field study of intrinsic biodegradation of chlorobenzene at the Joint Site could not be performed, or could not provide any useful information. Rather, EPA found that such additional study could not reasonably provide measurements of the field rate of intrinsic biodegradation of chlorobenzene *with sufficient certainty to rely upon it as the remedial action for the chlorobenzene plume*. Hence, regardless of whether additional studies were performed, there was a very low likelihood that results could be generated with sufficient confidence to alter a remedial selection decision at this time.

Simply, intrinsic biodegradation of chlorobenzene *is not* relied upon as part of the remedial action for the chlorobenzene plume because its reliable presence to a degree sufficient to meet remedial objectives is not supported by the state of the chlorobenzene plume, the state of knowledge on chlorobenzene biodegradation and the possible outcomes and degrees of certainty of any additional studies of chlorobenzene degradation. Therefore, EPA found that delaying the remedial selection decision to conduct such studies would not be protective of human health or the environment.

In contrast to chlorobenzene, intrinsic biodegradation of benzene *is* relied upon as part of the remedial action for the benzene plume because its reliable presence, sufficient to meet remedial objectives, is supported by several independent lines of evidence, including the state of the benzene plume, knowledge on benzene biodegradation, and site data.

Critical points in EPA's analysis of intrinsic biodegradation potential in the chlorobenzene plume included, but were not limited to, the following:

(1) The state of the chlorobenzene plume, especially the fact that the plume has been able to expand to its large lateral and vertical size, is not supportive of the presence of significant and dependable intrinsic biodegradation. The plume extends more than 1.3 miles downgradient and 1000 feet cross-gradient in the MBFC Sand. Chlorobenzene has moved through six hydrostratigraphic units to a depth of many hundreds of feet, and is currently found in the Lynwood Aquifer, a drinking water aquifer.

Concentration gradients are not tight; in fact, the change in concentration with distance is gradual over large portions of the plume. This plume does not resemble typical cases of tight, naturally contained plumes in which intrinsic biodegradation is relied upon as a remedial alternative. These conditions are not indicative of *reliable* intrinsic biodegradation.

(2) Because of its size and depth, and its presence at higher concentrations in hydrostratigraphic units of greater transmissivity, greater risks are associated with continued movement of the chlorobenzene plume. Remedial actions for the chlorobenzene plume therefore require greater chances of success to ensure that these risks are mitigated. Because of these multiple factors indicating the lack of reliable intrinsic biodegradation, great certainty as to the occurrence and rates of intrinsic biodegradation would be necessary to warrant even considering reliance upon it in a remedial action, other than as a "bonus" to move any selected remedial action faster.

(3) The mechanisms by which chlorobenzene can be degraded in groundwater, while outlined in theory, are only partially understood, are supported by a relative paucity of laboratory studies, and are even less understood in field conditions. The evidence for biodegradability of chlorobenzene in the laboratory is more conclusive for aerobic degradation than for anaerobic degradation. Yet, the conditions in the MBFC Sand and Gage Aquifer, where chlorobenzene has traveled the farthest, are most-likely anaerobic. In general, laboratory studies that have reported anaerobic biodegradation are few and are matched by other laboratory studies that report no biodegradation of chlorobenzene under anaerobic conditions.

(4) While studies could be designed to provide an estimate of the rate of intrinsic biodegradation of chlorobenzene in the Joint Site groundwater, the methods for performing such studies on plumes with the characteristics of the chlorobenzene plume are not yet developed to the point where a significant degree of certainty can be attained with the results. This is true at the same time that, as discussed above, the degree of certainty in such results necessary to rely on intrinsic biodegradation would have to be high and the coverage extensive. Such studies also require long periods of time to conduct when done properly.

(5) Due to a variety of characteristics of the chlorobenzene plume, including but not limited to its size and heterogeneity, it would be exceedingly difficult to correlate differences in concentration within the plume with actual loss of MCB mass due to intrinsic biodegradation. It is unlikely that a study could be performed that would permit sufficient certainty of a chlorobenzene intrinsic biodegradation rate to form a dependable basis for selecting one remedial alternative over another.

The comment states that EPA has "sharply criticized" the commenter, Montrose Chemical Corporation (Montrose), for seeking to undertake an evaluation of biodegradation of chlorobenzene. In fact, EPA has not discouraged the commenter from doing any such investigative work at the Joint Site. The statements in EPA's letter to Montrose that were cited by the comment were to clarify (1) that the matter of biodegradation of chlorobenzene had been addressed, (2) the reasons that field studies proposed by Montrose were unlikely to produce data of sufficient certainty to alter remedy selection and/or justify delaying the selection of the remedy, (3) that such studies were likely to take years, and (4) that Montrose was initiating such long-term studies at an inappropriate time, within months of the anticipated ROD, after 14 years of investigations, during which Montrose did not suggest such studies. EPA objected to Montrose's method, timing, and intended objectives for performing its biodegradation studies, not with the notion of such studies in abstract.

The comment states that "EPA fails to follow through with its own conclusion that only additional field studies could conclusively resolve the issue of MCB [monochlorobenzene] natural attenuation." The commenter takes EPA's statement out of context. It is true that because the chlorobenzene plume is so large and shows no other evidence of being contained by intrinsic biodegradation, only laboratory and field studies of considerable certainty could *potentially* provide a basis for relying on intrinsic biodegradation of chlorobenzene as a remedial mechanism in this case. However, EPA did not imply that performance of such studies should be done prior to remedial selection, particularly when for numerous reasons it did not appear that such studies would be able to produce results with the requisite level of certainty to make intrinsic biodegradation of chlorobenzene a reliable remedial mechanism.

In a similar vein, the commenter references three factors that EPA mentioned that can be considered, in addition to investment in field studies, to justify the extent of intrinsic biodegradation. EPA referred to these as independent factors. EPA's reason for discussing these factors was to establish why intensive field studies of very high certainty would be needed to indicate intrinsic biodegradation of the chlorobenzene plume, when less certain field studies could be relied upon for the benzene plume (outside the chlorobenzene plume). Again, EPA did not intend to imply, as the comment suggests, that additional studies of all such factors be performed for the chlorobenzene plume. The fact that the chlorobenzene plume is extremely large and deep, and exhibits flat concentration gradients, is in fact already studied and established, runs counter to the assertion that reliable intrinsic biodegradation of chlorobenzene is occurring, and suggests that, were field studies to be performed, extremely high certainty would have to be achieved to make the results reliable for remedial selection purposes.

EPA disagrees with the commenter's statement that natural attenuation is an appropriate remedy for the chlorobenzene plume. EPA also disagrees with the commenter's statement

that EPA's remedy may mobilize DNAPL; the remedial selection process has considered this potential and the remedial action will be designed to address this concern.

The commenter states that Zeneca (Montrose Chemical Corporation's Parent Company), has completed a 1997 study showing that conditions are favorable for intrinsic biodegradation of chlorobenzene at the Joint Site. EPA disagrees that this study supported such a conclusion and provided extensive reasons for this position in a letter to Montrose dated September 10, 1997, which is in the administrative record. In fact, the Zeneca study was highly preliminary and relied almost entirely on laboratory microcosm studies. Its brief assessment of the Joint Site is unreliable because, in addition to other reasons, it relied upon dissolved oxygen data that are not likely representative of actual field conditions. EPA found numerous unsupported and over-extended conclusions in the Zeneca study (also discussed in EPA's September 10, 1997 letter to Montrose). EPA also disagrees with the commenter that there is a compelling reason to delay remedy selection to wait for the commenter's independent study of intrinsic biodegradation of chlorobenzene. To the extent that intrinsic biodegradation occurs, it will assist the remedial action selected by this ROD in that remedial goals will be met sooner. EPA welcomes any reliable and fully supportable results from Montrose's future studies of intrinsic biodegradation.

General Comment 4. Adoption of Technical Impracticability ("TI") Waiver Zone Is Fully Justified.

As provided by 40 C.F.R. Section 300.430(f)(1)(ii)(C)(3), compliance with applicable or relevant and appropriate requirements ("ARARs") may be waived where such compliance is "technically impracticable." With respect to the known DNAPL zone underlying the Montrose Chemical Site, such a condition of technical impracticability plainly exists for affected areas in the upper Bellflower Aquitard and portions of the underlying Bellflower and Gage Aquifer.

Cleanup of the upper Bellflower Aquitard is not practicable because its low hydraulic conductivity, heterogeneous sediments and co-location with the DNAPL and LNAPL zones. Therefore, the upper Bellflower Aquitard is properly included entirely within the "TI waiver zone" planned for the DNAPL-impacted area. As a general proposition, EPA's decision to issue a TI waiver for contaminant-specific drinking water standards in the DNAPL zone at the Montrose Chemical Site is sound. However, a 700 gpm dissolved phase extraction remedy threatens to undermine the TI waiver zone by mobilizing DNAPL vertically, increasing the long-term risk to deeper drinking water units, such as the Silverado Aquifer.

30 EPA Response:

When properly implemented, the 700-gpm-extraction remedy will not increase the long-term risk to deeper drinking water units by mobilizing DNAPL vertically. The JGWFS performed a full analysis of this issue, and was supported by an extensive groundwater modeling effort. All modeled scenarios, and hence all remedial alternatives, were designed

from the beginning based on ensuring that NAPL was not mobilized. The JGWFS showed that it is feasible to prevent lateral and vertical adverse DNAPL movement under any of the alternatives, including Alternative 4, which has the 700-gpm extraction rate.

The 700-gpm system is specifically *not* highly aggressive due in part to concern for the issue raised by the commenter. In other words, EPA has already adjusted the pump rates of all pumping rates considered *downward* to protect against the movement of NAPL. When viewed in terms of aquifer pore volume flushing rates, neither 700 nor 1400 gpm is highly aggressive. In fact, cleanup of the chlorobenzene plume could have safely been accomplished at much higher pump rates if the NAPL were not present.

General Comment 5. EPA's "Preferred" 700 Gallon Per Minute Groundwater Treatment System Could Mobilize DNAPL at the Montrose Chemical Site.

EPA has selected the 700 gpm system as the "preferred" remedial program because of its reportedly limited incremental cost and early-year plume reduction potential, which the agency argues increases the "certainty" of the overall program. This analysis, however, improperly fails to consider the increased risk and uncertainty associated with any pumping scenario that is greater than a containment-only strategy (*e.g.*, 190 gpm).

It is undisputed that the establishment and containment of a DNAPL containment zone is required to minimize the potential for future release of groundwater containing high concentrations of dissolved phase contaminants into the regional groundwater system. Hence, any operation that increases the difficulty of DNAPL containment (either horizontally or vertically) creates higher risk and uncertainty for the entire program. The higher the pumping rate, the higher the probability of DNAPL migration, and therefore the higher the risk that the overall program will ultimately fail to meet expectations. Hydrogeologically, the 190 gpm dissolved phase containment scenario provides the least hydrological stress on the DNAPL zone, thus affording the highest certainty of successful DNAPL containment, while at the same time halting migration of the dissolved phase MCB plume.

Reinjection of treated effluent is also required at the Montrose Chemical Site to (1) prevent increasing the downward hydraulic gradient; (2) minimize the increase in the horizontal hydraulic gradient; and (3) achieve minimal drawdown in the DNAPL impacted area. Although the steady-state model simulations suggest that it would be theoretically possible to minimize these hydraulic effects, achieving the required hydraulic balance to prevent uncontrolled DNAPL migration into more sensitive deeper units would be extremely difficult to achieve at the 700 or 1400 gpm rates. Nearly 100 percent of the DNAPL is located within the TI waiver zone. Uncontrolled downward migration of DNAPL could therefore exacerbate the long-term impact to the deeper hydrogeologic units, especially the Gage and Lynwood Aquifers. The 190 gpm system offers the least risk to uncontrolled migration.

The 190 gpm containment scenario also improves the level of certainty with respect to para-chlorobenzene sulfonic acid ("p-CBSA"). All available scientific evidence indicates that this chemical is non-toxic. However, until EPA concludes that p-CBSA is not a chemical of concern (a decision that the agency should no longer defer), it is undesirable to require the extraction of elevated concentrations of this chemical from one location and redistribution thereof throughout the entire remedial area via high-rate reinjection. Of the remedial alternatives reviewed, the 190 gpm system contributes the least to the extent of p-CBSA redistribution through all the water-bearing units (*e.g.*, Bellflower Sand and Gage Aquifers).

According to EPA, higher pump rates may also require up to two years of treatment of p-CBSA prior to reinjection. As discussed further in comments relating to the fluidized bed reactor, technologies for treating p-CBSA are experimental and not reliable. Therefore, a 700 gpm system that contemplates an untested and short-term treatment plant for a non-toxic chemical materially and needlessly increases the uncertainty of the program. The increased uncertainty attributable to DNAPL migration and p-CBSA redistribution plainly outweigh the marginal advantage assigned by EPA to early-year plume reduction.

Although not discussed in EPA's documents or analysis, aggressive pumping requires more infrastructure and imposes increasingly more risk of catastrophic failure associated with the additional pipelines, wells and increased access by workers to public streets in down-gradient areas. EPA does not adequately consider the increased hazard of operating an extensive system of numerous off-site extraction and reinjection wells. However, the various issues of p-CBSA reinjection and redistribution, safety, and catastrophic mechanical failure become more manageable with decreasing pump rates, and all are important considerations favoring a 190 gpm containment remedy.

31 EPA Response:

Before directly addressing the comment, EPA must make several points with respect to adverse migration of NAPL. This ROD contains requirements to limit adverse migration of DNAPL. As will be discussed below, the JGWFS thoroughly evaluated this potential and found that it is feasible to implement any of the alternatives considered without significant adverse NAPL migration, if the remedial action is appropriately designed.

EPA has not specified in this ROD that no adverse migration of NAPL shall occur at all, nor has it specified that the potential for such migration shall be completely eliminated. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of NAPL and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. This ROD contains provisions for such a possibility, requiring that the remedial design be adjusted to reverse and contain the adverse migration. It is crucial to note that limiting adverse migration of contaminants, including NAPL, shall not take preeminence over all other performance

criteria and remedial action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone.

This comment misrepresents the risks associated with possible DNAPL movement as well as the analyses performed by the JGWFS to evaluate this potential. It is important to note that all of the NCP criteria, not merely those the commenter discusses as being the basis for EPA's decision, were considered in the evaluation of the remedial alternatives. Throughout the comment the "containment-only" scenario (190-gpm) is referenced, a remedial alternative favored by the commenter which would imply containing the *entire* distribution at the Joint Site by hydraulic extraction and treatment, with no significant reduction in the concentrations of contamination over time. By definition, this scenario would not meet the remedial action objectives (RAOs) and does not attain ARARs in a reasonable time frame. When the 190-gpm and 700-gpm scenarios are compared, EPA believes that the risks associated with DNAPL movement have been properly accounted for and can be mitigated during remedial design and action at either pump rate. However, such analysis is moot in that *the 190-gpm scenario does not meet the requirements of CERCLA and the NCP on the most fundamental level.*

The comment offers no basis for the assertion that the 190-gpm scenario would be safe with respect to NAPL migration but that any pump rate greater than this would not. Such an assertion is entirely arbitrary. The JGWFS and the supporting modeling effort were designed carefully from the beginning with painstaking attention to the issue of potential DNAPL migration, so that such risks could be minimized. The effect of pumping within the area of the DNAPL was quantitatively evaluated by examining drawdowns and gradients induced near the NAPL. The analysis showed that, with proper design, DNAPL migration can be minimized even at the 1400 gpm pump rate. It was for this reason that in the JGWFS, (1) the containment zone was enlarged to some degree to minimize the impact on NAPL, (2) that scenarios exceeding 1400 gpm were not modeled or considered, and in part (3) EPA selected not 1400 gpm but 700 gpm for the chlorobenzene plume.

Contrary to several assertions in the comment, the 700 gpm (selected by this ROD) is not a particularly aggressive pump rate given the nature and extent of the chlorobenzene plume, when the pore volume flushing rates and overall cleanup rates are considered. Had NAPL not been present, it is likely EPA would have pressed for consideration of pump rates far exceeding the maximum 1400 gpm scenario that was considered in the JGWFS. It is therefore incorrect that the remedy selection process did not adequately consider the potential for NAPL migration, and the implication that 700 gpm is highly aggressive is without merit.

The uncertainty or risk associated with a particular pumping/injection remedial program is not so much a function of the pumping rate as much as it is a function of the spatial array and temporal operation of the pumping and injection facilities (i.e., a rate of 190 gpm, on its own, does not necessarily decrease the risk of generating adverse conditions, likewise, a 700 gpm pump rate, on its own, does not necessarily increase the risk of generating adverse conditions). The remedial action will be designed and implemented in such a way as to reduce the risks of adverse contaminant migration while still meeting all other remedial objectives.

The commenter asserts that 190 gpm scenario, having the lowest pump rate, would have least risk of causing NAPL migration. We point out that, if this is the case, then a zero pump rate would present even less risk. However, no pumping, as well as the 190-gpm scenario, would not adequately protect human health and the environment nor would it meet ARARs in a reasonable time frame. The key question is whether it is feasible to design a system at pump rates higher than these minimal approaches that still meets remedial objectives and which reasonably minimizes the risk of DNAPL migration. The JGWFS showed that this is indeed the case, in contrast to the speculative statements in the comment.

The commenter mentions that the 190-gpm scenario would provide certainty to the remedy. One of the primary concerns EPA evaluated with respect to certainty was whether ARARs would be attained and the remedy would become fully protective in a reasonable time frame. Since the 190-gpm scenario does not attain ARARs, it would provide the *least* certainty of such attainment, and of the ultimate protection of human health and the environment.

The comment that the prevention of uncontrolled DNAPL migration into more sensitive deeper units would be extremely difficult is subjective and unsupported. Once again, 700 gpm is not highly aggressive. The related issues of operating the various alternatives developed in the JGWFS are discussed under the "implementability" criterion in Section 10.

EPA wishes to remind the reader that the particular wellfields used in the JGWFS are not required by this ROD; rather, EPA will require that additional modeling be performed during the remedial design phase to optimize the performance of the remedial action, and where possible to evaluate and reduce the potential for DNAPL migration still further in the process of establishing the exact locations of pumping and injection wells, and the rates of pumping of individual wells. Hence, the matter of DNAPL migration will continue to be addressed during remedial design.

General Comment 6. Groundwater Pumping At Higher Rates Could Mobilize the Del Amo Benzene LNAPL Plume.

Closely related to DNAPL stability at the Montrose Chemical Site is the 700 gpm system's potential for destabilizing other NAPL or dissolved VOC plumes at neighboring remediation sites (*e.g.*, Del Amo, Trico, Jones Chemical, and McDonnell Douglas). Of these sites, the most critical is the Del Amo Site, where EPA is recommending intrinsic biodegradation as the prime remedial agent for benzene, a remedial plan that requires minimal disturbance of the groundwater environment to afford bacteria the opportunity to degrade chemicals naturally.

EPA acknowledges that higher pumping and reinjection rates may alter hydraulic gradients in the Del Amo benzene plume and diminish the overall effectiveness of benzene biodegradation. *JGWFS Report*, Section 5.3.2 at pp. 5-64, 5-69. The "spreading of benzene in response to chlorobenzene pumping could be severe because of the long time frame required for the [MCB] remedy." *Id.* at p. 5-69. EPA states that any scenario that does not model the inherent tension between active MCB pumping and benzene isolation, the very situation here, achieves "lower level of certainty." *Id.* at p. 5-69.

Having noted this dilemma, EPA nonetheless chooses the less certain path, electing to undertake no modeling of the situation and simply "assuming" long-term benzene isolation. *See JGWFS Report*, Section 5.4.4.2, at p. 5-102. The agency also concludes that actual benzene migration could "deviate" from EPA assumptions. *Id.* at Section 5.4.3.3. Thus, the success of this joint program depends in large part upon a high-risk $30 million agency "assumption," which if incorrect, may only exacerbate benzene conditions and lead to even more expensive corrective action.

632 EPA Response:

This ROD contains requirements to limit adverse migration of dissolved contaminants (including, as referenced by the comment, the plume at Del Amo). As will be discussed below, the JGWFS thoroughly evaluated this potential and found that it is feasible to implement any of the alternatives considered without significant adverse migration, if the remedial action is appropriately designed.

EPA has not specified in this ROD that no adverse migration of contaminants shall occur at all, nor has it specified that the potential for these shall be completely eliminated. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of dissolved phase contaminants and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. This ROD contains provisions for such a possibility, requiring that the remedial design be adjusted to reverse and contain the adverse migration. It is crucial to note that limiting adverse migration of contaminants shall not take preeminence over all other performance criteria and remedial

action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining ARARs in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone.

The comment is highly misleading because it implies that the JGWFS did *no* modeling of the effects that hydraulic extraction for the chlorobenzene plume would have on the benzene plume. This is not the case. In fact, the JGWFS modeled the effects of the 350-, 700-, and 1400-gpm scenarios for chlorobenzene in conjunction with either intrinsic biodegradation alone or hybrid containment for the benzene plume, with one exception. Based on the references provided by the comment, the commenter has obscurely referred to this exception to give the false impression that no modeling was done *at all.*

For the purpose of the JGWFS, no modeling of Combined Scenario 3 (plume reduction 1 for chlorobenzene and hybrid containment for benzene) is necessary. Conceptually, the hybrid containment scenario for benzene is inherently more protective than intrinsic biodegradation alone. Specific reasons for this under the plume reduction 1 pumping/injection rates are detailed in Section 10.2.5 of the JGWFS. The modeling results presented in Sections 4.5.5 and 4.5.6 support the position that hybrid containment protects fully against adverse benzene migration under scenarios with higher chlorobenzene plume extraction rates (700 and 1,400 gpm); hence, it can be assumed that it would also protect against benzene migration at the lower 350-gpm extraction rate for the chlorobenzene plume in Combined Scenario 3.

The reference to the statement that "the spreading of benzene could be severe" is taken out of context and refers to EPA's analysis of the benefits of including hydraulic extraction to contain the MBFC Sand of the benzene plume (hybrid containment). Clearly, EPA has been concerned with the potential movements of benzene in response to chlorobenzene pumping, as the commenter suggests. It was partly for this reason that EPA selected the hybrid containment option for the benzene plume as part of the remedial action. However, the JGWFS demonstrated the feasibility of the hybrid containment system to contain the benzene under any of the three considered chlorobenzene extraction scenarios. The assumption of long-term benzene isolation is sound and is anticipatory of the implementation of a performance-based remedy that will, in fact, prevent the benzene plume from moving as a result of chlorobenzene pumping. The implementation will be performed in a manner that does not exacerbate the extent of the benzene plume.

As with the issue of DNAPL migration at the former Montrose plant, the JGWFS and the attending modeling effort were conceived and designed with attention to minimizing the impact on NAPL at the former Del Amo plant. As stated in the last response, the JGWFS showed that, properly designed, adverse migration of benzene can be minimized or eliminated at the 350-, 700- or 1400-gpm extraction rates for benzene.

EPA disagrees that the remedy for chlorobenzene will be "high-risk," and believes that the remedy can be designed to prevent benzene movement. EPA wishes to remind the reader that the particular wellfields used in the JGWFS are not required by this ROD; rather, EPA will require that additional modeling be performed during the remedial design phase to optimize the performance of the remedial action, and where possible to evaluate and reduce the potential for benzene and benzene NAPL migration still further in the process of establishing the exact locations of pumping and injection wells, and the rates of pumping of individual wells. Hence, the matter of benzene and benzene NAPL migration will continue to be addressed and refined during remedial design.

Furthermore, extraction at rates greater than 190 gpm would result in increasing inefficiencies: Specifically, during the implementation of the 700 gpm and 1400 gpm groundwater remedies, the MCB plume will contract, and groundwater concentrations at outlying extraction wells will decrease to below the cleanup goal. These extraction wells will presumably be shut down at this point, as they no longer assist in the cleanup of the plume. Because of the reduction in the number of extraction wells, a 1400 gpm system would operate at only 850 gpm after 10 years, and at 620 gpm after 20 years. A 700 gpm system would operate at about 550 gpm after 10 years, and at 350 gpm after 50 years. Building large systems to operate at the original design capacity for only a few years is inefficient and not cost-effective. A 190 gpm system could be operated at a near constant rate throughout its life, thus maximizing the use of equipment and resources.

33 EPA Response:

The statement that pumping rates greater than 190 gpm "...would result in increasing inefficiencies" is arbitrary and unsupported.

The general premise that larger systems (more wells, higher pumping/injection rates) will result in more operational problems is implicitly considered in Section 10 of the JGWFS under the "implementability" criterion (pages 10-40 to 10-43).

The argument that the larger system will result in waste of well capacity ignores the potential that the wells that come to be located outside the plume as it shrinks may not only be shut down, but re-installed (i.e. relocated) within the remaining plume to maximize the cleanup rate of the remaining plume. Thus, to a significant extent, the "capacity" of the system can continue to be used and the numerical calculations provided by the comment will not be realized. EPA intends to require the use of a model during remedial design and remedial action to optimize the remedial action; hence, it will be assured that such relocated wells will be installed in locations and at pump rates that will be safe with respect to adverse migration of NAPL and other contaminants in the containment zone. This will mitigate the issue raised in this comment.

The advantages of the 190 gpm system also fit smoothly within any future natural attenuation strategy. If natural attenuation processes are found to be present at the site, as prior studies suggest and future studies may confirm, the 190 gpm system works well with that remedial option, as it provides a barrier against further migration of the dissolved plume while natural attenuation processes occur.

634 EPA Response:

Intrinsic biodegradation is not considered a viable remedy for chlorobenzene (see JGWFS, Sections 2 and 5, and response to General Comments above). EPA disagrees for reasons already stated that previous studies suggest that intrinsic biodegradation is occurring in Joint Site groundwater in a manner that can be relied upon for remedial decisionmaking. Also, as stated before, a containment system at 190 gpm, or otherwise, would not meet the RAOs and would not attain ARARs in a reasonable time frame.

Finally, natural attenuation (intrinsic biodegradation, in this case), to whatever extent it exists, would occur and a barrier to further migration would be provided regardless of the pump rate used for hydraulic extraction. To the extent that intrinsic biodegradation of chlorobenzene occurs at the Joint Site (whether or not it can be measured) it would only serve to enhance the performance of the remedial action and reduce the overall cleanup time. There would be no negative aspects to this "bonus," and no way that it could result in the action occurring "too fast." As the remedial action is already less aggressive than ideal due to the presence of NAPL and other factors, intrinsic biodegradation would only make the remedial action more protective. It would "fit smoothly" with any of the scenarios considered, not merely the 190-gpm scenario.

General Comment 7. EPA's Screening Process and Evaluation of MCB Plume Reduction Overlooks the Most Important Remedial Objective.

EPA's screening of remedial options in Sections in 5.2 and 5.3 of the JGWFS Report is not premised upon the reduction in mass of MCB, as it should, but the volumetric reduction of the physical dimensions of the MCB plume. *See* Table 5-3 at p. 5-54. In so doing, EPA overlooks the fact that mass defines toxicity and thus risk. Because no human consumption of the groundwater has or will legally occur, the agency's goal of early plume reduction misses the principal objective.

Focusing on the fastest plume-reducing strategy necessitates, by definition, higher pump rates and more expensive wellfields. Mass reduction, however, is not so dependent on pumping rate. As indicated in Table 5-3 of the JGWFS Report, mass reduction is less sensitive to pumping rates of 350, 700 or 1400 gpm over 50 years (82, 92 and 94 percent mass reductions in the Middle

Bellflower C Sand, respectively), and the achievement of mass reduction flattens out significantly with time. Accordingly, within a reasonable time frame, virtually the same remedial objective is obtained regardless of whether a 350, 700 or 1400 gpm system is implemented, but the costs differ significantly. EPA is thus selecting the more expensive path to arrive at essentially the same result.

Focusing on the volumetric dimensions of the plume is misdirected because it is functionally equivalent to trying to control regional air pollution by limiting geographically where vehicles may drive and ignoring altogether tailpipe emissions. Mass reduction drives the toxicology issues and should therefore take priority over plume-reduction goals. EPA's risk contour analysis also lacks significance if mass reduction is not given greater weight than the plume's dimensions over time. Once the priorities are properly reestablished, it is clear that the same remedial goal of mass reduction could be achieved within 50 years at rates considerably less than 700 gpm.

35 EPA Response:

This comment is incorrect. It is not mass but *concentration* which drives the "toxicology" to which the commenter refers, in that the health risk posed to a person exposed to contaminated groundwater arises based on the concentration of the contaminant in that water. Concentration is *mass* per unit *volume*. EPA considers it unacceptable for a person to be exposed to groundwater at a concentration above health-based standards. Any physical volume of groundwater with concentrations of contaminants above health-based levels continues to pose an unacceptable health risk if it is used.

Therefore, in considering volumetric reduction of the chlorobenzene plume, EPA was primarily concerned with the reduction in the volume of the aquifer affected by *concentrations of contaminants above health-based standards*. Mass reduction is inherent in the reduction in concentration within the affected volume of the aquifer. Mass reduction may reduce the concentration, which would reduce the potential health risk, but may not necessarily increase the volume of aquifer which no longer poses an unacceptable health risk.

We do agree with the commenter that mass reduction is a critical parameter to consider for the remedial action. Mass reduction decreases the load of contaminants that available for migration at any given time. However, EPA placed a greater focus on the volume of groundwater at a mass per unit volume that would pose an unacceptable health risk in comparing remedial alternative performance.

We note that mass reduction is of highly critical value when considered in relation to NAPL recovery/removal, even when the total volume of contaminants above health-based standards remains fixed (as in the containment zone). In this case, reducing the mass of NAPL contaminant reduces the time frame that the NAPL will continue to dissolve and may also reduce the potential for NAPL migration. This is a separate issue.

General Comment 8. EPA's "Additional" Remedial Action Objective For Greater Near-Term Reduction In Contamination Is Not Based Upon the National Contingency Plan.

EPA's strong desire to achieve substantial early-year reduction in contaminants overshadows its evaluation of all remedial options, regardless of the fact that under scenarios greater than 350 gpm measurable progress converges in terms of mass or volume reduction through the first 50 years of operations. *JGWFS Report*, Sections 5.2 and 5.3. In so doing, EPA establishes the "additional" remedial action objective of "near-term reduction" of groundwater contamination. However, there is no legal authority mandating accelerated early-year plume reduction, especially where the impacted water will be unsuitable for water supply purposes indefinitely. *See JGWFS Report*, Section 3.7, at p. 3-21. Despite suggestions to the contrary, the National Contingency Plan does not measure "timely" cleanup on the basis of results achieved during the first half of a remedial program as compared to the second half of a program.

36 EPA Response:

At issue is the very long time frames involved (on the order of 100 years) with any of the alternatives developed in the JGWFS being able to fully achieve the RAOs. Under these circumstances, benefit is provided by early-time performance, as described in Section 10.2.6.3 of the JGWFS. While the NCP does not explicitly describe "early-time performance" per se, it does require that cleanup be achieved in a reasonable time frame. Moreover, the NCP requires that EPA consider short-term effectiveness, which includes considering the progress achieved during the course of the remedial action. In this case, of course, this "short-term" is stretched over a very long time. Nonetheless, EPA disagrees that considering early time performance is not based on the NCP.

The importance of early-time performance is exemplified by the feasibility study for groundwater for the Montrose Chemical Site that was in draft prior to the current joint groundwater feasibility study (this document was never finalized and is used here only for illustration). Two of the alternatives in that draft FS were a 30-year scenario and a 60-year scenario (interestingly, the pump rate for the 60-year scenario was approximately 2600 gpm; one can see how much EPA has reduced pump rates in the remedial selection process and that the 700 gpm system is *not* highly aggressive). The names of those scenarios were based on how long it would take to reduce groundwater to drinking water standards everywhere in the chlorobenzene plume. When looking at modeling results for these two scenarios, it could be seen that while the 30-year scenario cleaned all of the groundwater in half the time, the 60-year scenario nonetheless cleaned a very large percentage (perhaps 85 percent) of the plume in the first 30 years. The last portion of the plume typically takes the longest to clean up.

When the JGWFS was initiated, it did not define alternatives in terms of total time to reduce the volume of the plume at concentrations above health-based standards to zero, as did its draft predecessor. Rather, given the long time frames involved, it gave more weight to the interim gains during the process. Time frames on the order of 100 years are so long that they otherwise may not be considered reasonable, as required by the NCP. However, achieving most of the plume reduction in the early years lends "reasonableness" to the time frame, even if the total time is long. This is because most of the cleanup will have been complete much sooner than the total time frame. In addition, early time performance enhances the short-term effectiveness of the remedy. As explained in the JGWFS, and in Section 11 and 12 of the Decision Summary of this ROD, when more of the plume is removed at early times, less of the plume remains in later years when the uncertainties are greater and the model is less reliable.

Among the chlorobenzene scenarios, the 350-gpm scenario has relatively poor early-time performance and progresses toward cleanup with a much flatter curve. The 700- and 1400-gpm scenarios have much better early-time performance by achieving quicker plume reduction, followed by a leveling off. It is this early performance that makes the long time frames of the remedy more reasonable at the 700- and 1400-gpm pump rates, which are only relatively moderate in aggressiveness.

The commenter's argument seems to imply that the total time to cleanup is the only means of alternative evaluation supported by the NCP, and that early-time performance should be ignored. EPA does not agree with this position.

It is noteworthy that EPA's remedial and natural attenuation program at the adjoining benzene plume (and other regional sites) measures completion in centuries. With respect to Montrose, however, program completion is measured in decades, with no compelling reason to draw such expensive distinctions between sites. Near-term reduction imposes the requirement of substantial additional investment in larger wellfields, with higher risk of failure and related safety concerns.

637 EPA Response:

The commenter, once again, confuses containment of the containment zone (which extends not only to the Del Amo Site but also the Montrose Chemical Site) with plume reduction of the chlorobenzene plume. The containment of the containment zone is, by definition, *indefinite*. This is because of the presence of NAPL, and nature of its occurrence, at both sites. For the benzene plume, intrinsic biodegradation (natural attenuation) is relied upon to *contain* the benzene within the containment zone, *not* to reduce the concentrations of contaminants to drinking water standards in a reasonable time frame (which would be technically impracticable). Conceptually it is true that, some centuries into the future, the NAPL will entirely dissolve and so containment will become unnecessary. However, this

time frame is not reasonable and so the containment action should not be confused with a full clean-up action. EPA has *waived* the requirement to restore the water within the containment zone to drinking water standards in a reasonable time frame. We emphasize that this includes an extensive zone of DNAPL at the Montrose Chemical Site, as well as the Del Amo Site solely mentioned by the comment.

In contrast, for the portion of the chlorobenzene plume that is outside the containment zone, the requirement to reduce the concentrations of contaminants to at or below health-based standards *in a reasonable time frame* has not been waived, and applies. It is true that larger wellfields are required to achieve this purpose, however, the benefit of doing so is not insignificant. On the contrary, the extensive groundwater contaminated outside the containment zone will no longer pose a health threat if used.

As discussed herein, the larger infrastructure required to achieve higher pumping translates into significant additional costs. The goal of near-term reduction might be more appropriate if the remediation of the subregional MCB plume were the critical path in restoring the regional groundwater system to full beneficial use. However, there is no foreseeable near-term use of the regional groundwater for most beneficial purposes, and none is expected for centuries given the existence of widespread interconnected plumes and strong institutional controls. In light of the fact that the Montrose program is inextricably linked to the larger regional conditions, an artificially expensive and aggressive near-term strategy premised upon an arbitrary "additional" EPA remedial objective is highly wasteful.

#38 EPA Response:

As established in earlier responses in detail, EPA disagrees that (1) the remedy is aggressive (in fact, it is far less aggressive than it ideally would be), and (2) there is no chance that groundwater will be used in the future.

General Comment 9. The Granular Activated Carbon, Fluidized Bed Reactor Technology Proposed for p-CBSA, MCB and Benzene at the Joint Site is Too Experimental and Uncertain To Be Considered a Viable Treatment Technology for Future Remedial Design.

EPA's proposal to incorporate liquid phase granular activated carbon, fluidized bed reactor ("LGAC-FBR") technology at the Montrose Chemical Site needs to be screened out of any further remedial design consideration, especially given LGAC-FBR's highly experimental nature and unproven effectiveness in the field. At the request of EPA, McLaren Hart undertook a bench-scale LGAC-FBR study in 1996-97 concerning the treatability of p-CBSA, MCB, benzene and other groundwater contaminants. *See GAC-FAR Bench-Scale Treatability Study, Montrose Chemical Superfund Site, Torrance, California* (June 13, 1997). The McLaren Hart study

concluded that full-scale LGAC-FBR units with reinjection, as needed here, have experienced profound operational problems, making effective full-scale operation extremely uncertain. However, EPA in its discussion of this technology, either ignored the identified drawbacks, presented a different evaluation of the facts or implied that the problems were easily overcome. Exhibit "A" to this submittal presents a summary of the critical issues and compares the statements of EPA in the JGWFS Report with the actual conclusions presented in the McLaren Hart study.

The McLaren Hart study could confirm no meaningful industry experience of LGAC-FBR technology at sites suitable for practical comparison. In particular, McLaren Hart noted a lack of meaningful operational experience within the industry of LGAC-FBR technology where aggressive reinjection of groundwater is, as here, anticipated. Indeed, bench-scale LGAC-FBR studies confirmed that not all compounds in the groundwater were effectively treated, offering at best only a partial treatment if scale-up could in fact be achieved. Further, existing chemicals in the groundwater had a deleterious impact on the effectiveness of the bed-reactor. Based on the bench-scale studies, it was not possible to conclude with any reasonable degree of certainty that p-CBSA and other chemicals of concern could be reduced to levels suitable for reinjection under the *de facto* state concentration standard of 25 mg/l. This emerging technology cannot be given serious weight for purposes of remedial design because of its enormous expense and operational uncertainty.

39 **EPA Response:**

EPA has included FBR, as a coarse removal process, coupled with a polishing process (Liquid GAC), as one of the treatment trains available in remedial design under the ROD. It should be noted that the FS demonstrated that carbon alone, not FBR, would likely be the most cost-effective treatment train. The combined process (coarse process with polishing process) meets treatment goals and is cost-competitive, particularly during periods of high organic loading. EPA believes the pilot-scale test data provides a sound basis to estimate performance of a full-scale system. A full-scale FBR system is capable of consistently achieving high removal rates for p-CBSA, chlorobenzene, and benzene. Based on the FBR pilot test results, the JGWFS conservatively assumed a 95-percent removal rate for p-CBSA, chlorobenzene, and benzene, for the feasibility study purposes. For a more detailed response to this issue, please refer to EPA responses to Exhibit A.

General Comment 10. EPA's Proposal to Defer Indefinitely Agency Decisionmaking With Respect to p-CBSA as a "Chemical of Concern" Ignores Available Data That p-CBSA Is Not a Hazardous Substance.

Available studies on the toxicological effects of p-CBSA have indicated that the substance has low toxicity. *See JGWFS Report,* Section 3.3.2.3, at p. 3-15. As acknowledged in the JGWFS

Report, no lethality was observed in LD50 toxicity studies up to 4,000 mg/kg. *Id.* at p. 3-16. No mutagenicity was found in mutagenicity assays. *Id.* No effects were observed in teratogenicity tests. *Id.* No adverse health effects were noted in an animal 28-day oral toxicity study. *Id.* Furthermore, p-CBSA's actual water solubility suggests that it may have a low bioavailability and may pass through a human body with little absorption. *Id.*

No p-CBSA studies are in progress and none is planned. *Id.* In addition to available studies, no federal or state agency has promulgated drinking water standards or action levels for the chemical. *Id.* at pp. 3-16, 3-16. However, in spite of this consistently favorable evidence, EPA has suggested the adoption of a *de facto* reinjection standard of 25 mg/l for the chemical, based on a unofficial state standard that is, in turn, based on an unidentified "provisional" toxicity value. *Id.* at p. 3-17. This "standard" was, by EPA's admission, used only as a potential ARAR for the purpose of evaluating remedial alternatives in the JGWFS Report. *Id.*

The unfortunate result of EPA's indecision with respect to the status of p-CBSA is that significant uncertainty remains. The effect on the future of the program after redistribution of the chemical in the aquifer by high-rate reinjection cannot be reasonably determined or addressed. *See JGWFS Report*, Section 5.4.1.5. Indeed, EPA has suggested deferring any agency decision until a much later (unknown) date, while admitting that it is extremely unlikely that any new toxicity data will be forthcoming. *Id.*

At a minimum, EPA's failure to determine that p-CBSA is <u>not</u> a chemical of concern for purposes of the Montrose Chemical Site needlessly increases the cost of the program without any quantifiable benefit. On the weight of the consistently favorable scientific evidence, p-CBSA should be eliminated conclusively from the proposed remedy as a chemical of concern. *See* Exhibit "B" for more specific comments.

40 <u>EPA Response</u>:

pCBSA has been identified as a contaminant of concern because: (1) pCBSA is exclusively related to the manufacture of DDT, arising from the sulfonation of chlorobenzene in the presence of sulfuric acid, two of the basic raw materials in the DDT-manufacturing process, and was released by the former Montrose plant; (2) it is a pollutant or contaminant under CERCLA; (3) it is found in extremely high concentrations and over a very large extent at the Joint Site (larger in area, in fact, than chlorobenzene); and (4) there are insufficient studies and inadequate data upon which to base health-based standards.

As an overview, the studies and tentative conclusions from those studies as listed by the commenter are correct. However, these studies do not allow EPA to conclude that pCBSA has no toxicity. Of particular note is that there are no chronic tests of pCBSA toxicity (cancer or non-cancer) at all. Regardless of the likelihood of more studies being conducted, it would be inappropriate for EPA to eliminate pCBSA as a contaminant of concern.

EPA has not deferred the decision on pCBSA. Rather, the actions to be taken for pCBSA are specified in the ROD as for every other contaminant. Based on what we know today, these actions are protective of human health and the environment. EPA notes that removing pCBSA as a chemical of concern from the ROD would have no practical effect in that EPA is required by law to re-examine the remedial action at least every five years to determine that the remedy remains protective of human health and the environment. Should additional toxicological studies provide adequate data to support a health standard for pCBSA at the time of one of such reviews, EPA would have to evaluate whether the remedy remained protective in light of that standard. As such, it is also possible that future information may result in EPA's designating pCBSA as a CERCLA hazardous substance. It was for this reason that EPA advised Montrose to address treating as much of the pCBSA as possible. But, as discussed in other comments, Montrose appears resistant to employing viable treatment technology that could remove significant quantities of pCBSA from extracted groundwater.

General Comment 11. EPA's Treatment of Groundwater Modeling Uncertainty Potentially Skews the Results and May Lead to Inaccurate Agency Conclusions.

EPA emphasizes modeling uncertainties numerous times throughout the modeling discussions in Section 5, Appendix B, as well as in other sections of the JGWFS Report. The word "uncertain" or variants thereof are used nearly 110 times in Section 5 and Appendix B and 34 times in Section 10. Despite stated concerns about the effects of uncertainty, EPA gives much more weight to modeling uncertainties that could potentially result in actual program cleanup times that exceed model estimates. In contrast, EPA either emphasizes to a lesser degree or fails to mention modeling uncertainties that could result in actual cleanup times faster in rate than predicted by simulations. These potentially favorable factors include the following, which are discussed in greater detail in Exhibit "C."

641 EPA Response:

The factors listed below by the commenter were addressed in the same way by the model for each of the simulated alternatives, and the alternatives with the higher groundwater extraction/injection rates were found to be able to achieve all of the time-dependent RAOs (e.g., plume reduction) faster. It is critical to note that EPA did not use the model to obtain absolute cleanup times for any of the alternatives, and the model cannot be used for this purpose. Rather, the model can only be used for a *relative* comparison of performance among alternatives. It is possible that the actual time to achieve all of the RAOs could be shorter than the model predicts. Typically, however, actual cleanup times using conventional pump-and-treat technologies are greater than initially predicted.

Possible MCB Biodegradation - Even relatively small degradation rates can significantly reduce the cleanup time compared to model simulations. However, no biodegradation was factored into the modeling.

42 EPA Response:

For clarity, the model did include biodegradation rates for benzene but not for chlorobenzene. There is no evidence that there is significant intrinsic biodegradation of chlorobenzene at the Joint Site (see Section 2 of the JGWFS and response to General Comment 3) and certainly no reliable estimate of the rate at which it might be occurring. The inclusion of this parameter in the modeling would, therefore, have been inappropriate.

Extraction Wells Remaining Active Throughout Model Simulations - In order to reduce the complexity of the modeling effect, model simulations were run based on the assumption that extraction wells would continue pumping even after the plume had been cleaned up in the vicinity of the wells. In reality, wells would be turned off or the pumpage would be shifted to particular wells as the plume was cleaned up. Plume cleanup time frames would therefore tend to be shorter than the model simulations.

43 EPA Response:

Under the conditions stated in the comment, it is not certain that the cleanup time frames would necessarily be shorter than under the current model. To make that determination would require specific modeling of specific wellfield operational patterns. This type of modeling would most appropriately be conducted during remedial design.

Aquitard Mass - MCB concentrations throughout the aquitards were estimated to be equal to the average of the concentrations in the overlying and underlying aquifers. The sensitivity analysis performed by Hargis + Associates suggests that if the actual mass in the aquitards is less than that assumed in the model, then cleanup times would be considerably shorter than shown by simulations.

44 EPA Response:

This comment is correct. If the actual contaminant mass in the aquitards is less than that assumed in the model, the simulated time required to achieve cleanup would be shorter

than under the current modeling assumptions. However, it is not possible to say, without conducting simulations using different values for the contaminant concentrations in the aquitards, whether the reduction in duration would be "considerably shorter."

In so doing, EPA reaches the potentially erroneous conclusion that actual cleanup times will likely take longer than the model predicts, therefore justifying a 700 gpm system because it provides a greater margin of safety.

Given the full range of modeling uncertainties that cut in both directions, it cannot be concluded with reasonable certainty that the cleanup will take longer than simulations predict. EPA's consistent view that any modeling uncertainty should be resolved in favor of higher rates of extraction gives the false impression that the model is essentially marginally reliable.

45 EPA Response:

The discussion as to whether the model will predict longer or shorter cleanup times than the real cleanup time unnecessarily diverts from the fact that the remedial action selected by this ROD, which employs approximately 700 gpm for reducing the extent of the chlorobenzene plume outside the containment zone, will provide for a shorter and more reasonable cleanup time, with superior early time performance, than the 350-gpm pump rate of Alternatives 2 and 3, and the 190-gpm scenario favored by the commenter, in any case.

Regardless, EPA does not explicitly state that the actual cleanup will *necessarily* take longer than the model predicts (i.e., that the model overestimates the cleanup time), although this result is likely. EPA acknowledges that the time to achieve complete cleanup could occur faster than the model results suggest. Experience at other sites would indicate that longer cleanup times than predicted by the model are common due especially to sorption tailing effects and local heterogeneities which cannot be accounted for by the model.

The model is very reliable for the purposes to which it has been put; namely, to *relatively* compare the performance of alternatives. Moreover, the model is the best tool we have for doing that, and it is not EPA's intention to dismiss the model but rather to see its results in light of their relative uncertainties and limitations. This is appropriate and practical approach for use of any model.

The focus by the commenter on total cleanup time frames is misplaced. In this case, the model cannot be used to reliably predict the time to achieve full cleanup of the chlorobenzene plume under any of the alternatives. The time frame to achieve complete

elimination of the plume outside the DNAPL TI waiver zone is beyond the time frame within which the model is reasonably reliable and accurate (modeling uncertainties grow as the time frame increases). The support for the 700-gpm system lies not in a head-to-head quantitative comparison of total cleanup times, for which the model cannot reliably be used in this case, but rather, in an acknowledgment that the total cleanup time is *long*, that the 700-gpm system performs better than the 350-gpm system in terms of factors such as pore volume flushing, early-time performance, and performance at time frames the model can reasonably predict (such as 10 or 25 years), certainty in meeting ARARs, etc. These factors, in turn, lead to the qualitative conclusion that the total cleanup time is less for the 700-gpm system than for the 350-gpm system.

So, for instance, the current model states that the 350-gpm scenario will remove 30 percent and the 700-gpm scenario will remove 70 percent of the plume in the first 25 years. The commenter takes objection with EPA's contention that the performance likely will be less than these values indicate. If, in reality, there would be more performance by 25 years as follows: 350-gpm: 50 percent; 700-gpm, 90 percent; the conclusion is still that the remedial time frame is long, and that the 700-gpm performs better than the 350-gpm scenario, resulting in better certainty of attaining remedial action objectives.

Therefore, the question of whether the absolute cleanup times predicted by the model are likely to be longer or shorter than reality is not the primary factor in evaluating alternatives. Moreover, for the most part the JGWFS does not link modeling uncertainties with the need for higher pumping/injection rates, rather it ensures that the model is not used for purposes which are outside its limitations. For the most part, it is the uncertainties in future aquifer conditions that support the consideration of higher pumping rates to reduce the duration of the remedy and, therefore, increase the certainty that the RAOs can be achieved.

Filtering out any uncertainty that has the effect of reducing program life has a skewing effect on agency decisionmaking, leading to the selection of a remedy alternative (700 gpm) that is needlessly aggressive and expensive.

46 EPA Response:

We remind the commenter that there are many uncertainties both in modeling and in future conditions. Many of these have nothing to do with "program life," as discussed above. Opting to reduce uncertainty in achieving the RAOs and achieving protection of human health and the environment, the mandates of CERCLA, in a reasonable time frame, is not inappropriate and does not by definition result in remedies that are "needlessly aggressive and expensive."

EPA further indicates that model predictions beyond 50 years are not meaningful to its analysis because of increased uncertainty. *See JGWFS Report*, Section 5.1.4.3. The sensitivity analysis performed by Hargis + Associates indicates that for most modeling parameters, the compounding effect of errors are likely to be greater at earlier points in the modeling program, *i.e.*, prior to 25 years, as opposed to modeling errors after 25 years. Further, the agency provides no rationale or basis for establishing 50 years as the appropriate baseline for model simulations. The fact that the adjoining benzene plume will be allowed to naturally attenuate for hundreds of years defeats the urgency of EPA's argument that cleanup must be achieved in no more than 50 years.

47 EPA Response:

This comment generally refers to the degree to which the model does not account for existing conditions (and no model perfectly does), including not only general aquifer parameters but their local variations, various physical processes not simulated by the model, etc. The comment is not clear. We can find no evidence in the sensitivity analyses for the model performed by Hargis + Associates that would prove that modeling error does not exacerbate the longer the time period being simulated. It is very doubtful that errors in the simulation of solute transport (that are based on improper, or non-representative, input values) would improve with simulated time. It is further unlikely that one could measure errors after 25 years of simulated time as the actual conditions after 25 years from the initiation of contaminant release are not entirely known.

General Comment 12. EPA's Cost Estimates are Flawed and Cast Doubt on the Remedy Selection Process.

One of the major factors cited by EPA for the selection of the 700 gpm alternative for the Montrose program is that the incremental cost of this option compared to the 350 gpm system is reportedly modest with perceived improved early-time results. However, the cost estimates presented in the JGWFS Report indicate significant mathematical errors, which alter the relative costs of the various alternatives and cast doubt on EPA's cost evaluation.

48 EPA Response:

EPA has encountered minor spreadsheet entry errors in certain cost tables in Appendix C of the JGWFS, which were passed to other spreadsheets and thus affected the estimates of costs of remedial alternatives. The errors were discovered by EPA after the release of the JGWFS. The errors in the spreadsheets were small, resulting in minor changes to the estimated costs of the remedial alternatives. The total cost of each alternative was increased anywhere from 1.61 percent to 2.45 percent, depending on the alternative,

without impacting the ranking of the alternatives (or EPA's preferred remedy). None of the estimates of the costs of the alternatives decreased due to the error, resulting in virtually the same relative differences of costs among alternatives. The technical assumptions used for cost estimates in Appendix C are correct, and do not change. A cost estimate for feasibility study purposes, including the JGWFS, is an "order-of-magnitude" cost estimate, defined as an approximate estimate with an expected accuracy of plus 50 percent and minus 30 percent. In this context, this error has no significant impact to the analysis.

The table below presents the changes to the total costs of the alternatives:

TABLE
Changes to the Total Costs of the JGWFS Alternatives

Alternative	Old Cost	New Cost	Difference	Percent Increase
Alt. 2	$20,843,000	$21,353,000	$510,000	2.45
Alt. 3	$25,971,000	$26,481,000	$510,000	1.96
Alt. 4	$29,981,000	$30,490,000	$509,000	1.69
Alt. 5	$39,871,000	$40,514,000	$643,000	1.61

All affected cost tables have been corrected and the corrected versions are attached within the document, *Correction of Cost Estimates Following A Spreadsheet Numerical Error, Joint Groundwater Feasibility Study for the Montrose and Del Amo Sites, May 1998* **(January 20, 1999). This document is being added to the administrative record by EPA with this ROD. All pages of text in which cost estimates for remedial alternatives appeared in the JGWFS have been changed to reflect the revised cost estimates, and copies of such pages are attached within the referenced document. Pages are included in their entirety; thus, if the pages in the referenced document are directly substituted for the same-numbered pages within the original JGWFS, the JGWFS is fully modified so as to correct the minor spreadsheet error.**

Nearly 50 percent (15 of 36) of the cost tables contain errors, and these errors influence all remedial alternatives. Exhibit "D" presents a brief narrative summary of the errors: An expanded version of this cost information has already been delivered to EPA at its request under a separate submittal. Although Montrose understands that all costs developed for the JGWFS Report have a wide range of acceptable precision (+50 to -30%), the incremental costs between competing alternatives should be reasonably precise for sound decisionmaking.

249 EPA Response:

The mathematical errors are minor and the cost tables have been corrected as shown in the referenced document. The incremental cost between the competing alternatives are not impacted by the small errors found in the cost tables to the extent that the relative cost comparisons would be altered. Please also see the response immediately above. EPA also points out that, if the commenter considers the modified cost estimates to be more reliable, then the difference in the cost estimates for Alternatives 2 through 5 have actually narrowed, not widened.

As shown in the table below, the incremental increased net present value ("NPV") cost over 30 years between the 350 gpm and 700 gpm air stripping system is estimated by EPA to be approximately $4 million. As corrected, the incremental difference is actually closer to $7 million.

Comparison of Incremental Cost of 350 and 700 GPM Systems:

Evaluated Alternatives	EPA Calculated Differential (Million $)	Corrected (Million $)
LGAC	4.01	4.64
FBR	4.74	7.07
Air Stripping	4.16	6.59

Using air stripping technology as an example, it actually costs an additional 41 percent to shift from the 350 gpm system to the 700 gpm system, not an incremental increase of only 26 percent, as mistakenly believed by EPA.

250 EPA Response:

The minor mathematical errors had an impact on the estimated costs of the alternate treatment methods (i.e., the FBR and air stripping technologies). These treatment technologies are not used as the basis for the cost comparison of alternatives, because each alternative used the cost representative technology, which was liquid phase carbon adsorption. The following table presents the corrected cost figures and the incremental differentials for all three technologies.

Treatment Technology	350 gpm	700 gpm	Corrected Incremental Differential (Million)
LGAC	$13,482,000	$17,491,000	$4.0
FBR	$16,032,000	$22,478,000	$6.45
Air Stripping	$16,440,000	$22,406,000	$5.97

Using air-stripping technology as an example, it costs an additional 36 percent to shift from the 350-gpm system to the 700-gpm system.

EPA's screening also prematurely eliminated the 190 gpm containment scenario. By eliminating this alternative too early in the process, the cost-effectiveness of this containment alternative has not been fairly evaluated, and an accurate comparative analysis of the incremental costs of the various systems cannot be appropriately and accurately prepared. To illustrate the potential impact of screening out the containment strategy, the Montrose version of the JGWFS Report fully evaluated the 190 gpm alternative and provided a full cost estimate (a total 30 year NPV of $11.39 million for the air stripping treatment technology). In contrast, EPA's total corrected cost for the 350 gpm air stripping system is $16.22 million. Hence there is an increased cost of $4.83 million, or 42 percent, to shift from the 190 gpm alternative to the 350 gpm. Furthermore, shifting from the 190 gpm alternative to the 700 gpm requires an incremental cost of $11.01 million, or a 97 percent cost increase.

#51 EPA Response:

The 190-gpm scenario may be a low-cost system but it is not an effective scenario. This scenario did not meet the RAOs and did not meet ARARs in a reasonable time frame and was screened out in Section 5 of the JGWFS because it did not meet the effectiveness or ARARs criteria. (See also response to General Comment No. 5 above).

General Comment 13. EPA's Application of Residential Preliminary Remediation Goals to the Montrose Chemical Site Is Inappropriate.

In the RI Report, EPA compares site data regarding groundwater contamination to its own federal toxicological standards known as "Preliminary Remediation Goals" ("PRGs") for tap water, although groundwater is not used for human consumption. In addition, EPA inappropriately compares soil and sediment data at this historically industrial site to generic PRGs for residential soil. EPA's use of these generic and conservative PRGs is inappropriate and

misleading because it does not incorporate relevant site-specific conditions, gives a false impression of risk, and may bias subsequent agency decisions regarding the need for remedial action for soil, sediment, and groundwater.

EPA does not provide sufficient rationale for applying residential and tap water PRGs as the standard by which to compare soil concentrations and characterize the magnitude and extent of contamination at this heavy industrial site. There are no plans to redevelop the site for residential purposes. Nonetheless, EPA provides no information to evaluate the relevancy of residential PRGs, or the lack thereof. Nor does it discuss the use of alternate comparative criteria such as the PRGs for industrial soil and/or site specific health-based cleanup levels, which may provide a more relevant, appropriate, and meaningful comparison. In short, EPA's use of such highly conservative residential PRGs in lieu of industrial PRGs for an industrialized area that dates back to the 1940s is inappropriate. See Exhibit "E" for specific comments.

52 EPA Response:

Preliminary Risk Goals are the environmental concentrations that, based on a standard set of exposure assumptions, would produce the lower of a 10^{-6} cancer risk or a hazard index of 1, whichever is lower. It is important to note that EPA's use of such values in the *Remedial Investigation Report for the Montrose Superfund Site*, May 18, 1998 (Montrose Site RI Report) does not indicate a risk management decision; that is, EPA has not decided that such values will be cleanup values for the Montrose Chemical Site nor has it determined that residential, as opposed to industrial, exposure assumptions will be used for determining such values. Rather, EPA was attempting to provide the reader of the RI with a reasonable benchmark value to assist the reader put the environmental concentrations found at the Montrose Chemical Site into perspective. While residential PRGs may be conservative for this purpose, EPA does not believe that their use, in this fashion, is inappropriate.

Also, in choosing to compare the soil data to residential PRGs, EPA was simply following EPA Region 9 PRG guidance, which states that "when considering PRGs as preliminary goals, residential concentrations should be used for maximum beneficial uses of a property" (EPA, 1998). In the RI Report, on page 5-4, EPA clearly acknowledges the limitations of the PRGs and that residential PRGs are likely to be a conservative indication of contamination.

It should be noted that the future use of the Montrose property has not been established. In addition, EPA has not approved site-specific, health-based cleanup levels (HBCLs) *for soils* at the Montrose Chemical Site. (This ROD sets the cleanup standards for groundwater) Once the future use of the former Montrose plant property is established and HBCLs *for soils* are approved by EPA, the HBCLs would be appropriate for use in more site-specific, in-depth comparison of the data.

The following excerpt provides detail on what PRGs are:

EPA Region IX Preliminary Remediation Goals (PRGs) are risk-based tools for evaluating and cleaning up contaminated sites. They were developed to streamline and standardize all stages of the risk decision-making process. EPA Region 9 PRGs combine current EPA toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media (soil, air, and water) that are considered protective of humans, including sensitive groups, over a lifetime. Chemical concentrations above these levels would not automatically designate a site as dirty or trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. Further evaluation may include additional sampling, consideration of ambient levels in the environment, or a reassessment of the assumptions contained in these screening-level estimates (e.g., appropriateness of route-to-route extrapolations, appropriateness of using chronic toxicity values to evaluate childhood exposures, and appropriateness of generic exposure factors for a specific site.) (EPA, 1998).

Please see the Response to Exhibit E for responses to similar comments.

General Comment 14. EPA Erroneously Concludes That Montrose Is the Source of "Chemicals of Concern" of Unknown Origin.

The issue of whether certain "compounds of concern" relate to former Montrose operations or non-Montrose operations has been an ongoing controversy with EPA throughout this thirteen-year RI/FS process. Numerous industrial operations, located upgradient, cross-gradient, and downgradient from the Montrose property, have come and gone since the 1940s, which are likely to have contributed VOCs to the soil and groundwater at the Joint Site. With insufficient regard to historical alternative sources and decades of industrial activity before Montrose's arrival, EPA concludes that any uncertainty must be resolved against Montrose, thus attempting to hold Montrose responsible for the presence of benzene, chloroform, tetrachloroethylene, TCE, toluene, xylene, ethylbenzene, the dichlorobenzenes, and other chemical compounds in both soil and groundwater. As discussed more fully herein, Montrose objects to EPA's conclusions in the JGWFS Report regarding the origin of the various chemicals of concern in the regional groundwater.

53 **EPA Response:**

Montrose's objections are noted for the record.

The chemicals of concern (COCs) referred to in the JGWFS are based on the RI Reports. In the Montrose Site RI Report, EPA presents a fair and balanced assessment of the source of the contamination found in the subsurface and acknowledges that some contaminants in the subsurface at the property may result from neighboring operations.

For example, the discussion of the source of benzene indicates potential sources both off- and on-property. As stated on pages 5-33 and 5-34:

". . .there are several possible contributors of the benzene found in the saturated zone emanating from the Montrose Property. Possible sources of benzene in groundwater include:

- **Benzene used in the production of benzene hexachloride (BHC), stored near the location of the BHC plant**
- **The benzene that occurred as an impurity in the Montrose chlorobenzene feedstock**
- **The gasoline storage tank located south of the machine shop**
- **Fuel transmission pipelines in the LADWP right-of-way**
- **Underground fuel storage tanks located at Jones Chemical Company**
- **The Del Amo Site**

EPA believes this is a fair and objective discussion of possible sources of benzene and does not unfairly resolve any uncertainty against Montrose.

As an aside, EPA wishes to point out that City of Los Angeles Bureau of Sanitation inspection notes indicate that Montrose Chemical used "mono-chlor benzol" and "benzene alcohol" at the former Montrose plant property (*See* A.R. No. 0177).

EPA treats the presence of PCE in the subsurface on and in the vicinity of the property in a similar manner:

"Sources of PCE have been documented at the Jones Chemical Company property south of the property and at other facilities located northwest, north, and northeast of the property (Levine-Fricke, 1995; and Dames & Moore, 1996). Records also indicate that Jones Chemical Company sold the Montrose various chemicals, including PCE, between 1968 and 1973. *The occurrence of PCE in the subsurface beneath the Montrose and Jones Chemical property appears to be primarily due to sources of PCE that originate at the Jones Chemical property.* PCE tanks were located on the Jones Chemical property near Borings LF-44 and LF-47. Groundwater concentrations of PCE appear to extend northward from the Jones Chemical Property, upgradient and under the Montrose facility. As discussed in the Montrose Chemical Site and Operational History Section, Jones Chemical, for some period of time, may have dumped some of its wastes into the Montrose wastewater recycle pond at the time that the LADWP canceled Jones Chemical's permit to discharge to the county sewer. The locations of the soil samples collected in this RI were not necessarily sufficient to fully evaluate this potential release point for PCE. Therefore, the Montrose Property may potentially be a contributing source of PCE to the subsurface." (emphasis added).

General Comment 15. EPA's Takeover of the RI Report Is Inappropriate and Unwarranted.

On January 8, 1998, EPA served notice of its disapproval of the Montrose RI Report and its intent to assume control of the RI process. Montrose flatly disagrees with EPA's depiction of Montrose's investigation efforts since 1985, especially after having spent well in excess of $20 million over the last thirteen years assessing site conditions and responding to EPA's various, often inconsistent directives.

RI Report preparation began in 1988. For four years, Montrose met regularly with EPA on a monthly basis to review and prepare individual sections of the report. Montrose delivered a final Draft RI Report to EPA in October 1992 and received no substantive comments at all from EPA for more than three years. When EPA refocused on the RI Report in 1996, it explained that its attention had shifted to other matters: "EPA appropriately shifted its priorities to address the residential situation. These priorities taxed the limited resources that EPA had available to the Montrose project for more than two years, to the point that EPA could not generate comments on the RI document." September 11, 1996 letter from J. Dhont of EPA to Montrose. When EPA did in fact respond to the 1992 final Draft RI Report on or about January 29, 1996, its new project manager delivered a single-spaced, forty-three page letter with comments on the draft 1992 RI Report that were so sweeping as to require virtually the entire 1992 RI Report be scrapped.

EPA conceded more than ten years into the process that it envisioned a much different RI Report in 1996 because "the greatly enhanced interest in this site by the community since the 1992 RI draft necessitates that a greater degree of clarity and usefulness of the document be achieved." *See* September 11, 1996 letter from J. Dhont of EPA to Montrose. Accordingly, Montrose was forced to prepare a revamped 1996 RI Report to support a then-anticipated 1997 Record of Decision, only to be advised subsequently that EPA would likely seek a third, superseding post-1998 RI Report.

Although working relations with EPA's project management have unfortunately been difficult since 1995, the RI/FS process progressed in a meaningful fashion through 1995 and was on the eve of remedy selection. The arrival of new EPA project management, however, led to the implementation of a vastly different agenda, three additional years of supplemental assessment activities, the expenditure of millions of additional dollars. Despite the extensive supplemental investigation, EPA has elected to conduct no additional natural attenuation studies at the Montrose Chemical Site.

Although EPA disclaims any responsibility for the enormous expense of having to prepare and recreate the RI Report multiple times, this process has been prolonged needlessly by inconsistent

agency direction, shifting priorities and community pressure. Even EPA's 1998 version of the RI Report continues to include the disclaimer that EPA remains interested in obtaining additional assessment data and thus the current RI Report should not be considered "final." RI Report, Section 1.1. EPA indicates that it may collect additional samples from neighborhoods and sewers, and thus this 1998 RI Report will be "significantly supplemented." *Id.*

Montrose has consistently been interested in preparing a factually accurate RI Report to support a sound remedial strategy. As discussed more fully in the comments below, Montrose continues to object to EPA's approach to the RI Report as not being faithful to the facts and simply designed to improve EPA's litigation position against Montrose.

#54 EPA Response:

This comment is primarily directed to enforcement issues between the U.S. EPA and Montrose Chemical Corporation of California, and is not pertinent to the nature of the selected remedy or EPA's evaluation of alternatives. While EPA disagrees with many of the commenter's statements, it would not be appropriate to place discussion of such matters in the Record of Decision. EPA therefore defers this discussion for resolution in other forums, except to submit the following:

EPA believes it was reasonable and appropriate to take over the RI Report because Montrose failed, after years of multiple and repeated drafts, to submit a version of the RI Report adequately addressing EPA's comments. Likewise, Montrose refused to include within the RI Report a great number of pertinent facts and inferences about the sources of contamination within the former Montrose plant, even in cases where the information was derived from Montrose-generated documents.

General Comment 16. EPA's Version of the Operational History at the Montrose Chemical Site in the 1998 RI Report Is Speculative and Designed to Improve EPA's Litigation Position.

EPA and its sister federal agency, the National Oceanographic and Atmospheric Administration, have been aggressively litigating against Montrose for eight years, demanding from Montrose in various actions over $1 billion in alleged natural resource damages, $30+ million for a partial groundwater remedy (excluding future DNAPL and soil remedies), and many millions more for both on-site and off-site activities (*e.g.*, sewer restoration, 204th Street fill removal, Kenwood drain assessment work, and neighborhood relocations).

In 1994, EPA caused serious alarm within area neighborhoods by needlessly relocating dozens of households because DDT (formerly the most widely used pesticide in California and the world) was detected in imported fill material behind three homes. This extraordinary EPA response

proved to be a costly overreaction. In the aftermath of the relocation, Montrose was left in the position of having to litigate against hundreds of residents who were too quick to believe the agency's early assessment of the human health risk (EPA later concluded that DDT did not present a significant health risk in area homes but nonetheless agreed to three years of subsidized housing and permanent relocations). Compounding the adversarial relationship, EPA suggested that Montrose purchase the homes of 204th Street residents and pay the costs for permanent relocation of residents.

As a hostile litigant, EPA now seeks to benefit through the RI process and improve its litigation position against Montrose by building a "record" of alleged facts and legal conclusions relating to releases and practices at the Montrose Chemical Site from the 1940s. EPA has attempted to use its administrative oversight powers to compel Montrose to accept as indisputable "fact" EPA's view of the operational history through "comments" and "prototype language" that Montrose must incorporate as its own into the report.

[5] While trying to find a middle ground for the last several years, Montrose has consistently objected, without much success, to EPA's legal conclusions and revisionist site history as an improper purpose for the RI Report.

While Montrose cannot compel EPA to remain faithful to the established facts in this administrative process, it is not obligated to accept as "fact" EPA's conclusions regarding liability issues, its view of Montrose's operational history, or otherwise accede to EPA's efforts to improve its own litigation position. Accordingly, to the extent EPA has rewritten substantive portions of Montrose's operational history since the January 1998 document takeover (the latest Montrose version was prepared in approximately June/July 1997), Montrose objects and disclaims any ownership of or concurrence with EPA's version of the operational history in the RI Report (*e.g.*, pp. 1-1 through 1-60), and specifically disagrees with the characterization of the report as a "Montrose document" (pp. 1-3).

In lieu of objecting to each and every misstatement and false conclusion of EPA in the 1998 RI Report, which would be highly inefficient and unworkable, Montrose disclaims those portions of the report authored by EPA as an effort to suit its own litigation objectives. Montrose stands by its latest 1997 version of the site operational history submitted to EPA prior to the EPA takeover and believes it is suitable for remedy selection purposes. Unfortunately, EPA has departed from the original purpose of the RI Report and, accordingly, Montrose objects to EPA's 1998 substantive modifications as unfounded speculation and hearsay. Nothing in EPA's version of the RI Report should be construed as acquiescence by Montrose to EPA's characterization of the

[5] In its extensive January 29, 1996 comments on the October 1992 RI Report, EPA instructs Montrose as follows: "The goal of EPA's comments is to direct the revision of the RI Report. Thus, ultimately EPA defines the address of a comment not as a statement about how or whether the comments will be addressed, but the actual revision of the draft RI Report."

nature of Montrose's site operations or releases of hazardous substances. See Exhibit "F" for specific comments.

55 EPA Response:

Montrose's objections are noted for the record.

Several portions of this comment are not pertinent to the selection of remedy process, and are not addressed here.

EPA disagrees with the commenter that the site history in the Montrose Remedial Investigation Report is "revisionist history," or designed to advance EPA's litigation position. The purpose of a site and operational history in an RI Report is not to provide the basis for a legal brief. Rather, the investigation at the site must be shown to be reasonable and complete in light of the former operations at the site. Moreover, the conceptual model developed for contaminant migration must be consistent with those operations. Site history leads to environmental characterization; and in turn, environmental characterization leads one to expand the site history. Prior to EPA's attempts to revise the operational history of the RI, Montrose Chemical Corporation (the commenter) had omitted so many pertinent facts about operations that it was hard to discern from the earlier draft versions of the RI why sampling efforts were showing extreme contamination in the subsurface at the site. The earlier drafts acknowledged chemical usage and operations, but there was insufficient reasonable analysis, whether based on unequivocal facts or on reasonable possibilities, that would explain how the contamination came to located as it is in the environment. This was especially true with respect to industrial waste handling. How was one to know, for instance, that samples, wells, and other measurements in the investigation comprehensively addressed the locations and means by which contaminants entered and moved in the environment, if this was not included in the report? EPA's modifications to the report corrected this problem.

More detailed responses are provided in response to Exhibit "F".

General Comment 17. EPA's Fragmented Approach to a Comprehensive Site Solution Is Highly Inefficient and Potentially Counterproductive.

Fundamental problems have been created by EPA's fragmented approach to the Montrose remedial program. For instance, dissolved phase extraction seriously complicates the goal of DNAPL containment. At extraction flow rates higher than 190 gpm (*i.e.*, all plume-reduction scenarios), the two actions have the potential to conflict. On one hand, an extraction well arrangement is being proposed to contain the DNAPL, a critical action toward eliminating potential releases of chemicals of concern to the aquifers. But on the other hand, immediately downgradient, a much larger extraction system is proposed to reduce the existing dissolved phase

plume. The DNAPL containment system must be designed to capture groundwater with high concentrations of VOCs emanating from the DNAPL-impacted zone, and concurrently, the dissolved phase remedial system must be designed not to overcome the DNAPL containment system. This is a delicate balance and predicated on computer modeling of a very complex environment. The obvious solution is to harmonize the dissolved phase containment system, applying the 190 gpm scenario to work in conjunction with the DNAPL containment system, not against it.

EPA also fails to consider how this proposed groundwater remedy at the Joint Site may conflict with any future Montrose soil or DNAPL remedy. For instance, EPA's proposal contemplates an extensive wellfield, piping and treatment system located on and off the Montrose Chemical Site for at least the next fifty years. Conceivably, this system may have to be deactivated or relocated in the event of surface capping or other soil remedy within the next fifty years. There is no evaluation of how future soil or DNAPL remedies may render this proposal highly inefficient or impracticable. It would be far more efficient to defer any final decision with respect to groundwater in order to coordinate any future soil or DNAPL remedy.

If, however, EPA declines to proceed with a coordinated multimedia remedy at the Montrose Chemical Site, a 190 gpm system is far more advantageous because a smaller-scale system located at the site is easier to reverse, modify or remove, if necessary, to accommodate a soil remedy. It also allows a thorough evaluation of bioremediation, and minimizes wasteful future re-engineering of the groundwater remedy to implement any future DNAPL strategy.

56 EPA Response:

The commenter grossly overestimates and misrepresents challenges that may be posed in ensuring that DNAPL containment is consistent with plume reduction, and that further remedial actions at the Montrose Chemical Site do not interfere with the joint groundwater remedy.

NAPL isolation keeps contaminants in the *dissolved phase* from leaving the isolation zone (not to be confused with NAPL recovery). This will be effected by extraction wells significantly downgradient from the center of the Montrose Chemical Site. The commenter is correct that the system accomplishing NAPL isolation must work in concert with the (farther) downgradient wells which are effecting reduction of the chlorobenzene plume. But the suggestion that this can only be accomplished using the 190-gpm scenario is mere speculation and without basis or support. In fact, it was a primary focus of the analyses and modeling in the JGWFS, from the beginning, to evaluate whether and how such "in-concert" functioning would be feasible, and the facts in the JGWFS demonstrate that it is feasible, at any of the pump rates considered by the JGWFS, up to and including the 1400-gpm scenario for the chlorobenzene plume. The remedial design phase of this

remedial action will require that NAPL isolation be effected in a manner consistent with the downgradient plume reduction.

The commenter raises the prospect that other possible future remedial actions at the Montrose property for surface soils and/or NAPL recovery may interfere with the joint groundwater treatment system if it is implemented now. These actions might include a cap over some or all of the property, digging and excavating portions of soil, NAPL recovery or steam injection wells, as examples. The commenter's statement that any chlorobenzene pumping system more aggressive than the 190-gpm scenario would pose insurmountable problems due to such conflicts is unsupported and frankly, without basis.

The commenter is correct, to the extent it is implied, that evaluating and alleviating the potential for such conflicts is a reasonable concern. The remedial design for this remedial action will need to accomplish this. The remedial action selected by this ROD does not specify the precise locations for treatment facilities for groundwater. Nor does it select the exact well arrangement that will be used in the implemented action. The remedial design will have the flexibility to accommodate such issues, which EPA does not believe are insurmountable at any of the pump rates considered.

It is noted that the NAPL contamination at the Montrose Chemical Site is in and near the former Central Process Area in the north-central portion of the former plant. The high concentrations of surface soil contaminants at the Montrose property are in the Central Process Area, the northwestern and western areas of the former plant, and near areas of former or current surface water transport. It is likely that future actions will be concentrated in these areas. There are other areas of the former plant, as noted in the JGWFS, particularly the area of the former plant parking lot, where concerns for conflicts for future actions are less (though they must still be considered).

This is counterposed with the following. As mentioned, the extraction and injection wells for this remedial action, including those for NAPL isolation, most-likely will be located off the Montrose property or in the extreme southeastern end of the property and so will not pose a significant potential for future action conflicts.

The groundwater treatment system itself does not require a particularly large area. Depending on the technology used in the ultimate remedial design, the treatment plant may reasonably fit in an area on the order of 3600 square feet (60 feet on a side if square). This is true even at the 700 gpm pump rate selected by this ROD for the chlorobenzene plume. While a 700-gpm system does require a larger system in terms of areal ground space than the 190-gpm system referred to by the commenter, the size difference is not proportional and the larger system still would not be significantly harder to locate within the former Montrose property than the smaller one.

The action of creating the containment zone should not be confused with NAPL recovery, which will be the subject of the second and later phase of this remedial action. NAPL recovery involves removing NAPL from the ground, rather than solely containing dissolved phase contaminants moving past the NAPL. If EPA selects remedial actions for NAPL recovery, however, they will be taking place near and within the former Central Process Area. EPA would specifically avoid placing the groundwater treatment system required by this ROD within the former Central Process Area for this reason.

A surface soil cap over the entire property, if selected, could interfere with existing groundwater treatment equipment more than the other potential future actions, and so possible cap installations will need to account for this, as discussed, in remedial design.

In short, EPA agrees that the commenter has raised a reasonable issue with respect to cap design to be addressed in remedial design, however, EPA believes that the commenter's interpretations of the matter are exaggerated. EPA sees no basis for the statements that any system larger than the 190-gpm system will interfere with future actions. EPA does not find sufficient justification to delay the implementation of remedy selection based on this issue.

General Comment 18. Miscellaneous Comments on EPA's JGWFS and RI Reports.

Other technical comments have been prepared based on a review of the JGWFS and RI Reports. These comments address a number of accuracy, consistency and clarity issues. Attached as Exhibits "G" and "H" are miscellaneous specific comments relating to the JGWFS and RI Reports, respectively.

#57 EPA Response:

Please see EPA responses to Exhibits "G" and "E."

CONCLUSION

Given (i) the absence of a significant present or future human health risk, (ii) the certainty that the nature and extent of the regional groundwater problem cannot be fully remedied for the next century, (iii) the sound agency decision that the adjoining benzene plume shall be allowed to attenuate naturally for hundreds of years, (iv) the fact that increased benzene and DNAPL migration will likely occur with higher extraction rates, (v) the fact that subregional groundwater remedies could not, either alone or collectively, result in a significant environmental benefit, (vi) the fact that there is no groundwater discharge that affects other biologic receptors, (vii) the fact that significant mass removal may be accomplished in 50 years at pumping rates much less than

700 gpm, (viii) the fact that the proposed remedy may conflict with any future soil and DNAPL program, (ix) the fact that the West Coast Basin is operating at or near its maximum sustainable yield and could be maintained indefinitely so through a plume isolation remedy, and (x) the fact that the dissolved phase MCB plume is potentially biodegrading, selecting a costly and potentially counterproductive plume reduction program for the Montrose Chemical Site would be a waste of economic resources and contrary to the National Contingency Plan.

58 EPA Response:

Responses to each of these points are presented both above in the above section, where the comments are summarized, and below where the same comments are presented in more detail. Accordingly, detailed specific responses to these conclusion statements are not repeated here. We do note that EPA disagrees with the majority of assertions above that are listed as "facts." See above comments for the basis of EPA's disagreement.

Based upon the foregoing comments, Montrose believes any Record of Decision purporting to justify more than plume isolation for the MCB dissolved phase plume at the Montrose Chemical Site is inconsistent with the National Contingency Plan.

59 EPA Response:

EPA strongly disagrees with this statement. As this ROD, and the underlying administrative record demonstrate, EPA has appropriately conducted this remedy selection process and has appropriately selected the remedial actions specified in this ROD. As discussed previously, the action preferred by Montrose Chemical (referenced in the comment at "plume isolation" as stated in these comments would be inconsistent with (and in fact would violate) the threshold criteria in the NCP. Such an action would not be protective of human health and the environment because hazardous substance contamination and resulting risks to groundwater users would persist for an unacceptably long time, and there would be little or no significant reduction of these over time. These risks would persist in an groundwater designated by the State of California as having potential beneficial potable use. Such an action also would not meet ARARs in that the likely effect of the action would be to merely contain the entire groundwater contaminant distribution, not restore the groundwater resource to drinking water standards in a reasonable time frame.

RESPONSE TO EXHIBITS: Written Comments from Montrose Chemical, Continued

EXHIBIT "A"

Exhibit for Comment No. 9: The Granular Activated Carbon, Fluidized Bed Reactor Technology Proposed for p-CBSA, MCB and Benzene at the Joint Site is Too Experimental and Uncertain to be Considered a Viable Treatment Technology for Future Remedial Design

In general, EPA's evaluation of the potential capability of the fluidized bed reactor (FBR) treatment system was elected to promote the capability of the system and minimize the considerable drawbacks and uncertainties identified by the McLaren Hart study. The following comparison presents direct quotations regarding critical technical aspects of the FBR system evaluation from the McLaren Hart study and from EPA's evaluation in the JGWFS. Comments are provided where appropriate.

60 **EPA Response:**

It should be noted that McLaren Hart was contracted by Montrose to conduct the FBR Study. EPA's evaluation indicates the following. Biologically activated fluidized bed reactors (FBRs) have been used commercially for wastewater treatment since the late 1980s. They have proven to be robust, to require less space than more conventional biological treatment processes, and to be effective at biological oxygen demand (BOD) removal with relatively low retention times. A site-specific bench-scale study of FBR for p-CBSA, MCB, and benzene removal was conducted on groundwater from the Montrose Chemical Site. Consistent removal efficiencies of 99, 95, and 95 percent of p-CBSA, MCB, and benzene, respectively, were observed during the study. The track record of FBR for BOD removal in wastewater treatment and the site-specific study results indicate that FBR is neither uncertain nor experimental for application at the Joint Site.

Comment A-1.
General Applicability of FBR Treatment Technology to Site Groundwater

McLaren Report:

"While p-CBSA is biodegradable in a bench scale environment, other compounds present in groundwater beneath the Montrose Chemical Site were not effectively treated. Hence, even if the significant scale-up and operational issues could be overcome, the technology still only offers partial treatment of the groundwater in the vicinity of the Montrose property." (page vii)"From the data generated by this study, it is not possible to determine realistic treatment goals due to the

unknown effects on the treatment system performance from potentially toxic [biologically inhibiting] compounds existing in the groundwater beneath the Montrose Chemical Site." (page 7-2)

EPA Evaluation:

"A fluidized-bed process, utilizing LGAC FBR, was tested at the former Montrose Chemical Site and found to be effective for treating the site groundwater." (page 4-27).

"Although FBR alone does not appear able to achieve MCLs for all COCs, a treatment train containing a FBR step may be an optimal process configuration for treatment of groundwater at the Joint Site." (page 4-29)

Montrose Comment No. A-1:

As shown above, the EPA's comments were inconsistent and were structured to make a broad positive statement while later in the discussion admitting that there were significant drawbacks.

61 EPA Response:

The comment's excerpt from page 4-27 of the JGWFS is taken out of context. EPA's statements were entirely consistent. Contrary to the implications of the comment, EPA never envisioned that FBR acting alone would treat *all* contaminants in Joint Site groundwater to drinking water standards. The comment implies that this is a "significant drawback." EPA disagrees.

The JGWFS evaluates FBR as a coarse (bulk) organic removal process. This means it carries the load of removing the majority of the mass of contaminants, leaving a certain remainder that can be treated by other means at lower cost. In the JGWFS, the FBR process is coupled with a polishing process (in this case, LGAC) to meet the drinking water standards and injection standards for all compounds in groundwater. The design concept of a low-cost coarse removal process (FBR) followed by a polishing process (LGAC) is shown to be effective, to provide for lower operation and maintenance costs, and fall within the same basic range of costs as LGAC alone or Air Stripping with LGAC. The fact that FBR is coupled with a polishing process in order to meet remedial objectives does not in any way represent a "drawback" to the process, given these facts. We point out that air stripping, similarly, requires a polishing step if contamination in treated groundwater is to be reduced below drinking water standards.

The paragraph on page 4-28 of the JGWFS that presents the concept that the FBR will function as a coarse-removal process, as opposed to a process that meets MCLs in one step, is consistent with the earlier paragraph that discusses the pilot-test data results.

The paragraphs starting on page 4-27 state that the pilot-scale FBR consistently removed 99 percent of p-CBSA and 95 percent of chlorobenzene and benzene. The commenter is incorrect that 99 percent removal should not represent an effective process.

Biological processes are typically desirable because:

- **They are capable of tolerating high organic loads without proportional increases in O&M costs;**
- **The contaminant is destroyed onsite, and smaller volumes of waste GAC are generated;**
- **The O&M costs are reduced.**

Comment A-2.
Treatment Efficiency of p-CBSA

McLaren Report:

"The study indicated that under low flow bench-scale conditions, p-CBSA is biodegradable using GAC-FBR technology." (page vii)

EPA Evaluation:

"The study showed that an FBR can consistently reduce the p-CBSA by at least 99 percent." (page 4-27)

Montrose Comment No. A-2:

It is undisputed that p-CBSA is degradable by the test FBR system. However, EPA's evaluation strongly focuses on the belief that because p-CBSA could be degraded in a very small and highly simplified test, that reductions of up to 99% could be confidently obtained from a system running at many hundreds of gallons per minute.

62 EPA Response:

Use of pilot data to develop an estimate of full-scale system performance is a well established engineering practice. The bench-scale test data does provide a sound basis to estimate performance of full-scale system. A full-scale FBR system is capable of consistently achieving high removal rates for p-CBSA, chlorobenzene, and benzene. Based on the FBR pilot test results, the JGWFS conservatively assumed a 95 percent removal rate for p-CBSA, chlorobenzene, and benzene, for the feasibility study purposes. It is also noted that full-scale FBR systems are operating and are effective at treating contaminants at the higher flow rates.

Comment A-3.
Treatment Efficiency of Chlorobenzene and Benzene

McLaren Report:

"However, chlorobenzene and benzene were only partially degraded, ..." (page vii)
"Chlorobenzene was not consistently removed to below its MCL of 70 ppb and benzene was not consistently removed below its MCL of 1.0 ppb....." (page 7-1)

EPA Evaluation:

"This technology also reduced the concentrations of chlorobenzene and benzene by at least 95%." (page 4-27)

Montrose Comment No. A-3:

EPA is suggesting that the FBR system is highly effective (in terms of percentages removed) when in fact it could not consistently achieve the treatment goals anticipated to be required for the Montrose program.

63 EPA Response:

See EPA's response to comment A-1. Again, EPA did not envision FBR as a sole treatment process, but as a coarse removal process to be coupled with a polishing process (LGAC). The combined process (coarse process with polishing process) will meet treatment goals. The need to apply a polishing process is not a drawback to the technology.

Comment A-4.
Treatment Efficiency of Trichloroethylene and Tetrachloroethylene

McLaren Report:

"..... and there was little, if any, impact on trichloroethylene and tetrachloroethylene." (page vii)

EPA Evaluation:

Evaluation of trichloroethylene and tetrachloroethylene was not discussed

#64 EPA Response:

EPA did not discuss the ability of the FBR process to remove TCE and PCE, because the FBR process is not considered effective for removal of TCE and PCE. The FBR process proposed is an *aerobic* process. PCE has not been observed to degrade *aerobically*. TCE has only been observed to degrade *aerobically* under special conditions and with special organisms (i.e., cometabolically in the presence of methane, phenol, or toluene with methane degraders). Therefore, the *aerobic* FBR process proposed is not expected to effectively remove PCE or TCE and is not intended to do so. Once again, the LGAC polishing process would remove any TCE and PCE in groundwater and would allow for meeting drinking water standards in the treated water with respect to these contaminants.

Comment A-5.
Adequacy of Study Data for Scale-Up to Operational Size System

McLaren Report:

"The study, due to the low flow rates used and the lack of sub-systems comparable to a full-scale operation, did not generate data necessary to evaluate the feasibility of full-scale treatment of p-CBSA." (page viii)

"There are several important differences between bench-scale and full-scale GAC-FBR systems." "..... chemical concentrations at the reactor inlet in a bench scale system are much lower than that of a full scale system." ".....the bench-scale system used for this study did not provide a means to evaluate biomass capture and handling." "..... the bench-scale system employs manual control [dissolved oxygen] , it is difficult to maintain effluent DO to the desired concentration. Insufficient DO in the effluent can imply a deficiency in biological metabolism of organics while excess DO can result in off-gassing of volatile organic compounds." (page 3-3)

EPA Evaluation:

"Some questions may remain regarding the design parameters of a full-scale system based on the bench-scale pilot test that has been conducted. This pilot test developed the kinetic parameters for an FBR reactor degrading the COC's in groundwater at the site. The kinetic parameters are independent of reactor size and will be applicable to larger reactors as long as the larger reactor has similar hydraulic characteristics to the bench-scale reactor. This is a feasible task. Water treatment engineers have developed significant expertise in hydraulic designs for full-scale systems based on small scale models and the same techniques can be used to develop a full-scale FBR system for the Joint Site." (page 4-27)

Montrose Comment No. A-5:

The EPA evaluation only focused optimistically on the hydraulic design issue and ignored the lack of data available about the effects of other toxic contaminants in the influent stream and the lack of information generated on critical sub-systems such as contaminated biomass handling. The issue of the adequacy of the study data for system scale-up is much larger than just hydraulic design.

65 EPA Response:

EPA has previously provided responses to the commentor addressing concerns regarding the potential biological toxicity of chlorinated VOCs and complex organic pesticides. EPA's response is provided in a technical memorandum prepared by CH2M HILL, dated July 23, 1997. Data from available industry literature on each organic or class of organics (e.g., chloroform, TCE, PCE, BHC compounds, DDD, DDT, DDE) were compiled and presented in the technical memorandum. In all cases, the literature review showed that the existing concentrations of these contaminants at the Joint Site are well below biologically inhibitory concentrations. For a majority of the site contaminants, the concentrations at the Joint Site are a full order of magnitude less than the inhibitory levels. In addition, the McLaren/Hart pilot test data by itself showed that biological inhibition was not occurring.

Excerpts from the CH2M HILL, July 23, 1997, memorandum that provide details on the above information are presented below.

Toxic Effects of Pesticides and VOCs

Fixed film processes, like the FBR technology, are more resilient to the toxic effects of contaminants, compared to other suspended growth biological processes like activated sludge. This is because the fixed film systems rely on biomass, which is coated on the media in layers. The outer layers of the biological film protect inner layers from shock loadings of toxic contaminants.

Literature is available that presents data on the toxic effects of various VOCs. Eckenfelder (*Activated Sludge Treatment of Industrial Wastewater*, Technomic Publishing Co.) states that inhibitory concentrations of heterotroph bacteria for chloroform, trichloroethylene (TCE), and tetrachloroethylene (PCE) is 640, 130, and 1,900 parts per million (ppm), respectively. Peak influent levels of the Montrose Chemical Site during the study for all of these VOCs were less than 5 ppm and the projected values for the full-scale system described in the FS are less than 1 ppm. The Montrose influent is well below the inhibitory level for these VOCs.

**The EPA (*Communication: Removal of organic toxic pollutants by trickling filter and activated sludge, July 1988*) shows that a trickling filter spiked with 100 ppb of Lindane (gamma-BHC) did not inhibit the trickling filter performance, which reduced the Lindane concentration by 47 percent. The peak concentration of alpha, beta, and gamma-BHC in the Montrose groundwater during the testing period was less than 10 ppb. The FS provides no information indicating alpha, beta, and gamma-BHC concentrations above the levels observed in the bench-scale test. This data indicates the Montrose influent is well below the inhibitory level for Lindane (gamma-BHC). Finally, the Ontario Canada Ministry of the Environment (Ontario, Canada MOE) published data (*Thirty Seven*

***Municipal Water Pollution Control Plants*, December 1988) showing inlet VOCs and pesticides for 37 different Publicly Owned Treatment Works (POTWs). The Cornwall POTW was shown to have an influent of approximately 6 ug/l of DDT, DDD, and DDE, combined. The treatment process includes a biological digestor. The peak DDD concentration in the Montrose groundwater during the test period is 1.6 ug/l. The FS provides no information indicating DDT, DDD, and DDE concentrations above the levels observed in the bench-scale test. This data indicates the Montrose influent is well below the inhibitory level for DDT, DDD, and DDE, combined.**

The information above shows that the peak influent concentration of the VOCs and the pesticides, alpha, beta, and gamma-BHC, and DDT, DDD, and DDE at the Montrose Chemical Site will not biologically inhibit the FBR. The performance data from the pilot test support the conclusion that the concentrations of the pesticides are not at levels that are adversely toxic. The PRPs point to the data on Day 35 where traces of alpha- and gamma-BHC are present and effluent levels of p-CBSA, chlorobenzene, and benzene are higher than the prior sampling. The PRPs appear to believe that the data indicate a failure of the treatment system. EPA disagrees. On Day 35, the FBR removed over 99 percent of the p-CBSA, greater than 97 percent of the chlorobenzene, and greater than 98 percent of the benzene. These removal rates are considered to be indicative of excellent performance. After Day 35, the system had numerous days with "non-detect" effluent and always achieved greater than 95 percent removal of p-CBSA, chlorobenzene, and benzene.

Finally, on Day 79 (over 40 days past "breakthrough on Day 35"), the effluent levels of pesticides were at their highest level (about 10 percent of influent levels). Again on this day, the removal of p-CBSA was greater than 99 percent and the removal of chlorobenzene and benzene were greater than 95 percent. This is excellent performance. The approximate 90-percent removal of the pesticides is also considered good. The LGAC adsorbers provided in the conceptual EPA system is expected to remove any trace pesticides that pass through the FBR system.

Comment A-6.
Identification of Operational Problems

The McLaren Hart report identifies three primary potential operational problems, any one of which could render the FBR system ineffective for the Montrose program. As discussed further below, they are the effect of toxic compounds in the groundwater to be treated, the problems of biomass handling, and the compatibility of the characteristics of FBR operation and the use of injection wells as required at Montrose. None of these issues is mentioned or evaluated by EPA in the JGWFS.

Comment A-6.1.
Effect of Toxic Compounds in Extracted Groundwater on Biomass

McLaren Report:

"Groundwater underlying the Montrose Chemical Site contains various organochlorine compounds including alpha-BHC, beta-BHC, gamma-BHC, and 4,4-DDD, which are potentially toxic to the microorganisms responsible for biodegradation. The ability of the GAC medium to

adsorb toxic (biologically inhibiting) compounds provides a temporary means for controlling toxicity. However, break-through of compounds toxic to the microorganisms can lead to rapid failure of a GAC-FBR treatment system.", breakthrough of the organochlorine pesticides alpha-BHC and gamma-BHC occurred on day 35 of the test and the breakthrough event correlated with an overall decrease in system performance." (page 6-1)

EPA Evaluation:

Evaluation of potential toxic effects were not discussed.

566 **EPA Response:**

In the technical memorandum (CH2M HILL, July 23, 1997) excerpted in EPA's response to the last comment, EPA provided comments that showed that the concentration of chlorinated VOCs and complex organic pesticides are well below levels that are biologically inhibitory. In addition, the July 23, 1997 memorandum cited data from the PRP pilot test report that showed that the biological organisms were not inhibited. See response to comment A-5, above. EPA therefore disagrees with the characterizations in this comment.

Comment A-6.2.
Handling of DDT Impacted Biomass

McLaren Report:

"In most existing Envirex applications, this biomass is discharged to a permitted waste receiving system (i.e. sanitary sewer) or removed by filtration. This procedure will not be possible for the Montrose system." "[A]t the completion of the bench scale treatability test, a sample of GAC was collected from the GAC-FBR to determine if the biomass contained DDT. Results of the analyses showed that DDT was detectable in the biomass sample. Therefore, ARARs would need to be established for the handling, storage and disposal of biomass [estimated at 100 pounds per day from a flow rate of 300 gpm] from a GAC-FBR." (page 6-3)

EPA Evaluation:

Evaluation of biomass generation and handling were not discussed.

67 **EPA Response:**

In the above-referenced technical memorandum (CH2M HILL, July 23, 1997), EPA provided the following analysis:

Hazardous Waste Characteristics of the Biological Sludge

The report also raised concerns that the resulting biological sludge will retain hazardous wastes characteristics that will increase the cost of sludge disposal. Existing literature by the EPA (EPA/600/S2-89/026), which describes an acclimated biological activated sludge system spiked with chloroform, TCE, PCE, and Lindane, suggests that the sludge will not be a hazardous waste. Other, more conservative, calculations indicate the sludge may be a hazardous waste. To be conservative, we suggest assuming the sludge will be a hazardous waste.

While the sludge may be classified as a hazardous waste, the cost of disposing of the sludge is minor in comparison to the total remedial cost. There is literature and vendor data available to estimate the sludge yield for FBRs. Using estimated sludge yields, the projected system flow rate, and COD/BOD loadings, the waste activated sludge quantity (lbs dry solids per day) can be estimated. The report provides an estimated observed sludge yield of 0.17 lbs VSS/lb COD (Paragraph 6.3). Based on this sludge yield, the Montrose system will generate only 19 lbs per day for each 100 gpm of groundwater treated. Based on a final sludge solids concentration of 40 percent, the system would only generate approximately 9 tons per year for each 100 gpm of groundwater treated. Hazardous waste disposal, including solidification and disposal, will cost approximately $200 per ton, or $1,800 per year, for each 100 gpm of groundwater treated. This added cost is inconsequential in comparison to the scope of the remedial effort.

Amount and Handling Requirements of the Biological Sludge

Using the above-described sludge yield, the quantity of sludge can be estimated. This sludge quantity estimate can be refined utilizing mass yield and sludge solids concentrations provided by vendors, and reference literature. Based on the sludge quantity estimate, the size, scope, and cost of the solids handling equipment can be estimated to the accuracy required for Superfund Site FSs and RODs.

As described in the above excerpt, the cost of handling potentially hazardous waste biosludge is inconsequential relative to the other costs in the JGWFS. The handling requirements of biomass in terms of worker safety is similar as will be required for the spent carbon from an air stripper and LGAC system.

Comment A-6.3.

FBR System Compatibility with Treated Water Injection Systems

McLaren Report:

"The presence of DO and nutrients in the GAC-FBR effluent will promote biological growth which will impact downstream process equipment." "[T]herefore, provisions for post treatment

of the GAC-FBR effluent would be necessary to protect potential upset of downstream systems." page (6-2)

EPA Evaluation:

Compatibility with injection systems not evaluated.

68 EPA Response:

Dissolved oxygen (DO) in downstream water is likely to occur in air stripping and in ancillary treatment associated with LGAC due to exposure of the groundwater to atmospheric oxygen. DO in downstream water from FBR may be lower than with air stripping due to DO demand in the FBR treatment unit. Ancillary treatment has been applied to JGWFS treatment trains to reduce scaling potential of water for injection purposes. Chlorine feed has also been applied to JGWFS treatment trains to reduce the potential for biological fouling of injection wells. Enhancements to these processes can be considered during design. The application of these processes, or other ancillary treatment processes, for the purpose of preventing clogging or fouling problems during injection, or other water discharge activities, has been considered, evaluated, and will not undermine the overall feasibility of the primary treatment process.

Comment A-6.4.
Operational Experience with FBR Systems

McLaren Report:

"There is no operational experience with GAC-FBR available upon which to base a practical evaluation of the capabilities of the technology in an environment similar to that anticipated for the Montrose project. (page viii)." "[N]one of the systems reviewed had p-CBSA, DDT or chlorinated VOCs present in their waste streams. In addition, none of the systems had tested their biomass for contaminants or were concerned with biomass recharge or had permit conditions to prevent biomass reinjection." (page 6-3)

EPA Evaluation:

"The vendor, Envirex, has a number of installation at remediation sites. Most of these sites are handling hydrocarbons, including chlorobenzene and benzene. Other sites where FBR has been used do not have p-CBSA in groundwater." (page 4-27)

"FBR is a standard biological treatment technology utilized throughout the industry for treatment of organic waste streams. The technology is well-proven and significant expertise exists in the market place for its design, construction and operation." (page 4-27)

Montrose Comment No. A-6.4:

EPA's conclusion is that because other systems have been built for various purposes, it should be easy to build a system that will be effective for the unique characteristics of the Montrose extracted groundwater. The McLaren Hart Study, which consisted of both obtaining information from Envirex on existing systems and interviewing a cross-section of the actual operators, was unable to find even one system of similar size that treats a composite of chemicals similar to p-CBSA, chlorobenzene and benzene (not just as a small component of a higher concentration of other common hydrocarbon chemicals) or that being operated in conjunction with a treated water re-injection system. The critical point is that there is no existing use of FBR that is remotely comparable to the conditions expected at the Montrose Chemical Site and that the difference between the characteristics of commonly used FBR systems and those expected at the Montrose Chemical Site are potentially insurmountable.

69 EPA Response:

EPA agrees that exact conditions at the Montrose Chemical Site relevant to this issue are unique. It is not, by virtue of being unique, insurmountably different from all other situations where the technology is being used, however. When site conditions are unique, a candidate technology is pilot-tested to verify its applicability. The pilot study of FBRs completed for this site showed that FBR technology is effective. Please also refer to the above-detailed discussion. The potential problems raised by the commenters regarding this technology have been considered by EPA in the JGWFS and the technical memorandum cited herein. EPA has concluded that FBR is feasible as a coarse treatment process, primarily for removal of p-CBSA, and for bulk removal of chlorobenzene and benzene in extracted groundwater, and is cost-effective. Remedial design may suggest that other treatment processes can be utilized at lower cost due to additional costs involved with designing and operating an FBR system to accommodate the unique conditions at the Joint Site. However, no information has been provided that suggests FBR will not be feasible. On the contrary, significant amounts of information are available, and presented in the record, that suggest FBR will be feasible, and should be a cost-effective process for treating extracted groundwater.

EXHIBIT "B"

Exhibit for Comment No. 10: EPA's Proposal to Defer Indefinitely Agency Decisionmaking with Respect to p-CBSA as a "Chemical of Concern" Ignores Available Data That p-CBSA is Not a Hazardous Substance

EPA indicated in Section 5.4.1.5 of the JGWFS that during the remedial actions involving groundwater extraction and injection, the distribution of p-CBSA at concentrations >25 mg/l would decrease, whereas the distribution of p-CBSA at concentrations <25 mg/l would increase:

PAGES 5-73, PARAGRAPH 2: "It is important to understand the implication of injection on the future distribution of p-CBSA. Specifically, the spatial distribution of p-CBSA concentrations of less than 25 mg/L could increase over time during the remediation of the chlorobenzene plume. Concentrations of greater than 25 mg/L should decrease over time because these concentrations would be addressed by the chlorobenzene pumping. The increase in the distribution of p-CBSA concentrations of less than 25 mg/L would occur because of the locations of the injection wells relative to the current p-CBSA distribution together with the possibility that the concentration of p-CBSA in the injected water could be as high as 25 mg/L, per the state requirement."

In section 3.3.2.3 of the JGWFS, EPA indicated the following with respect to toxicity of p-CBSA:

"Currently, there are exceptionally few toxicological studies available on the possible health effects of p-CBSA. The absence of chronic toxicity data, in particular, precludes derivation of a drinking water standard; neither the federal government nor the State of California has promulgated any drinking water standard or action level (e.g., MCL) for p-CBSA. Based on the lack of carcinogenicity data, p-CBSA is classified in EPA weight-of-evidence group "D"—not classifiable as to human carcinogenicity."

"While these existing data would indicate a relatively low toxicity for p-CBSA, the data are insufficient to support the establishment of toxicity values that would allow EPA to set provisional in-situ cleanup standards for this compound."

"EPA has evaluated whether additional toxicological studies are in progress or planned for p-CBSA. Unfortunately, we have found no studies in progress, nor are any planned at this time."

In the Public Notice describing the Proposed Groundwater Clean Up Plan, EPA indicated that although they "do not currently propose to capture and shrink the area affected by p-CBSA contamination <u>at this time</u>", they may "<u>reconsider actions for p-CBSA</u> as new studies and information on p-CBSA may be obtained" (emphasis added). It is further stated that "very little is known about whether and to what extent p-CBSA has toxic properties" (pg. 13). EPA did not mention the potential future implications for p-CBSA in the JGWFS as they did in the Public Summary. It would be <u>extremely costly</u> to attempt to recover p-CBSA at some point in the future

following the implementation of the proposed groundwater remedy. The p-CBSA plume is projected to expand to a substantial degree due to the injection of treated groundwater containing p-CBSA. EPA should therefore resolve all potential concerns with respect to p-CBSA including its toxicological properties and potential breakdown products prior to requiring an aggressive remedy which results in substantial redistribution of p-CBSA.

70 EPA Response:

EPA responded to the points in this comment in response to General Comment No. 10 by this commenter (see above). EPA agrees that it would be costly to contain or fully remediate pCBSA after the implementation of this remedial action. By using the terms, at this "time," and "EPA may reconsider...," EPA was referring to the possibility that during a statutorily mandated 5-year review of the remedy, EPA may find that sufficient toxicological data exist to determine a health-based standard for pCBSA. Should this occur, EPA would have to reconsider whether the remedy remained protective in light of this new information. EPA cannot, as the commenter suggests, resolve *all* questions about pCBSA at this time because the information necessary to do so simply does not exist. It must also be considered that, if pCBSA arrives at drinking water wells, EPA may be forced to consider whether wellhead treatment is appropriate because, under in such a situation, direct and immediate exposure to the chemical would be imminent.

EXHIBIT "C"

EPA Responses to Comment No. 11: EPA's Treatment of Groundwater Modeling Uncertainty Potentially Skews the Results and May Lead to Inaccurate Conclusions

Specific Comment 1

PAGES 5-12; PARAGRAPH 2: "In addition, the retardation in the migration of dissolved contaminants caused by sorption/desorption processes, and the "tailing effects" that could result from slower than anticipated desorption, matrix diffusion, or hydraulically isolated pore spaces, is not fully accounted for by the model. As a result of these uncertainties, the model likely underestimates the time to achieve the remedial objectives."

EPA selectively emphasized those uncertainties that may prolong the cleanup time, which are referred to as "tailing effects.." However, the time required for plume cleanup may well be less than the model projections depending on which of the model uncertainties has the greater influence.

71 EPA Response:

The "tailing effects" of contaminant transport caused by more likely (and more complex) sorption/desorption processes, matrix diffusion, and hydraulically isolated pore spaces are not (and cannot be) taken into account by the model and are likely to act significantly to reduce the time to achieve complete cleanup. These parameters were not "selectively emphasized" to prolong the cleanup time. See above responses to General Comment No. 11 from this commenter. We note again that the model was not used for an accurate determination of total, absolute cleanup time. See earlier response to General Comment No. 11.

EPA incorrectly states that retardation of dissolved contaminants is not incorporated into the model, further giving the impression that the model results will underestimate the cleanup time. Retardation of dissolved contaminants is incorporated into the model.

72 EPA Response:

This comment is incorrect. It is not stated in the JGWFS that retardation of dissolved contaminants is not incorporated into the model. Instead, the JGWFS states (reference) that *"the retardation in the migration of dissolved contaminants caused by sorption/desorption processes, and the 'tailing effects' that could result from slower than anticipated desorption, matrix diffusion, or hydraulically isolated pore spaces, is not fully accounted by the model."* "Not fully accounted for" means that not all factors associated with the retardation of solute transport were considered in the model. Specifically, the statement refers to the fact that the model: (1) considers only linear sorption and constant in time distribution coefficients; (2) is based on only a few values of total organic carbon content, which is typically highly variable in space and time, and (3) does not consider mineral sorption (as opposed to organic sorption), matrix diffusion, or hydraulically isolated pore spaces. All of these factors affect the retardation of solute transport.

EPA did not acknowledge that other uncertainties could potentially cause the plume to clean up at a faster rate than indicated by the model simulations. These factors include:

Possible Chlorobenzene Biodegradation. Potential treatment of extracted groundwater using air stripping or, to a lesser extent, fluidized bed methods could increase the oxygen content of the injected water. It is likely that this would enhance in situ biodegradation of the chlorobenzene and could shorten the overall cleanup time frame relative to the model simulations, which were performed assuming no biodegradation. In addition, natural or intrinsic anaerobic biodegradation may be occurring within the current plume at a low rate. Even a very low rate of biodegradation

could significantly reduce the time required to remediate the chlorobenzene plume given the 50- to 100-year time frames simulated by the model.

73 EPA Response:

See response to General Comments 3 and 11 from this commenter, above.

Extraction Wells Remain on Throughout Model Simulations. In order to reduce the complexity of the modeling effort, model simulations were run assuming that extraction wells continue pumping even after the plume has cleaned up in the vicinity of the wells. In reality, wells would be turned off or the pumpage would be shifted to particular wells as the plume cleaned up, which would improve wellfield efficiency. Plume cleanup time frames would therefore tend to be shorter than the model simulations because of this increase in wellfield efficiency. Although EPA appears to acknowledge that the final wellfield could be operated in a more efficient manner than simulated by the model, they do not acknowledge that this could in fact lead to shorter rather than longer clean up times compared to the model simulations. (Section 5.1.4.1; pg. 5-11).

74 EPA Response:

See response to General Comment 11, above.

Aquitard Mass. Although EPA mentioned the fact that there is substantial uncertainty with respect to the distribution of chlorobenzene mass in the lower Bellflower and Gage-Lynwood aquitards, they apparently did not consider that this uncertainty could result in the model overestimating the cleanup time frame. For the modeling, chlorobenzene concentrations throughout these aquitards were assumed to be equal to the average of the concentrations in the overlying and underlying aquifers. This method of assigning initial aquitard mass in the model may significantly overestimate the actual aquitard mass and therefore overestimate the potential cleanup times simulated by the model. H+A evaluated the potential impact of this uncertainty on the model results (H+A, 1997), however, EPA elected not to mention these results in the JGWFS. The sensitivity analysis performed by H+A suggests that if the actual mass in the aquitards is less than was assumed in the model, then cleanup times would be considerably shorter than simulated.

75 EPA Response:

See response to General Comment 11, above.

Specific Comment 2

PAGE 5-13, PARAGRAPH 2: "Although achieving all of the remedial objectives would likely exceed 50 years with most of the scenarios, the level of uncertainty associated with the simulation of conditions over that time frame, and beyond, is sufficiently high as to make the (50-year) results unreliable. Therefore, the evaluation of remedial scenarios with respect to the cleanup time frames focuses on the rate of approaching cleanup as a qualitative measure of comparison between scenarios."

EPA indicated in Section 5.1.4.3 that model results beyond 50 years were not useable due to long-term uncertainty. However they provide no rationale or basis for establishing 50 years as the appropriate criterion for considering model simulations valid or invalid. The 50 year criterion is arbitrary, since conditions could change over shorter time frames than 50 years or could remain relatively stable over time frames considerably longer than 50 years. Because the model is being used for comparative purposes only, the simulation results for the different remedial alternatives provide a reasonable basis for comparison of long-term performance whether future hydraulic conditions change or not.

676 EPA Response:

EPA does not agree with the commenter that modeling simulations bear the same degree of uncertainty regardless of the time frame being simulated. The results of the model simulations are discussed in the JGWFS for a 25-year time frame. At 25 years, the modeling simulations are subject to much less uncertainty and therefore are more usable for making conclusions about relative remedial progress among the alternatives.

The JGWFS does not establish "*the criterion*" of 50 years for considering model simulations invalid. The JGWFS states, however, that the reliability of modeling results decreases with the longer time frames because (1) the uncertainty in the input parameters is exacerbated as time increases, and (2) future conditions in the basin could change. This decreased reliability (increased uncertainty) is so great in the 50 and 100-year time frames that EPA decided not to rely on these simulations. However, in doing so, EPA did not state that the level of uncertainty reaches unacceptability at precisely 50 years.

The statement that "conditions may change over shorter time frames than 50 years" is true, but the chances of significant changes occurring in groundwater use and demographic patterns, groundwater needs, hydraulic changes, etc. is greater the longer into the future one tries to predict. Taken at face value, the comment would imply that with predictions of any kind, there is equal likelihood of the prediction being right whether predicting one or a thousand years forward. Common sense, if nothing else, dictates that this is not the case. Predictions over greater periods of time are generally more difficult and carry greater uncertainty. It is true that neither change over a long period nor lack of change in a short

period is guaranteed; yet, all else equal, the longer the period of time, the greater the chance and opportunity for significant change to occur and have an effect.

Furthermore, the groundwater basin has been adjudicated such that total groundwater extractions by parties holding water rights are limited by court order. This indicates that the groundwater pumping trends in the basin should remain relatively constant. This significantly reduces the likelihood that hydraulic conditions in the West Coast basin will change in the future. Therefore, the model results beyond 50 years can provide a reasonable basis for assessing the relative performance of the various remedial alternatives.

✍77 EPA Response:

As discussed in the JGWFS, and discussed above under General Comment 1B (EPA Response ✍23 above, regarding institutional controls), the adjudication of the West Coast Basin does not preclude installation of new wells in the vicinity of the site. In fact, the Water Replenishment District of Southern California is currently evaluating the feasibility of desalter wells, pumping at several thousand gallons per minute, in the Torrance area. An average extraction in the West Coast Basin over the last several years was approximately 50,000 acre-feet per year, which is about 77 percent of the adjudicated extraction of 64,468 acre-feet per year. More water can therefore potentially be extracted from the basin, including from the vicinity of the Joint Site. This pumping could cause significant changes in hydraulic gradients and velocities of regional groundwater flow. Water use can also be redistributed even if the same overall groundwater use level is maintained. For these reasons, the results of the 50- and 100-year simulations originally presented by the Respondents were not considered reliable. See also earlier responses.

Specific Comment 3

PAGES 5-12; LAST PARAGRAPH: "The longer the simulated time period, the greater the degree of uncertainty in the model results. There are two principal reasons for this:
(1) uncertainty in the input parameters (identified above) is compounded over simulated time (e.g., nonrepresentative values of hydraulic conductivity or retardation coefficient affect the simulated rate of contaminant migration, and, in turn, affect the interpretation of the time required to achieve cleanup levels);

EPA's characterization in section 5.1.4.3 gives the false impression that if actual aquifer hydraulic and transport parameters vary from those used in the model, then the error in the model simulations will increase in a compound manner with time.

78 EPA Response:

In the statements referenced above, the word "compounded" is used in the same manner as the word "exacerbated." This should be clear by the example cited, which immediately followed the statement in question.

This gives the false impression that model error exceeds what would be expected under a constant or linear error function, and instead increases in a manner similar to the way compound interest accumulates, i.e., model error at later times increases exponentially compared to earlier model error. This is not true. In addition, the sensitivity analysis performed by H+A and submitted to EPA (H+A, 1997) clearly indicates that for most parameters, modeling error is in fact likely to be greater during the shorter model simulations, i.e., prior to 25 years, as opposed to the longer model simulations.

79 EPA Response:

This comment generally refers to the degree to which the model does not account for or accurately reflect actual conditions and processes (and no model perfectly does), including not only general aquifer parameters but their local variations, various physical processes not simulated by the model, etc. What the commenter refers to as an "error" is the degree to which the simulated result would deviate from the real-world result due to these factors.

The comment is not clear. We can find no evidence in the sensitivity analyses for the model performed by Hargis + Associates that would prove that the "modeling error" (as just used) does not exacerbate the longer the time period being simulated. It is very doubtful that such "errors" in the simulation of solute transport (that are based on improper, or non-representative, input values) would improve with simulated time. Moreover, because Hargis cannot know future conditions nor differentiate at 25 years the error attributable to differences in such conditions and deviations between the present-modeled and actual initial conditions, it is not realistic that Hargis has measured the "errors" at 25 years and shown them to be less than at lesser times.

EPA did not assert that the effect of "errors" would *necessarily* increase with time in a *geometrical* sense as the comment implies.

EXHIBIT "D"

Exhibit for Comment No. 12: EPA's Cost Estimates Are Flawed and Cast Doubt on the Remedy Selection Process

D-1: EPA cost estimates contain mathematical errors for all chlorobenzene plume reduction and treatment scenarios. Nearly 50 percent of the cost tables (15 of 36) provided in Appendix C of the JGWFS are affected by mathematical errors. These errors serve to increase the overall cost of the alternatives between $0.3 and $2.7 million. The FBR and air stripping scenarios for the 700 gpm alternative are most affected, increasing their overall cost by $2.6 and $2.7 million, respectively. A description of these mathematical errors is as follows:

80 EPA Response:

This comment was addressed in more detail in EPA's response above to General Comment 12; EPA Responses 48, 49, and 50. In summary, upon checking the cost numbers, we encountered minor mathematical errors in certain cost tables in Appendix C. This error occurred from a single spreadsheet error. The cost assumptions used in the JGWFS are correct and do not need adjustment. The errors are small, resulting in minor changes to the total costs of the JGWFS alternatives. The total cost of each alternative was increased anywhere from 1.69 to 2.45 percent, depending on the alternative, without an impact on the ranking of the alternatives (or on the preferred remedy). Table 1 in EPA Response 48 above presents the changes to the total costs of the alternatives. The changes are different than those characterized by the commenter.

D-2: Three of the cost estimate tables contained a mathematical error in the extraction piping calculation. The indicated totals for "pipe & fittings, installation, & labor" and "electrical" did not equal the product of the unit price and the number of feet of piping. These errors affected all 3 flow alternatives—350, 700, and 1,400 gpm.

81 EPA Response:

These tables are now corrected and reflect the product of the unit prices and the number of feet of piping. The corrected cost tables are attached.

D-3: One table for the 350 gpm alternative appeared to be missing a waste disposal cost and subtotal for the cost of injection wells. The actual subtotal did not equal the value shown in the cost summary sheet for this alternative.

82 EPA Response:

The comment is acknowledged. The table referred to was not printed fully because the print area was inadequately defined, resulting in items being inadvertently omitted. The table has been corrected. The corrected cost tables are attached.

D-4: Two tables for the 700 gpm alternative contained mathematical errors in the capital cost calculation. In these tables, several cost items are calculated as a percentage of total equipment costs. The costs indicated for "Site Piping", "Site I&C", "Site Electrical", "Common Facilities", and "Building/Lab Site Improvements" did not equal the product of the percentage and the total equipment costs.

83 EPA Response:

The comment is acknowledged. In these tables, a number was inadvertently typed over a spreadsheet formula with a cell entry that did not reflect the correct percentages of the treatment equipment costs. These tables are now corrected to reflect the product of the percentage and the total equipment costs. The corrected cost tables are attached.

D-5: All nine cost summary sheets contained errors affecting all flow scenarios—350, 700, and 1,400 gpm. These summary sheets incorporate costs from other tables and then add indirect costs as a percentage of the total direct costs. As a result, the 6 erroneous tables previously discussed impact all nine summary sheets as some costs are common to all treatment alternatives. Additionally, any change in the total direct costs then affects the calculation of indirect costs. One cost summary sheet included an additional error in which the wrong cost table was incorporated in the summation of direct costs.

84 EPA Response:

The comment is acknowledged. In these tables, a number was inadvertently typed over a spreadsheet formula with a cell entry that did not reflect the correct percentages of the treatment equipment costs. This resulted in one mathematical error cascading through the tables, causing the related errors in linked cost tables. These tables are corrected and attached. There was thus actually one error, not multiple errors.

D-6: Although not a mathematical error, the 700 gpm alternatives did appear to contain erroneous injection piping costs. The injection piping cost for the 700 gpm alternative is identical to the injection piping cost for the 350 gpm alternative. Clearly, the injection piping cost for the

700 gpm alternative should be more than the 350 gpm alternative but less than the 1,400 gpm alternative. With injection piping costs of $1.0 and $1.8 million for the 350 and 1,400 gpm alternatives, respectively, an injection piping cost of $1.4 million for the 700 gpm alternative is not unreasonable. Therefore, this error serves to increase all 700 gpm treatment alternatives by approximately $0.4 million.

85 EPA Response:

The cost of injection piping is the same for the 350-gpm and 700-gpm alternatives. This is because a) the injection piping lengths are assumed to be the same based on the configuration of the wellfields, and b) the unit costs are the same for the 350-gpm and 700-gpm alternatives.

EXHIBIT "E"

Exhibit for Comment No. 13: EPA's Application of Residential Preliminary Remediation Goals to the Montrose Chemical Site is Inappropriate.

EPA Note: Many of the comments made by the commenter are not pertinent to groundwater or groundwater remedy selection. Some of these have been identified in the course of EPA responses, some have not. In most cases, because the comments pertain to the RI Report, EPA has provided a response, even though such comments do not relate to the remedy selection. This applies largely to comments applying to soils issues.

Page 5-4, 3rd Paragraph:

(a) EPA's use of Residential PRGs for soil is inappropriate. The stated rationale for using residential values *i.e., "use accommodates the uncertainty with the future use of the Montrose Chemical Site"* is unrealistic. The following revisions are recommended to clarify the limited relevance and significance of PRG values, if the use of PRGs as a yardstick for comparison is to continue:

> *"For illustrative purposes only, concentrations of specific contaminants in soil at all depth intervals have been compared to EPA Region IX Preliminary Remediation goals (PRGs) and other human health risk-based criteria. PRGs are generic (i.e. non site-specific) risk-based concentrations that are used by EPA, and others, for planning purposes in the absence of site-specific risk assessments (EPA, 1998). PRGs have been developed for both residential and industrial soil. Although the planned future use of the Montrose Property is industrial, EPA does not recommend that industrial PRGs be used*

for screening sites unless they are used in conjunction with residential values (EPA 1998). Therefore, both residential and industrial PRGs are used in subsequent comparisons. The more relevant site-specific health-based cleanup levels (HBCLs), developed as part of the Human Health Risk Assessment for the Montrose Chemical Site, are also used for comparison (Reference Soil HRA) for residential soil.

The appropriate use of PRGs is based on development of a conceptual site model that identifies relevant exposure pathways and exposure scenarios for humans (EPA, 1998).The primary condition for any meaningful use of PRGs is that exposure pathways of concern and conditions at the site match those taken into account by the PRG framework (EPA, 1998). For soil, these exposure factors include direct ingestion, inhalation, and dermal contact. As such, PRGs and other risk-based criteria generally focus on the uppermost 1 foot of soil, where potential exposures are most likely. The use of PRGs for anything other than comparative purposes becomes increasingly less relevant with depth. HBCLs on the other hand, incorporate site specific evaluations of exposure pathways and exposure scenarios, and as such are more relevant than PRGs.

Another necessary step in determining the usefulness of Region 9 PRGs is the consideration of background contaminant concentrations. Background levels may exceed risk-based PRGs (EPA, 1998). "An illustrative example of this is naturally occurring arsenic in soils which frequently is higher than the risk-based PRG set at a one-in one-million cancer risk (PRG for residential soils is 0.38 mg/kg). After considering background concentrations in a local area, EPA Region 9 has at times used the non-cancer PRG (22 mg/kg) to evaluate sites recognizing that this value tends to be above background levels yet still falls within the range of soil concentrations that equate to EPA's "permissible" cancer risk range (EPA, 1998)."

PRGs are specifically not intended as a substitute for EPA guidance for preparing baseline risk assessments (EPA, 1998). Chemical concentrations above these levels would not automatically designate a site as "dirty" or trigger a response action. . The PRGs do not represent action levels that would require remedial action, nor are they cleanup goals that would need to be met by a remedial action implemented at the site. . Future use of the site and cleanup goals for soil are being established for the Montrose Chemical Site as part of the on-going Risk Assessment, FS, and remedy selection process."

86 EPA Response:

See EPA's response to General Comment No. 13. It is noted that this comment pertains to use of PRGs in the RI Report for comparison purposes to soil sampling results; this comment does not pertain to groundwater or to groundwater remedy selection.

Page 5-4 of the RI Report describes EPA's use of PRGs as follows:

"Concentrations of specific contaminants in soil at all depth intervals have been compared to EPA Region IX Preliminary Remediation Goals (PRGs) for residential soil. Residential soil PRGs have been used in the evaluation because they are more conservative (i.e., lower) than industrial soil PRG values, and their use accommodates the uncertainty concerning the future use of the Montrose Chemical Site. It should be noted that the PRG values for compounds are only used as a basis to compare the analytical results for soil samples analyzed under this RI. The PRGs do not necessarily represent action levels that would require remedial action, nor are they cleanup goals that would need to be met by a remedial action implemented at the site. Even though residential PRGs are being used, the property may be used for industrial purposes in the future. Future use of the site and cleanup goals for soil will be established for the Montrose Chemical Site at a later date."

In choosing to compare the data to residential PRGs, EPA was simply following EPA Region IX PRG guidelines that state that "when considering PRGs as preliminary goals, residential concentrations should be used for maximum beneficial uses of a property" (EPA, 1998). In the RI Report, EPA clearly acknowledges the limitations of the PRGs and that residential PRGs are likely to be a conservative indication of contamination. EPA also acknowledges that such a comparison does not imply a risk management decision (i.e. that PRGs shall be used as the actual cleanup values for soil). EPA's use of PRGs was to provide a reasonably conservative benchmark upon which to place the sampling results into some sort of context. Therefore, EPA's use of PRGs is appropriate and properly caveated.

EPA does not agree that the language proposed by the commenter is entirely correct, nor that it is necessary. EPA notes the commenter's position on this matter for the record, of course. However, while the Montrose property is zoned industrial, this does not imply that any comparisons to residential-based values are inappropriate. Assessing what would happen in the case of residential use of the property is useful information even if cleanup levels are not ultimately based on residential assumptions. The commenter's point about background levels exceeding PRGs is correct for some contaminants. EPA would consider this issue if, in the future, residential PRGs are proposed for use in the future for soils at the former Montrose plant.

To provide more detail on the use and limitations of PRGs, the following information about PRGs is noted:

"EPA Region IX Preliminary Remediation Goals (PRGs) are risk-based tools for evaluating and cleaning up contaminated sites. They were developed to streamline and standardize all stages of the risk decision-making process. EPA Region IX PRGs combine current EPA toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media (soil, air, and water) that are considered protective of humans, including sensitive groups, over a lifetime. Chemical concentrations above these levels would not automatically designate a site as dirty or trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. Further evaluation may include additional

sampling, consideration of ambient levels in the environment, or a reassessment of the assumptions contained in these screening-level estimates (e.g. appropriateness of route-to-route extrapolations, appropriateness of using chronic toxicity values to evaluate childhood exposures, and appropriateness of generic exposure factors for a specific site etc.) (EPA, 1998)."

(b) EPA uses PRGs from a 1996 EPA guidance document which has been superceded by a more recent 1998 version. If the use of PRGs is to continue, EPA should revise and update text and tables, as appropriate, to reflect the more recent guidance.

87 EPA Response:

This comment pertains to the EPA's use of PRGs as for contextual purposes (not as cleanup levels) for *soils* at the Montrose Chemical Site. This comment is not pertinent to groundwater or to groundwater remedy selection. The 1998 PRGs were published on May 1, 1998, after EPA completed preparation of the RI Report. Because few of the PRGs for contaminants at the site are different between the two versions, because the PRGs were used for a simple screening level comparison of the data and not as cleanup levels, and because the changes would have little overall effect on the RI Report, a revision of the RI Report is not warranted at this time.

(c) EPA needs to provide the technical basis and rationale for assigning PRG values to Total DDT and Total BHC, compounds for which PRGs have not been established. Total DDT is the sum of all isomers and metabolites of DDT (DDT, DDD, and DDE). Total BHC is the sum of all isomers and metabolites of BHC. EPA's guidance provides PRGs for isomers and metabolites of these compounds, however it does not provide PRGs for Total DDT or Total BHC. In the RI Report states that the PRGs for Total DDT and Total BHC in residential soil are 1.3 mg/kg and 0.071 mg/kg, respectively. If there is no technical basis for assigning PRGs, EPA could present the PRGs for each metabolite. For example, EPA's 1998 PRGs for DDT, DDD, and DDE in soil range from 1.3 mg/kg to 19 mg/kg. PRGs for alpha-, beta-, gamma-, and technical grade BHC in soil range from 0.09 mg/kg to 3.2 mg/kg (EPA, 1998).

88 EPA Response:

The majority of the total DDT detected at the Montrose Chemical Site was in the form of 4,4-DDT and 2,4-DDT isomers; therefore, the PRG for DDT was used for comparison. Likewise, the majority of total BHC detected at the Montrose Chemical Site was the alpha isomer; therefore, the PRG for alpha-BHC was used. The comparison of the analytical

results of each isomer of DDT and BHC to the PRG for each isomer is unwarranted for a screening level comparison and would have little overall effect on the RI Report.

(d) A more relevant alternative to PRGs could incorporate Site-specific HBCLs which were developed as part of the Risk Assessment for the Montrose Chemical Site. HBCLs for Total DDT ranged from 5.59 to 1080 mg/kg (McLaren/Hart 1997). HBCLs for Total BHC ranged from 1.05 mg/kg to 105 mg/kg. These HBCLs are protective of human health at risk levels acceptable to EPA.

89 EPA Response:

Site-specific, health-based cleanup levels (HBCLs) have not been approved by EPA for the Montrose Chemical Site. Once established and approved by EPA, the HBCLs would be appropriate for use in more site-specific, in-depth comparison of the data.

E-2: Page 5-12 and Page 5-84: (a) EPA's comparison of sediment results from municipal and industrial drains and drainages to PRGs for residential soils is inappropriate. EPA should provide a discussion regarding the technical appropriateness and relevancy of using PRGs for Residential Soil in describing and comparing concentrations of DDT in sediment collected along drainages which pass along "some of the most highly industrial areas in California, including chemical and petroleum refineries" (Section 1.4.4 Page 1-39).

90 EPA Response:

There are no established EPA Region IX PRGs for sediments. In the absence of PRGs for sediments, EPA believes it is reasonable to use soil PRGs for the purposes of a screening level comparison, and for placing some context upon the levels found. The nature of chemical exposures and the likely parameters involved may be reasonably similar for both soils and sediments (they are similar for dust and soils, for instance), were someone exposed to such sediments. See earlier response with respect to EPA intentions in using PRGs.

(b) EPA should provide the rationale for inconsistency in not using PRGs in comparing concentrations of dichlorobenzenes, Methylene Chloride, Ethylbenzene, total xylenes, Methyl Ethyl Ketone (MEK), Base Neutral/Acid Organic Compounds, and Chloral.

91 EPA Response:

A comparison of dichlorobenzenes, methylene chloride, ethylbenzene, total xylenes, and methyl ethyl ketone to PRGs is provided in Table 5.1A. Base neutral/acid organic compounds were not compared to PRGs because the intent of the screening level comparison was to focus on the primary contaminant of concern such as DDT, BHC, chlorobenzene, chloroform, and PCE. It should be noted that chloral does not have an EPA Region IX PRG.

Page 5-51, 5-54, and 5-66: EPA's use of tap water PRGs for DDT, BHC, and chloroform in characterizing groundwater conditions is misleading and inappropriate.

92 EPA Response:

EPA disagrees. As previously indicated, EPA used PRGs for a screening level comparison.

Page 5-85: EPA's use of subjective statements (e.g. the statement in reference to sediment results that *total DDT concentrations were as high at (sic) 3.83 mg/kg, well above the PRG for residential soil*") should be avoided. Analytical data should be presented objectively and without bias.

93 EPA Response:

The data was presented and discussed in an objective manner. As summary statements, such wording is accurate and true. In general, such summary statements were supported by more qualitative and detailed statements.

EXHIBIT "F"

F-1 Page 1-1: EPA's bias is apparent on page 1 of the RI document with the phrase " *hazardous substances, pollutants, and contaminants*" [emphasis added]. Any one of these terms would be adequate to make the point, but the use of all three terms is unnecessary.

94 EPA Response:

These three terms have formal statutory definitions in CERCLA, the Superfund law, and regulatory application in its attending regulation, the National Contingency Plan (NCP). For example, according to 40 C.F.R. 300.3(a)(2)(b), the scope of the NCP includes response to "releases of hazardous substances, pollutants, and contaminants." The three terms are

used together in the RI Report, to indicate the releases at Montrose fall within the scope of the NCP. No bias is present or intended.

F-2 Page 1-6: In contrast to a factual summary of a comparatively large amount of operational information, EPA's use of language, and the tone, character, and content of EPA's discussions reveals a substantial amount of bias and subjectivity. After 14 years of RI investigations and a discussion that spans 30 pages of single-spaced text, 16 figures, 7 aerial photographs, and a 100+ page appendix, EPA suggests that there remains much to discover about operations and site conditions prior to completing the RI Process. For example "*...this site history may be supplemented as necessary to support additional remedial decision processes...is based on information available at this time...continuing...investigations...subject to revision should new information come to light in the course of these investigations.*"

EPA's implication that the available information is insufficient to characterize site conditions, evaluate remedial alternatives, and select a remedy is unfounded.

#95 EPA Response:

Since the property was first developed for industrial use in the 1930s, operations on and adjacent to the Montrose property have undergone frequent change. Operations included paint manufacturing, sulfuric acid production, benzene hexachloride (BHC) production, DDT production, including the change from a "batch" to a "continuous-batch" process, and various onsite waste disposal methods. The site and operational history section was written to provide the reader with an understanding of the complicated history of the site. Figures and photographs were selected to show significant operational changes over the last 50 to 60 years or to indicate areas of potential waste discharges. Sufficient information is available for groundwater remedy selection; however, some additional data-gathering activities may be needed to supplement the soil data.

The commenter in fact, is involved in a litigation with EPA through which EPA discovered operational facts about the Montrose property that Montrose had not voluntarily disclosed to EPA in the course of 14 years of remedial investigation. Investigations are continuing in the neighborhoods surrounding the Montrose property. Investigations are proceeding in sanitary sewers that EPA previously did not know may be contaminated. In addition, inadequate numbers of soil samples may have been collected by Montrose in the surface soils at the former Montrose plant property. This has no effect on the selection of the remedy in this ROD, which pertains to groundwater. Regardless of the commenter's reference to the length of the Montrose operational history section, EPA believes it is appropriate to note to the reader in the RI Report that additional information may lead to the discovery of new information and as-yet unknown conditions, operations and contamination at the Montrose property.

F-3 Page 1-6: EPA's overstates the significance of events such as "*regulatory actions...taken by State and local agencies against Montrose during its operations*" without providing the context as to how these "actions" are relevant to the RI.

96 EPA Response:

A description of several air quality violations are provided on page 1-31, second paragraph. Sections 1.3.11, 1.3.12, and 1.3.13 list additional actions taken by regulators concerning waste discharges by Montrose. These actions are relevant to the RI Report because they document details of releases (e.g., when, where, and how much) of hazardous substances to the environment.

F-4 Page 1-6: EPA refers to a 1982 CERCLA inspection "*...during which DDT was detected...*" but does not provide a citation, supporting documentation, or the data.

97 EPA Response:

The document supporting this inspection, with supporting documentation, photographs, and results of data, are in the administrative record.

F-5 Page 1-7: EPA provides no supporting documentation for the statement that *"beginning in 1954, Stauffer operated a [BHC] pilot plant in the southeastern corner of the Montrose Property itself and later converted it to a BHC production plant." EPA continues with the generic statement that "BHC/Lindane production uses benzene as a feedstock chemical. Further processing of BHC to produce Lindane creates a waste stream containing alpha and beta-BHC."*

EPA should cite references and provide supporting documentation to establish the factual basis for demonstrating that these statements apply specifically to Stauffer operations.

98 EPA Response:

The City of Los Angeles granted a Certificate of Occupancy for the Stauffer BHC/lindane plant in May of 1954 (EPA DCN 0639-95120). Annual Stauffer Chemical Company Reports reviewing inter-company charges between Montrose Chemical Corporation of California, Stauffer Chemical Company and Montrose Chemical of New Jersey document the existence and operation of a "BHC" plant from 1955 until at least 1963 at the former Montrose plant property. See Stauffer Reports in the Administrative Record (EPA DCNs 0639-04678 through 0639-04685, consecutively). A City of Los Angeles document

establishes that the operation also included refining technical grade BHC into the pesticide lindane. The City of Los Angeles Department of Buildings "Certificate of Occupancy" dated May 19, 1954 (EPA DCN 0639-95120), identifies the new structure as a "lindane pilot plant." The Los Angeles Department of Public Works Bureau notes state that Stauffer Chemical operations produced 4,800 pounds of lindane 26% per day (*See* A.R. No. 0177).

According to the *Kirk-Othmer Concise Encyclopedia of Chemical Technology, John Wiley and Sons* (1985, page 269), BHC is the "product formed by light-catalyzed addition of chlorine to benzene." The reaction produces a product containing a number of isomers including gamma-, beta-, and alpha-BHC. The separation of gamma-BHC (also known as Lindane) from this mixture of isomers, would result in a compound containing alpha- and beta-BHC.

These documents are among several which may demonstrate the activity discussed by the commenter.

F-6 Page 1-8: EPA provides no basis or documentation for linking Montrose operations to Stauffer's Dominguez Facility.

99 EPA Response:

The connection between the Montrose Chemical operations at the Montrose plant property in Torrance and the Stauffer facility in Dominguez is a minor point in the RI Report. To date, EPA is aware of two significant connections. First, waste acid from the Montrose DDT production process was burned at the Stauffer Dominguez facility. See memorandum from R.G. Campbell, Stauffer Western Research Center, to E.C. Galloway, dated January 23, 1973 (EPA DCN 0639-95121). Second, technical grade DDT manufactured at the Montrose plant property was: directly sold to the Stauffer Dominguez facility to be ground for Montrose Chemical on a contract basis. See Montrose Chemical Corporation of California Documents in the administrative record (EPA DCNs 0639-95126 through 0639-95129, consecutively).

F-7 Page 1-9: EPA does not explain the relevancy or basis, if any, of the statement "*around 1970, partially in response to a lawsuit from an environmental group.*"

100 EPA Response:

This statement describes one of the reasons the Montrose may have changed its practice of discharging industrial wastewater to the sewer. More detail is provided in Section 1.3.11, page 1-23, where the text states:

"On October 22, 1970, the Environmental Defense Fund "EDF" sued Montrose and LACSD, alleging that the discharge of DDT into the sewer system was contaminating the estuaries and coastal waters of Southern California and violating various laws. Although Montrose disagreed with the EDF allegations, Montrose agreed to eliminate all process water discharge to the sewer, which was completed in about April 1971."

F-8 Page 1-10: EPA's states that "*Accounts vary as to whether the rework area was ever moved....some testimony indicates...other testimony indicates....*" No reference is provided as to what accounts and testimony are being referenced. The actual significance of these and similar statements, if any, is not clear to the reader.

101 EPA Response:

These statements help provide the reader with an understanding where on the Montrose property certain DDT manufacturing operations occurred, specifically the DDT rework. As stated in Section 1.3.9, page 1-17, a former employee has indicated that the rework filter press leaked considerable quantities of chlorobenzene. This type of information is useful in demonstrating that the remedial investigation was appropriate and sufficient. This information is contained in a deposition which is in the administrative record.

F-9 Page 1-10: EPA does not explain the relevancy or basis for the statement that "*in 1968, the rail spur was modified.*"

102 EPA Response:

This statement helps provide the reader with an understanding of how operations at Montrose changed over time. The rail spur was modified to allow unloading of chlorobenzene and chloral from railroad tank cars into 50,000-gallon storage tanks.

F-10 Page 1-10: EPA makes conclusions that do not appear to have a basis in fact. EPA states that "*Jones Chemical sold Montrose a variety of chemicals including, but not limited to tetrachloroethylene, or perchloroethylene (PCE), trichloroethylene (TCE), and acetone between 1968 and 1973.*" The reference for this statement is a Price Card which appears to list PCE and acetone, but does not appear to list TCE. The final entry, dated March 1982 (nine years beyond the time-frame represented by EPA), lists "...40# Pl. Trichloro."

The term "Trichloro" cannot reliably be construed to denote trichloroethylene. A variety of other common chemicals may be referred to as "trichloro" (e.g. *trichloro*propane, *trichloro*benzene, *trichloro*fluoromethane, *trichloro*ethane, *trichloro*phenol). Further, the unit of measure for the Price Card's "Trichloro" entry appears to be "*pounds*" as opposed to "*gallons*." This information, coupled with the fact that by the early 1980's TCE use in general was severely curtailed in the United States, does not support EPA's conclusion that Montrose purchased, used, handled, or disposed of TCE.

103 EPA Response:

EPA agrees that the term "Trichloro" may not necessarily refer to trichloroethylene.

F-11 Page 1-10: EPA's referenced documents do not appear to support EPA's interpretations. EPA states that "*...Montrose spent almost $5,000 in 1950 ... to purchase an unknown quantity of para-dichlorobenzene.*" Again, EPA makes a conclusion that does not appear to have a basis in fact.

The reference document with "*Auth. #577*" as "Para dichlorobenzene Eq." and an expenditure of $4,867 is listed under "Construction In Progress" along with facilities and equipment and not under "Raw Materials" where chemical products such as oleum and fuel oil are listed. The document does not appear to support EPA's conclusion that Montrose purchased para-dichlorobenzene.

104 EPA Response:

EPA will agree that the document may not refer to a purchase of dichlorobenzene, but it indicates that dichlorobenzene was handled in some manner by Montrose. The term "Eq" may refer to equipment that was being constructed to process or otherwise handle dichlorobenzene.

F-12 Page 1-10: EPA's textual discussions of Agrisolv 75 and Toxicol (reportedly raw materials used for the production of DDT) do not appear to be consistent with the supporting references cited by EPA and provided in Appendix L

In the text, EPA states that "*Agrisolv 75 is a heavy aromatic but contains benzene, toluene, ethylbenzene, and xylene at levels up to 1 percent. By weight, Toxisol-B is approximately 84 percent xylene, and 8 percent ethylbenzene. Toxisol-PX is mostly ethylbenzene and approximately 3 percent xylene by weight. Both Toxisol-B and Toxisol-PX also contain benzene and toluene.*"

In Appendix L, EPA presents supporting documentation which gives the reader a different sense. With regard to Agrisolv 75 the supporting documentation states that " *benzene, toluene, ethylbenzene, and xylenes make up less than 1 percent ... and are present in minute quantities.*" With regard to Toxicol, EPA provides documents which state that Toxicol-B and Toxisol-PX "*contained minuscule amounts of toluene, benzene, and ethylbenzene.*"

Aside from clarifying this apparent inconsistency, EPA should provide the reader with some sense of how, when, and for what purpose these materials were actually used in the manufacture of DDT and the quantities that were used. For example, the supporting documents provided in Appendix L seem to indicate that Agrisolv 75 is essentially "mineral spirits" or "naphtha" and that Toxisol-PX is used primarily as a blending component in production of gasoline with no apparent link to the manufacture of DDT.

105 EPA Response:

A Montrose document (included as part of Montrose's response to an information request from the National Oceans and Atmospheres Administration, NOAA), a facsimile from Montrose Chemical Corporation to Latham & Watkins dated March 13, 1990, describes the manufacture of DDT and lists Agrisolv 75 and Toxicol (also described as "aromatic petroleum derivative") as raw materials (see Document 67 in Appendix L of the Montrose Site RI Report). In addition, Document 70 in Appendix L of the Montrose Site RI Report indicates that Richfield Oil "marketed [Toxicol-B and Toxicol-PX] as solvents to be used in the manufacture of pesticides." This Montrose document also independently lists xylene and kerosene as raw materials used by Montrose at the Montrose plant property. These materials were often used in the pesticide formulation industry to produce DDT oil solutions and DDT emulsion concentrates. See Farm Chemicals Handbook page D80, 1977 (EPA DCN 0639-95130). The above-mentioned Montrose document lists both DDT oil solutions and DDT emulsified concentrate as "products" produced at the Montrose plant property. Therefore, Montrose itself may be the best source of further information concerning the use of these two chemicals in the DDT manufacturing process.

The statements concerning Agrisolv 75 are correct and not inconsistent. The documents in Appendix L of the Montrose Site RI Report indicates that benzene, toluene, ethylbenzene, and xylene "make up less than 1 percent " of Agrisolv 75. The document also states that benzene, toluene, ethylbenzene, and xylene are present in "minute quantities." In the text on page 1-11, EPA states that "Agrisolv 75 is a heavy aromatic but contains benzene, toluene, ethylbenzene, and xylene at levels up to 1 percent." As "less than 1 percent" could mean any quantity up to 1 percent, EPA believes that "up to 1 percent" is an appropriate characterization.

Appendix L of the Montrose Site RI Report provides several documents describing the composition of Toxicol. One of the documents, a Richfield Oil Corporation analysis dated November 7, 1963 (during the time that Montrose manufactured DDT), indicates that

Toxicol-B contains over 84 percent xylenes and over 8 percent ethylbenzene and that Toxicol-PX contains over 3 percent xylenes and several ethylbenzenes. Other documents in Appendix L indicate that the solvents Toxicol-B and Toxicol-PX contained "minuscule amounts" of benzene, toluene, and ethylbenzene. With regard to the amount of ethylbenzene in Toxicol, the documents do not appear to agree. However, these documents may be reporting the composition of Toxicol at different times and the composition of Toxicol *may* have changed over time. With regard to benzene and toluene, EPA does not believe the statements from Appendix L of the Montrose Site RI Report are in conflict with the text on page 1-11 where it states that "both Toxisol-B and Toxisol-PX also contain benzene and toluene." The solvents still "contain" benzene and toluene even if they contain "minuscule amounts" of benzene and toluene.

SECTION 1 TABLES AND FIGURES:

F-13. The following series of specific comments refer to Tables and Figures provided in Section 1 of EPA's RI Report.

106 EPA Response:

Many of the following comments request that EPA provide the basis for items identified on photographs and figures in Section 1 of the Montrose Site RI Report. Unless otherwise noted, the basis for the items includes, but is not limited to, the following. All items in the figures are supported by the administrative record.

- **Drawing C1-B of the facility titled Montrose Chemical Corp. of California, General Arrangement of Plant, dated December 17, 1946, latest revision November 20, 1963.**
- **Drawing of the facility titled Montrose Chemical Corp. of Calif, Plant Drainage, General Arrangement, dated March 20, 1953, latest revision July 16, 1963.**
- **Drawing of the facility titled Montrose Chemical Corp. of California, Process Area Drainage System, dated June 1975, revised January 9, 1982.**
- **Interviews with and depositions of former the Montrose employees**
- **As-built plans for Southwest County Project No. 1250, Line C, Unit 2, Los Angeles County Flood Control District (referenced on page 1-38 of RI Report)**
- **Los Angeles City Map No. 599**
- **Evaluation of aerial photographs**
- **Releasable documents obtained by EPA in its litigation with Montrose**

- **Documents appearing in Appendix L of the Montrose Site RI Report**
- **Documents appearing in the Administrative Record for this remedial action**

FIGURE 1.4: Incorrectly identifies Montrose Property as Montrose Chemical Site

107 EPA Response:

Comment noted. The figure should read "Montrose Property." The distinction between property and site is significant.

Does not indicate the meaning or significance of the Del Amo Site "Pan Handle"

108 EPA Response:

The term "panhandle" is commonly used to describe geographical features. This portion of the Del Amo Superfund Site is discussed in the text on page 1-36.

Adds labels for the Gardena Valley Landfill, Golden Eagle Refinery, and Cal Compact Landfill without showing geographic boundaries

109 EPA Response:

The labels indicate the area in which these facilities are located. For the purposes of this figure, geographic boundaries are unnecessary. A reasonable depiction of boundaries of these former solid waste/debris landfills can be found in the Del Amo Groundwater RI Report.

FIGURE 1.6A: Air Photo 1928: Label for Kenwood Drain does not appear to be consistent with text discussion.

110 EPA Response:

This comment is not specific enough to provide a response.

FIGURE 1.6E: Air Photo 1952: Does not provide basis/significance for "Area of Activity"

Does not provide basis for "Trench containing white toned material"

Does not provide basis for "Sugar Lime Pile"

Does not provide basis for "Laboratory."

FIGURE 1.6F: Air Photo 1952: Identifies Ponded runoff from Montrose, does not provide basis

Identifies Trench with white toned material, does not provide basis

Identifies Ditch with runoff (on-property and Off-Property), does not provide basis

111 EPA Response:

See response to Comment F-13.

Identifies Del Amo Site "Panhandle", does not provide basis or significance

112 EPA Response:

The term "panhandle" is commonly used to describe geographical features. This portion of the former Del Amo plant property is discussed in the text on page 1-36.

FIGURE 1.7A: Pre 1953 Plant Layout Standard Batch Process: Should indicate "schematic" and or "conceptual", does not provide basis–

113 EPA Response:

See response to Comment F-13. EPA agrees it is a schematic.

Identifies "lead-lined" waste trench, does not provide basis

Identifies "Stauffer Tanks", does not provide basis

Identifies "Turntable (1955)", does not indicate relevancy

114 EPA Response:

See response to Comment F-13.

The turntables were used to form chips or flakes of DDT from crystallized DDT.

Introduces acronym "MCB", does not define

115 EPA Response:

MCB is an acronym for monochlorobenzene, one of the primary raw materials used to make DDT and one of the primary contaminants at the former Montrose plant.

Identifies Warehouse #1 and Grinding Plant (where crystallization occurred), does not provide basis

Identifies Stauffer Acid Plant, does not provide basis

116 EPA Response:

See response to comment F-13.

Identifies a 10 foot sewer to Western Avenue, likely error? Should be 10-inch diameter?

117 EPA Response:

EPA concurs. The text should read 10-inch diameter.

Identifies numerous tanks but does not provide basis or distinguish between above ground and below ground tanks.

118 EPA Response:

For the basis of the tanks, see response to Comment F-13. It is EPA's understanding that all of the tanks shown in Figure 1.7A are above ground. When shown in figures in this report, belowground tanks are noted as such.

FIGURE 1.7B: Post 1953 Plant Layout: Identifies 18' sewer to LACSD 57-inch sewer (JOD), likely error? Should be *18-inch* diameter?

119 EPA Response:

EPA concurs. The text should read 18-inch diameter.

As comparison, Figure 1.3 shows a cross-over at JOD with JOD on east and District 5 on west, with a tie in to JOD.

120 EPA Response:

The sewer line configuration on Figure 1.3 is correct; the one on Figure 1.7 is in error.

Shows 10' sewer to Western Avenue, likely error? Should be 10-inch diameter?

121 EPA Response:

EPA concurs. The text should read 10-inch diameter.

FIGURE 1.7C: Post 1953 CPA

Identifies hot water heater, redundant?, does not provide basis–

122 EPA Response:

Hot water heater is a commonly used term. For the basis of the hot water heater, see response to Comment F-13.

Identifies surface drain to pond, does not provide basis and is inconsistent with Figure 1.11

123 EPA Response:

For the basis of the surface drain to pond, see response to Comment F-13. Figure is consistent with Figure 1.11. Figure 1.7C shows Central Process Area drainage while Figure 1.11 shows overall plant drainage.

Does not distinguish between above ground and below ground tanks

124 EPA Response:

Belowground tanks are noted as such in the label in Figure 1.7C.

Identifies surface drain to southeast corner of Property, does not provide basis

125 EPA Response:

See response to Comment F-13.

FIGURE 1.8B: Identifies "Spent oleum/oleum" as concentrated fuming sulfuric acid; spent acid as oleum; and spent oleum/oleum as (S.O./O.). EPA should clarify the distinction between "acid" and "spent acid"

126 EPA Response:

EPA concurs that this figure's terms could have been somewhat more clear, but even as they are, they are reasonably correct. Oleum is concentrated fuming sulfuric acid. When spent, it has become diluted through the DDT manufacturing process. However, "dilute" is misleading; it is only dilute in the sense that it is no longer strong enough for efficient use in the reaction to make DDT -- it remains an incredibly powerful acid by any other account. Spent oleum/oleum is mixture of spent (dilute) oleum and fresh oleum used to replenish it. As replenished, it is again concentrated enough to carry out the reaction.

Identifies acid resistant, brick-lined trenches and drains, does not provide basis

FIGURE 1.11: Identifies surface drainage at CPA, not consistent with Figure 1.7C, does not provide basis

127 EPA Response:

See response to Comment F-13.

Identifies 10' Sewer to Western (see previous re: likely error i.e. 10-inch)

128 EPA Response:

The text should read 10-inch.

Identifies Normandie Avenue ditch as On-Property, inconsistent and erroneous

129 EPA Response:

The arrow ideally would have been shorter to indicate a location closer to Normandie Avenue. The intent was not to indicate the ditch as on-property.

Identifies Plant drain Area in SE corner with no shading, error? Significance?

130 EPA Response:

The figure was adapted from a drawing provided by Montrose, which did not indicate the surface water runoff direction in this area.

FIGURE 1.12: Figure provided does not appear to be complete, (no shading)

131 EPA Response:

The commentor apparently reviewed a poor quality reproduction of the report. The shading is present in other copies of the RI Report.

Identifies 3 different "Swales", inconsistent terminology?

132 EPA Response:

This comment is not specific enough to provide a response. EPA finds no inconsistency.

Figure title creates improper association between 1941 (pre-Montrose) drainage and Montrose operations

133 EPA Response:

The figure clearly indicates that the drainage is in 1941 prior to the Montrose (top left corner indicates "Future Site of Montrose Chemical Corp.").

FIGURE 1.13: Identifies culverts (2), does not provide basis

134 EPA Response:

See response to Comment F-13.

Identifies "unimproved channel" where "Swale" was, inconsistent terminology?

135 EPA Response:

A swale is a natural, "low tract of land," in this case intended to imply an open (e.g. wider than a ditch or channel) depression in the landscape. The unimproved channel is a feature which appears on Los Angeles City Map No. 599 at the location shown. The channel exists within the range of the original swale, but was probably an artifact both of the original swale and of subsequent fill and construction activities in the neighborhood as houses and streets were built. The two are not inconsistent; one follows from the other at a later point in time.

FIGURE 1.14: Kenwood Drain construction

Figure should indicate dates and provide references/basis for features depicted

136 EPA Response:

See response to Comment F-13.

Identifies Kenwood drain at Armco as 36" Reinforced Concrete Pipe (thought was box drain)

137 EPA Response:

As stated on page 1-40, the Kenwood Drain varies in design, including both reinforced concrete pipe and reinforced concrete box sections.

Identifies oblique rather than perpendicular connection with Torrance lateral

138 EPA Response:

Comment noted. The schematic should show a perpendicular connection with Torrance Lateral. Irrelevant.

Identifies Storm Drain Easement east of Normandie crossing Del Amo Boulevard and 204th Street, does not provide basis

139 EPA Response:

See response to Comment F-13.

FIGURE 1.15: Misidentifies location of Normandie Avenue Ditch

140 EPA Response:

The Normandie Avenue Ditch is properly located.

Identifies an oblique rather than perpendicular connection to Torrance Lateral

141 EPA Response:

Comment noted. Irrelevant.

EXHIBIT "G"

Exhibit for Comment No. 18: Miscellaneous Comments on JGWFS Report

This exhibit provides additional specific comments to EPA JGWFS.

SECTION 2 - PHYSICAL CHARACTERISTICS AND CONCEPTUAL MODEL

FIGURE 2-9: Groundwater elevations in the Lynwood Aquifer are not contoured. The text implies that water level contours were not prepared for the Lynwood due to "limited data." However, Lynwood aquifer water level data have been contoured many times during the 7 years of groundwater monitoring conducted in the Lynwood aquifer as part of the Montrose RI. Lynwood aquifer water level contours are presented in EPA's Final Draft RI Report.

142 EPA Response:

There are insufficient data over a wide enough area to make contouring groundwater levels meaningful. Contouring the data, therefore, does not add any particular benefit.

Water level data shown on Figure 2-9 are different than presented in the Montrose RI Report. The difference in elevations most likely results from disparity between the Montrose and Del Amo survey elevations for these wells.

143 EPA Response:

The water-level data in the JGWFS were as used by Montrose and the Del Amo Respondents in the JGWFS effort.

PAGE 2-21, FIRST FULL PARAGRAPH: The conclusion that "groundwater flow directions and gradients within each unit at the Joint Site" are relatively consistent is not very compelling considering the limited time period (about 3 years) which is provided as the basis for this conclusion. The discussion should base any conclusions on the full 12 years of available water level data. The text indicates that "the trend of rising water levels is generally consistent in all hydrostratigraphic units", however the trend in the Lynwood aquifer exhibits substantial upward and downward shifts in water level which differ from the trend in the shallower units.

144 EPA Response:

The statement in the JGWFS refers to data, "...over a period of more than 3 years..." (page 2-21, paragraph 1). The water-level-data are interpreted across the whole Joint Site. Accordingly, the data for both the Montrose and the Del Amo Sites must be for a consistent period of record. Although the period of record for water-level data at the Montrose Chemical Site may be 12 years, the period of record at Del Amo is less.

The comment regarding the Lynwood Aquifer is misleading. Although the JGWFS does state that, "... the trend of rising water levels is generally consistent in all hydrostratigraphic units." The sentence goes on to qualify the specific units and the Lynwood Aquifer is not listed).

In addition, it should be mentioned that the gradient and direction of groundwater flow at the water table is variable near the southern portion of the Del Amo Site due to localized mounding (Figure 2-5b). The mounding of the water table in this area is apparently due to local recharge from sources such as sewer or water lines. These mounds may tend to act as a hydraulic barrier to the migration of benzene. Changes in this local recharge could occur if these lines are replaced or repaired, potentially causing changes in the direction of groundwater flow and hydraulic gradients in the water table units, which could in turn affect the migration of benzene.

145 EPA Response:

This is an excellent and important comment. This is one reason that the migration of benzene must be monitored and if it does occur, contingent active hydraulic means, as established by this ROD, will be used to contain it.

PAGE 2-21, SECOND TO LAST PARAGRAPH, LAST SENTENCE: The regional infiltration rate, which was backed out of the groundwater flow model during calibration, is unlikely to be representative of site-specific infiltration rates. The sentence should merely state

that a uniform infiltration rate of 1 inch per year, which is approximately 7 percent of the average rainfall, was used in calibration of the regional groundwater model.

146 EPA Response:

The recharge rate of 1 inch per year may well be representative of the site-specific conditions with the exception of local recharge areas. Your revised statement is not incorrect, however.

PAGE 2-22, FIRST PARAGRAPH: The statement that "there is no evidence that the water table *could* have been as deep as the MBFC during the operations at the Del Amo facility" is misleading. The statement should read "insufficient data are available to determine if the water table *was* as deep as the MBFC sand..."

147 EPA Response:

Comment noted.

There is at least one plausible explanation for how the water table *could* have been as deep as the MBFC during the operations at the Del Amo facility. Given the nature and timing of War Era operations at the Del Amo facility, the amount of water needed to supply plant requirements was likely substantial. It is likely that plant needs were supplied partially, if not entirely, by large capacity groundwater extraction wells located at the facility. Such industrial water supply wells, especially if completed at or near first water, would be expected to create cones of depression that could substantially lower the water table locally. Information regarding War Era operations at the Del Amo facility may be available by way of Freedom of Information (FOIA) requests from the U.S. Government.

148 EPA Response:

Comment noted.

PAGE 2-28: The statement "LNAPL at the MW-20 area is limited to the saturated zone and has not been detected in the vadose zone" is not accurate. The statement should be qualified to more accurately represent inherent uncertainties by merely stating the LNAPL was detected (or

149 EPA Response:

Comment noted.

EPA should discuss the basis for the determination that NAPL detected in piezometer P-1 is unrelated to the Del Amo facility operations.

150 EPA Response:

The JGWFS discussion of LNAPL in piezometer P-1 is sufficient. Specifically, the JGWFS states that the NAPL in piezometer in P-1, "... is a complex petroleum product, which is likely associated with one or more petroleum pipelines in the vicinity of the Joint Site." A formal determination that the LNAPL is not related in any way to the Del Amo Site was not made, although it does not lie within the former plant property or operations and lies aligned with the pipeline.

FIGURE 2-11, SOURCE AREAS: This figure implies that the Montrose Central Process Area is a benzene "source area", based on "elevated" concentrations of benzene in groundwater at monitor wells XMW-2 and XUBT-03. However the maximum detected concentration at these wells, (230 ug/l), is relatively low compared to the concentration of benzene near the southern boundary of the Montrose Property (Figure 2-15). The high concentration of benzene and the occurrence of naphthalene at the southern Montrose property boundary (monitor well XMW-1) indicate that the likely source of the elevated benzene is either the Del Amo facility or the pipeline corridor located immediately south of the Montrose Property. EPA should revise the text and Figure 2-11 to indicate that these facilities, rather than the Montrose Central Process Area, are the suspected sources of the elevated benzene concentrations near the southern boundary of the Montrose Property.

151 EPA Response:

The available data cannot be reasonably interpreted to preclude the Montrose plant's Central Process Area from being a potential source of benzene contamination. There is no basis for concluding that there is only one source of benzene. EPA identified potential sources of benzene for the area. EPA also does not discount the possibility that the pipeline corridor or the Del Amo facility is a potential contributor, as suggested by the comment.

FIGURE 2-12, AREAS OF KNOWN OR HIGHLY SUSPECTED NAPL: The DNAPL area indicated at the Montrose Chemical Site is the approximate area of suspected or inferred DNAPL. The confirmed area of DNAPL occurrence is represented by a smaller area as indicated on Figure 5-44 of the Montrose RI.

152 EPA Response:

The area depicted in Figure 2-12 of the JGWFS is approximately the same size area in Figure 5-44 where the DNAPL occurrence is designated as "uncertain."

EPA should provide the basis for the word "Highly" as used in the figure title and/or delete it.

153 EPA Response:

The term "areas of highly suspected NAPL" refers to areas where NAPL and/or indirect evidence of NAPL (e.g., elevated concentrations, ROST results) was observed. Areas of suspected NAPL are those areas where the evidence of NAPL is less pronounced (e.g., concentrations are elevated, but lower than in areas of highly suspected NAPL). Please refer to the original reference for the definition of these terms (i.e., The Final Groundwater Remedial Investigation Report, Dated May 15, 1998, by Dames & Moore, prepared on behalf of the Del Amo Respondents).

PAGE 2-33, SECOND PARAGRAPH: EPA should explain the suggestion that there is more than one source of LNAPL at the MW-7 area.

154 EPA Response:

No explanation is necessary as the word, "sources" is a typographical error and should have read "source" in the sentence in question.

FIGURE 2-13: This figure should be replaced with the more recent Figure 5-44 from the Montrose RI Report, which more accurately depicts the area of DNAPL occurrence.

155 EPA Response:

We agree that doing so would have been an improvement, but does not affect the conclusions or analyses of the document.

PAGE 2-38: The statement that "the origin and distribution of both benzene and chlorobenzene are representative of other COCs detected at the Joint Site, the distribution and origin of which are similar to those of benzene or chlorobenzene" is inaccurate and misleading. The statement needs to more accurately and objectively reflect what is known and not known about sources and the nature and extent of COCs other than chlorobenzene and benzene in groundwater.

156 EPA Response:

To clarify: EPA did not intend to imply that the origins of all contaminants at the Joint Site are the same. Rather, the statement was intended to imply that within the distributions of these two contaminants lie the majority of the distributions of all other COCs which are pertinent to the Joint Site. The JGWFS does present extensive analysis of the distributions of chlorobenzene, benzene, and TCE/PCE, which do provide an appropriate basis for plume divisions as identified in the JGWFS. The relevant information about all of the COCs is presented in the RI Reports.

EPA's definition of COCs (contaminants of concern) in the JGWFS is inconsistent with the terms "chemicals of concern" (COCs), "chemicals of primary concern (COPCs)", and "compounds of concern (COCs)" used in various RI documents. This is confusing and should be rectified by consistent definition and use of these terms. A specific listing of COCs for groundwater should be provided in the JGWFS as opposed to referring the reader to the two different lists included in the two separate RI Reports.

157 EPA Response:

The JGWFS clearly identifies the contaminants of concern consistently with the RI Reports as the chemicals shown as detected in the RI Reports (Section 2.2.3, page 2-38). The contaminants of concern in groundwater include all chemicals in groundwater at the Joint Site that arrived in groundwater directly or indirectly due to human activities and which are either hazardous substances or pollutants and contaminants as described under CERCLA. These are "of concern" in that they must be addressed by the remedial action. This includes a large number of chemicals (more than 25) in the case of the Joint Site. When the JGWFS refers to COCs, the term is used to mean the full list of chemicals, as described above; hence, there is no inconsistency.

However, EPA simplified the JGWFS by focusing the principal remedial action analyses on a smaller list of contaminants from the standpoint of their ability to have a significant effect on the evaluation of remedial alternatives. EPA provides clarifying statements in Section 2 (Section 2.2.3, page 2-38) of the JGWFS explaining this. When the JGWFS evaluates discharge options, it considers all COCs, nonetheless.

Copying in large amounts of information from the RI Reports about *all* COCs, beyond that needed for the analyses in the JGWFS, would be redundant and would not serve the purpose of the JGWFS. The RI Reports and the FS reports stand as "the RI/FS" and reference to the RI Reports within the FS is not inappropriate.

PAGE 2-41: EPA states that "TCE is considered to be a dominant chlorinated solvent because it has been detected at higher concentrations than other chlorinated solvents, and its spatial distribution is representative of the other detected chlorinated solvents." EPA's statement regarding the similar distribution of the chlorinated solvents is misleading in that other chlorinated solvents have their own distinct distribution and in some areas the concentration of other chlorinated solvents exceeds the concentration of TCE. For example, the concentration of PCE exceeds that of TCE in the vicinity of the Jones Chemical site.

158 EPA Response:

In the statement on page 2-41 that is in question, EPA primarily refers to TCE at the western boundary of the former Del Amo plant. As stated in the JGWFS, the distribution of chlorinated solvents near Jones Chemical as well as in other areas within the chlorobenzene plume is not well defined because the analytical detection limits for TCE have been due to the presence of elevated chlorobenzene concentrations. The use of the term "TCE" to represent TCE and PCE is a short-hand convention; the TCE/PCE near the Jones Chemical site is within the chlorobenzene plume will be addressed by the remedial actions for the chlorobenzene plume, regardless of small differences which may exist in the TCE and PCE distributions. It is the TCE/PCE outside the chlorobenzene plume within the Joint Site which form the "TCE plume" as defined for the FS.

PAGE 2-53: As previously discussed, there is a plausible mechanism which could allow for the presence of LNAPL, and therefore account for the high benzene concentrations in the MBFC, which EPA fails to mention. Although the potential occurrence of unknown abandoned wells is raised in the context of allowing downward dissolved benzene transport, the potential for these same production wells to have locally lowered the water table into the MBFC sand allowing LNAPL penetration was not discussed.

159 EPA Response:

Comment noted.

PAGE 2-54: EPA's statement that "A conclusive link between the high concentrations detected in Well XG-19, which is one of the farthest downgradient wells, and the DNAPL source area on the Montrose property has not been established." is misleading and suggests that it is likely that DNAPL occurs at this well, but that not enough data have been collected to demonstrate this. This statement provides a false sense that there is somehow a significant potential for DNAPL to have migrated to this depth and location. This is unreasonable speculation given the distance from the site, the depth of the Gage aquifer, and the lower concentrations which occur in the

water table at this location and in the Gage aquifer upgradient of this location. In addition, this implication is inconsistent with the discussion of the distribution of chlorobenzene in the Gage aquifer provided in the EPA-revised RI Report. EPA should remove this type of speculation from the JGWFS and ensure consistency with discussions provided in the RI Report.

160 EPA Response:

The statement in question does not suggest that there is, "...a significant potential for DNAPL to have migrated to this depth and location." In fact, the wording implies just the opposite. See also, for example Figures 2-12 and 2-13, which neither illustrate nor suggest that DNAPL extends from the DNAPL source area on the Montrose property to XG-19. Instead, the wording clearly implies that source of elevated chlorobenzene concentrations in XG-19 (via dissolved transport) has not been specifically confirmed to be the Montrose DNAPL source area.

PAGE 2-65, SECOND PARAGRAPH: EPA misrepresents the occurrence and distribution of TCE in groundwater. The statement "based on the *limited* well points, *some* TCE contamination also occurs north of the Montrose Property" completely discounts the extensive area of high TCE concentrations detected at multiple locations north of the Montrose Property. EPA is referred to Figure 5.69 of EPA's May 18, 1998 RI Report. EPA should ensure consistency between data presented in different project documents and the characterization of the distribution of TCE.

161 EPA Response:

EPA acknowledges that there is a source of TCE contamination at the McDonnel Douglas facility at locations significantly north of the Montrose plant, which is under investigation by the California Regional Water Quality Control Board. The number of well points immediately north of the Montrose property is, however, somewhat limited. The distribution suggests that the TCE concentrations rise again in the vicinity of the former Montrose plant property. The data presented in the JGWFS and other documents are consistent, but it is true that the JGWFS does not present all data previously collected as shown in the RI.

PAGE 2-65: EPA indicates that "additional data on the upgradient TCE distribution and sources will be collected in the remedial design phase." However, EPA does not indicate who will be responsible for collection and evaluation of these data.

162 EPA Response:

The responsibility for the collection of additional data is not the subject of the JGWFS, nor, in fact, for this ROD. Liability and allocation of work will be addressed by EPA outside the remedy selection process.

PAGE 2-81: As previously commented, EPA should clarify how it intends to fulfill its assumption with regard to TCE north of the Montrose Property when it states that "further investigations during the remedial design will be conducted to assess the distribution and sources of TCE at that location, evaluate the impact of the site remedy on the TCE distribution, and develop measures that mitigate the potential adverse impacts..."

163 EPA Response:

Elaboration on these issues of further data collection is not relevant to the JGWFS. These investigations are the subject of the subsequent remedial design. It is important to realize that remedy selection is not the same as remedy design.

PAGE 2-82, THIRD FULL PARAGRAPH: EPA states: "Based on the low organic content of the aquifers beneath the Joint Site, the effects of retardation on the plume migration are not expected to be significant." This seems to imply this is the case for all COCs although the rest of the paragraph goes on to discuss benzene specifically. It should be noted that chlorobenzene retardation factors used in the model range up to about 2 for the Gage aquifer, which exerts a significant influence on the transport of chlorobenzene.

164 EPA Response:

The statement in question refers only to the benzene plume.

PAGE 2-86, SECOND PARAGRAPH: The statement "...in fact, the observed chlorobenzene plume is more extensive than what is expected...", should be deleted because it appears to be a matter of opinion for which there is no factual basis.

165 EPA Response:

The statement in question is based on the results of groundwater modeling, as stated in the JGWFS. Had this statement not been taken out of context by the commenter, it would be clear that "What is expected" refers to the simulated result in comparison to the actual current distribution of chlorobenzene.

SECTION 5

EPA made a number of subjective statements and conclusions regarding performance of the various remedial alternatives. For example, EPA characterized the 1,400 gpm scenario as "not an extremely high" flow rate but one that is "at the upper end of the reasonable range." EPA indicated that the flushing rate "is substantial for the 1,400 gpm scenario but not excessive" (Section 5.2.1.4; pg. 5-36, paragraph 2). Both of these statements are subjective, open to a wide range of opinion, and indicate a lack of objectivity.

166 EPA Response:

The context for these statements is presented in the paragraph referenced and technically defensible reasons for the statements are provided. EPA does not believe that 700 gpm or even 1400 gpm are highly aggressive scenarios for the chlorobenzene plume, given the relatively modest pore volume flushing rates implied, the size of the plume being addressed, and the modeled performance at 25 years, as well as other factors discussed. This has been discussed extensively in response to other comments above. The commenter has consistently attempted to portray such scenarios as highly aggressive. In fact, the pump rates are not aggressive and in fact were kept to a lower range of pump rates because of the desire to keep the potential for movement of benzene within a reasonable range. It was important to establish, therefore, that the 1400 gpm scenario does not represent a highly aggressive option, even though it was the highest pump rate considered in the FS.

EPA stated that the main benefit of injection of the treated water is to control the dissolved chlorobenzene plume and minimize the impact to the TCE and benzene plumes (ref). A more important objective of injection is to balance the effect that the groundwater extraction would otherwise have on the drawdown and vertical hydraulic gradient in the DNAPL impacted zone. Control of the vertical hydraulic gradient during pumping of the remedial wellfield is likely to be critical in order to reduce the potential for mobilizing DNAPL downward into deeper aquifer units. Although EPA briefly mentioned this issue in the JGWFS, they did not adequately emphasize the importance and potential implications of this issue. (mentioned briefly on pg. 5-6

first bullet and following paragraph and on pg. 5-35 Paragraph 3 and on pg. 5-37, Paragraph 2) with respect to DNAPL isolation well locations).

167 EPA Response:

The JGWFS appropriately emphasizes the importance of not mobilizing DNAPL during the course of implementing the chlorobenzene remedy. The comment is selective in the statements identified. There is no shortage of emphasis or analysis of limiting the drawdowns in the DNAPL impacted zone; and the model simulations inherently and comprehensively considered this issue.

In addition, the potential difficulty of maintaining the required balance between the effects of injection and extraction in the DNAPL impacted area during the period of transient drawdown and recovery that will occur during wellfield start up and shutdown was not mentioned. The feasibility of controlling transient hydraulic gradient changes was not explored during the FS modeling because the model was run under a steady state flow condition. Furthermore, maintaining control over vertical gradients in the DNAPL zone is expected to be much more difficult to accomplish at higher wellfield flow rates. Thus the perceived benefits of a faster cleanup time obtained through greater wellfield flow rates must be balanced against the increased risk of potential DNAPL mobilization. This was not adequately discussed by EPA.

168 EPA Response:

These issues are more appropriately addressed in the remedial design phase. The JGWFS and the remedial selection are not the remedial design. The JGWFS did reasonably show that meeting the objectives of this ROD are feasible, however.

EPA stated that some DNAPL mobilization would be acceptable if it is balanced against NCP criteria and if it could be controlled and provided for in the groundwater remedy. However, EPA did not address the uncertainty in predicting DNAPL behavior in a complex hydrogeologic system, to what extent downward mobilization of DNAPL would be acceptable, and by what method DNAPL mobility can be reliably controlled. The uncertainty of this issue argues for extreme caution and restraint with respect to changing the hydraulic gradients at the DNAPL impacted zone, which becomes increasingly likely as the remedial wellfield pumping rate is increased.

169 EPA Response:

The JGWFS acceptably showed that pumping at the rates implied by the remedial action selected by this ROD feasibly can be accomplished without inducing the significant

movement of DNAPL. EPA agrees that caution with respect to DNAPL movement is warranted, and to the degree it possible while still meeting all remedial objectives, it should be minimized or eliminated. At the same time, EPA wanted to state that eliminating 100.00 percent of all potential for NAPL to move under any circumstances may not be necessary or reasonable given more critical objectives and requirements, such as restoring the groundwater to ISGS levels. EPA does acknowledge that there are uncertainties with respect to NAPL movement.

The majority of specific issues addressed in the comment are more appropriately addressed in the remedial design phase. EPA does not agree that by simply and solely increasing the wellfield pumping rate, that NAPL migration is *necessarily* more likely, though we do agree that the design challenges may increase. The design of the wellfield (well location, pump rates from each well, etc.) are as critical as the pump rate. EPA reiterates that the wellfield pumping rates used in the alternatives in the JGWS were already adjusted to lower levels based on limiting the potential for NAPL movement.

APPENDIX B - GROUNDWATER MODELING RESULTS

Page B-18: EPA indicates that "The predicted contaminant concentrations in the Gage and Lynwood Aquifers could be significantly underestimated by the model because of uncertainties in hydrogeologic properties and contaminant sources and concentrations in the LBF and GLA." EPA further indicates that "modeling results indicate that concentrations of contaminants in the these aquifers will achieve MCLs without any remedial actions." EPA has incorrectly included the Gage aquifer in this characterization of modeling uncertainty. The model simulation of the no action scenario did not indicate that the Gage aquifer cleans up without any remedial action, but in fact remains relatively stable and expands downgradient as would be expected.

5170 EPA Response:

The comment is incorrect. The JGWFS refers to chlorobenzene in the Lynwood Aquifer, and benzene in the Gage Aquifer. The quasi-calibration simulations of benzene transport indicate that benzene in the Gage Aquifer cleans up without any remedial actions (see Figure B-3.4d of the JGWFS). Likewise the simulations would indicate that the Lynwood Aquifer cleans up without any actions. EPA points out the reasons that such predictions are highly unlikely to be accurate and the basses of modeling uncertainty that most-likely give rise to an unreliable simulation for these units.

Page B-14: EPA indicates that the model cannot be relied upon for simulating chlorobenzene transport within the Lynwood aquifer. Although there is uncertainty with respect to the nature of

the source of the chlorobenzene in the Lynwood aquifer, the data indicate that the source is constrained to the immediate vicinity of the Montrose Chemical Site and therefore model simulations of hydraulic containment of this area are expected to be representative and useful for remedial design.

171 EPA Response:

Simulating hydraulic containment is different from simulating chlorobenzene transport. Hydraulic containment is simulated with the flow portion of the model, and is independent from the transport modeling. The flow portion of the model is more reliable than transport model, and is appropriate to evaluate containment in the Lynwood Aquifer. The model is not, however, appropriate for simulating chlorobenzene transport in the Lynwood aquifer, and evaluating the percent reduction in contaminant mass and volume as has been performed for the MBFC Sand and Gage aquifers. This is discussed in Section 11.1 of the Decision Summary of this ROD and in Section 5 of the JGWFS. It is also extensively discussed in response to other comments by this commenter.

APPENDIX D - GROUNDWATER MONITORING

Page D-2: EPA assumed that five additional monitor wells would be required in the Gage Aquifer, for the purposes of costing the monitoring program. However, EPA provides no rationale for why so many additional wells are needed in the Gage aquifer.

172 EPA Response:

The current distribution of monitoring wells in the Gage Aquifer is insufficient to characterize the full lateral extent of the chlorobenzene plume in this hydrostratigraphic unit. These wells will, therefore, be necessary to determine the effectiveness of the plume reduction pumping. As explained in full in the JGWFS, Appendix D was created to provide a reasonable cost basis for monitoring in the JGWFS; a separate monitoring plan will be developed in the remedial design phase which may differ to some extent from the plan shown in Appendix D.

APPENDIX E - RATIONALE FOR TECHNICAL IMPRACTICABILITY ARAR WAIVER

Appendix E does not indicate whether the chlorobenzene in the lower Bellflower aquitard or the Gage-Lynwood aquitard is included within the TI Waiver or whether it is expected that these units will be required to be cleaned up in areas outside the TI Waiver zone. In the body of the FS text, it is stated that the points of compliance for achieving cleanup goals "will be considered to be

all points within the contaminated aquifers outside the TI Waiver zones." (pg. 3-20, second to last paragraph). This implies that aquitards are not required to comply with cleanup goals, however it is not clearly stated that this is the intent.

173 EPA Response:

In the chlorobenzene plume, the LBF is included in the TI waiver zone. However, the Gage-Lynwood Aquitard is not.

PAGES 3-19, LAST PARAGRAPH: EPA states that the TI Waiver applies to the UBA, MBFB-sand and the Gage aquifer. The MBFC sand is not mentioned. This statement is not consistent with the TI Waiver Appendix which includes the MBFC sand.

174 EPA Response:

The commenter is correct that there is an error at this location in the text. The text should read "water table units (Upper Bellflower and MBFB Sand), MBFC Sand, Lower Bellflower Aquitard, and the Gage Aquifer."

MINOR COMMENTS

PAGE 2-2, FIGURE 2-1: The location of the Del Amo waste pits is not accurate.

175 EPA Response:

Figure 2-1 is to be used as a site vicinity map based on the USGS 7.5 minute topographic quadrangle for Torrance California, dated 1981. The locations of the important features, including waste pits, are approximate and not meant to be indicating the "exact" locations.

PAGE 2-3, SECOND PARAGRAPH: In the JGWFS, EPA appears to be the acknowledged author of the Final Montrose RI. However, in the Final Montrose RI, EPA indicates that the document is an "*EPA-modified version of a Montrose document, rather than an 'EPA-authored' document.*"."

176 EPA Response:

The statement in the Montrose Site RI Report is the correct statement. The Montrose Site RI Report is not a wholly-EPA-authored document and, while it was substantially revised by EPA, significant content remains from earlier Montrose drafts.

PAGE 2-4, FIGURE 2-3: The graphic should indicate that the Lynwood Aquifer was reached in the southwest portion of the Del Amo Study Area during Montrose RI investigations at monitor wells LW-2 and LW-4.

177 EPA Response:

The fact that the Lynwood Aquifer was reached in this way is true.

The table should provide the references for the average thickness and base elevation range for the units extending from the Bellflower aquitard to the Gage aquifer.

178 EPA Response:

Please refer to the "Final Groundwater Remedial Investigation Report" dated May 15, 1998, prepared by Dames & Moore Group on behalf of the Del Amo Respondents for the original information.

The table should indicate that the Silverado Aquifer *was* reached in the Montrose Study area based on the Jones Well Driller's Log (Footnote 4).

179 EPA Response:

Please refer to the "Final Groundwater Remedial Investigation Report" dated May 15, 1998, prepared by Dames & Moore Group on behalf of the Del Amo Respondents for original information.

EPA should provide clarification for the statement "*most* facilities that caused contaminant releases to groundwater have been removed."

180 EPA Response:

EPA agrees that the statement is somewhat vague. It was intended to imply that there may be facilities such as piping remaining of which EPA is not aware, underground; and, that the waste pits still remain. Otherwise, the plant has been removed.

EPA should clarify and quantify the basis for the statement "facilities where *large volumes* of contaminants were stored, processed, or disposed." What is a large volume?

181 EPA Response:

The many hundreds of thousands of gallons that were handled would be considered large from the standpoint of potential environmental release by any reasonable reckoning, so EPA assumed it would be safe to use the term "large" without clarifying a threshold value.

PAGE 2-28 through 2-37: EPA should clarify and provide the basis for the concept of "known" NAPL sources, "highly suspected" NAPL sources, "suspected" NAPL sources and "other potential" NAPL sources. What is the basis for this hierarchy?

182 EPA Response:

Please refer to the "Final Groundwater Remedial Investigation Report" dated May 15, 1998, prepared by Dames & Moore Group on behalf of the Del Amo Respondents for original information. This comment was addressed in a previous response.

FIGURES 2-15 AND 2-16: EPA needs to ensure consistency in the use of potential data representativeness as described in the explanations to these Figures. For instance the comparatively low benzene results for monitor wells MW-5, MW-6, MW-11, and MW-27 shown on these figures may not be representative based on review of data trends for these wells from previous sample results. As such, these wells should be shown with the larger diameter symbol.

183 EPA Response:

Please refer to the "Final Groundwater Remedial Investigation Report" dated May 15, 1998, prepared by Dames & Moore Group on behalf of the Del Amo Respondents for the original information. In general, the maps show what they purport to show. Trend analysis is also important and was performed as part of the RI Report.

FIGURE 2-17: As described in the previous comment, benzene concentrations detected in Bellflower Sand monitor wells BF-6 and BF-7 may not be representative based on review of data trends. EPA needs to ensure consistency for each compound on all of the water quality maps.

184 EPA Response:

Please refer to the "Final Groundwater Remedial Investigation Report" dated May 15, 1998, prepared by Dames & Moore Group on behalf of the Del Amo Respondents for the original information. See last response.

FIGURES 2-20 AND -21: As with previous comments, these two figures are inconsistent with respect to their depiction of the representativeness of results from monitor well MW-12.

185 EPA Response:

Please refer to the "Final Groundwater Remedial Investigation Report" dated May 15, 1998, prepared by Dames & Moore Group on behalf of the Del Amo Respondents for original information. See last responses.

FIGURE 2-24: Does not accurately represent that Lynwood Wells LW-1 and LW-2 were each sampled and analyzed during the third sampling period in 1995.

186 EPA Response:

Comment noted.

PAGE 2-66: EPA's statement that "TCE detection's in the Gage Aquifer are limited to Well XG-14" is incorrect as TCE was detected in monitor well G-13 located south of the waste pit area at a concentration of 10 ug/l in 1991. EPA's statement also does not appear to be consistent with the 3 wells where TCE has apparently been detected in the Gage aquifer shown on Figure 2-28B.

187 EPA Response:

Comment noted; it is correct that TCE was detected in Monitoring Well G-13 in 1991. Figure 2-28B indicates "approximate" distribution under the legend for the purpose of the plume definition and not necessarily exactly where TCE was detected.

FIGURE 2-28: To be more meaningful, this figure should, at a minimum, provide a common list of analytes for each well and quantify the value of the detection limit rather than using the acronym "ND" for compounds not detected.

188 EPA Response:

Comment noted; Figure 2-28 was taken from the *Final Groundwater Remedial Investigation Report* dated May 15, 1998, prepared by Dames & Moore Group on behalf of the Del Amo Respondents (i.e. Figure 5.2-34). Please refer to this document for the original information.

FIGURE 2-28B: EPA needs to revise this figure to more accurately reflect the available data, especially in regards to the occurrence of TCE (e.g. the number and location of detects in the Gage Aquifer and the numerous detections not depicted at locations upgradient of the Montrose Property).

189 EPA Response:

The Figure 2-28B indicates "approximate" distribution under the Legend for the plume definition and not necessarily where exactly where TCE was detected.

PAGE 2-3, SECOND PARAGRAPH: Add the letter "y" to the word "hydrostratigraph" in the upper left hand box.

190 EPA Response:

The typographical error was not found in Page 2-3.

PAGE 2-3, LAST PARAGRAPH, FIRST SENTENCE, THIRD LINE: Typo. Delete "*the*" prior to heterogeneous.

191 EPA Response:

Comment noted.

PAGE 2-4, FIGURE 2-3: The title block obscures the explanation.

192 EPA Response:

Comment noted.

PAGE 2-21, SECOND PARAGRAPH, NEXT TO LAST SENTENCE: Typo add "ly" to the word "significant"."

193 **EPA Response:**

Comment noted.

FIGURE 2-10A, HISTORICAL HYDROGRAPH: EPA should provide the references for the water level data and well construction inferences for well 806C.

For consistency, monitor well MW-4 should be identified as "XMW-4." To avoid confusion, monitor well MW-4 should be identified as being completed at the water table.

194 **EPA Response:**

Comment noted.

FIGURE 2-10B: For consistency, monitor well MW-4 should be identified as monitor well XMW-4 and shown to be located on the Montrose Property.

195 **EPA Response:**

Comment noted.

FIGURE 2-29, WELLS OF RECORD: For completeness, Figure 2-29 should show the location of well 4S/14W/12E1 shown on Plate 2 of *Poland et al* along the slough near the intersection of what is now Torrance Boulevard and New Hampshire Avenue, south of the Del Amo waste pit area.

196 **EPA Response:**

Comment noted.

PAGE 2-34, THIRD FROM LAST PARAGRAPH: For consistency with other documents change the word "processing" to "process" when used to describe the term Central Process Area.

197 EPA Response:

"Central Process Area" is intended, consistent with other uses in the document.

PAGE 2-28, THIRD PARAGRAPH: The acronym "ROST" does not appear to have been defined.

198 EPA Response:

The acronym ROST stands for Rapid Optical Screening Tool

Clarify the term "production well" at the MW-20 area.

199 EPA Response:

The words "and production" in this statement should be deleted. The statement should read, "At the MW-20 area, LNAPL with a measurable thickness is consistently present in monitoring wells."

PAGE 2-33, BULLET #4: The acronym WRC does not appear to be defined.

200 EPA Response:

In the *Final Groundwater Remedial Investigation Report* dated May 15, 1998, prepared by Dames & Moore on behalf of the Del Amo Respondents, the initials "WRC" are used in reference to a building that is known as the WRC building, on the eastern half of the former Del Amo plant.

PAGE 2-41, LAST SENTENCE: Insert the words Del Amo after "former" and prior to "plant operations.

201 EPA Response:

The sentence should read accordingly.

FIGURE 2-15: The explanation shows a concentration of benzene of 780 ug/l for well XMW-11 which is inconsistent with the map which indicates benzene as not detected at this well. The explanation should be corrected.

202 EPA Response:

The map that indicates that benzene was not detected is correct.

The explanation, and associated text, should indicate that the chlorobenzene MCL in this usage is specifically the California MCL for drinking water.

203 EPA Response:

MCL typically refers to the lower of the state or federal MCL where both exist, unless otherwise noted, as this is the level typically considered to be an ARAR. The comment is noted.

FIGURES 2-15 THROUGH 2-28: The figures as presented are cluttered and confusing and the data are illegible or obscured.

204 EPA Response:

These figures were modified by EPA using the original figures in the draft JGWFS that was offered by Montrose Chemical (commenter) and the Del Amo respondents. The "imprint" of chlorobenzene distributions is added to the original figures to distinguish the benzene distributions that are commingled with the chlorobenzene. The original data can be referred to in the *Final Groundwater Remedial Investigation Report*, dated May 15, 1998, prepared by Dames & Moore on behalf of the Del Amo Respondents for the Del Amo Site.

PAGE 2-66: EPA should specify which other sources are referenced in the statement "source area 2 and other potential sources upgradient of the Joint Site.."

205 EPA Response:

The other potential sources are described in Section 2.2.3.3.

EXHIBIT H-1: ADDITIONAL SAMPLING

Specific Comments

H-1.1 Page 4-28: EPA implies that TOC data are required for groundwater:

"no TOC contours are plotted because there are insufficient data points"

"It is anticipated that if wells on the Montrose Property were analyzed for TOC, the TOC plume may be shown to originate at Montrose"

"No TOC analyses were available for the Gage Aquifer monitoring wells within the Montrose Property"

"Insufficient TOC samples are available to identify the source of the TOC plume"

"It is anticipated that if wells on the Montrose Property were analyzed for TOC, the TOC plume may be shown to originate from Montrose"

TOC concentrations in groundwater represent the sum of the organic constituents as opposed to any distinct or individual contaminant. Given that the individual organic compounds are addressed in detail, a separate evaluation of TOC is of little benefit. The concept of a single "TOC plume" is also not useful considering the multiple compounds and sources of individual organic compounds that contribute to TOC in groundwater.

206 EPA Response:

Total Organic Carbon (TOC) is a widely used analytical parameter that gives an overall indication of organic contamination in groundwater. Because TOC concentrations are a measure of the total concentration of organic constituents in the groundwater, not just those on the typical analyte lists (VOCs, semivolatile organics, pesticides/PCBs), TOC concentrations provide a broader indication of the presence of organic contaminants that are not included in the standard analyses. For this reason, the presentation and evaluation of TOC data is valuable and adds to the understanding of the Montrose Chemical Site. The statements on TOC quoted above describe the available TOC data in the different HSUs at the Montrose Chemical Site and point out apparent data gaps. However, the TOC data gaps are not considered critical for the remedy selection process presently being undertaken. Additional data may be required in the future depending on what contaminants are found in treatment system influent and future remedy selection processes, including amendments.

H-1.2 Page 5-4: Northwest Corner sampling was completed by Montrose in March 1997. More than 1-year later EPA has yet to provide comments. Instead, EPA now merely states:

"Because the northwest corner investigation was only recently completed, sampling locations (and analytical results) for that investigation are provide in Figure 5.5A and Appendix K."

The title of Figure 5.5A is "*Preliminary Results.....*"" EPA provides no indication as to why these results are considered preliminary or when the "final" results will be available. The sampling results are presented in a format which makes it difficult to compare directly with the remainder of the soil result figures.

The cover page for Appendix K includes the following: "**Disclaimer—The report is included for reference only. The results and conclusions presented in this report are not necessarily endorsed by the U.S. Environmental Protection Agency."*

EPA provides no discussion regarding why the *results* of the northwest corner sampling are not endorsed by EPA, and provides only a brief discussion later in the document as to why the *conclusions* are not endorsed by EPA. At this point in the RI/FS process EPA should be in a position to state its opinions regarding the results and conclusions of the Northwest Corner sampling, and the sufficiency of the full body of soil data to support remedy selection.

207 **EPA Response:**

EPA's concern with the Northwest Corner sampling report is described on pages 5-18 and 5-19 of the Montrose Site RI Report:

> **"EPA does not agree with the conclusion made by Montrose in the report on the northwest corner investigation (attached as Appendix K) that the investigation successfully characterized chemicals in the soil in the adjacent Off-Property area. Because the sampling results indicate DDT soil contamination extending Off-Property an undefined distance in several areas, EPA does not believe that Montrose has fully assessed the extent of DDT concentrations Off-Property. Further sampling may be required."**

In a July 30, 1996 conference call (prior to sampling), Montrose's consultants indicated that they could not "chase" potential contamination to the west of Montrose Property because of the presence of a large number of metal storage cabinets. Montrose's consultants requested that the sampling be limited initially to two rows just outside the western property boundary and they agreed to take additional samples further out if the initial samples showed contamination. The results of the Northwest Corner sampling did indeed indicate contamination outside the western boundary. As stated on page 5-18, concentrations were as high as 124 mg/kg (almost 100 times the residential PRG for DDT) in samples from the western portion of the former Montrose facility. To EPA's knowledge, no additional sampling has been conducted to determine the extent of this offsite contamination; therefore, EPA has stated in the RI Report that further sampling may be required.

While the Northwest Corner sampling was conducted in March 1997, Montrose's consultants did not prepare their latest draft report until October 1997. In addition, the results of the Northwest Corner investigation are presented in Figure 5-5A of the Montrose Site RI Report in a format different from the other data because EPA believes it is an effective method of showing the results of the immunoassay sampling and contract laboratory program sampling on the same figure. Because of the number of samples, the presentation of the data on a smaller scale map would be very crowded and difficult to read. Montrose's consultants prepared this figure as part of the report on the Northwest Corner investigation. EPA included the figure in the RI Report.

The northwest corner sampling was for DDT in surface soils. There are essentially no implications from this sampling for groundwater remedy selection. Hence, resolving all issues which pertain to this sampling is not necessary in order for EPA to proceed with groundwater remedy selection. Other remedy selections will follow, such as for soils on the former Montrose plant property, wherein these data, and possibly additional data, will be more crucial.

H-1.3 Page 5-5: The statement *"the highest DDT concentrations are still in the same general area as before the grading, near the former junkyard and machine shop"* appears out of context and should be clarified as to what portions of the property, what depths, and what data are being compared.

208 EPA Response:

As indicated by the title of the section from which the quote was taken, the depth is "near surface soils," generally defined as 0 to 6 feet bgs. The portions of the property discussed in the text, the former junkyard and machine shop, are shown in Figure 1.3. As also indicated by the section title, the data being compared are the DDT concentrations in near-surface soil before and after grading in the Northwest Corner. Pre- and post-grading sample results are discussed in further detail in Sections 5.3 and 5.4.

H-1.4 Page 5-7: EPA states *"...in addition, there are some hot spots (e.g., portions of the Normandie Avenue ditch) that occur Off-Property..."* EPA should define the term "hot spot", quantify the concentrations, and discuss the locations.

209 EPA Response:

The term "hot spot" is a term commonly used in the environmental field to indicate an area of contamination that contains higher concentrations of contaminants relative to the immediate surrounding area. The term "hot spot" is typically used to describe contamination in general terms and, as a result, there are no industry-accepted criteria for defining a hot spot. It should be noted that Section 5.2 of the Montrose Site RI Report is a summary section. A more detailed discussion of the DDT hot spots that occur in the Normandie Avenue Ditch is provided in Section 5.4 including Section 5.4.1.2.

H-1.5 Page 5-10

a) The statement "*Because of the age of the groundwater monitoring data (2 to 7 years old), the extent of groundwater contamination described in this report may be potentially underestimated*" implies that "newer" data are necessary. The statement should be deleted or rewritten. The available data indicate that although the extent of groundwater contamination may be underestimated, it is as likely overestimated, and more likely generally the same. Statements regarding observed changes in the extent of groundwater contamination with time should honor the existing data trends, which provide no consistent indication that the extent of groundwater contamination is substantially changing.

210 EPA Response:

The paragraph from which the text was quoted serves to notify the reader that the most recent groundwater analyses used to assess the extent of contamination are from 1995 and that many of the wells were not sampled in 1995. The most recent analyses for those monitoring wells not sampled in 1995 are from 1990 and 1991. Therefore a complete round of recent groundwater analyses from all wells was not available to prepare the groundwater contaminant plume maps. Nonetheless, EPA agrees that the quality and quantity of data are sufficient to describe the extent of groundwater contamination and to evaluate and select the remedy.

b) The statement *"The downgradient extent of detectable p-CBSA plume is not fully characterized with the presently existing monitoring wells."* implies that additional monitor wells will be required. The current array of monitor wells are sufficient to characterize the distribution of contaminants in groundwater at concentrations exceeding drinking water MCLs or other regulatory criteria. The reader should be reminded that the extent of

detectable pCBSA at the parts per billion level is not relevant to the remedy selection process because regulatory criteria for this compound have been established at the parts per million level.

211 EPA Response:

The statement indicates the extent of pCBSA contamination was defined to approximately the 100 parts-per-billion (ppb) level and not to the limits of detection.

There are *no* promulgated regulatory criteria for this compound. EPA has excepted a "To-be-considered" criterion of the State of California related to aquifer reinjection. Hence, there is no "cookbook" concentration to which the pCBSA distribution should be characterized. EPA agrees that no additional wells are necessary for EPA to complete remedy selection, given that EPA's remedy is protective based on what is known about pCBSA. However, additional wells will in fact be required during the remedial design phase of the project as required by this ROD so that pCBSA can be properly monitored in relation to its proximity to groundwater production wells. EPA agrees with the latter portion of the comment that the detectable p-CBSA at the parts-per-billion level is not relevant to the remedy-selection process given available information.

H-1.6 Page 5-12: *"...a definable plume is not apparent based on the most recent sampling...a plume could be present but undetected."* EPA should avoid speculation in the absence of data.

212 EPA Response:

The statement is taken out of context. The full statement is, "Because of very high detection limits (up to 300 µg/L) in some monitoring wells, a plume could be present but not detected." This statement is indicating that the detection limits were not low enough to detect significant concentrations of chloroform in the groundwater. This statement is highly appropriate and serves to flag a supportable possibility.

H-1.7 Page 5-18: With regards to the northwest corner sampling EPA states that *"the results of the northwest corner investigation in 1997 indicates that high concentrations of DDT may have been diluted by the grading, but that DDT concentrations remain elevated in the same general area of the Property"*

..."the results of the northwest corner investigation also indicate soil contamination extending Off-Property"

... "EPA does not agree with the conclusion made by Montrose in the report on the northwest corner investigation that the investigation successfully characterized chemicals in the soil in the adjacent Off-Property area. Because the sampling results indicate DDT soil contamination extending Off-Property an undefined distance in several areas, EPA does not believe that Montrose has fully assessed the extent of DDT concentrations Off-Property. Further sampling may be required."

At this point in the RI/FS process, EPA should present the northwest corner results in conjunction with the results of the other 17 years worth of soil data presented in the RI Report and provide the specific objectives and rationale for all additional soil sampling, both On-Property and Off-Property, that is needed to fulfill the RI/FS data requirements.

✍213 EPA Response:

See response to Comment H-1.2 above. We note that additional data for the northwest corner, to the extent they are required, will not have impact on the remedy selection for groundwater and hence groundwater remedy selection can proceed without them.

H-1.8 Page 5-19: The statement *"except that the concentrations* [of Total DDT detected in neighborhood soil samples] *were distinctly higher than the background samples"* is misleading because given the difference in sample populations, the distinction is not clear. An objective comparison would state the range of concentrations detected in background samples and provide the reader with a comparison of the number of neighborhood samples which were greater than concentrations detected in background samples and the number of neighborhood samples which were less than the background samples."

✍214 EPA Response:

EPA believes it is clear to the reader that the range of DDT concentrations reported in neighborhood samples (0.29 to 53.8 mg/kg) is distinctly higher than the range in background (0.033 to 2.58 mg/kg). Nevertheless, a review of the data indicates that approximately 63 percent (35 of 56 samples) of the neighborhood samples are greater than the background range and approximately 37 percent (21 of 56 samples) are less than background range. These statistics are sufficient to indicate the need for additional investigation by EPA in these areas.

H-1.9 Page 5-27: *"because BHC alone is relatively immobile in soil, it is likely that the DNAPL facilitated the transport of BHC to these depths."* The premise, here and elsewhere in the

document, that the occurrence and migration of BHC is directly associated with DNAPL is unfounded.

215 EPA Response:

In using the words "it is likely," EPA is indicating that one, but not necessarily the only plausible explanation for detecting BHC at the 60.5 feet depth, is transport with the DNAPL. This same mechanism of transport is, in fact, the basis of the conceptual model for DDT transport to groundwater espoused in both Montrose's draft RI Report and EPA's final RI Report. Because (1) DNAPL transport through soils clearly occurred at the former Montrose plant, (2) both DDT and BHC are soluble in the DNAPL, and because (3) DDT is present in the DNAPL; this statement is not mere speculation.

It is also true that cross-contamination from shallower soil or dissolved aqueous transport over an extended period of time are other possible explanations.

H-1.10 Page 5-32: "*the DNAPL, consisting primarily of chlorobenzene, has greatly increased the mobility and lateral and vertical extent of DDT as monitoring well* [sic] *as BHC.*" This statement implies a direct link between DNAPL and the mobility and extent of BHC which cannot be supported with the existing data.

216 EPA Response:

Please see response to Comment H-1.9 above.

H-1.11 Page 5-34: *"the locations of the soil samples collected in this RI were not necessarily sufficient to fully evaluate this potential release point for PCE. Therefore, the Montrose Property may potentially be a contributing source of PCE to the subsurface"* This argument can be used forever no matter how many "ND" samples are collected. EPA conducted the grid sampling at the Site If there is no indication of significant PCE use or disposal then the data collected to date should be considered adequate for decision making purposes. Further refinement could be achieved, as appropriate, during the remedial design/remedial action phase of this RI/FS process.

217 EPA Response:

Information is now available that indicates the use of significant quantities of PCE on and adjacent to the Montrose Property. Because this information was discovered after most of the soil sampling was conducted, the locations of the soil samples were not necessarily sufficient to fully evaluate potential release points for PCE. The number of samples at the

site is irrelevant; it is the number and locations of samples actually analyzed for PCE in soils. The "grid sampling" to which the comment refers was very widely spaced. The available data presented in the RI is considered adequate for the remedy selection process for the groundwater at the Joint Site.

H-1.12 Page 5-35: *"the locations of the soil samples collected in this RI were not necessarily sufficient to fully evaluate this potential release point for TCE. Therefore, the Montrose Property may potentially have contributed TCE to the subsurface."* See previous comment.

218 EPA Response:

See response to Comment H-1.11 above.

H-1.13 Page 5-49: *"It is important to realize that not all monitoring wells were sampled in 1995, and for those monitoring wells that were sampled, analyses were not completed for all chemicals"* The reason that this is important is not clear. The statement implies that more complete analyses were required or necessary. The statement should be expanded to discuss the objectives and rationale of the 1995 sampling and state that the sampling was conducted in accordance with a field sampling plan and quality assurance project plan amendment proposed, reviewed, and approved by USEPA.

219 EPA Response:

The statement indicates the scope of the 1995 monitoring event and does not necessarily imply that "more complete analyses were required or necessary" beyond what was proposed in the EPA-approved work plan amendment. The scope of the 1995 groundwater sampling was to verify the existing plume configuration, therefore, the analytes were limited to save analytical expense. The fact that sampling occurs does not mean that it is fully comprehensive for all purposes. For additional information relative to this response, see Response H-1.5 (a).

H-1.14 Page 5-64: *"The full extent of detectable p-CBSA to the southwest has not been determined"* Defining the full extent of p-CBSA to the parts per billion detection limit is unnecessary.

220 EPA Response:

Please see response to Comment H-1.5 (b) above.

H-1.15 Page 5-65: *"The extent of the p-CBSA plume in the Lynwood Aquifer is not monitoring well* [sic] *defined."* EPA should provide the reader with an understanding of the difference between "detectable p-CBSA" and a "p-CBSA plume" and state that the extent of detectable pCBSA is not relevant for decision making purposes.

221 EPA Response:

Please see response to Comment H-1.5 (b) above.

EXHIBIT H-2: DNAPL CHARACTERIZATION

General Comment

H-2.1 EPA's discussion of DNAPL in Sections 5 and 6 does not reflect the current level of understanding regarding the nature and extent of DNAPL and DNAPL mobility.

222 EPA Response:

EPA believes the document adequately reflects the current understanding of the extent and mobility of DNAPL at the Montrose Chemical Site. Please refer to the responses to specific comments below.

Specific Comments

H-2.2 Page 5-6: For clarification and accuracy EPA should qualify, quantify, or delete the term "viscous" in describing DNAPL.

223 EPA Response:

Based on verbal descriptions of the DNAPL from field personnel and the high DDT content of the DNAPL (over 40 percent DDT by weight), it was assumed that the DNAPL was viscous (i.e., had a greater viscosity than water); however, since the viscosity of the DNAPL has not been measured, EPA agrees that the term "viscous" is not appropriate in this sentence.

H-2.3 Page 5-9: For accuracy, completeness, and consistency the statement *"The presence of laterally continuous low permeability clay layers within the Upper Bellflower Aquitard also inhibits the downward migration of DNAPL and cause the DNAPL to spread laterally"*, should be revised to reflect the fact that the low permeability layers do not appear to be laterally continuous; appear to be comprised primarily of silt and silty sand as opposed to clay; and migration of DNAPL has likely occurred in a downward stair-step manner.

224 EPA Response:

Based on the available lithologic data, there are indications of the presence of "localized" continuous low permeability clay layers within the Upper Bellflower Aquitard that may have inhibited the vertical migration of the DNAPL and contributed to the spreading of the DNAPL laterally. EPA does not rule out migration of DNAPL in a downward stair-step manner as another plausible scenario.

H-2.4 Page 5-32: EPA should explain and provide the basis for the statement with regard to BHC that *"The DNAPL, consisting primarily of chlorobenzene, has greatly increased the mobility and lateral and vertical extent of DDT as monitoring [sic] well as BHC."*

225 EPA Response:

The word "monitoring" in the last part of the sentence is a typographical error and should have been deleted. Please see response to Comment H-1.9 above. Detectable BHC in subsurface soils is observed at many locations where DDT is detected. Therefore, transport of BHC with DNAPL is but one potential and likely mechanism, along with borehole cross-contamination, and aqueous transport that could explain the presence of BHC in the subsurface. EPA agrees that the presence of BHC in soil, does not, in and of itself, indicate transport by DNAPL.

H-2.5 Page 5-43, second paragraph of section 5.5.1.2, EPA wrote *"An anomalously low value of 12,000 mg/L chlorobenzene (sample date May 14, 1998) and anomalously high value of DDT (3,100,000 mg/L were not included in the calculation of the range and average composition of the DNAPL."* The correct sample date for the anomalously low value for chlorobenzene (12,000) is May, 14, 1991. The sample date of the anomalously high value for DDT (3,100,000) is July 27, 1988, which should be included for completeness.

226 EPA Response:

The two referenced DNAPL analyses are correctly listed in Table 5.3b. The May 14, 1991, sample was not used in calculating the average DNAPL composition, because the chlorobenzene concentration (12,000 mg/L) was much less than all other DNAPL analyses. The July 27, 1988, analysis of DNAPL was not used, because the DDT concentration (3,100,000 mg/L) corresponds to a sample that is more than 300 percent DDT, a physical impossibility.

H-2.6 Page 5-43, third paragraph of section 5.5.1.2, EPA wrote *"The sum of the results exceeded unity for a mass balance between the two methods for one sample (dated July 27, 1988)"* This statement is incorrect. The mass balance for DNAPL actually exceeded unity for three of the samples, dated January 18, 1988, March 18, 1988, and July 27, 1988.

227 EPA Response:

The text should state that three samples, dated January 18, 1988, March 18, 1988, and July 27, 1988, exceeded the mass balance for DNAPL.

H-2.7 Page 5-43, fourth paragraph of section 5.5.1.2, EPA wrote "*The specific was used for the calculation of percent by weight of chlorobenzene and DDT.*" This sentence does not make sense. It appears that the word "gravity" should be added following the word specific.

228 EPA Response:

The word "gravity" should be added after the word "specific."

H-2.8 Page 5-45, third paragraph. EPA wrote "*Table 5.3c indicates that the observed chlorobenzene concentrations in groundwater have exceeded 1 percent of the chlorobenzene solubility for Monitoring Wells MW-5 and MW-9 within the Upper Bellflower Aquitard and for Monitoring Wells BF-02, BF-03, BF-04, and BF-09 within the Bellflower Sand. Therefore, the potential presence of DNAPL is indicated at those monitoring well locations.*" EPA should recognize that although groundwater concentrations in excess of 1 percent of the solubility of a DNAPL constituent may be an indicator of pure phase DNAPL in a groundwater system, they are not necessarily indicative of DNAPL at a specific sampling location. Sample locations downgradient of a DNAPL source area frequently exceed 1 percent of the solubility of a DNAPL constituent without DNAPL being physically present at the sample location. Thus groundwater concentrations should be used in conjunction with other site data, such as groundwater flow direction, when using this information to infer the presence and location of DNAPL within the subsurface.

229 EPA Response:

EPA recognizes that the 1-percent "guideline" is commonly used for the possible "indirect" indication of the presence of pure-phase NAPL at a "sampling point" in the groundwater. This guideline is very rough and general and cannot be used as a "direct" or absolute indication of presence of DNAPL in subsurface media. DNAPL samples will be collected from the suspected source areas at the Montrose Chemical Site to directly verify presence of the pure-phase DNAPL as part of the planned DNAPL source investigation.

H-2.9 Table 5.3C and 5.3D: Tables 5.3C and 5.3D do not include shading as indicated in footnotes.

230 EPA Response:

The commentor must have received a poor quality reproduction of the document. The shading is present in all other copies of the report we have checked.

H-2.10 Page 6-6, first paragraph, EPA is inconsistent in reporting the chemical composition of DNAPL. For example, on Page 6-6 EPA reports that ."..*DNAPL beneath the Central Process Area that contains an average of 40 percent DDT and 36 percent chlorobenzene.*" This ratio of DDT to chlorobenzene is inconsistent with the ratio of 43 percent chlorobenzene and 47 percent DDT previously stated in section 5.5.1.2 and the "*estimated chlorobenzene to DDT ratio of 60 percent to 40 percent by weight* " subsequently presented on Page 6-10.

231 EPA Response:

The report should consistently state that " the DNAPL beneath the Central Process Area contains an average of 43 percent DDT and 47 percent chlorobenzene" using the assumptions stated in Section 5.5.1.2. However, we note that none of the analyses performed on the DNAPL to date would allow for enough accuracy to make the difference in the ratios cited distinguishable and significant.

H-2.11 Page 6-12, first paragraph, EPA wrote ."..*composed of approximately 40 percent DDT and 60 percent chlorobenzene by weight...*" Same comment as previous. Other examples are present in the text but are not presented here.

232 EPA Response:

Please refer to response to Comment H-2.10 above.

H-2.12 Page 6-16, second last paragraph, EPA wrote "*However, transport of the DNAPL components by groundwater flow is controlled by the properties of the individual chemicals.*" This statement omits a number of additional factors which also affect migration of dissolved DNAPL components and is therefore not completely correct. The transport of dissolved DNAPL constituents will be controlled by the properties of the individual chemicals in conjunction with the all of the other fate and transport considerations, i.e. groundwater velocity, organic carbon, multi-component solubilities, presence of oxygen, microbes etc. Transport of pure phase DNAPL is controlled by several factors besides the properties of the individual chemicals. These factors

include saturation of DNAPL; pore size and distribution; heterogeneities in the subsurface; geological features such as dipping beds; and groundwater flow velocity.

233 EPA Response:

EPA agrees that the additional factors mentioned in the comment influence the transport of DNAPL in the groundwater as described in Section 6.4.1.2, 6.4.1.3, and 6.4.4. The quoted statement was not intended to imply that only the "properties of individual chemicals' control the transport of DNAPL.

H-2.13 Page 6-30, last paragraph, EPA wrote "*Vertically, most VOCs of concern have migrated from the Upper Bellflower Aquitard through the Gage and Lynwood Aquifers. The vertical migration of dissolved VOCs is likely caused by the downward hydraulic gradients between the hydrogeologic units at the site and the vertical migration of DNAPL.*" Several comments apply to the previous quote.

a) The statement that "*Vertically most VOCs of concern have migrated from the Upper Bellflower Aquitard through the Gage and Lynwood Aquifers*" is grossly inaccurate. Most VOCs of concern have not migrated from the Upper Bellflower Aquitard through the Gage and Lynwood Aquifer. Chlorobenzene, chloroform, and benzene are the only VOCs detected in groundwater samples collected from Lynwood Aquifer monitor wells.

234 EPA Response:

The commenter is correct to make this clarification. The reference to "VOCs of concern" was not the best choice of words. There are many COCs which are VOCs. However, among all of these, the JGWFS focuses largely on chlorobenzene, benzene, and TCE for the purposes of the groundwater remedy selection. By stating "most VOCs of concern," EPA was referring to chlorobenzene and benzene. EPA agrees with the statement that only chlorobenzene, chloroform, and benzene have been detected in groundwater samples collected from Lynwood Aquifer monitoring wells.

b) The statement implies that DNAPL has migrated *through* the Gage and Lynwood aquifers. The data are not adequate to draw this conclusion.

235 EPA Response:

The statement does not mean to imply that DNAPL has migrated through the Gage and Lynwood Aquifers. As explained in the next to last paragraph, the statement refers to the dissolved VOCs in the groundwater and not the DNAPL.

c) The statement that "*The vertical migration of dissolved VOCs is likely caused by the downward hydraulic gradients between the hydrogeologic units at the site and the vertical migration of DNAPL.*" The word "and" should be changed to "or" or "and/or" because the two transport mechanisms are not always concurrent. Vertical migration of VOCs may occur with or without vertical migration of DNAPL.

236 EPA Response:

The word "and" in the quoted sentence should be changed to "and/or."

H-2.14 Page 6-38, second to last paragraph, While referring to DNAPL spreading laterally on a low permeability layer, EPA wrote "*The lateral spreading of DNAPL will generally continue until residual saturation is reached.*" This statement is inaccurate and implies that DNAPL will migrate until the DNAPL body is completely converted to residual saturation and thus becomes immobile. Residual DNAPL is considered immobile under hydraulic gradients which typically occur in groundwater systems. Residual DNAPL generally forms at the trailing edge of a DNAPL body as it migrates. DNAPL pools will generally spread laterally until the lateral driving force is no longer strong enough to overcome the capillary forces, or hydraulic pressures, in the surrounding porous media. DNAPL pools can be remobilized if the local hydraulic gradient changes and the capillary entry pressure of the surrounding porous media is again exceeded. A DNAPL body could not theoretically spread if the DNAPL within it was at residual saturation, thus the point at which residual saturation is reached defines the maximum spreading that could occur.

237 EPA Response:

EPA agrees with the commenter's clarification of this issue.

H-2.15 Page 6-39, second to last paragraph, EPA wrote ".. *it is expected that only a small percentage of the total DNAPL mass could be recovered using hydraulic enhanced extraction, and that the residual DNAPL will continue to be a near-perpetual source of dissolved chlorobenzene to groundwater.*" Although the percentage of DNAPL that could be hydraulically removed would not be large enough to prevent DNAPL from acting as a continuing source of dissolved chlorobenzene to groundwater, it is possible that a high percentage of the mobile mass

of DNAPL could be recovered using hydraulic enhanced extraction. Collection of data required to perform this sort of evaluation has been proposed in the "Field Sampling Plan and Quality Assurance Project Plan, DNAPL Evaluation, Montrose Chemical Site, Torrance California." (Montrose, 1998). The proposed data collection will be conducted to support the DNAPL FS.

238 EPA Response:

EPA concurs.

EXHIBIT H-3: OTHER ISSUES

Specific Comments

RI SECTION 1: Introduction

H-3.1 Page 1-3 Section 1.1 under "*Important Note on the State of the RI Report: How EPA Produced This Report*"

EPA misrepresents the history of progression of the RI process and creates confusion regarding authorship of the RI document with its disclaimer that EPA revised the document "*to rectify long-standing problems and deficiencies...which EPA considered unacceptable.* [EPA has] *made modifications which EPA believes brings the document to a minimum level of acceptability...the reader should therefore consider this document an EPA -modified version of a Montrose document, rather than an 'EPA-authored' document.*"

a) EPA's modifications and revisions have introduced bias and subjectivity which is inappropriate. What EPA now refers to as "long-standing problems and deficiencies" are largely differences of opinion which have been openly and freely discussed with Montrose over more than a decade and which have little if any impact on remedy selection. The predecessor documents to the EPA-revised RI Report were previously accepted by EPA as the foundation for a series of RI/FS documents prepared over the past decade, including risk assessments, soil and groundwater feasibility studies, and technical memoranda.

b) EPA does not provide the reader with an accurate, fair, and honest accounting of the history of progression in preparing the Montrose RI/FS documents. EPA should acknowledge that the Draft RI Report was first prepared in October 1990, EPA comments to that report were provided in February 1992 and a Final RI Report was prepared and submitted to EPA in October 1992. At no time during that process did EPA consider the document unacceptable. Indeed the 1992 RI Report became the foundation for the complete series of near-final RI/FS documents submitted to and reviewed by EPA during the period from 1992 through 1994 including a PHEE, a soil FS, a groundwater FS, a DNAPL technical memorandum, and an FS executive summary. In January 1996, EPA issued a series of broad comments to which Montrose responded in an October 1996 revision to the October 1992 Final RI Report. EPA issued another series of broad comments during the period from October 1996 through August 1997 when the August 1997 revised RI Report was submitted to EPA. In January 1998, EPA rejected that document and took over the process. Now, after 5 months of modification, EPA has issued a document whose only substantive changes are the inclusion of conjecture and allegation.

239 EPA Response:

EPA disagrees with the commenter's interpretations of the development of the RI Report. The commenter is incorrect that EPA never informed Montrose that EPA considered the draft RI Report unacceptable. In fact, EPA accompanied its comments to Montrose with the statement that the report was not acceptable as written and that EPA's comments had to be addressed in order for EPA to accept (and thereby approve) the document. While EPA did not formally disapprove Montrose's draft of the RI document until January 1998, EPA had outstanding comments and issues with the report during the entire time period from the initial draft of the RI until that time. In most cases, Montrose's modifications to the report made only minimal modifications, ignoring many of EPA's comments and/or responding in a minimalist and unsatisfactory manner to many others. As stated in this portion of the document, Montrose's drafts of the RI omitted many pertinent facts about how the plant operated, virtually lacked a conceptual model about contaminant release and movement, was missing vast numbers of analyses of the data presented, and was written in such an obfuscatory manner as to virtually eliminate its use as a practical resource about the site. EPA's modifications were an attempt to reasonably rectify these problems.

The commenter mentions that the draft RI Report was relied upon for the development of other required documents. The data in the draft RI Report did allow for additional work to take place on other documents, even though EPA did not agree with Montrose on many conclusions, interpretations, and omissions of information in the report or that Montrose had completely addressed all of EPA's comments to make the report itself acceptable.

EPA strongly disagrees that the only substantive changes made by EPA to the document are "conjecture and allegation." The enforcement-related aspects of the RI Report are not the subject of the ROD, and are not further discussed here. Those wishing more information about EPA's takeover the RI Report can be found in EPA's letter to Montrose Chemical Corporation of January 10, 1998, which is in the administrative record.

H-3.2 Page 1-3: The statement "*figures that EPA altered, or that EPA added, do not show the Hargis + Associates name*" is not accurate. There are instances where figures altered by EPA retain the H+A name and logo and there are instances where the H+A logo was removed from figures that were not altered by EPA. Examples of these inconsistencies include figures 1.3, 1.4, 1.24, 2.1, 2.4, 2.16, 2.17, 2.18, 2.19, 2.21, 5.75, 5.78, 5.79 and 5.82. There is at least one instance where EPA revised the H+A name and logo in the title block. For example after revising Figure 1.4, instead of removing the H+A name and logo, EPA revised it to include the address and phone number of H+A's Pasadena Office. These discrepancies create more confusion for the reader in attempting to understand who prepared what portions of the document. To be consistent, EPA should review each figure for changes and revise the title blocks appropriately.

For completeness, EPA should include the name and logo of its consultant, CH2M HILL, on figures prepared for EPA.

240 EPA Response:

Figures 2.16, 2.17, 2.18, 2.19, 2.21,5.75,5.78,5.79, and 5.82 were slightly altered (only the title of the figure was changed), so the Hargis + Associates (H+A) name and logo was removed. Figures 1.3, 1.4, 1.24, 2.1, and 2.4 were also altered, albeit slightly, and should have had the logos removed. The changes to these latter figures were adding a dry well, adding area hazardous waste sites, changing a footnote and title, adding "1981" to a title, and adding several 1981 sampling locations, respectively. Figure 1.4 should not contain the Pasadena address of H+A. However, it should be noted that H+A's Pasadena address was present in the electronic version of the figure provided to EPA by H+A for the revision of the RI Report. EPA presently has no plans to include the name of its consultant, CH2M Hill, on the figures.

H-3.3 Page 1-3: The statement that *"EPA has....deleted or altered language that was biased or reached technically inappropriate conclusions"* presupposes that EPA's language is unbiased and reaches technically appropriate conclusions. Such language is inflammatory and inappropriate and should be deleted. At a minimum EPA should revise the statement to read "EPA has...deleted or altered language which in EPA's opinion was biased or reached technical conclusions that did not comport with EPA's opinion. In its place EPA has inserted text that is more consistent with EPA's opinion."

241 EPA Response:

EPA does not believe that the statement EPA has made is inappropriate. That such statements are EPA's opinion is inherent since EPA is the one evaluating Montrose's draft and revising the report.

H-3.4 Page 1-6: EPA should provide data and references for the statement "*EPA conducted a CERCLA inspection at the Montrose plant in 1982, during which DDT was detected in surface water drainages leaving the plant property in the nearby Normandie Avenue ditch*" The sample dates, sample locations, sample matrices, laboratory reports, and QA/QC documentation should be provided, and the results should be tabulated and presented along with the results of the preceding 1981 data and subsequent 1983 to 1988 data.

242 EPA Response:

The RI Report did not rely on or use the numerical results from the CERCLA inspection in question. All data and the report from the CERCLA inspection itself are available in the administrative record.

H-3.5 Page 1-52: EPA should indicate that Pre-RI activities were conducted during the period from 1981 into 1985 as opposed to 1982 through 1985.

243 EPA Response:

The text should read "Pre-RI activities were conducted during the period from 1981 to 1985."

H-3.6 Page 1-52, Figure 1.24: Figure 1.24 should be updated with sampling events conducted in 1981, 1982, 1994, 1995, and 1997.

244 EPA Response:

Montrose's consultants prepared this figure. EPA assumes it was submitted by Montrose in good faith and without intentional omission or error. In the interest of completing the Montrose Site RI Report and moving ahead with remedy selection, EPA believes that revising Figure 1.24 as suggested is not warranted. The sampling events are described in detail in Section 2.0 of the RI Report.

H-3.7 Page 1-52: EPA should reference the basis for its discussions regarding sampling conducted in 1981 and prepare parallel factual discussions for each sampling event. EPA should clarify which ditch the February 1981 samples were collected from and what analyses were performed. EPA should provide the laboratory reports and backup QA/QC data from each analytical laboratory and tabulate the results. EPA should present and organize the data and references provided in Appendix L in such a manner that they are useable to the reader.

245 EPA Response:

A Montrose interoffice correspondence (Document 54 in Appendix L of the Montrose Site RI Report) from John Kallok (former Montrose plant engineering and maintenance supervisor and plant manager) dated May 21, 1981, states that the February 1981 samples were collected from "a common storm drainage ditch serving the Montrose and Jones Chemical facilities." The 1981 sampling including analytes is also discussed in Sections

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247 EPA Response:

For the purposes of discussion, it was reasonable to describe the "mud" samples as soil samples. There is no significant inconsistency.

H-3.10 Page 1-59: EPA should explain the meaning of the word "*developed*" in the statement "*...12 were developed for VOCs.*"

248 EPA Response:

The text should read ". . . 12 were analyzed for VOCs."

H-3.11 Page 1-59: EPA should identify the lead agency and provide the current status of investigations being conducted at Jones Chemical Company.

249 EPA Response:

For the purposes of the discussion in Section 1 of the RI Report, EPA believes the information provided is sufficient.

H-3.12 Page 1-60: EPA's discussion regarding Neighboring Investigations omits investigations being conducted at Del Amo, McDonnell Douglas, Amoco Chemicals, Trico Industries, Mobil Refinery, International Light Metals, Akzo, Armco Royal Boulevard, Golden Eagle Refinery, and a variety of other neighboring sites. For completeness, EPA should expand its discussions to include an overview of the history, regulatory status, lead agency, and current investigation status of these neighboring investigations.

250 EPA Response:

For the purposes of the discussion in Section 1 of the RI Report, EPA believes the information provided is sufficient. Information about the other investigations can be obtained from the State of California, and from EPA for the Del Amo Site.

H-3.13 Page 1-60: For clarity, the following statements should be revised as indicated: "*In 1994, the Farmer Brother* ['s Coffee Company] *began construction of a building expansion on the* [north-]*east side of* [its] *property. Because* [of] *the proximity...*

251 EPA Response: EPA concurs that the wording is better as suggested by the comment.

H-3.14 Figure 1.3: EPA should provide the reference for the "Dry Well" added to this figure.

252 EPA Response:

The source is: Levine-Fricke, Preliminary Endangerment Assessment, Jones Chemicals Facility, Torrance, California, June 28, 1995.

H-3.15 Figure 1.4: For clarity, accuracy, consistency, and completeness EPA should use the term "Montrose Property" as opposed to "Montrose Chemical Site" when referring to the Montrose Property; EPA should show the geographic boundaries of Mobil, Farmer Brothers, Golden Eagle, Gardena Landfill, Cal Compact Landfill, and other sites that are currently omitted (e.g. Akzo etc.). EPA should clarify the meaning and significance of the term "Del Amo Site 'Panhandle'."

253 EPA Response:

The figure should read "Montrose Property." EPA believes the general location of other hazardous waste sites presented on the figure is adequate for the purposes of this figure. The majority of these other sites are identified in the JGWFS. The term "panhandle" is a common geographical term. In fact, the commenter has used this term in Comment No. H-3.64. This portion of the Del Amo Superfund Site is discussed in the text on page 1-36. The "panhandle" was addressed in responses to previous comments.

RI SECTION 2: Site Investigation Activities

H-3.16 Page 2-3: EPA indicated that *"Available documentation does not indicate why those five specific areas were selected for sampling. However it is likely that these areas were selected because they were potential waste discharge areas."* The second sentence regarding the 1983 sampling is speculative and should be deleted:

254 EPA Response:

The statement is, indeed, speculative. However, the presumption of a "potential waste discharge" is inherent in any environmental sampling.

H-3.17 Sections 2.3 and 2.4: EPA should provide a more thorough discussion regarding the scope, objectives, rationale, methods, and procedures for the additional EPA 1994 sediment and surface water sampling conducted by CH2M HILL. In addition, the corresponding tables should be updated and appended.

255 EPA Response:

The requested information can be found in the following document (referenced in Section 2.3, page 2-18 and Section 2.4, page 2-22): Field Report, Surface Water, Sediments, and Biological Sampling in Stormwater Pathway from Montrose Chemical Company to Los Angeles Harbor, Montrose Superfund Site, Torrance, California. Prepared for U.S. EPA, Region IX, by CH2M HILL, July 31, 1995.

H-3.18 Figure 2.1: This figure does not show 1981 soil sample locations as the title implies and as indicated in the text on Page 2-2.

256 EPA Response:

The 1981 soil sampling locations are shown in Figure 5.2.

RI SECTION 3: Data Quality

H-3.19 EPA's data quality evaluation presented in Section 3 appears to focus primarily on groundwater. For completeness EPA should provide the results of data quality evaluations and supporting documentation for each of the following events:

1981 data added by EPA

1982 EPA data

1983 soil sampling data

1985 EPA soil sampling conducted by M&E

1986 EPA soil sampling conducted by E&E

1985-1988 RI Soil Data

1994 EPA sampling conducted by CH2M HILL

1997 Northwest Corner Sampling (McLaren)

257 EPA Response:

In the interest of completing the RI Report and moving ahead with a groundwater remedy, this section focuses on groundwater data quality. If necessary, this section of the Remedial Investigation Report may be supplemented with the requested information for soil at a later date.

RI SECTION 4: Physical Characteristics

H-3.20 EPA did not incorporate soil moisture and pH data from the 1981 sampling. For consistency and completeness EPA should tabulate these data, present them on the appropriate corresponding maps, and evaluate them along with the other available data.

258 EPA Response:

In the interest of completing the RI Report and moving ahead with remedy selection in this ROD, EPA believes that tabulating such data is not warranted at this time. The requested information can be found in Appendix L of the RI Report. If necessary, the data may be tabulated in a supplement at a later date.

H-3.21 Pages 4-23 through 4-28: EPA has prepared isoconcentration contour maps for TDS, Chloride, Sulfate, and TOC in groundwater. EPA should:

a) Be consistent with EPA's prior direction to Montrose to include water quality data from other nearby sites (e.g. Del Amo, McDonnell Douglas, Trico, Amoco, Armco etc.).

b) Update and revise the text discussions and conclusions as appropriate, after the above-referenced additional data are incorporated

259 EPA Response:

EPA prepared the isoconcentration contour maps for TDS, chloride, sulfate, and TOC in groundwater from the existing data from Montrose water quality database at the time the maps were prepared. These maps were prepared to show the overall concentration trends of dissolved major inorganic constituents (TDS, chloride, and sulfate) and organic indicator parameters (TOC) in groundwater. The distribution of data is sufficient to support the contouring where provided on the figures.

3. To ensure objectivity, EPA should refrain from speculating in the absence of data. For example from Page 4-28:

"It is anticipated that if wells on the Montrose Property were analyzed for TOC, the TOC plume may be shown to originate at Montrose"

"it appears a TOC plume exists in the Gage Aquifer"

260 EPA Response:

The contoured data for TOC in groundwater (Figure 4.27) strongly indicate that the source of TOC in groundwater originates at the Montrose Chemical Site, even in the absence of data for any of the monitoring wells located on the Montrose Property. In addition, the shape and extent of the TOC plume and the location of the plume axis is almost exactly the same as that for p-CBSA in groundwater within the Bellflower Sand (Figure 5.58). Of those organic contaminants that have been identified in groundwater beneath or downgradient of the Montrose Chemical Site, p-CBSA is the largest contributor to the TOC value in groundwater. In addition, the highest concentrations of p-CBSA have been shown to be present beneath the Site. Therefore, the sampling of monitoring wells on the Montrose Property is strongly expected to confirm the hypothesis that the TOC plume originates on the Montrose Property. Only a limited number of well analyses were available for TOC in the Gage Aquifer. Here again, given the primary contribution of the p-CBSA concentrations on the TOC values and the extent of the p-CBSA plume within the Gage Aquifer (Figure 5.59), a TOC plume can reasonably interpreted with the available data.

d) Table 4.1 should be updated with the 1981 data

e) Table 4.4 should be re-aligned.

f) Figure 4.7 should be updated with 1981 data.

g) Figure 4.8 should be updated with 1981 data.

261 EPA Response:

In the interest of completing the RI Report and moving ahead with a groundwater remedy, EPA believes that revising Tables 4-1, 4-4 and Figures 4.7 and 4.8 is not warranted at this time. The requested information can be found in Appendix L of the RI Report. If necessary, the tables and figures can be revised in a supplement at a later date.

- The date for the Model Input Arrays in the explanations for Figures 4.14, 4.15, 4.16, and 4.17, should be corrected from 1987 to 1997

262 EPA Response:

Comment noted.

- Figures 4.23a, 4.23b, 4.23c, 4.24a, 4.24b, 4.24c, 4.25a, 4.25b, 4.25c, 4.26, 4.27, and 4.28 should be updated and revised as previously discussed to include Del Amo and other site vicinity water quality data and to reflect the timing and origin of sample data. Figure 4.24b is incorrectly contoured in the vicinity of the Montrose Property.

263 EPA Response:

See response to H-3.21 (c).

RI SECTION 5: Nature and Extent of Contamination

H-3.22 Page 5-1: EPA should indicate that RI field work began in 1985. Sampling conducted in 1981 and 1983 prior to the RI was not part of the RI investigation. Work conducted in 1995 and 1997 was a supplement to RI field work.

264 EPA Response: This information is discussed in Chapter 2 of the RI Report. Section 5 of the RI Report discusses nature and extent of contamination. The facts provided in the comment are, essentially, correct.

H-3.23 Page 5-2: and "Note to Reader" before Section 5 Figures: EPA overemphasizes the significance of dry vs. wet weight sample results. EPA should provide the reader with the following perspective regarding dry vs. wet weight results:

The difference between dry vs. wet weight analyses, which is expected to average about 12 percent, is not significant.

The difference between dry vs. wet weight results is within the range of laboratory acceptance criteria for soil sample analyses which is generally on the order of about 30%.

Given the 6 orders of magnitude range in concentrations detected, the difference between dry vs. wet weight is not significant.

The difference between dry vs. wet weight results is less than sample variability typically resulting from soil matrix heterogeneity.

The difference is within the range of reproducibility in comparing duplicate and split sample results.

Samples were analyzed in accordance with EPA methods. The only difference is that the analytical laboratories reported the results on a wet weight basis.

Results reported on a wet weight basis may actually be more representative for risk assessment, feasibility study, and remedial action purposes since wet weight results reflect actual soil conditions at the site.

265 EPA Response:

The text suggested above is unnecessarily long and obscures the fact that DDT concentrations in soil in this report are, on average, 12 percent lower than what should have been reported using standard EPA reporting protocols. This simple conclusions stands and EPA has not made any further conclusions about the "significance of wet-weight samples." EPA does not refute the fact that there are other sources of variability in soil samples, some of which may exceed the expected variability due to using wet-weight samples. The wet-weight issue causes a systemic bias toward low results, however, which cannot be treated as any other form of variability.

The statement that wet-weight results are more representative from a risk standpoint because they represent actual conditions at the site is not clear. There is no connection between the effect on laboratory analysis of using wet samples, on the one hand, and the effect of a chemical on the body when ingesting a wet sample, on the other. All health-based standards assume that environmental samples being compared to the standard will be reported on a standardized dry-weight basis. Montrose did not report on this basis and did not follow the standard. Hence, a notice to that effect is warranted.

The point that soil samples span 6 orders of magnitude does not necessarily mean that a wet-weight bias will not be significant for samples at a particular location.

Whether 12 percent is significant, likewise, may depend to which the data are being put.

H-3.24 Page 5-2: For clarification EPA should resolve the apparent discrepancy between the statement on page 5-2 *"alpha-BHC generally comprises about 50 percent of the total BHC"* with the statement on page 5-25 *"the majority of the BHC detected at the Montrose Chemical Site was alpha-BHC"*

266 EPA Response:

The two statements are entirely consistent. To illustrate, assume that exactly 50 percent of the total BHC is actually alpha-BHC. The remaining 50 percent of the total BHC would be either beta-, delta-, or gamma-BHC. If more than one of the other isomers is present in the sample in any amount (as was the case in most samples), the majority of BHC would be alpha-BHC.

H-3.25 Page 5-3: For completeness EPA should expand the discussion of supplemental data to include (at a minimum):

Del Amo

McDonnell Douglas

Trico

Armco

Amoco

267 EPA Response:

EPA believes that revising this section with additional information on these sites is not necessary. The necessary information on these sites with respect to the joint groundwater is present in the Del Amo Groundwater RI Report, the JGWFS, and in the administrative record. Information about the other investigations can be obtained from the State of California and EPA with respect to the Del Am o Site.

H-3.26 Page 5-5, Third full paragraph: EPA should provide rationale for using a concentration threshold of 1,000 mg/kg for Total DDT as a key criterion for comparing soil concentrations.

268 EPA Response:

EPA believes that 1,000 mg/kg is a reasonable threshold for discussion of high concentrations of DDT, not only based on the distribution in the data itself but on the fact that levels of in excess of 1000 mg/kg would clearly represent an unacceptable cancer risk. This level is not a "criterion" as in a health-based criterion.

H-3.27 Page 5-7, Second full paragraph: EPA introduces the term "hot spots" for describing high concentrations of DDT Off-Property, but does not provide the basis or quantitative criteria for use of the term.

269 EPA Response:

The term "hot spots" is a term commonly used in the environmental field to indicate an area of contamination that contains higher concentrations of contaminants relative to the immediate surrounding area. The term "hot spot" is typically used to describe contamination in general terms and, as a result, there are no industry-accepted criteria for defining a hot spot. It should be noted that Section 5.2 of the RI Report is a summary section, describing DDT contamination in relatively general terms. Section 5.4 describes the concentration of DDT in the soil in more quantitative terms.

H-3.28 Table 5.1A: The many subjective descriptions should either be quantified or deleted (e.g. "greatly exceed", "many samples", "frequent detections", "some above PRGs", "mostly", "mainly", and "about").

270 EPA Response:

EPA is using these terms to generally describe contamination in a summary section. These terms are appropriate for this type of summary discussion. A more quantitative discussion is provided in Section 5.4 of the RI Report. In fact, EPA deleted the majority of such terms which were in the draft RI Report prior to EPA's taking over the work on the RI Report.

H-3.29 Page 5-10: EPA should eliminate the implication that a 0.1 percent difference in concentration is *"significantly less"*

271 EPA Response:

The text should read ". . . are significantly less (up to 50 percent). . . ."

H-3.30 Page 5-11: EPA should clarify that groundwater plumes are not "*visible.*"

272 EPA Response:

EPA is not implying that the groundwater plumes are literally "visible." In the context of the discussion on page 5-11 and the rest of the RI Report, the term is used to mean that a sufficient number of areally distributed groundwater monitoring well analysis are available within a particular hydrogeologic unit to contour a plume of groundwater contamination.

H-3.31 Page 5-11: EPA should provide the primary reference of the statement *"chloroform was present as an impurity."*

273 EPA Response:

The reference is: Kennedy/Jenks/Chilton, Report of Technical Documents Review and Groundwater Sampling, prepared for McDonnell Douglas Corporation, Torrance, California, June 12, 1991. In this document, it is stated that the Montrose facility in Henderson, Nevada, has reported that the chloral/chlorobenzene mixture produced for the Montrose Torrance facility also contained 0.1 to 0.2 percent chloroform by weight.

H-3.32 Page 5-12: The statement that "a plume could be present but undetected" is speculative and should be deleted.

274 EPA Response:

The quoted statement is true. Due to detection limits up to 300 μg/L for chloroform, concentrations up to that value could not be detected. Given the fact that chloroform concentrations up to 11,000 μg/L are present in groundwater within the Upper Bellflower Aquitard beneath the Central Process Facility, the complete absence of chloroform within the Bellflower Sand is surprising. The elevated detection limits provides a logical explanation as to why the chloroform is not observed within the Bellflower Sand.

H-3.33 Page 5-12: EPA introduces the concept of a "*regional benzene plume*" in the Bellflower sand which extends downgradient from the Montrose Property. EPA should refrain from using

the phrase "regional benzene plume" and the implied association with the Montrose Property, and should expand the discussion regarding uncertainties regarding the origin of benzene detected in the Bellflower Sand.

275 EPA Response:

The uncertainties regarding the origin of benzene are discussed in Section 5.2.3.5 of the Montrose Site RI Report. Possible sources include other sources besides Montrose. It is true that the benzene referred to is downgradient of the Montrose property.

H-3.34 Page 5-13. The statement "*The results* [of surface water analyses] *indicate a decrease in DDT concentration with distance from the Montrose Property*" should be qualified to indicate (1) concentrations of DDT detected in surface water were low, and (2) the ability to draw conclusions regarding the origin of low concentrations of DDT detected in downstream areas is complicated due to the widespread historical DDT use.

276 EPA Response:

EPA agrees that the DDT concentrations in surface water downstream from the Montrose Property are low compared to the concentrations close to the Property. However, if the low concentrations in downstream areas were assumed to be due to widespread historical use of DDT, the gradient indicating contamination from the Montrose Property would be even greater!

The notion of historical use of DDT in the area surrounding the Montrose plant is in contention. While there was agricultural use in the area, it had generally ceased prior to the time when DDT was first introduced and used. EPA has no information documenting that mosquito abatement districts in the area used DDT (although we cannot rule out the existence of such records).

H-3.35 Page 5-14: EPA should remain consistent in reporting units of measure for chemical concentrations (e.g. ug/kg v. mg/kg).

277 EPA Response:

While not incorrect, for maximum clarity the concentration on the last line of the third paragraph on page 5-14 could state that ". . . DDT was detected in near-surface soils in the east and southeast portion of the Property at concentrations over 1,800 mg/kg."

H-3.36 Page 5-14 and Figure 5-3: EPA should report which results from which of the three analytical labs are presented for the May 1981 sampling. EPA should present the results from each of the three laboratories in tabular form.

278 EPA Response:

The results from two of the laboratories are provided in Appendix L of the Montrose Site RI Report. The results from Stauffer are provided in Figure 5-3.

H-3.37 Page 5-14: EPA should provide the basis and rationale for the statement *"Stauffer Chemical Company, for and at the direction of Montrose"*

279 EPA Response:

The Stauffer memorandum which reports the results of this sampling effort was addressed to the president of Montrose Chemical, S. Rotrosen, and includes an offer of additional assistance, "if requested." See Memorandum from T.J. Meyers and J.A. Johnson, Stauffer de Guigne Technical Center-Richmond, to S. Rotrosen dated August 4, 1983 (A.R. No. 0459; EPA DCN 0639-03607). The memorandum also states that sampling locations were designated by Montrose "consultants" (and former employees) J. Kallock and B. Bratter. These facts are more than sufficient to support the interpretation that the sampling was "for and at the direction of Montrose."

H-3.38 Page 5-16: EPA should substitute a more quantitative comparison in place of the phrase *"elevated DDT concentrations."*

280 EPA Response:

The statement is quantified in the next sentence where it states, "Over 90 percent of the samples collected in 1981 and 1983 exceed EPA Region IX's Preliminary Remediation Goal (PRG) of 1.3 mg/kg established for residential soil."

H-3.39 Page 5-16: Table 5.5A, which reportedly shows DDT results for the northwest corner investigation conducted in 1997, should be provided.

281 EPA Response:

The text should refer to Figure 5.5A.

H-3.40 Page 5-17 and Figure 5.5A: EPA should present the results of the northwest corner sampling in the same tabular format and on the same figures as are used for presenting other soil sampling results. The legend to Figure 5-5A is confusing to the reader. EPA needs to define and discuss the terms "grid point", "biased point" "shallow" vs. "subsurface" and "CLP Pesticides", as well as an explanation for "immunoassay" results. For ease of use by the reader to compare results, EPA should provide the soil boring identifiers for pre-1987 samples and other relevant reference points such as the outline of the Central Process Area. EPA should also provide the rationale for why these results are considered "preliminary" as indicated in the Title Block.

282 EPA Response:

The results of the Northwest Corner investigation are presented in Figure 5-5A in a format different from the other data because EPA believes it is an effective method of showing the results of the immunoassay and the CLP analytical results together on one figure. Because of the number of samples, the presentation of the data on a smaller scale map (e.g., Figure 5.5) would be very crowded and difficult to read. Montrose's consultants prepared this figure as a part of the report on the Northwest Corner investigation. EPA scanned the figure and included it in the report. In the interest of completing the RI Report and moving ahead with remedy selection, EPA believes providing additional reference points in Figure 5-5A is not warranted. The figure is "preliminary" because EPA has not approved the Northwest Corner investigation report for the reasons described in the response to H-1.2.

The Northwest Corner sampling is described in greater detail in Appendix K. Montrose, who prepared the northwest corner sampling report, should provide the suggested information. However, this information is not necessary or pertinent to the groundwater remedy selection.

H-3.41 Page 5-18: EPA should revise the statement *"the results of the northwest corner investigation in 1997 indicates that high concentration of DDT may have been diluted by the grading..."* to describe the difference between pre-grading and post-grading surface elevations which indicates that after the 1985 grading and capping, the northwest corner of the Property appears to have been a "cut" area. The results of the 1997 sampling are most likely representative of the original soil remaining in-situ after cutting, and would not therefore be expected to be subject to mixing or dilution.

283 EPA Response:

By its very nature, grading of the Property no doubt would have mixed, diluted, and spread the high concentrations of DDT contamination from the Northwest Corner to other parts of the Property. It should be noted that Figure 2-2 indicates that even though the

majority of the western portion of the Property was a cut area, a portion of the Northwest Corner had no change in elevation. Also, the commenter has no basis for assuming that the "cut" was "clean," that is, that all material that was cut was completely removed and none mixed in with the soils below the "cut." Given the operation was done with bulldozers, this cannot be assumed. By spreading the material, it is not surprising that the concentrations in the northwest corner may have dropped from pre-grading levels.

H-3.42 Page 5-18: For clarity, consistency, and completeness, EPA should provide the rationale for excluding the sampling conducted in 1997 from discussions provided in this section.

284 EPA Response:

The results of the Northwest Corner sampling are briefly discussed on this page (page 5-18), in the first paragraph, in the next to last paragraph, and in the last paragraph. The results are discussed in more detail in Appendix K.

H-3.43 Page 5-18: For clarity, EPA should provide the basis for its definition of "*successful*" characterization; provide concentration thresholds for defining "*DDT soil contamination*"; indicate the specific areas Off-Property for which DDT in soil is not "*successfully characterized*"; and provide the criteria that form the basis of determining at what point the extent of DDT concentrations Off-Property will be considered "*fully assessed.*" At this stage in the RI process, and after approximately 18 months since the northwest corner data were obtained, EPA should explicitly identify what and where "*further sampling may be required*", the objective and rationale for that sampling, and the projected schedule for its completion.

285 EPA Response:

A key measure of a successful investigation would be accomplishing the objectives established in the sampling plan for the investigation. In this instance, Montrose did not meet the stated objective of assessing the extent of DDT in soils off-property (this objective can be found on page 1-2 of the Northwest Corner report in Appendix L of the Montrose Site RI Report). Six samples collected just west of the Montrose Property boundary contained DDT concentrations higher than the residential PRG for DDT. Because there were no samples collected to the west of these detections, extent of the contamination to the west is not defined. For this reason, EPA has stated that further sampling may be required. See earlier responses to the same comment earlier.

H-3.44 Page 5-19: The expression "*DDT concentrations are still quite high*" is subjective. For clarity EPA should substitute a more quantitative description or comparison.

286 EPA Response:

This statement is part of a topic sentence comparing DDT concentrations in the depth interval 3 to 6 feet bgs. The statement is quantified in the next two sentences where it states, "Over 55 percent of the soil samples collected in the Central Process Area exceed the PRG. The highest concentration of total DDT detected in soil samples collected from the Central Process Area in this depth interval was 4,460 mg/kg in a soil sample collected from Boring 14D at 5 feet bgs."

H-3.45 Page 5-20: EPA should provide the basis for the statement "*highly mobile solvents like chlorobenzene.*"

287 EPA Response:

The mobility of VOCs is discussed in Section 6.2.2.1 of the RI Report.

H-3.46 Page 5-21: EPA should revise the sentence "*Concentrations of DDT detected in near Off-Property two soil samples in two borings...*"

288 EPA Response:

The sentence should read, "Concentrations of DDT detected in soil samples in near Off-Property soil borings in the interval from 6 to 10 feet bls were less than 1.0 mg/kg."

H-3.47 Page 5-24: EPA should explain the notation: "*It should be noted that other figures and tables, except table 5-1A, in this report do not include this data*"

289 EPA Response:

This statement is included because it is EPA's understanding that Montrose did not include the Farmer Brother's and Jones Chemical data in preparing its prevalence tables (e.g., Table 5.1F).

H-3.48 Page 5-25: EPA should explain and resolve the apparent inconsistency between the sentence "*...the majority of the BHC detected at the Montrose Chemical Site was alpha-BHC*"

on this page and the sentence on page 5-2 that states *"alpha-BHC generally comprises about 50 percent of the total BHC..."* For ease of use by the reader, a factual presentation of the number of samples collected and the frequency of detection and concentrations of each isomer detected would be more meaningful and more useful.

290 EPA Response:

See response to Comment H-3.24. EPA believes that further breakdown in reporting the isomers of BHC is not warranted at this time.

H-3.49 Page 5-28: EPA should explain the notation *"Other figures and tables in this report do not include the 1994 data."*

291 EPA Response:

See response to Comment H-3.47.

H-3.50 Page 5-29: EPA should explain the distinction, if any, between the *northwest corner* of the property and the *western portion* of the Property.

292 EPA Response:

As used here, there is no distinction. The Northwest Corner was where high levels of DDT were originally found spawning the need for additional investigation; that investigation spread to include the entire western boundary of the property in addition to the northwest quadrant.

H-3.51 Page 5-33: EPA should provide the primary reference for the statement *"chloroform ...was known to be an impurity in the chloral chlorobenzene mix"*

293 EPA Response:

The reference is Kennedy/Jenks/Chilton, Report of Technical Documents Review and Groundwater Sampling, prepared for McDonnell Douglas Corporation, Torrance, California, June 12, 1991. In this document, it is stated that Montrose's Henderson, Nevada facility has reported the chloral/chlorobenzene mixture produced for Montrose's Torrance facility also contained 0.1 to 0.2 percent chloroform by weight.

H-3.52 Page 5-34: EPA stated that "*benzene found in the saturated zone emanating from the Montrose Property.*" In light of the other confirmed and potential sources of benzene in the immediate vicinity of the Montrose property, EPA should provide the basis for the speculation that benzene is "emanating" from the Montrose Property.

294 EPA Response:

The quoted sentence is not complete and is taken out of context. The full sentence reads, "*Therefore, while the soil samples analyzed did not reveal significant benzene, there are several possible contributors of the benzene found in the saturated zone emanating from the Montrose Property.*" In the sentence that immediately follows the quoted sentence, possible additional sources (contributors) of benzene are identified including the Del Amo Site, fuel transmission pipeline in the LADWP right-of-way, and the underground fuel storage tanks located at Jones Chemical Company. Benzene may be emanating from the Montrose property because benzene was a contaminant in industrial chlorobenzene, because of releases from Montrose's gasoline storage, or because of the activity at the Stauffer BHC plant. It is true that not all of the possible sources just-mentioned are on the Montrose property; hence, the sentence would have been more clear if it had not used "emanating from" and instead used "extending downgradient of."

H-3.53 Page 5-34: EPA should provide the basis for the statement *"the 0.3 percent benzene which occurred as an impurity"*

295 EPA Response:

Comment noted.

H-3.54 Page 5-34: EPA states ... "*Jones Chemical, for some period of time, may have dumped some of its wastes into the Montrose wastewater recycle pond at the time that the LADPW canceled Jones Chemical's permit...*" [note: emphasis added]. EPA should quantify the period of time, refrain from use of language such as "dumped"; quantify the volume of "waste"; define the nature and composition of the waste; specify the time at which the permit was canceled; and provide supporting references.

296 EPA Response:

The permit was canceled in 1971. The verb "dumped" is an appropriate term; Jones Chemical may have hauled waste to the Montrose wastewater recycle pond and dumped it. As noted on page 1-23, the reference for this discharge of waste is an LADWP inspection card dated May 26, 1971 (Document 30 in Appendix L of the Montrose Site RI Report). The document does not indicate composition of the waste nor how long of a time period the waste was dumped in the wastewater recycle pond, hence EPA cannot provide this information.

H-3.55 Page 5-34: EPA should revise the statement "*the locations of the soil samples collected in this RI were not necessarily sufficient to fully evaluate this potential release point for PCE. Therefore, the Montrose Property may potentially be a contributing source of PCE to the subsurface..*" EPA is now in the business of identifying "data gaps" and "data deficiencies" for soil data that were generated more than 10 years ago. For completeness, context, and ease of understanding by the reader, EPA's discussion should reflect that PCE was neither a target chemical nor a compound of concern in conducting the Montrose RI; that although the RI sampling was not conducted specifically to evaluate the occurrence of PCE in soil, soil samples were analyzed for VOCs in general; the RI data indicate that the Montrose Property as a whole was not a significant contributor of PCE to the subsurface, if at all; that the Jones Chemical PEA sampling was conducted to evaluate the occurrence of PCE in soil and soil gas, and that Jones Chemical does appear to be a significant contributor. EPA should present and discuss the results of the Jones PEA sampling. It should not be unreasonable at this time to expect that EPA should be in a position to specifically identify the objectives, rationale, and locations for additional sampling that would be sufficient to fulfill EPA's objectives to "fully evaluate this potential release point."

297 EPA Response:

Information is now available that indicates the use of significant quantities of PCE on and adjacent to the Montrose Property. Because this information was discovered after soil sampling, the locations of the soil samples were not necessarily sufficient to fully evaluate potential release points for PCE. For that reason, EPA cannot conclude that the Montrose Property was not a contributor of PCE to the subsurface. Soil sample results from the PEA

conducted at the Jones Chemical are presented in Figures 5.35, 5.36, and 5.37 and discussed on page 5-34. EPA agrees that there is substantial evidence that Jones Chemicals is a contributor of PCE and TCE. Furthermore, it is possible that Montrose is not a contributor of these compounds. Nonetheless, the distribution of PCE under the Montrose property does not rule out a Montrose potential contribution. EPA does not find Montrose at fault for not sampling for PCE in the original investigation; yet, what the available data show and do not show are simple facts regardless.

H-3.56 Page 5-58, fourth paragraph: EPA wrote ".. *groundwater samples collected from Upper Bellflower Aquitard Monitoring Well MW-25 have previously averaged approximately 900 ug/L, the results of the December 1995 sampling event were only 44 ug/L and 59 ug/L.....These values are much less than the previous data, and indicate that the 1995 data may be anomalous. Additional sampling is needed to confirm the chlorobenzene concentration at this location.*" EPA's proposal that additional sampling is necessary to confirm chlorobenzene concentrations in groundwater at monitoring well MW-25 is not warranted.

EPA provides possible reasons for declines in chlorobenzene concentrations in several monitoring wells completed in the upper Bellflower aquitard. The reasons stated are not consistent and at times different reasons are given for the same well in separate sections of the report. These sections should be rewritten for consistency. The following excerpts were taken from the report as examples of the inconsistencies.

H-3.57 Page 5-46, second paragraph, "*The large decrease in concentrations of chlorobenzene observed at Monitoring Wells MW-5 and MW-9 may be the result of either: (1) the dissolution of DNAPL residuals and adsorption of contaminants to aquifer sediments, (2) the presence of previously occurring lateral flow of groundwater or vadose zone water containing high dissolved chlorobenzene concentrations during plant operations, or (3) infiltration of surface water during the late 1995 rainy season and subsequent dilution of dissolved contaminants.*"

H-3.58 Page 5-50, third paragraph, In discussing the decrease in 1995 chlorobenzene concentrations in groundwater from wells MW-05, MW-06, MW-09, MW-10, MW-25, and MW-27, EPA wrote "*The reason for the decrease is not known, but may be due to (1) rapid infiltration of rainfall during the above-average late 1995 winter rainy season in the Los Angeles Area and the resultant dilution of dissolved groundwater contaminants at the water table or (2) potential QA/QC problems.*

H-3.59 Page 5-59, first paragraph, In discussing 1995 concentrations of chlorobenzene in groundwater from monitoring wells MW-5, MW-9, MW-10, and MW-11 EPA wrote "*The substantial reduction in concentrations of chlorobenzene detected in groundwater samples collected from these monitoring wells is not readily explainable based on concentration trends*

over time, changes in water levels, or distinct changes in observed directions of groundwater flow. Potential explanations for the..... include rainfall infiltration and percolation of water from leakage or seepage from or along the alignment of the nearby sewer lines paralleling Normandie Avenue resulting in flushing or enhanced biodegradation of chlorobenzene."

H-3.60 Page 5-59, second paragraph, In discussing 1995 concentrations of chlorobenzene in groundwater from monitoring wells MW-6, and MW-25, EPA wrote "*The reduction in concentrations .... is not readily explainable based on the available data, but given the fact that these are water table monitoring wells located along the margin of the chlorobenzene plumes the reduction may be attributable to such factors as the rise in water levels, a change in the direction of groundwater flow, or biodegradation.*"

Measured chlorobenzene concentrations in several monitoring wells decreased in December 1995 from previous sampling events. EPA proposes several reasons why the concentrations may have decreased but concludes that the decrease in concentrations is not readily explainable from the available data.

An evaluation of groundwater gradients at the site over the past decade provides a reasonable explanation for the observed decrease in chlorobenzene concentrations in groundwater from wells located in the vicinity of the Central Process Area. In the mid-1980's groundwater gradients in the upper Bellflower aquitard, beneath the Central Process Area, formed a radial pattern outward from the Central Process Area. The radial flow pattern was likely associated with mounding of groundwater in the upper Bellflower aquitard. By the end of the 1980's and beginning of the 1990's, the observed mounding had dissipated and groundwater gradients in the upper Bellflower aquitard assumed a generally south to southeast direction. For monitoring wells MW-5, MW-9, MW-11, and MW-27, the observed decrease in chlorobenzene concentrations in 1995 is not surprising because groundwater no longer flows from the source area (the CPA) towards the wells. It is expected that shifting groundwater gradients in the vicinity of MW-6 are responsible for the observed decrease in chlorobenzene concentrations in this well also.

Monitoring well MW-25 also showed a decrease in chlorobenzene concentrations in groundwater in 1995. Previously the high concentrations of chlorobenzene observed in groundwater at this well location were believed to be associated with upward migration of chlorobenzene impacted groundwater from the underlying Bellflower sand. In 1995 a downward gradient between the upper Bellflower aquitard and the Bellflower sand was present. This downward gradient would likely prevent upward migration of chlorobenzene impacted groundwater from the Bellflower sand and could cause the decrease in concentrations observed. Additionally, because it is not likely that a fixed source exists in the vicinity of MW-25, small changes in the horizontal groundwater gradients in the upper Bellflower aquitard could shift the chlorobenzene plume in the vicinity of the well causing significant changes in groundwater concentrations at that location.

Although EPA provides several possible explanations which could account for decreased concentrations in the above mentioned wells, changes in the groundwater gradients within the upper Bellflower aquitard are likely responsible for the majority of the observed concentration decreases. Unless specific QA/QC problems with the data are uncovered, the data should be considered valid.

298 EPA Response:

H-3.56 through H-3.60 Response: The reason provided by the commenter for the decrease in chlorobenzene concentrations (change in local hydraulic gradient) is reasonable and represents another potential mechanism that may be responsible for the concentration reductions during the 1995 groundwater monitoring round. The 1995 groundwater monitoring data were in the RI to assess the nature and extent of groundwater contamination.

H-3.61 Page 5-48: EPA should resolve the difference between the implication here and on page 5-76 that 1,2-DCA is a *"common degradation product of TCE and PCE, which is known to exist in groundwater in the vicinity of the Montrose Chemical Site"* with the statement on Page 5-76 that *"the presence of 1,2-DCA does not correlate well with the presence of TCE or PCE in groundwater. Therefore, the source of 1,2-DCA appears to be more likely from a fuel or benzene NAPL sources than from TCE and PCE degradation."*

299 EPA Response:

The 1,2-DCA could be present in groundwater either as a previously used additive to leaded gasoline or from the degradation of TCE and PCE. Insufficient data are available to definitively conclude the source of 1,2-DCE.

H-3.62 Page 5-49: EPA should provide the reader with the specific objectives and rationale for the 1995 sampling and indicate what the objectives, rationale and scope of that sampling was, rather than emphasizing what it was not. EPA understates uncertainties regarding the sporadic detection of DDT in groundwater samples and overstates the significance of the detection of DDT in groundwater in order to support subsequent discussions regarding "zones of detected DDT" and "areas of historically detected DDT", which are then used as the basis for a hypothesis which does not adequately address the uncertainties inherent in the data used to develop that hypothesis. EPA needs to present the factual data in a more balanced and objective fashion prior to drawing inferences and conclusions.

300 EPA Response:

The objectives and scope of the 1995 sampling are discussed on page 2-15 and repeated below:

"In November and December 1995, pursuant to EPA's request to obtain additional data to support the Joint Groundwater Feasibility Study (FS) for the Montrose and Del Amo Sites (U.S. EPA, 1998), groundwater samples were collected from 25 Montrose monitoring wells. The purposes of this sampling were to provide a current understanding of groundwater conditions and to verify the existing plume configuration at the Montrose Chemical Site in support of the Joint Groundwater FS. Groundwater samples collected from these wells were analyzed for VOCs. A subset of samples were also analyzed for pesticides and p-CBSA."

EPA used the term "zones of detected DDT" and "area of detected DDT" to describe the area in which DDT has been detected in at least one groundwater sample. This terminology is not meant to imply that DDT is consistently detected in groundwater within these areas. The number of detected values versus the number of groundwater samples is quoted in the text and provided in Table 5.5.

If EPA is going to differentiate between the various isomers of BHC, then EPA should provide the range and average percent concentrations for each of the BHC isomers detected.

301 EPA Response:

Comment noted. The requested information is not necessary for groundwater remedy selection. In the interest of completing the RI Report and moving ahead with a groundwater remedy, EPA believes that calculating the range and average percent concentrations for each of the BHC isomers is not warranted at this time. The requested information can be determined from Table G-1. If necessary, the requested information can be provided in a supplement at a later date.

H-3.64 Page 5-58: EPA's presentation of the data does not provide the reader with a complete sense of the nature and extent of contamination, and the apparent and potential sources. As an illustration, naphthalene is a chemical compound which occurs in groundwater; appears to be related to sources of naphthalene at the Del Amo Site; and does not appear to be related to Montrose operations. The occurrence of naphthalene in groundwater indicates that naphthalene, originating from Del Amo sources east of Normandie Avenue has migrated westward in the vicinity of the "Del Amo Panhandle", across Normandie Avenue and beneath the Montrose Property where naphthalene, as well as elevated benzene and other VOCs, are detected in

groundwater samples collected from Montrose monitor well MW-1. Naphthalene also appears to have migrated southward to the vicinity of the Armco Royal Blvd. site where naphthalene has been detected in samples collected from monitor well MW-25.

302 EPA Response:

This comment is well taken, and may *potentially* represent plausible evidence that contaminants from the Del Amo plant property historically (and most likely, locally) moved toward the Montrose property. While EPA did not include this analysis of naphthalene, EPA specifically included the former Del Amo plant as a possible contributor of the benzene found downgradient of the Montrose Chemical Site. There are other pieces of information that would counter this hypothesis, however. For example, the groundwater directly between (midline) the two plant properties is not contaminated. A final conclusion as to source attribution cannot be made and EPA appreciates the commenter's input in terms of the naphthalene observation.

H-3.65 Page 5-59: EPA should expand its discussion regarding the representativeness of the most recent groundwater analyses, to compare concentrations of other chemical compounds, in addition to chlorobenzene.

303 EPA Response:

A comparison of the 1995 groundwater analyses compared to previous data is provided for chloroform (page 5-67) and benzene (page 5-73). The 1995 data were not intended to provide such information with respect to other compounds.

H-3.66 Page 5-59: The statement that *"the full downgradient extent of the detectable chlorobenzene plume in the Bellflower sand is not defined by the existing monitoring wells"* should be replaced with the statement that "the downgradient extent of chlorobenzene in groundwater at concentrations exceeding both the Federal MCL and the more conservative California MCL for drinking water has been defined."

304 EPA Response:

Both statements are accurate.

H-3.67 Page 5-63: EPA should provide the basis for the statement that *"p-CBSA in groundwater .... occurs west of Western Avenue"* in light of the fact that there are no data presented for monitor wells located west of Western Avenue,

305 EPA Response:

p-CBSA in groundwater occurs as far west as Western Avenue in Monitoring Well BF-32. Given the high concentration of p-CBSA in groundwater from Well BF-32 (7,100 μg/L), it is likely that detectable p-CBSA occurs west of Western Avenue.

H-3.68 Page 5-66: EPA should qualify the statement that *"the extent of the p-CBSA plume in the Lynwood Aquifer is not monitoring [sic] well defined."*

306 EPA Response:

The downgradient extent of *detectable* p-CBSA contamination in the Lynwood Aquifer is not well defined. EPA is not implying that additional data are needed for pCBSA prior to remedy selection. See also Response to H-1.5 b above.

H-3.69 Page 5-66: EPA should refrain from speculation and better qualify such statements as *"Chloroform may exist in groundwater from other monitoring wells at concentrations below the elevated detection limits"*

307 EPA Response:

It is appropriate to call attention to the elevated detection limits for chloroform (up to 300 μg/L) for many of the Bellflower Sand monitoring wells. The elevated detection may mask the potential presence of chloroform in groundwater.

H-3.70 Page 5-68: EPA should rephrase the following statement with regards to choice of such terms as "usual" and "matrix interferences":... *"the usual detection limit of 1 ug/L for chloroform is greatly elevated...due to...matrix interferences ... and a chloroform plume extending downgradient from the Montrose Chemical Site may be present."*

308 EPA Response:

EPA's statement is appropriate.

H-3.71 Page 5-68: EPA should expand or delete the discussion *"chloroform may be present but undetected in other monitoring wells"*

309 EPA Response:

See H-3.69 Response.

H-3.72 Page 5-69 and 5-70: EPA should refrain from speculation with the statement *"It is also possible that a rail tank car carrying chloroform may have spilled on the rail spur north of Montrose, although there are no records nor other soil sampling evidence of such a spill"*

310 EPA Response:

The statement itself identifies that there is no record or other evidence of such a spill. The section merely points out a possibility at an operating facility which had a rail spur and a loading dock because spills are not uncommon when loading and unloading at industrial facilities. The chloroform must have arrived in groundwater directly under the Montrose facility due to some cause; the report merely explores possibilities.

H-3.73 Page 5-70: EPA should provide the basis for use of the term *"hot spot"*, this time in relation to benzene in groundwater.

311 EPA Response:

The term "hot spot" is a term commonly used in the environmental field to indicate an area of contamination that contains higher concentrations of contaminants relative to the immediate surrounding area. The term "hot spot" is typically used to describe contamination in general terms and, as a result, there are no industry-accepted criteria for defining a hot spot.

H-3.74 Page 5-70: EPA should refrain from implying that the *"hot spots"* of benzene are superimposed on the *"backdrop, of a wider distribution of benzene in groundwater at and downgradient of the Montrose Property."*

312 EPA Response:

EPA has attempted to describe the observed concentrations in an unbiased manner. The distribution of contamination does, in fact, support such a statement and EPA sees no reason for refraining from making it.

H-3.75 Page 5-70: EPA should indicate that benzene from Del Amo sources may extend beneath the Montrose Property (e.g. as with naphthalene in monitor well MW-1).

313 EPA Response:

See earlier comment with respect to naphthalene.

H-3.76 Page 5-71: EPA should rephrase the conclusion that *"Near monitoring well MW-20....pure benzene LNAPL has been found in groundwater...but there is no benzene remaining in the vadose zone."* The implications that (1) LNAPL at MW-20 is pure benzene and (2) that no benzene remains in the vadose zone are over-broad. LNAPL at MW-20 (1) is composed *primarily* of benzene; (2) occurs *at and beneath* the water table; and (3) has *not been observed* in the overlying vadose zone.

314 EPA Response:

Comment noted and previously addressed.

H-3.77 Page 5-78: EPA's speculation that *"A PCE plume may potentially be present from the Central Process Area to Monitoring Well BF-24 at the Armco site"* and *"elevated PCE detection limits ranging from 10 to 100 μg/L;...the extent of PCE contamination may be greater than is indicated by the detected PCE values" is unfounded.*

315 EPA Response:

EPA is making the reader aware of the significantly elevated detection limits for PCE (up to 500 μg/L). The potential for the plume is real, although its presence cannot be confirmed with existing data. The readers can draw their own conclusions from the data as to whether a plume may actually be present.

H-3.78 Page 5-80: For clarity EPA should provide the basis for the statement that "*a plume of 1,1-DCB is indicated with a width of approximately 800 feet and a length of approximately 2,000 feet.*"

316 EPA Response:

For clarity, a plume of 1,4-DCB is indicated with a width of approximately 800 feet and a length of approximately 2,000 feet. The plume is shown in Figure 5-70.

H-3.79 Page 5-83: EPA should qualify or provide the technical basis for inferring a "gradient" in the statement "*The sediment sampling results indicate that there is a DDT concentration gradient extending from the Montrose Chemical Site through the Kenwood Drain to the Torrance Lateral. As would be expected, the highest concentrations of DDT in sediment are nearest to the Property.*" The term gradient seems to imply a continuum of sediment, which is inaccurate and misleading.

317 EPA Response:

There was no intent to imply a continuum of sediment. However, sediment is and has been present at many locations in the surface water drainages from the Montrose Property to the Torrance Lateral. A concentration gradient was clearly present in the sediment samples, with the highest concentrations being closest to the Montrose Property.

H-3.80 Page 5-89: EPA should provide the basis for the statement..."*chloroform in surface water appears to originate....or the Farmer Brothers facility.*"

318 EPA Response:

The basis for the statement is provided in the portion of the paragraph that precedes it.

H-3.81 Table 5.10A: For clarification and ease of use by reader EPA should present the results of 1994 EPA sediment sampling in a format consistent with other RI data as opposed to using the "*Range of Detected concentrations for Sample Location Group*"

319 EPA Response:

In the interest of completing the RI Report and moving ahead with a groundwater remedy, EPA believes that reformatting the results of the sediment sampling is not warranted at this

time. If necessary, this additional information can be provided in a supplement at a later date.

H-3.82 Table 5.10A and 5-12A : For clarification and completeness EPA should discuss the footnotes "*detected value that has been qualified for quantitative use*" in reference to EPA's 1994 Sediment and Surface water sampling results.

320 EPA Response:

This statement reflects the results of data validation conducted on the sediment and surface water data. It indicates that the result is valid.

H-3.83 Figure 5.73: For clarification and ease of understanding by the reader, EPA should provide additional clarification for the "segments" and location of the sediment samples collected along the Normandie Avenue Ditch and should provide the dates for all the various sampling events shown on this figure.

321 EPA Response:

The dates for the sediment sampling are provided Section 1.7.4 and Section 2 of the RI Report. Further details can be obtained in the following document (referenced on page 5-83): Field Report, Surface Water, Sediments, and Biological Sampling in Stormwater Pathway from Montrose Chemical Company to Los Angeles Harbor, Montrose Superfund Site, Torrance, California. Prepared for U.S. EPA, Region IX, by CH2M HILL. July 31, 1995.

H-3.84 Figure 5.73 and 5.74A: EPA should provide the units of concentration for DDT in sediment

322 EPA Response:

The units of concentration are mg/kg.

H-3.85 Figure 5.81: EPA should review the Figure against previous draft figures for appropriate assignment and designation of EPA Data Qualifiers.

323 EPA Response:

Comment noted.

RI SECTION 6.0

H-3.86 Page 6-22: EPA should provide clarification for the statement that *"The potential for DDT and BHC to be transported into the atmosphere and surface water with solid particles or as particulates is high"* in light of the fact that the site is capped:

324 EPA Response:

This statement indicates that DDT and BHC were likely transported with solid particles or as particulates before the Property was capped. Montrose manufactured DDT for 35 years at the Property and the RI and its associated investigations have clearly demonstrated that large quantities of DDT (and, to a lesser extent, BHC) have been transported from the Property into the surrounding community. The statement also indicates that there is current potential for DDT and BHC to be transported in the atmosphere and surface water, primarily from numerous offsite sources of contamination that are not capped (e.g., contaminated sediments, neighborhood soil contamination, soil to the west of the Property). EPA notes that the "cap" on the Montrose property is not permanent.

H-3.87 Page 6-23: EPA provides a discussion of aerial dispersion and transport of particulate DDT but does not provide the basis.

325 EPA Response:

The basis for the discussion can be found in Section 1 of the RI Report, primarily Section 1.3.7, and includes the following:

- **According to a Montrose appropriation request dated May 7, 1975, (and as discussed on page 1-16):**

  "In the grinding operation, it is necessary to transport many open bins filled with a finely ground material into this outside area for processing. When it is windy the air scatters this dust throughout the building and into the surrounding area. A protective windshield has been installed in this area, but it is ineffective. The proposed addition will not only provide needed shelter, but will also prevent the loss of DDT into the environment (Montrose, 1975)."

As discussed on page 1-32, in the 1960s and 1970s, Montrose received several citations from the Los Angeles County Air Pollution Control District for violating the California Health and Safety Code. For instance, on October 3, 1974, Montrose received a citation, and was fined for releasing fumes from the post reactor (LACAPCD, 1974). In addition, in July 1975, Montrose received a citation from the Air Pollution Control District for the discharge of particulate matter from a roof vent at a capacity of 75 percent (LACAPCD, 1975).

DDT was ground in a ball mill located outside. As discussed on page 1-16, the Formulating and Grinding Plant converted technical DDT chips into 75 percent DDT water-dispersible powder by adding various dispersing agents and amorphous silica and grinding the mixture into fine particles (Montrose, 1976). In the "pre-grind" portion of this plant, added in 1965, the DDT Krisp Chips were ground in a ball mill and the resulting pre-grind powder was pneumatically conveyed to a baghouse where the powder was collected (Montrose, 1977a). The ball mill was located outside of Warehouse Number 3, as shown in Figure 1.7B.

As discussed on page 1-16, an appropriation request dated September 11, 1974, provided for installation of a baghouse in the Formulating and Grinding Plant to control the dust and fume problem at the plant (Montrose, 1974). According to the request, "a nuisance dust and fume problem exists at the DDT plant (Montrose, 1974)."

H-3.88 Pages 6-26 - 6-30: EPA should rephrase all discussions and inferences regarding "*groundwater contamination extending* *through* *the Lynwood Aquifer*" as opposed to *into* the Lynwood aquifer. Same comment in reference to "*through* *the Gage Aquifer*" as opposed to "*into* the Gage aquifer"

326 EPA Response:

The comment is noted. The intent was in the sense of identifying affected units from the list of units, rather than specifying how deep within each unit the contamination extends. EPA agrees that there is no evidence that contamination has physically extended through the Lynwood Aquifer at this time.

H-3.89 Page 6-29: EPA should rephrase the statement "*an average infiltration rate of 1 inch per year is expected in the vicinity of the Montrose Site*" to a more accurate statement which would state that an average infiltration rate of 1-inch per year was used during calibration of the regional groundwater flow model, but is not necessarily the rate of actual infiltration at the site.

327 EPA Response:

The 1-inch-per-year average infiltration rate was determined by Montrose consultants and was the best available value. Any parameter used in the model may not reflect perfectly the factor it represents; on the other hand, why would one pick a value on purpose that is non-representative? In this case, the value chosen was an attempt to properly reflect this parameter.

H-3.90 Pages 6-40 through 6-42: EPA should edit the document to ensure that changes in terminology are made consistently and in such a manner that the meaning is not changed. For example EPA has frequently, but inconsistently, changed the term "*monitor well*" to "*well*" or "*monitoring well*" in various portions of the text. Unfortunately, this change in nomenclature is not consistently reflected in the associated tables, figures, and appendices and at times the changes in nomenclature result in significant changes to the actual meaning of statements. For example, in Section 6.5, at the conclusion of the RI Report, there are at least two dozen instances where "*monitoring well*" is used inappropriately as a descriptor for water supply wells, including public supply wells, irrigation wells, and domestic wells.

328 EPA Response:

EPA believes that a word processing error occurred here. The term "monitoring" should be removed as a descriptor for water supply wells, including public supply wells, irrigation wells, and domestic wells. Monitor well and monitoring well should be read synonymously.

RI SECTION 7.0 - References:

H-3.91 EPA cites Zeneca's 1997 Natural Attenuation Study in the references, but does not appear to incorporate any discussion in the text.

329 EPA Response:

The 1997 Zeneca study was preliminary and, for reasons which EPA has made clear on the record, significantly flawed. Discussion of the study was not appropriate in the RI Report.

RI APPENDICES

H-3.92 Appendix D: a) titled "*Qualified Data*", has been supplemented with 5 new tables (Tables D.22 through D.26) variously titled "*Split Sample Results* ...[Volatile Organic Compounds...Organochlorine Pesticides...Base/Neutral Acid Organic Compounds...Trace Metals,...and Common Ions] ...*in Groundwater.*" These tables appear to duplicate *unqualified* original, duplicate, and split groundwater analytical data displayed in Appendix G, titled "*Analytical Results of Groundwater Samples.*"

330 EPA Response:

The title of Appendix D should read Qualified Data and Split Sample Results. Tables D.22 through D.26 present the split sample data (the split, duplicate and original sample results) in a format that allows the reader to check agreement between the laboratory results. Appendix G contains the full data set where the split sample data are repeated.

b) EPA should remain consistent with the long-established Montrose RI project nomenclature for "split" samples. "Split samples" in the context of the Montrose RI are specifically designated as either "laboratory split" samples which are replicate samples analyzed by a "secondary" or "check" laboratory, or "agency split" samples which are replicate samples provided to agency representatives for their independent analyses. In the context of EPA's use of the term "split" in comparing original, duplicate, and split sample results, the term "replicate sample" would be more appropriate.

331 EPA Response:

EPA is using the same definition of split samples. EPA has simply provided the split, duplicate and original sample results side-by-side for easy comparison.

c) EPA should refrain from presenting *unqualified* data in the Appendix titled "*Qualified Data.*"

332 EPA Response:

This data was included in Appendix D to aid in the qualification of the data as a whole. The split sample data are crucial in establishing data reliability and usability. The title of Appendix D should read Qualified Data and Split Sample Results. Section 3.1 of the RI Report describes Tables D.22 through D.26 in detail.

d) EPA omits parallel discussions regarding data assessment, data validation, and data quality evaluations for soil, sediment, and surface water. For completeness, EPA should provide the results of data evaluations for each environmental media evaluated as part of the Montrose RI.

333 EPA Response:

These are not necessary to complete the remedy selection process for groundwater. In the interest of completing the RI Report and moving ahead with a groundwater remedy, the data quality evaluation focuses on groundwater data quality. If necessary, the data quality evaluation in the RI Report may be supplemented with such information for soil at a later date.

4. Responses to Written Comments Received From The Del Amo Respondents

Preface by EPA:
In this section, EPA summarizes its responses to written comments provided by the Del Amo Respondents. The Del Amo Respondents include Shell Chemical Corporation and Dow Chemical Corporation. The term "Respondents" is used by these corporations to refer to themselves jointly when conducting activities under a Superfund Administrative Order on Consent with respect to the Del Amo Site. Where appropriate, responses are given both within the body of a comment as an issue arises, as well as at the end of an overall comment. The commenter's text is shown in normal text. The summary of EPA's response is given in **bold and back-shaded text.**

The Respondents presented their comments in the format of a report, which is focused on four major issues. Each issue is taken up in turn in an introductory section followed by sections each of which take up each issue in more detail. For efficiency and to limit the need for redundant responses, EPA regrouped some of the Respondents comments (i.e., combined introductory or summary position comments with the specific comments).

The text of the Respondents' comments which required a response from EPA is re-numbered. Introductory comments are numbered 1 through 4. Detailed comments are included as subsections of the corresponding introductory comments (e.g., Comments 1.1 through 1.4 are detailed comments corresponding to the introductory Comment 1). The text of comments which require a response from EPA are otherwise incorporated verbatim.

COMMENT NO. 1:
THE PROPOSED REMEDY FOR TCE SOURCES NEEDS TO BE DESIGNED AND ITS PERFORMANCE UNDERSTOOD BEFORE FINALIZING THE CHLOROBENZENE REMEDY.

Data collected since the October 1995 sampling event indicate continued growth, both vertically and laterally, of TCE and related compound plumes under natural gradients. These findings reveal significant uncertainty regarding the nature and distribution of TCE sources and dissolved phase plumes. Recent increases in concentrations of TCE-plume compounds in the Gage aquifer prompt the need for serious consideration of the presence of DNAPL sources in deeper units. Based on these findings, modeling results, and the proximity of the chlorinated sources and plumes, it is likely that pumping associated with either the proposed TCE or chlorobenzene remedy could exacerbate the distribution of TCE. The Respondents believe that the EPA and parties responsible for the releases of TCE and related compounds into groundwater need to

define the sources and extent of these contaminants, establish whether DNAPL is present in the source areas, and assess how deeply DNAPL may have penetrated. Once this has been completed, the design of the TCE remedy can be completed in such a manner as to not interfere with the chlorobenzene remedy and vice versa.

334 EPA Response:

The remedial action for TCE plume does not have to be designed before the decision is "finalized " to select the remedial action in this ROD. The existing data are sufficient to support the selection of the elements of the remedial action that apply to the TCE plume. The basis for this appears in the JGWFS and in EPA's proposed plan. While the JGWFS evaluates differing remedial actions for the three plumes (benzene, chlorobenzene, and TCE), this ROD selects a single, unified remedial action. All components of the remedial action will be designed so as to ensure meeting all of the specifications and provisions in this ROD.

The data presented by the Del Amo Respondents (hereafter, "Respondents"), which can be interpreted to suggest that TCE might move adversely if not addressed as part of the overall remedial action, are consistent with EPA's understanding of TCE (and related chlorinated solvents) contamination at the Joint Site. This is why EPA added remedial action elements for TCE in the JGWFS. The Draft FS dated May 16, 1997, which was authored by the joint parties (Montrose Chemical and the Del Amo Respondents) did not address TCE. The remedial action selected by this ROD will prevent the "exacerbation of the distribution of TCE."

This comment and many of the comments which follow do not sufficiently distinguish between remedial selection and remedial design. What the commenter means by "finalization" is not clear. A clarification of this is therefore important in EPA's initial response here.

The Superfund process includes remedy evaluation and selection, followed by remedial design and action. When the remedial action is selected, it is *not* yet designed. Some of the means that will be used to attain the provisions in the ROD are not yet developed pending the design. The design and optimization of the remedial wellfields for this remedial action (finalized locations of extraction and injection wells, distribution of pumping among wells, etc.) will be performed during the remedial design stage, not during remedial selection. The requirements and provisions of this ROD are to be met and cannot be overridden by the design, however.

EPA agrees with the commenter that additional field data are required to complete the *design* as required by this ROD. Some of the necessary data pertain to refining the distribution and sources of TCE and related solvents in the TCE plume, as suggested in the comment. This ROD requires that these data be collected as part of the remedial design phase (see responses to Comments 1.1 through 1.4). These data will allow the design to ensure that TCE will not move adversely in response to any hydraulic extraction that occurs as part of the remedy.

However, EPA does not agree that the remedial *selection* cannot occur prior to collecting this data. The feasibility of the selected remedial alternative is established sufficiently as documented by EPA's proposed plan, the JGWFS, and the administrative record. EPA agrees that remedial design of the remedial action (as a whole, not just for chlorobenzene) depends on additional data; we disagree that remedial selection does.

The commenter suggests that the parties responsible for the TCE contamination near the western border of the former Del Amo plant should collect the data necessary for the remedial design. This ROD does not specify allocations of responsibility for remedial design nor financial liability. Rather, the ROD specifies *what* will be performed and achieved as the remedial action, independent of the question of who will conduct this work.

[The Following Text Taken from Commenter's Section 1]
In the proposed plan the EPA recognizes the significance of chlorinated solvents as an integral aspect of the proposed groundwater remedy. Inclusion of the TCE plumes and the associated sources in the remedy correctly indicates that the TCE plumes are within the hydraulic influence of the proposed chlorobenzene plume remedy, and must be addressed as part of the groundwater remedy. This conclusion is supported by groundwater modeling, which predicts that without countermeasures, the proposed chlorobenzene remedy results in unacceptable excursion of TCE. The principal element of EPA's proposed remedy for the TCE plume is to partially contain the sources of chlorinated solvents[1] by pumping and treating groundwater at low rates in the immediate vicinity of the sources. Additionally, chlorinated solvents present within the capture zone of the chlorobenzene plume reduction remedy will be removed and treated along with the chlorobenzene.

Several technical issues remain to be resolved before this aspect of the remedy can be successfully implemented. First, as stated by EPA, "Additional sampling during remedial design will confirm

[1] The term chlorinated solvents as used in this document refers specifically to all chlorinated compounds detected at the Joint Site and surrounding area exclusive of monochlorobenzene (i.e., chlorobenzene) and dichlorobenzene isomers. The use of the term TCE plume in this document to describe chlorinated solvent issues is consistent with EPA's definition in the proposed plan.

the exact size and nature of the TCE plume in the MBFB Sand for design purposes." (page 35 of the Proposed Plan). The Respondents fully agree and interpret this statement to address both the dissolved TCE plumes and the sources of TCE. Secondly, the EPA recognizes that the design of the TCE source control remedy will be directly tied to this further characterization and for that reason states that "If the data reveal unexpected information, adjustment to the remedy will be proposed and implemented by the EPA, as necessary." (page 35 of the Proposed Plan). Equally important in this regard is to fully understand the influences that the proposed TCE source control well(s) will have on the chlorobenzene remedy and, vice versa, in order to avoid adverse competitive impacts on each remedy element.

335 EPA Response:

The commenter refers to the "chlorobenzene remedy." The JGWFS evaluated actions for each of three plumes, and evaluated how such actions might affect each other. However, this ROD selects one remedial action. All of the components of the remedial action will be optimized together in the remedial design phase. Once the remedial action is designed, extraction and injection wells typically serve a primary purpose with respect to one of the three plumes, but may play a role in the action for all three plumes, depending on the location of the wells. EPA therefore interprets the term "chlorobenzene remedy" as an imprecise term which loosely refers to the portion of the remedial action that is primarily targeted toward the chlorobenzene plume.

EPA is well aware of the importance of coordination within the remedial wellfield to ensure that adverse migration of contaminants (whether of TCE, benzene, or chlorobenzene) does not occur. This is why the JGWFS and this ROD include criteria for the development of the wellfield that require the prevention of adverse movements of contaminants or what the comment refers to as "competitive impacts" from the operation of the wellfield on the distribution of all contaminants. EPA also understands the potential need for additional data on the TCE distribution and sources; however, these data are needed for the design of the remedial system rather than for the conceptual evaluations performed in the JGWFS (See last response).

EPA has not specified in this ROD that no adverse migration of contaminants shall occur at all, nor has it specified that the potential for these shall be completely eliminated. While the JGWFS has shown that it should be feasible to adequately limit adverse migration of NAPL or dissolved phase contaminants and still meet remedial action objectives, it is possible that some adverse migration could occur during remedial implementation. This ROD contains provisions for such a possibility, requiring that the remedial design be adjusted to reverse and contain the adverse migration. It is crucial to note that limiting adverse migration of contaminants shall not take preeminence over all other performance

criteria and remedial action objectives of the selected remedial action. Rather, limiting adverse migration shall take place within the context of meeting all such requirements, including but not limited to attaining applicable or relevant and appropriate requirements (ARARs) in a reasonable time frame, and attaining the required rate of reduction in the volume of the chlorobenzene plume outside the containment zone.

The optimization necessary to limit adverse migration as discussed by the commenter can occur in remedial design and still meet all of the remedial objectives and specifications in this ROD. The remedial design may not violate the provisions of this ROD.

Groundwater modeling results definitively show that without corrective measures, the chlorobenzene remedy will result in unacceptable vertical and lateral excursion of TCE, contrary to EPA's stated performance requirements.

#336 EPA Response:

The commenter's statement that groundwater modeling "definitively shows" that TCE migration will be unacceptable without corrective measures is an overstatement and is not supported. We note that the degree of uncertainty associated with TCE simulations is much higher than for benzene and chlorobenzene in the modeling efforts referred to by the commenter. The model does not "definitively" predict the migration of TCE in any reasonable sense of the word "definitive." Nonetheless, as already discussed, EPA does agree with the commenter that the potential for TCE migration should be addressed by the remedial action. EPA included a component of the remedial action to address TCE in the JGWFS specifically because the remedial action components for chlorobenzene and benzene could adversely impact the distribution of TCE in the absence of a containment scenario for TCE. The modeling performed by the potentially responsible parties (PRPs), including the commenter, did not include the TCE remedial action proposed by EPA and the model therefore simulated a "vertical and lateral excursion of TCE" referred to in this comment.

These modeling results are based on a preliminary estimation of the TCE sources and plume which were defined only in a most general sense. The degree of resolution regarding both the location of the sources and the spatial distribution of the dissolved phase plume diminishes with increased depth. Recent data collected since the modeling effort (Dames & Moore, 1998b) show increased TCE concentrations and apparent continued vertical and lateral migration of TCE, including elevated concentrations in the Gage aquifer. These data cast significant uncertainty as to the presence, location, and vertical penetration of chlorinated solvent DNAPL sources. The uncertainties in all units are significant and must be resolved to adequately design the proposed remedy for the TCE plume.

6337 EPA Response:

EPA fully understands the uncertainties associated with TCE distribution and sources, as repeatedly stated in the JGWFS, and intends to resolve these uncertainties at the remedial design stage, as appropriate.

Additionally, because the TCE sources are within the hydraulic influence of the proposed chlorobenzene pumping wells, TCE source containment by pumping will likely have some effect on the chlorobenzene remedy. The low biodegradability of these chemicals under site conditions, coupled with the local presence of continuing sources in positions upgradient of the Joint Site are principal factors influencing the continued movement of the TCE plume. In light of these conditions, it is imperative that a more thorough understanding of the TCE plume and related source areas be developed prior to implementing any elements of the proposed Joint Site remedy if EPA's stated performance requirements are to be achieved. It is exactly for this reason the "EPA proposes to collect additional confirmatory data on the TCE plume in the remedial design Phase" (page 33 of the Proposed Plan). The Respondents concur with and strongly support this concept; however, the Respondents also believe that a more protective, effective, and efficient remedial response can be achieved by accelerating the acquisition of these additional data in advance of other elements of the proposed Joint Site remedy.

6338 EPA Response:

EPA concurs that the sources and extent of chlorinated solvents at the Joint Site need to be further assessed prior to completing the design of the Joint Site remedy. The *design* of the remedial action components for the TCE plume, however, does not need to be conducted prior to remedy selection and the evaluation of the feasibility of the overall remedial action, including those components targeting the chlorobenzene and benzene plumes. The existing data are sufficient for the feasibility-study-level evaluations, such as the comparative evaluation of different remedial alternatives. The selected remedy for the dissolved contaminants at the Joint Site, such as the pump-treat-inject approach for the (1) containment of the dissolved contaminants, (2) containment of the chlorobenzene and TCE sources (i.e., DNAPL), and (3) plume reduction/removal of chlorobenzene mass, will not likely change based on the potential findings on TCE distribution and sources. However, as stated in the proposed plan, adjustments to the TCE and chlorobenzene remedies can be proposed and implemented by EPA if the collected data reveal unexpected information.

If the commenter means to suggest that remedial design itself should, in some manner, be phased such that the data are obtained at the proper point in the remedial design process to allow for design completion, then EPA agrees with this comment and will take it under

advisement. EPA does not necessarily agree, however, that all remedial design must wait for the acquisition of this data. The statement that it is "imperative" that a more thorough understanding of the TCE plume and source areas be obtained prior to implementing *any* of the components of the Joint Site remedy may be an overstatement.

COMMENT NO. 1.1: MODELING OF CHLOROBENZENE PUMPING SHOWS A SERIOUS POTENTIAL TO CAUSE ADVERSE MIGRATION OF CHLORINATED SOLVENTS.

Modeling results described below strongly indicate that a delicate balance must be maintained during the chlorobenzene remedy to avoid inducing adverse migration of the TCE plume. This balance is required in a region of the MBFC and Gage where overlying units are known to contain significant concentrations of chlorinated solvents.

339 EPA Response:

EPA's understanding of the potential TCE migration is consistent with the results of the conceptual modeling performed by the Respondents. The Draft Joint Groundwater Feasibility Study report prepared by the PRPs, including the commenter, dated May 16, 1997, did not include any remedial measures for TCE in spite of the potential for adverse migration of the TCE plume in the course of the remedial actions that were contemplated in that document. When EPA took over the JGWFS effort in July 1997, this technical gap was identified as a shortcoming of the PRP draft of the feasibility study. Therefore, a remedial action for TCE was included in the EPA-authored JGWFS for the reasons that are pointed out by the Respondents (e.g., the TCE plume is within the hydraulic influence of the pumping wells primarily focused on the chlorobenzene plume).

EPA agrees that the remedial action should have an "optimization" process during and/or after the additional TCE data are collected. (It is not clear, however, that EPA's notion of "optimization" exactly parallels that of the commenter. This is further discussed in EPA's responses to comment 2.) The optimization, however, takes place in the remedial design phase, while the remedial objectives, remedial action (i.e., pump-treat-inject) and the degree of aggressiveness of the remedial action was appropriate to evaluate during the feasibility study. The selection of the final remedy from the technical approach and aggressiveness standpoint does not preclude further optimization of this remedy during the remedial design phase. Based on the findings of the remedial design, the wellfield will be optimized to reduce and/or prevent adverse migration and the competing effects of wells, if necessary (again, see also discussion of "optimization" in response to comment 2).

It is also important to point out that the proposed TI waiver zone in the Gage does not encompass all of the area described above. This is particularly true of the area upgradient of the most probable location of injection wells currently envisioned for the Gage component of the proposed chlorobenzene remedy. Consequently, as configured, the proposed remedy would not contain the TCE plume pulled down into the Gage in this area as a result of chlorobenzene pumping. Therefore, consideration should be given to either expanding the TI waiver zone in this area into the Gage aquifer or optimizing the chlorobenzene plume remedy in order to avoid downward migration of the TCE plume into the Gage. The modeling results clearly show that further definition of the sources and limits of the TCE plume is a prerequisite to designing the remedy, which, in turn, is a prerequisite to finalizing the chlorobenzene remedy. The following discussions provide additional details regarding findings of more recent groundwater monitoring events as they relate to the need to define and understand the TCE plume and its sources.

340 EPA Response:

EPA agrees that the potential exists for the TCE plume to migrate to the Gage Aquifer, if mitigating actions are not taken. Additional data required during the remedial design phase will assist in designing the remedial action so that this does not occur. Based only on existing data, the TI waiver zone cannot be justifiably extended to the Gage Aquifer below the benzene or TCE plumes at this time. EPA can implement amendments or other modifications to the selected remedial action in the event that the additional data obtained during remedial design indicate the need for such modifications.

The commenter's statement that the remedial action "as currently configured" would not contain TCE contamination drawn down into the Gage aquifer assumes that this ROD restricts the wellfield used in the modeling scenarios. This is not the case. This ROD contains a provision that the TCE be contained, and so the remedial action does in fact address this issue. If significant movement of TCE to the Gage occurs, then the remedial design will be modified to address this problem.

Once again, EPA does not agree that the chlorobenzene remedy cannot be selected supportably prior to obtaining the data in question about TCE. The comment again states that "designing the remedy" is a prerequisite to "finalizing the remedy." To the extent that "finalizing" implies "selecting," EPA disagrees. As stated, EPA does agree that designing the remedy fully will depend on additional data about TCE.

COMMENT NO. 1.2: WHAT ARE THE DATA THAT INDICATE CONTINUED GROWTH OF THE TCE PLUME?

New groundwater data collected since October 1995 indicate local changes in contaminant concentrations that influence how the groundwater remedy should be implemented. More specifically, these new data report locally increased concentrations of one or more chlorinated solvents in all units in locations that lie within the hydraulic influence of the both the TCE plume remedy and the chlorobenzene plume remedy. These data indicate uncertainty as to the nature and distribution of TCE plume and sources.

341 EPA Response:

See responses to Comments 1 and 1.1. The final design of the remedial action will be based on consideration of the data identified above. These data are not inconsistent with the conceptual framework already used in selecting the remedial action. The JGWFS has developed the criteria for the performance of this remedy. The final design of the remedy will be performed at the remedial design stage based on the results of additional data acquisition, including, presumably, the data referred to by the commenter. The design of the remedial action components for the TCE plume will be balanced with respect to all other aspects of the remedial action to limit the adverse migration of contaminants while still meeting all other provisions of this ROD.

COMMENT NO.1.3: WHY ARE ADDITIONAL DATA NECESSARY TO FURTHER DEFINE TCE DISTRIBUTION?

Available data relative to TCE in soil and groundwater are lacking compared to that for benzene and chlorobenzene. Consequently, the level of resolution regarding the lateral and vertical distribution of TCE in both the vadose zone and the saturated zone is insufficient to adequately define contaminant source areas and the resultant dissolved plume to the level required to allow implementation of EPA's proposed remedial responses in a manner consistent with achieving EPA's stated performance requirements. The following sections review the available data and outline the reasons why additional soil and groundwater data for chlorinated compounds are required in advance of proceeding with any of the proposed remedial responses.

342 EPA Response:

See responses to Comments 1.1 and 1.2. EPA agrees that additional TCE data are needed and intends to collect additional data during the remedial design phase. The JGWFS develops and evaluates the feasibility of a conceptual TCE remedy, which, according to the criteria for the development of the groundwater scenarios presented in the JGWFS, will prevent adverse migration of TCE. The selected remedial action will also be optimized with respect to the chlorobenzene plume based on findings during the remedial design phase, if needed, so as to provide the best balance among the remedial actions for the TCE plume, the benzene plume, and the chlorobenzene plume.

EPA does not agree that absolutely *all* aspects of this data acquisition necessarily must be completed prior to *any* advancement of the remedial design or action, however.

COMMENT NO. 2:

BENZENE PUMPING SHOULD BE A CONTINGENT REMEDY AND NEEDS TO BE LINKED TO THE PERFORMANCE OF AN OPTIMALLY DESIGNED CHLOROBENZENE REMEDY

The EPA cites uncertainty regarding the migration of benzene as a principle reason for proposing pumping to prevent unwanted movement of benzene. Previous modeling has shown that unwanted movement of benzene could occur if the chlorobenzene remedy is not properly designed. Likewise, modeling has demonstrated that unwanted movement of benzene can be avoided, and improvements in the overall performance of the chlorobenzene plume reduction can be achieved, by optimizing the chlorobenzene pumping and injection wellfield design. Prior to receipt of the June 1998 Proposed Plan, optimization had not been conducted for Alternative 4. Consequently, the Respondents are convinced that **optimization modeling of the chlorobenzene remedy is a critical first step** in the design of the remedy wellfield. As shown by our initial optimization effort included herein, the chlorobenzene remedy can be optimally designed and its performance understood through modeling and/or verification monitoring. The Respondents believe that only after these steps have been completed can the remedy for benzene be properly considered.

343 EPA Response:

This comment and the majority of those which follow use the term "optimization." EPA wishes to clarify the use of this term as it is not clear that the commenter's definition parallels EPA's. Optimization is a process that occurs in the remedial design phase. Optimization of a wellfield involves adjusting and testing differing locations of extraction

and injection wells, pump rate distributions, and pumping techniques to maximize the efficiency with which the remedial system will meet the requirements of the ROD. Among other things, the wellfield at the Joint Site should be optimized to limit the potential for adverse migration of contaminants, *while still meeting all other objectives and requirements of the remedial action.* While the JGWFS showed that this was feasible, there will be flexibility to modify the wellfields used in the JGWFS in the remedial design phase.

EPA envisions that optimization for this remedial action will include numerical simulations of the groundwater flow and solute transport using a model. However, the process of simulation will be to a significant extent based on pilot testing and adjustment during installment and operation of actual remedial systems. The existing model of the Joint Site, used in the JGWFS, will be refined and updated based on pilot testing to increase the reliability of the model simulations for the optimization process. This point is crucial because the existing model is not sufficient for the optimization of the remedial system.

In addition, there is a definite limit to the degree of optimization that can be provided by modeling alone. Modeling will be used fully as a tool within the context of and in full view of modeling limitations. However, the design of this remedial action cannot be fully optimized solely by modeling. The commenter, in this comment and many of those which follow, refers almost exclusively to modeling optimization. We stress that some of the limitations and uncertainties that EPA has noted with respect to the JGWFS model will apply to all models. Ultimately, only the actual installation of the system, followed by actual *field* optimization, will ensure that remedial objectives (e.g. containment of a plume) can and will be met.

As stated in our above responses with respect to the TCE plume, optimization modeling (as the commenter refers to it) and verification monitoring will take place during remedial design and remedial action. Limiting the unwanted movement of benzene, within the context of attaining all other remedial objectives, is clearly an objective in this ROD and the entire JGWFS effort. However, EPA cannot agree with the statement by the commenter that only after the remedial design is completed for chlorobenzene can a "remedy for benzene be properly *considered*" [emph added]**. In terms of remedy selection, the remedial action for benzene has been properly considered already. The commenter implies that remedial actions for chlorobenzene must be not only designed but functional before any evaluation of remedial selection issues for the benzene plume is even possible. This is not true. The analyses in the JGWFS properly evaluate actions for the benzene plume in concert with actions for the chlorobenzene plume and TCE plume and this ROD selects remedial actions for the benzene plume.**

The remedial design activities do not represent a re-evaluation of whether the requirements of this ROD shall be met; rather, they are a means to optimize the manner in which they shall be met.

Following the selection of Alternative 4 as the remedy in the Proposed Plan, the Respondents have made an attempt to model the optimization of chlorobenzene plume reduction wellfield. By adding one injection well between the fringe of the benzene plume and the centerline of the chlorobenzene pumping wells in the MBFC and maintaining the same total injection rate, the modeling convincingly shows that the pumping-induced benzene excursion can be completely eliminated. The results reinforce the Respondents' strong conviction that pumping the benzene plume can be avoided with optimization of the chlorobenzene wellfield.

Due to reasons listed below, the Respondents believe that pumping benzene in the MBFC needs to be considered only if modeling and performance monitoring show adverse migration of benzene even after the best efforts of optimization of the chlorobenzene remedy have been carried out. Specific attention should be given to reducing potential vertical migration into the Gage aquifer and to maintaining the natural stability of the benzene plume. Contingent measures can be considered and implemented following the optimization and implementation of the chlorobenzene remedy, should unexpected conditions develop that warrant such actions.

344 EPA Response:

EPA takes this opportunity to provide a coherent framework for its response not only to this comment but to many of those which follow.

This and several of the following comments are related to the basic issue of whether to use hydraulic extraction to actively contain the benzene plume in the MBFC Sand. Active containment as it is used here includes using hydraulic extraction, possibly in tandem with aquifer injection, to induce hydraulic changes at some location(s) within the aquifer system to contain the benzene plume in the MBFC Sand. The commenter's stated position is that hydraulic extraction (pumping) should be avoided; that optimization of the wellfield should be undertaken instead with monitoring to see whether the benzene plume in the MBFC Sand stays contained on its own.

We believe that the commenter misrepresents *optimization* and *hydraulic extraction* for the MBFC Sand benzene plume as exclusive alternatives. In fact, the remedial design phase will include optimization of the remedial wellfield *regardless* of whether the benzene plume in the MBFC Sand is actively contained with pumping (see response to last comment regarding "optimization"). The issue therefore is more properly represented as whether hydraulic extraction is to be one of the components of the remedial action being optimized

for the benzene plume in the MBFC Sand. In this ROD, EPA addresses this issue in the affirmative.

With respect to the benzene plume in the MBFC Sand, EPA did consider the commenter's favored option of reliance on intrinsic biodegradation, monitoring, and contingent actions only. However, EPA's evaluation led to the conclusion that the risks of such an option are greater than the risks of actively containing the benzene plume in the MBFC Sand using hydraulic extraction and injection, assuming such containment is properly designed and optimized. This ROD, the proposed plan, and the JGWFS support the basis for this conclusion. It is important to note that the basis accounts for several other factors other than the modeling results themselves. They are briefly mentioned below and in the course of the following responses and the response to comment 2.1. Among the principal elements of this basis are the following:

- **The MBFC Sand and Gage Aquifers are more permeable, and deeper, than the UBF and MBFB Sand, and therefore potential deviations between simulations and reality are more critical (contamination is closer to water actually being used for drinking, has more production potential, and the water has the potential to move more quickly);**

- **The Gage Aquifer is the first significantly-water bearing unit in which the benzene plume does not occur; at the same time, it is much more likely to be used as a drinking water source than is the MBFC Sand (noting that the State of California designates all units at the Joint Site as having potential potable beneficial use);**

- **As suggested by the commenter, vertical migration into the Gage Aquifer is of paramount concern and protection of the Gage Aquifer critical;**

- **The Lower Bellflower Aquitard (LBF) separating the MBFC Sand and the Gage Aquifer is very fine-grained and cannot be effectively monitored;**

- **The movements of contaminants from the MBFC Sand through the LBF into the Gage Aquifer could be influenced by localized phenomena such as preferential flowpaths;**

- **The model used in the JGWFS is not appropriate for modeling vertical contaminant *transport* from the MBFC Sand through the LBF into the Gage Aquifer (see comments which follow on this subject);**

- **No amount of additional modeling "optimization" is likely to overcome the uncertainties in distribution of preferential flow paths with the LBF, which could allow vertical migration of the benzene plume from the MBFC Sand into the Gage Aquifer, and other modeling limitations discussed in the JGWFS;**

- **The vertical transport of benzene into the Gage Aquifer can only be monitored with wells placed in the Gage Aquifer. Therefore, migration of the benzene plume cannot be detected until benzene arrives into the Gage Aquifer. Such arrival would significantly complicate and may even prevent the effectiveness of future remedial actions, which would, in effect, be "after the fact:" contamination would already be in the aquifer and have become entrenched in the low-permeable strata in the LBF.**

Because benzene transport into the Gage cannot be reasonably monitored, cannot be reliably simulated without unacceptable uncertainty, and threatens a more critical aquifer, EPA determined that implementing hydraulic extraction to directly contain the contamination in the MBFC Sand was preferable and carried less risk over the long term than trying to simulate optimizations of injection wells and/or relying solely on intrinsic biodegradation to contain the benzene plume in the MBFC Sand.

As part of its comments, the commenter has submitted the results of new modeling efforts using the JGWFS model, claiming that these efforts provide a limited optimization of the remedial wellfield. The JGWFS modeling effort was sound for feasibility study purposes, but not optimized as a design. Optimization, as discussed in EPA's Response #344, above, and in several other responses. Such optimization should include not only modeling, but also adjustment during actual implementation and testing of remedial systems. Optimization shall occur within the context of meeting all requirements put forth in this ROD.

However, for reasons that EPA will expand upon in responses to many of the comments which follow, the JGWFS model, while sound for feasibility study purposes, cannot be used to "optimize" the wellfield with respect to vertical migration of benzene from the MBFC Sand through the LBF into the Gage Aquifer. Therfore, EPA disagrees with the commenter's use of the model for this purpose.

We point out that both hydraulic extraction and injection alter hydraulics and can induce unwanted movements of contaminants if not designed properly. Yet, the commenter's preliminary effort at "optimization" focuses solely on adjusting the locations of injection wells already otherwise in use for chlorobenzene plume reduction, while ignoring extraction wells. The commenter (see following comments) then states that it considers hydraulic extraction in the MBFC Sand to be "high risk" because it may upset a "natural stability"

in the benzene plume, while at the same time attaching no apparent risk to injection. It is not clear why the commenter would want to avoid hydraulic extraction for benzene in the MBFC Sand when injection optimization did not raise such concerns.

A sound, reasonably certain, and effective method of containment of the high concentrations of benzene in the MBFC Sand realistically depends on both extraction and injection, and this is what EPA employs in its selected remedial action for the benzene plume in the MBFC Sand. Containing a plume solely by injection (i.e. creating a hydraulic barrier by creating mounding at injection wells) often is a more complicated and uncertain approach than containing by hydraulic extraction and injection (i.e. capturing contaminants by extraction wells with the subsequent removal of contaminated water). The latter approach is more straightforward and provides greater certainty of containment. This certainty, given the conditions just discussed, is necessary in this case.

. Reasons for the Respondents' position are as follows.

- The benzene plume is currently stable in all major hydrostratigraphic units underlying the Del Amo Site largely as a result of intrinsic biodegradation. This condition is convincingly supported by multiple lines of field and modeling evidence.

345 EPA Response:

See responses to Comment 2.1.

- Modeling conducted for the Joint Groundwater Feasibility Study (JGWFS) shows that deliberate care needs to be exercised when locating the chlorobenzene extraction and injection wells in order to prevent unwanted movement of benzene and other chemicals. It is therefore critical to maintain the natural stability of the benzene plume while implementing the chlorobenzene remedy. An unoptimized chlorobenzene remedy could lead to a temporary or permanent disruption in the natural stability of the benzene plume.

346 EPA Response:

EPA concurs that it is important to contain the benzene plume while implementing the remedial action, particularly those aspects of the action targeting the chlorobenzene plume. To the extent that the benzene plume displays a natural stability (see responses below to comment 2.1, also), it bodes well for this containment. The criteria for the development of the portion of the wellfield primarily targeting the chlorobenzene plume developed in the JGWFS require minimizing the adverse effects of pumping on other contaminants at the

Joint Site, including benzene. In the case of 700- and 1,400-gpm wellfields, however, additional protective actions (e.g. hybrid containment) are required to ensure the containment of the benzene plume within the TI waiver zone over the long term.

- Results of previous and recent optimization modeling efforts of the chlorobenzene plume reduction wellfields clearly demonstrate that by strategically locating injection wells in the MBFC and Gage, one can eliminate the need for active pumping to contain benzene in the MBFC. Uncertainty regarding the stability of the benzene plume can be reduced by monitoring appropriately located and constructed wells.

347 EPA Response:

The commenter is overconfident of the modeling results and fails to adequately consider the limitations and uncertainties of the model when interpreting the simulation results with respect to vertical migration from the MBFC Sand to the Gage Aquifer, as discussed in Section 5 of the JGWFS. The modeling presented by Respondents is not adequate for demonstrating that strategic placement of injection wells alone can prevent benzene migration in the MBFC Sand (see responses to Comments 2.2 through 2.4) or "eliminate the need" for active pumping to contain benzene in the MBFC Sand. Moreover, the commenter's use of the model for such vertical simulations is inappropriate (see responses to comments 2.2 through 2.4).

- Lastly, implementation of the benzene gradient control by counter-pumping in the UBF and MBFB is a difficult challenge that may overshadow any potential benefits to be expected.

348 EPA Response:

The statement that the challenge associated with the benzene gradient control wells "may overshadow any potential benefits to be expected " is not clear. Hydraulic extraction is a common way to control hydraulic gradient, including vertical gradient. The proposed gradient control wells will create a localized drawdown in the UBF and MBFB Sand to offset the increase in the vertical component of hydraulic gradient between these units and the MBFC Sand that could otherwise be caused by pumping of the benzene containment well in the MBFC Sand. This gradient control will minimize the potential of increased vertical migration of the benzene plume from the UBF and MBFB Sand into the MBFC Sand. Because flowrates of the gradient control wells will be small (only several gpm), the influence of pumping will be limited to the area in the immediate vicinity of these wells. Therefore, the adverse impact of these wells on the benzene plume is unlikely. While fully

understanding the "challenge" of the benzene gradient control, EPA also believes that this remedial measure is feasible from an engineering perspective.

[The following text taken from commenter's Section 2]
COMMENT NO. 2.1: THE BENZENE PLUME IS CURRENTLY STABLE DUE TO INTRINSIC BIODEGRADATION, A CONDITION THAT SHOULD BE PRESERVED.

The EPA clearly recognizes that "there is significant evidence of intrinsic biodegradation of the benzene plume in the UBF and the MBFB sand" (page 14). The Respondents would like to emphasize that this is equally true for the benzene plume in the MBFC around the Waste Pit Area. The same lines of evidence that the EPA uses to evaluate the UBF and MBFB support this conclusion. These are (pages 14-15 of the Proposed Plan):

- The concentration gradients at the leading edge of the benzene plume are steep;
- The lateral extent of the dissolved plume outside of the NAPL sources is small;
- The benzene plume is much smaller than what would be expected on groundwater velocity and expected retardation in the absence of intrinsic biodegradation; benzene has not migrated far from the NAPL sources despite being in the ground 20-40 years;
- The plume appears to be at steady state and does not appear to be migrating laterally;
- In-situ measurements of geochemical parameters (e.g., dissolved oxygen, nitrate, sulfate, methane, etc.) indicate biological activity that is related to (varies spatially with) the benzene concentration in groundwater;
- Biodegrader organism counts in groundwater indicate greater biological activity inside the benzene plume than outside [of] the benzene plume;
- Computer modeling runs could not be reasonably calibrated without assuming significant biodegradation"
- Owing to strong influence of active intrinsic biodegradation, the Respondents are convinced that the benzene plume is currently stable in all hydrostratigraphic units. The Respondents strongly believe that this stability can and needs to be preserved.

349 EPA Response:

EPA agrees that the benzene plume in the MBFC Sand currently appears to be relatively immobile and is significantly affected by the process of intrinsic biodegradation. EPA also agrees with the commenter than many of the factors applying to the MBFB Sand and UBF also appear to apply to the MBFC Sand. However, the conclusion drawn by commenter that the benzene plume in the MBFC Sand is absolutely stable over the extreme long term cannot be made with the degree of confidence the commenter attributes. More important than the "natural stability" of the benzene plume in the MBFC Sand, which assumes long-term stability exists, is that the benzene there remain contained. The implication of the comment is that intrinsic biodegradation is sufficient to maintain this containment. However, in evaluating the effectiveness and appropriateness of a remedial action which relies on intrinsic biodegradation for the MBFC Sand benzene plume, different considerations arise than for the UBF and MBFC Sand. These were discussed in detail in the JGWFS, the proposed plan, and this ROD.

These were among the considerations in the evaluation of the reliability of alternatives in which benzene plume containment in the MBFC Sand is effected solely by intrinsic biodegradation, given long-term pumping of the remedial wellfield targeting chlorobenzene:

1. **In the absence of reliable long-term monitoring data (for at least 10 to 15 years), the hypothesis regarding the stability of the benzene plume is based primarily on the assumptions of the timing of the release of LNAPL sources to the aquifers beneath the Joint Site (i.e., the assumption that the sources were introduced about 30 to 40 years ago). Without this assumption, the observed benzene distribution pattern, as well as the geochemical evidence of biodegradation, is not a proof of plume stability (e.g., the limited extent of the plume could be attributed2:43 PM to a more recent source; and, the presence of biodegradation, by itself, does not necessarily indicate that the plume has reached a stable condition). While EPA has agreed that the plume appears relatively stable and sufficiently so to provide a strong indication of the reliable presence of intrinsic biodegradation, absolute long-term stability is not proven.**

2. **While assumptions regarding the timing of LNAPL releases appear to be reasonable for the UBF and MBFB Sand, the contaminant release into the MBFC Sand at the Waste Pit Area is more uncertain. Several issues are not well understood: (1) the high concentrations of benzene; (2) the anomalous geochemistry of Well SWL0040, and (3) the fact that benzene concentrations in the MBFB Sand (directly above Well SWL0040) are lower than in Well SWL0040, are not well-understood. The Del Amo RI report lists several potential explanations for these phenomena, some of which imply that the timing of release at this location is uncertain and could differ from the other releases at the site (D&M, May 15, 1998). For example, if vertical migration from the MBFB Sand is responsible for high concentrations in the MBFC Sand (one of the explanations presented in the RI report), the timing of the contaminant release can be more recent than the initial introduction of LNAPL to the subsurface. Therefore, a relatively limited extent of dissolved benzene in the MBFC Sand downgradient of the Waste Pit Area can be explained by a recent source rather than plume stability.**

3. **The presence of the laterally extensive low-concentration benzene distribution in the MBFC Sand is not fully understood. If this significant lateral extent of benzene is attributed to the presence of chlorobenzene, which could have increased the benzene mobility in the MBFC Sand, the mobilization of the currently immobile benzene sometime in the future cannot be ruled out.**

4. **Due to the uncertainty associated with the benzene source in the MBFC Sand, modeling of benzene transport and the focused transport calibration (FTC) cannot be solely relied upon for the determination of the transport parameters such as half-life, and demonstration of the future immobility of the benzene plume. While the**

FTC assumed long-term sources for all units, the sources in the MBFC Sand could be more recent than LNAPL sources in the UBF and MBFB Sand. Consequently, the half-life of the benzene plume could be underestimated by the focused transport calibration. This, in turn, could cause the migration of benzene in the MBFC Sand to be underestimated.

5. **The MBFC Sand is deeper and more permeable than the UBF or MBFB Sand. Risks associated with failed containment in this hydrostratigraphic unit are therefore greater.**

6. **The MBFC Sand lies directly above the Lower Bellflower Aquitard (LBF), which cannot be reliably monitored. Contaminants passing through the LBF would enter the Gage Aquifer. By the time monitoring picked up benzene contamination in the Gage Aquifer, benzene would have migrated through the fine-grained LBF and continued contamination in the Gage Aquifer would be inevitable. The Gage Aquifer is more likely to be used for drinking water than the upper water-bearing zones, even though all zones are classified by the State of California as having potential potable beneficial use.**

7. **Movement of the benzene plume in the MBFC Sand, if it does occur, would move it toward the chlorobenzene plume in the MBFC Sand where benzene does not appear to be rapidly biodegrading, and potentially into the Gage Aquifer through extended dissolved transport.**

COMMENT NO. 2.2: MODELING RESULTS AND OBSERVATIONAL DATA SUPPORT THE SOURCE OF BENZENE IN THE MBFC.

The EPA states in the JGWFS (page B-17) that "A significant uncertainty is associated with the source of LNAPL in the MBFC." and that "The high benzene concentrations in the MBFC in this area are likely due to the vertical migration of benzene from the upper units.". The EPA cites general reasons for this. First, the EPA asserts, we believe incorrectly, that there is "no evidence that the water table could have been as deep as the MBFC during the operations at the Del Amo facility." The EPA contends, therefore, that the presence of LNAPL at the depth of the MBFC at the Waste Pit Area is "difficult to explain." The EPA further suggests that uncertainties surrounding the groundwater model simulations preclude using them to accurately represent vertical migration into deeper units. Specifically, the EPA states that the modeling results for vertical transport from the MBFC to the Gage are "associated with such high uncertainty as to be largely unreliable" (page 17 of the Proposed Plan).

To the contrary, the Respondents believe that a continuing, NAPL-like source is present in the MBFC based on review of the following modeling and field data. This conclusion is supported by the demonstrated competence of the flow and transport model used in the analysis. Furthermore, uncertainties regarding this area of the model can best be addressed through monitoring of appropriately located and constructed wells.

350 EPA Response:

EPA agrees that the possibility of LNAPL occurrence at the top of the MBFC Sand cannot be completely ruled out, although it is more likely that LNAPL was trapped by the relatively low-permeable sediments of the UBF and MBFB Sand than by more homogeneous sands of the MBFC Sand. EPA refers primarily to the bottom of the MBFC Sand, where SWL0040 is screened, when discussing the low likelihood of LNAPL occurrence in the MBFC Sand. As with other site-specific data, EPA relied primarily on the findings and discussions of the Del Amo RI report for the information on the MBFC Sand benzene plume origin and causes (D&M, May 15, 1998, Section 5.3.3.1). The Del Amo RI report states that submerged LNAPL is only one of several potential explanations of high benzene concentrations in the MBFC Sand near Waste Pit Area. It also states, "LNAPL is unlikely to be present at the base of the MBFC Sand where Well SWL0040 is screened since the water table is unlikely to have been this deep during operation of the plant site."

Other potential explanations for high-concentration benzene in the MBFC Sand presented in the Del Amo RI report are:

- **Surfactants and/or high TDS concentrations in the contaminant solution may have influenced contaminant mobility in this area.**
- **A dry well or other unknown conduit may exist in the vicinity of SWL0040 by which concentrated contaminant solutions have been introduced directly to the MBFC Sand and or B/C Sand in the past without a significant impact on the overlying zones.**
- **Contamination associated with the Waste Pit Area may have migrated down into the MBFC Sand in some areas when groundwater elevations were lower. Given a higher hydraulic conductivity/lower biodegradation rate for the MBFC Sand, higher VOC concentrations in the MBFC Sand relative to the overlying units downgradient of the Waste Pit Area could result.**

- **A naturally occurring, preferential flow path is locally present through which relatively high concentrations of contaminants associated with the Waste Pit Area enter the MBFC Sand in the vicinity of Well SWL004.**

Additional monitoring wells could provide some insight into the source of contamination in the MBFC Sand, but are just as likely to fail to resolve the issue as to resolve it. It is noted that the TI waiver zone was extended to the MBFC Sand regardless of the resolution of whether there is a NAPL at the bottom of the MBFC Sand. While not ruling out the possibility of a NAPL source, EPA has simply determined that it cannot be concluded with sufficient certainty upon which to base a TI waiver determination.

Why is vertical migration of dissolved benzene a less likely mechanism explaining the MBFC benzene plume?

During the development of the model, it was postulated that there might not be a continuing benzene source present in the MBFC beneath the waste pits. Rather, it was postulated that the current benzene plume in the MBFC may have resulted from vertical migration of dissolved benzene from the overlying units. Numerical simulations were conducted to test this hypothesis. Case BT7H was developed in which continuing benzene (LNAPL) sources at the Waste Pit Area were assigned in the UBF and MBFB only. No continuing benzene source was assigned in the MBFC at the Waste Pit Area. The case was simulated in the same manner as the calibrated transport model (BT7), assuming 40 years of flow and transport under the natural gradient. Figure B-5.53b (modified from Draft JGWFS, as is the case for other Draft JGWFS figures referenced herein) clearly shows that simulated concentrations of benzene in the MBFC are significantly less than observed concentrations. For example, the simulated concentration of benzene in the basal MBFC unit is less than 1 ppb for well SWL0040 where 110000 ppb was detected in the third quarter of 1995. Similarly, at SWL0055, the simulated concentration is less than 100 ppb, compared to an observed concentration of 8800 ppb at the same time. In comparison, the simulated concentrations for BT7, in which continuing sources were assigned in the MBFC at the Waste Pit Area, are in close agreement with measured concentrations (Draft JGWFS Figure B.3.13c). Moreover, attempts to simulate "vertical conduits" of higher permeability in order to get benzene to move vertically worsened the calibration of the flow model (see discussion below). Collectively, these modeling results strongly invalidate the notion that vertical migration of dissolved benzene is solely responsible for the MBFC benzene plume; hence, the Respondents conclude that a continuing benzene source is present in the MBFC.

6351 EPA Response:

Modeling performed by the Respondents is not adequate to resolve the uncertainty associated with the source of benzene in the MBFC Sand. As discussed in detail below, the sitewide model is not calibrated to simulate a small-scale contaminant migration near the

Waste Pit Area. The model is not refined to provide the resolution necessary to simulate phenomena on the localized scale in question at the waste pits. The model was intended and designed to provide a reasonable comparison of the performance of alternatives on a bulk-flow/transport basis and does not include accommodation for the processes which might be responsible for the high-concentration contamination in the bottom of the MBFC Sand in the benzene plume (at the waste pit area). In addition, the model simulations that are used by the commenter to demonstrate the presence of LNAPL in the MBFC Sand do not include any of the alternate plausible scenarios listed in the RI report (e.g., dry well, preferential flow path, and surfactants). EPA therefore does not consider the modeling results presented in this comment compelling or reliable.

Why is a NAPL-like source of benzene in the MBFC possible?

The MBFB and MBFC sands are merged beneath the Waste Pit Area. The fine-grained mud separating the two units is not present and the merged MBFB/MBFC here behaves as a single groundwater flow unit. The MBFC portion of the merged unit is approximately 50 feet thick, with the top-of-unit and bottom-of-unit depths of approximately 85 feet below ground surface (bgs) and 135 feet bgs, respectively (Draft JGWFS Table B-2.2, Boring SBL 0084). The current depth to first water in this area is between 50 to 55 feet bgs. Thus, the distance between first water and the top of MBFC in this area is on the order of 30 to 35 feet.

Historical data on water table levels dating back to the early to mid 1900s are scant; hence, only general statements regarding historical water table levels during the early operation of the former plant site can be made. Available data from wells completed in deeper units suggest that basin-wide water levels reached historic low levels as early as the mid- to late 1950s (LACFCD wells 794B, 795) to no later than the mid 1960s (LACFCD well 806C). Subsequently, water levels have risen at an approximate rate of 1 foot per year. Therefore, water table levels may have been as much as 35 to 40 feet lower than today, or at a depth of 85 to 95 feet bgs. This places the historical low water table as much as 10 feet below the top of the MBFC. A LNAPL-like source that was likely present at the water table during this historically low water level period may have easily penetrated several or more feet into the saturated sands beneath the water table, particularly if the contaminant accumulations were sufficient (a reasonable assumption). Considering this, the most reasonable conclusion is that an LNAPL-like smear zone extends into the MBFC.

352 EPA Response:

EPA agrees that the possibility of LNAPL occurrence at the top of the MBFC Sand cannot be completely ruled out, although it is more likely that LNAPL was trapped by the relatively low-permeable sediments of the UBF and MBFB Sand than by more homogeneous sands of the MBFC Sand. EPA refers primarily to the bottom of the MBFC

Sand, where SWL0040 is screened (see responses above) when referring to the low likelihood of LNAPL occurrence in the MBFC Sand.

Why is the Current Model an Adequate and Appropriate Tool for Predicting Vertical Migration of Contaminants into the Gage?

It is recognized that modeling conducted for the JGWFS, like any other numerical model, is subject to some uncertainties and limitations. In particular, we recognize that the assumption of linear equilibrium sorption may result in an overestimate of contaminant removal rate from groundwater when simulating the effects of pumping. Otherwise, selection of transport parameters was done in a reasonably conservative manner, which has resulted in a model that conservatively predicts plume behavior. Additionally, the model has been calibrated against measured groundwater levels in 209 monitoring wells and piezometers, and against observed concentrations of benzene and chlorobenzene. Furthermore, the model has been tested in a series of sensitivity analyses (Tables B-4.1 and B-4.2, Draft JGWFS). For the indicator chemicals of concern that were simulated (including chlorobenzene, benzene, and TCE/PCE), model uncertainties are primarily associated with TCE/PCE source assumptions.

The Respondents also realize that in general there is less observation data in the deeper units for model validation; however, we disagree with the notion that these modeling results of deeper units are subject to a high degree of uncertainty. In particular, the Respondents disagree with EPA's statement that the modeling results for vertical transport from the MBFC through the LBF to the Gage "are associated with such high uncertainty as to be largely unreliable" (page 17 of the Proposed Plan). On the contrary, calibration results support that the flow and transport model is adequate for the purposes of comparative evaluation of remedial alternatives. The root-mean-squared (RMS) of simulated vs. measured hydraulic heads, and the ratio of RMS to the total head change across the entire model domain, are commonly used to measure the accuracy of calibration of flow models. The smaller the RMS value and ratio of RMS to total head change, the more accurate the model. Of the major water-bearing units modeled, the RMS values are 1.23, 0.36, 0.47, and 0.33 feet for the UBF, MBFB, MBFC, and the Gage, respectively (Figures B-3.11b through B-3.11e). The head changes for these units are approximately 9.1, 5.3, 5.2, and 3.9 feet, respectively. Accordingly, the ratios of RMS to total head change are 14%, 6.8%, 9.0%, and 8.5%. Therefore, the accuracy of the flow calibration is approximately the same for the MBFB, MBFC, and Gage. Note that measured water levels from 41 and 27 monitoring points were used in the calibration in the MBFC and Gage, respectively. The number of data points used for each of these hydrostratigraphic units is sufficient to generate a reliable flow calibration.

In terms of contaminant transport, simulated benzene concentrations generally agree within an order of magnitude with observed values in the MBFC sand and Gage aquifer (Draft JGWFS Figures B-3.13c and B-3.13d). This agreement is better than in the overlying units (Draft JGWFS Figures B-3.13a and B-3.13b), where observed concentrations are orders of magnitude higher and

concentration variations are more drastic. Lastly, sensitivity analyses of the flow and transport model in which the hydraulic conductivity was increased to simulate postulated high vertical permeability conduits resulted in worse comparison with measured water levels as well as excessively larger than observed benzene plumes (Draft JGWFS, Tables B-4-1 and B-4-2).

For these reasons, the Respondents conclude that the calibrated flow and transport model "is a highly useful tool for providing a basis of evaluating the performance of alternatives on a comparative basis" (page 17 of the Proposed Plan), particularly for flow and transport in the MBFC and Gage.

353 EPA Response:

EPA concurs that the model of the Joint Site is a "useful tool for providing a basis of evaluating the performance of alternatives on a comparative basis." EPA wishes to emphasize that the modeling effort for the JGWFS at the Joint Site was sound and exemplary in many ways for a feasibility study effort, and that the model is extraordinarily useful for the specific purposes to which it is appropriate. All models have limitations. By discussing modeling limitations, EPA does not discredit the model, but rather elucidates the fact that the model cannot be used for all purposes or to answer all questions.

The comment above refers heavily to the *flow calibration* and the low RMS values between actual and simulated heads in the aquifer system. EPA believes that the flow calibration for the modeling effort in the JGWFS was excellent. Unfortunately, the commenter attempts to use this as a support that the *transport calibration* for the MBFC Sand - LBF - Gage units is accurate and that *transport* simulations are correct. The two do not follow. In fact, a sound calibration for vertical transport of benzene in these three units was not achieved (see discussion, below). This is not a failure of the model as there are rarely sufficient data upon which to base such transport calibrations; however, the limitation must be noted.

Contrary to the comment, the current model is not an adequate and appropriate tool for predicting vertical migration of contaminants into the Gage Aquifer or for optimizing remedial alternatives as ascertained by the commenter. The commenter places too much emphasis on the simulation results and fails to consider the limitations and the uncertainties of the model when interpreting results. Specifically, the model of the Joint Site cannot be used reliably to demonstrate that strategic placing of injection wells can prevent benzene migration into the Gage Aquifer. Consideration is given to the following modeling limitations and uncertainties, among others:

- **As mentioned above, the numerical model of the Joint Site is not appropriate for evaluating vertical migration of benzene into the Gage Aquifer at the Waste Pit Area. In order to reproduce this small-scale migration of benzene, the model has to be refined and calibrated at a very small scale, including calibration for solute transport. The site-wide steady-state flow calibration, while useful for simulating average flow conditions and responses to pumping, is not sufficient for meaningful simulations of the small-scale benzene migration.**

- **The quasi-calibration of solute transport was limited by a moderately successful attempt to reproduce the historic benzene migration at a site-wide scale (the term "quasi" indicates the accuracy of the transport calibration is low relative to the accuracy of the flow calibration). In fact, the model did not reproduce the historic benzene concentrations in the Gage Aquifer (Figure B-3.13d of Appendix B of the JGWFS). Therefore, while the simulation of average benzene migration (primarily lateral) is acceptable for the FS-level comparison of conceptual remedial alternatives on a relative basis, the use of the model for predictive estimates of small-scale vertical migration is not appropriate.**

- **In the FTC, the assumptions regarding the long-term sources were made for all units. As discussed previously, the sources in the MBFC Sand are less certain and could be more recent than LNAPL sources in the UBF and MBFB Sand. Therefore, the FTC could underestimate the half-life of the benzene plume, which in turn could result in the underestimate of the future benzene migration. This underestimation of the benzene migration could be the explanation for why the model did not reproduce the historic benzene concentrations in the Gage Aquifer.**

- **As discussed in Section 5.3.2 of the JGWFS, it is possible that the benzene plume from the Waste Pit Area in the MBFC Sand is contributing to the benzene contamination in the Gage Aquifer (i.e., the observed benzene contamination in the Gage Aquifer could be caused by the downward vertical migration of benzene from the MBFC Sand via uncharacterized contaminant migration pathways in the LBF). These potential migration pathways through the LBF are not incorporated into the current model of the Joint Site because of limitations of the currently available technology to characterize small-scale heterogeneities in the LBF that could facilitate migration of the benzene plume. Therefore, if the observed distribution of benzene in the Gage Aquifer is due to the migration along these potential pathways in the LBF that are not incorporated in the model, the model is not a representative tool for evaluating the future vertical migration of benzene from the MBFC Sand into the Gage Aquifer.**

COMMENT NO. 2.3: UNOPTIMIZED CHLOROBENZENE PLUME REMEDY CAN HAVE SIGNIFICANT ADVERSE IMPACT ON CONTAMINANT MIGRATION.

During model development, the modeling team conducted a number of remedial simulations for pumping and injection of the chlorobenzene plume. Several modeling approaches were considered in an effort to comparatively evaluate the performance of the chlorobenzene wellfields in terms of: (1) isolation and containment of NAPL sources; (2) long-term reduction in the chlorobenzene plume; (3) short-term removal of chlorobenzene mass; and, (4) minimizing disruptive effects on the demonstrated stable benzene plume. Wellfield configurations simulated included: Dual Cell and Centerline Extraction supplemented with Plume Edge Injection, Cross Plume Flow, and Upgradient Injection. Hybrids combining dual-cell and centerline approaches in different hydrostratigraphic units were also attempted. The relative merits of wellfield approaches are summarized in Appendix B of the Draft JGWFS. For each wellfield approach, various locations and pumping rates were also tested in an attempt to increase the overall performance of the pump-and-treat system. These results have been presented to the EPA in the form of working technical memoranda and/or orally during the monthly project meetings.

Results of those intermediate runs have clearly shown that if not optimized, the chlorobenzene wellfield can cause excessive migration of dissolved chlorobenzene itself (Figures 2-1 through 2-3 for chlorobenzene in the MBFB, MBFC, and Gage under the IIIA5 wellfield). Although the total extraction rate was only 550 gpm or approximately 75% of that in Alternative 4, the figures show that unoptimized pumping led to a severe expansion of the Gage plume by as much as 500 feet westerly and southerly due to induced downward migration from the MBFC. Additionally, the poor alignment of injection wells in the MBFC also pushed the contaminant into the MBFB, extending the MBFB plume by over 1200 feet in the southeast direction. Because of the paucity of data on source locations and plume extent for TCE and related compounds, simulations aimed at evaluating the chlorobenzene remedy wellfields on these compounds were not carried out to an adequate level of rigor. However, the impact of the chlorobenzene remedy on TCE and related compounds is expected to be similar to that predicted for chlorobenzene, due to the similarities in sorption and biodegradability.

For comparison, the chlorobenzene distributions under an improved wellfield (IIIA15) are shown in Figures 1-4 through 1-6. A comparison of these with the figures for the IIIA5 wellfield clearly illustrate that optimization of the chlorobenzene remedy is critical in order to avoid unnecessary adverse vertical migration of contaminants from the MBFC into the Gage.

354 EPA Response:

EPA's responses here parallel those given with respect to the commenter's earlier comments regarding the TCE plume. EPA agrees with the statement that the chlorobenzene remedy needs to be "optimized" (see discussion of the term "optimization,"

EPA Response 334). However, the final optimization of the remedial action, which aims to achieve full compliance with the development criteria presented in the JGWFS, will be performed during the remedial design stage. See also the responses to Comment 2.2 (i.e., the existing model of the Joint Site can not be reliably used to "optimize" the selected remedy). In fact, optimization requires more than modeling but also adjustments performed in the course of testing, implementation and operation of actual remedial systems.

COMMENT NO. 2.4: PUMPING BENZENE IN MBFC CAN BE AVOIDED WITH OPTIMIZATION OF CHLOROBENZENE PLUME REDUCTION WELLFIELD

The proposed 700-gpm wellfield for reducing the chlorobenzene plume (Alternative 4) has yet to be designed or optimized (page 43 of the Proposed Plan). In modeling simulations of chlorobenzene pumping effects, the modeling team recognized that some local, minor increases in benzene concentrations were predicted by the model in the MBFC sand, mainly due to vertical migration from the MBFB. However, the modeling runs performed for the JGWFS were not fully optimized with respect to the chlorobenzene wellfield because the team was not certain which alternative would be chosen, and it was agreed upon that the optimization would be carried out in the Remedial Design phase of the project.

The Respondents would like to re-emphasize that benzene pumping proposed by the EPA for containment in the MBFC can be avoided with proper optimization and design of the chlorobenzene remedy. The minor excursion predicted in certain simulation scenarios can be eliminated with strategically located chlorobenzene plume reduction wells, as indicated by comparing results of benzene plume distributions under Alternatives 4 (700 gpm chlorobenzene pumping scenario) and 5 (1400 gpm chlorobenzene pumping scenario) (Draft JGWFS Figures B-5.34c1, B-5.34d1, B-5.45c1, and B-5.45d1). In the former alternative (Draft JGWFS Figures B-5.34c1 and B-5.34d1), a small excursion of 100 ?g/l benzene is predicted in the MBFC extending from the Waste Pit Area toward the centerline of the chlorobenzene extraction wellfield. This excursion occurs as a result of induced vertical migration from the overlying MBFB unit by pumping in the MBFC. In the latter alternative (Draft JGWFS Figures B-5.45c1 and B-5.45d1), in which pumping and injection are double that of Alternative 4, this excursion is effectively eliminated by strategically positioning injection wells between the Waste Pit Area and the centerline extraction wellfield.

The effectiveness of this strategy is more convincingly demonstrated by results of additional modeling performed and described below. Since Alternative 4 was proposed as the remedy in the Proposed Plan, the Respondents have made an attempt to optimize the chlorobenzene plume reduction wellfield associated with this Alternative. The original 700-gpm wellfield (known as Chlorobenzene Plume Reduction 2 in the Final JGWFS) was slightly modified by splitting an

injection well (I7 at a rate of 52 gpm as shown in Table B-5.13, Draft JGWFS[2]) into two wells in the MBFC: well I7A with a rate of 30 gpm at the same location and well I7B with 22 gpm approximately 450 feet northwest of I7A (Figure 2-7). Well I7B was chosen in order to enhance the hydraulic circulation toward chlorobenzene pumping wells P2 and P3, and at the same time to reduce benzene migration away from the Waste Pit Area as well as TCE migration from the Trico site. Note that the total injection rate remains unchanged. In addition, the single well designated for containing the benzene plume in the Waste Pit Area (labeled as BIZ-18 in Table B-5.13, Draft JGWFS) was removed in the optimization simulation. The simulated benzene concentrations in the MBFC1 and MBFC2 after 25 years of operation of this modified 700-gpm wellfield are shown in Figures 2-7 and 2-8. For comparison, earlier results obtained with the original 700-gpm wellfield are shown in Figures B-5.34c2, B-5.34d2, and B-5.38c2 as adapted from the Draft JGWFS. As discussed in the JGWFS, modeling showed that without BIZ-18 benzene concentrations in a small area southwest of the 2-Series Pits would exceed 100 ppb due to vertical migration from the overlying MBFB (Figures B-5.34c2 and B-5.34d2). However, the benzene concentrations in the same area are reduced to be less than 10 ppb within 25 years by the new wellfield (Figures 2-7 and 2-8). This optimized simulation also shows improvement in comparison to the EPA proposed wellfield with BIZ-18 (Figure B-5.38c2). These results clearly demonstrate that the minor benzene excursion induced by chlorobenzene pumping in the MBFC can be effectively eliminated by carefully placing and designing the chlorobenzene plume reduction wellfield, a viewpoint that the Respondents have stressed all along. As in Alternative 4, this wellfield has no adverse impact on benzene distributions in the Gage and MBFB, which for simplicity are not presented herein.

The Respondents are convinced that the benefits from the optimization efforts discussed above, in conjunction with the suggested alternative described below to contain MBFC benzene, will address the EPA's concerns over uncertainty which led to the proposal to actively contain the MBFC benzene plume. Additionally, Section 3 will discuss significant benefits of this more optimized wellfield with respect to remediating chlorobenzene and TCE plumes.

355 EPA Response:
Again, as discussed above, optimization, on the one hand, and active containment of the benzene plume in the MBFC Sand, on the other, are not exclusive alternatives. Optimization efforts will occur in remedial design and will be important in ensuring that the benzene plume remains contained for the long-term. In addition, EPA has selected active hydraulic containment of the benzene plume for the MBFC Sand, including hydraulic extraction, in response to uncertainties in long-term containment under the conditions being contemplated for the Joint Site (see discussion above). The modeling does not erase these uncertainties.

2Note that some pumping and injection rates labeled in chlorobenzene and TCE figures for this scenario in the Draft and Final JGWFS are not accurate

In this comment, the commenter has again presented modeling results in an attempt to optimize the remedial action and to show that containment can be achieved for benzene with respect to vertical transport from the MBFC Sand across the LBF to the Gage Aquifer using the existing model. As discussed in responses to previous comments and in Section 5.3.2 of the JGWFS, the current model of the Joint Site is not a reliable tool for evaluating the benzene migration from the MBFC Sand into the Gage Aquifer; therefore, it can not be used for the optimization of the portion of the wellfield targeted to chlorobenzene plume reduction. As discussed in previous responses, given the uncertainties associated with the source of benzene in the MBFC Sand (i.e., the source could be more recent than assumed for transport calibration), the half-life of benzene in the MBFC Sand could be significantly underestimated. In addition, preferential flow pathways in the LBF that could serve as conduits for benzene are not incorporated in the model. Therefore, the results of the existing model simulations cannot be reliably used to demonstrate that strategic placing of injection wells can prevent adverse migration of the benzene plume. EPA agrees, however, that additional optimization could be required during the remedial design following the collection of additional data, including TCE data (see earlier discussion of the definition of optimization, above).

While fully understanding the "challenge" of containing the benzene plume in the MBFC Sand, EPA also believes that the use of hydraulic extraction for controlling the flow and creating an adequate capture zone is more reliable, predictable, and easier to achieve from the implementability standpoint than the use of injection. Section 5.3.2 of the JGWFS further discusses the potential difficulties associated with the injection of treated water as the only means to offset the effects of chlorobenzene pumping on the benzene plume.

COMMENT NO. 3: A REASONABLE AND RELIABLE ALTERNATIVE TO ACTIVE PUMPING TO CONTAIN THE MBFC BENZENE PLUME IS SUGGESTED.

A reliable and feasible alternative exists that increases certainty of containment of the MBFC benzene, does not require countermeasures or additional corrective responses, and uses as its principal components the remedial elements already proposed by the EPA for chlorobenzene. The alternative emphasizes the strategic placement of the chlorobenzene remedy injection and pumping wells. As discussed above, previous and recent modeling results show that the chlorobenzene remedial wellfield can be optimized to: (1) greatly increase groundwater flushing toward the chlorobenzene source isolation area (i.e., the central process area, CPA) and hence accelerate the cleanup of the chlorobenzene plume; (2) increase the certainty for containing the TCE plume; and, (3) prevent disturbing the current stability of the benzene plume. Modeling results further indicate that total optimization of the chlorobenzene remedy will decrease its

overall scope and cost. Lastly, this alternative could be augmented, if necessary, with enhanced biodegradation of the MBFC benzene.

356 EPA Response:

While EPA agrees that the portion of the remedial wellfield primarily targeted toward chlorobenzene plume reduction would benefit from additional optimization, this optimization will be performed at the remedial design stage upon collection of additional data, including data on TCE distribution and sources. The "optimization" of the wellfield presented by Respondents as part of this comment was performed using the existing groundwater model. However, the existing model, while appropriate for the relative comparison of conceptual alternatives, is not adequate for optimizing the remedial scenarios. Uncertainties and limitations of the existing model that prevent the use of this model for reliable estimates of benzene migration from the MBFC Sand into the Gage Aquifer are listed in responses to Comment 2.4 and in Sections 5.3.2 and 5.4 of the JGWFS.

The Respondents are convinced this suggested alternative, with wellfield optimization and enhanced biodegradation, if needed, along with proper sequencing of remedial elements, will improve the performance of the overall groundwater remedy. The Respondents anticipate that ongoing groundwater monitoring will continue in the future, and will provide data necessary to verify remedy performance and continued benzene plume stability.

357 EPA Response:

See earlier responses. As mentioned above, modeling optimization has limitations. Even after the remedial wellfield is optimized, uncertainties associated with the benzene migration from the MBFC Sand through the LBF into the Gage Aquifer would remain. This, in conjunction with the many factors related to the aquifer system and our inability to monitor or reliably simulate the vertical migration of benzene among these units justifies the hybrid containment of the benzene plume. The optimization referred to is still an investigative/modeling based procedure which has inherent limitations.

In summary, the Respondents support a phased approach having the following sequential steps.

1. TCE source and plume definition
2. TCE source remedy design and performance assessment
3. Chlorobenzene remedy optimization
4. Chlorobenzene remedy final design and performance assessment

5. Benzene remedy design and performance assessment

The Respondents urge the EPA to provide for sufficient flexibility in the ROD so that the final decision regarding MBFC benzene considers each of these steps and the issues, concerns and suggestions summarized in the following sections.

4358 EPA Response:

See responses to Comment 1.

EPA agrees that further TCE source and plume definition will occur in the remedial design phase, and that optimization efforts will take place at that time for the entire wellfield, addressing all three plumes. EPA does not agree to postpone remedy selection with respect to the benzene plume until actions for the chlorobenzene plume and TCE plume are entirely designed and implemented. This is not necessary; actions for benzene can be evaluated and selected presently. The the ROD will provide enough flexibility for phasing the implementation of the proposed remedy and provisions for collection of the additional TCE data. The proposal provided by the commenter is taken under advisement and has some merit, if not taken too rigidly. The structure of the remedial design efforts need not run solely strictly and serially in the order the commenter suggests, although some aspects may benefit from such an order.

A principal performance requirement proposed by the EPA (the Proposed Plan, page 32) is "to require that the benzene plume remain contained within the TI waiver zone." The Respondents are in agreement with this performance requirement, and believe the data collected indicate, to a high degree of certainty, that this requirement is being met today and would be met in the future provided significant changes to the groundwater flow environment do not occur.

It is recognized by EPA and the Respondents, however, that significant changes to the groundwater flow environment could occur as a result of groundwater pumping associated with the proposed remedy for chlorobenzene plume reduction. For this reason, and the uncertainty expressed by the EPA regarding the ultimate fate of the benzene plume in the MBFC under such pumping, the EPA has proposed active containment of the MBFC benzene plume.

The Respondents wish to suggest an alternative means by which to control the movement of benzene. The alternative comprises three components, the first of which should be an outcome of the performance optimization modeling of the chlorobenzene remedy, which EPA proposes to be conducted during the Remedial Design phase (page 43 of the Proposed Plan). The second component involves monitoring of the remedy performance and benzene plume migration. The

third component takes advantage of and enhances the natural biodegradation of benzene in groundwater, which the EPA agrees is: (1) naturally occurring in groundwater at the site; (2) is an important factor in the observed stability of the UBF-, MBFB-, and MBFC-benzene plumes; and (3) is a proven and highly robust process. The three components of the suggested alternative are:

- Strategically inject pumped water between the chlorobenzene source control area and the fringe of benzene plume in the MBFC, in order to: (1) minimize adverse changes in lateral hydraulic gradient within the MBFC benzene plume; and (2) maximize groundwater flushing toward the chlorobenzene source isolation area (i.e., the CPA); and (3) create a hydraulic barrier to prevent TCE plume migration from the Trico area;

- Installation of properly located and constructed monitoring well(s) to monitor benzene plume migration in the area of modeling uncertainty;

- If necessary, enhancing the natural biodegradation of the benzene, and thereby accelerating the reduction of benzene mass, within the MBFC near the downgradient margin of the TI waiver zone beneath the Waste Pit Area.

The Respondents believe this three-component approach is a feasible and superior means of controlling benzene movement because: (1) it would be reliable and adjustable; (2) it would promote a proven, naturally-occurring, biological process in groundwater; (3) it would accelerate benzene mass reduction; (4) it would offer a greater degree of protection of the Gage and MBFC aquifers from adverse migration of benzene or other co-located chemicals, such as TCE and related compounds; (5) it would be verifiable through monitoring; and (6) it would increase the long-term effectiveness of the performance requirements of the remaining elements of the groundwater remedy proposed by the EPA. If performance modeling and monitoring indicate performance requirements for benzene cannot be met, and if the EPA believed this contingency would bring the remedy into compliance with the performance requirement, then the benzene pumping contingency would be implemented.

The components of the suggested alternative and their advantages over the currently proposed benzene remedy are described below.

359 EPA Response:

See response to detailed Comments 3.1 through 3.3.

COMMENT NO. 3.1: WHY INJECTION BETWEEN THE BENZENE AND CHLOROBENZENE PLUMES IN THE MBFC?

The EPA indicates (page 44 of the Proposed Plan) that "The modeling simulations resulted in small movements of benzene toward the chlorobenzene plume under the various pumping rates for chlorobenzene which were simulated. This simulated movement was slight, however it is precisely in the area least desirable for benzene movement. Benzene at this location would be entering the chlorobenzene plume and possibly moving downward into the Gage Aquifer."

The Del Amo Respondents are highly sensitive to the potential adverse movement of benzene and other chemicals, such as chlorinated solvents, caused by the proposed chlorobenzene remedy. In a January 30, 1998 letter to the EPA (attached), the Del Amo Respondents stated that "it is of paramount importance to not allow the remediation of the chlorobenzene plume to upset the current stability of the benzene plume beneath the Waste Pit Area." The Respondents further state "that this naturally occurring balance, which has resulted in containment of the benzene plume beneath the Del Amo Site, must be preserved, especially during pumping of the chlorobenzene plume".

Modeling results show that this goal can be achieved by strategically designing the chlorobenzene plume reduction wellfield. The limited initial optimization simulations conducted so far involved well placement optimization in the MBFC aquifer as well as the Gage aquifer. Strategic placement of injection and extraction wells in both aquifers was carried out so that the performance of the wells was not only complimentary in the goal of plume reduction and minimizing adverse movement of contaminants, but also somewhat redundant. That is, the wells were spaced such that temporary downtime of an injection well (which could happen during maintenance or repair) would not affect the overall hydraulic effect created by the complete system.

Results of Optimization Simulations

The initial optimization runs discussed above included strategic placement of injection wells between the MBFC benzene plume and chlorobenzene (MBFC) pumping wells in order to minimize changes to the lateral hydraulic gradient in the vicinity of the Waste Pit Area. A comparative analysis of the initially optimized 1400 gpm chlorobenzene scenario with the unoptimized 350 gpm scenario shows approximately the same predicted benzene distribution in the MBFC (Draft JGWFS Figures B-5.45d2 and B-5.27c2, respectively). Moreover, the optimized 1400 gpm scenario predicts the elimination of the adverse excursion of 100+ ppb benzene that is shown to occur in the unoptimized 700 gpm scenario predictions (Draft JGWFS Figures B-5.45d2 and B-5.34d2, respectively). Again, it is stressed that the optimized 1400 gpm scenario is 2 to 4 times larger than the unoptimized scenarios documented in the JGWFS, which equates to a significantly larger potential burden on the aquifer hydraulics.

Additionally, as discussed in Section 2 (Figures 2-7 and 2-8), an initial optimization of the 700-gpm wellfield has been modeled following the selection of Alternative 4 in the Proposed Plan. A comparative analysis of the earlier and new modeling results clearly and convincingly shows that optimization holds great promise toward achieving the EPA's performance requirements of no benzene movement beyond the TI Waiver Zone, efficient chlorobenzene removal, and TCE plume containment.

Advantages of Minimizing Adverse Gradient Changes in the MBFC

The Respondents believe that optimization of injection and extraction wells in both the Gage and MBFC aquifers is a feasible and effective means of controlling the adverse migration of benzene in an area that EPA indicates is "precisely in the area least desirable for benzene movement." The new modeling results presented in Figures 2-7 and 2-8 clearly show that strategic placement of chlorobenzene plume reduction wells can provide a great degree of reliability, adjustability, and redundancy in achieving the performance requirements in the Proposed Plan, including the specific controls against adverse movement of benzene in this "least desirable area."

Additionally, strategic injection of pumped water between the fringe of the benzene plume and the centerline of the chlorobenzene pumping wells in this area will help to increase groundwater flushing toward the chlorobenzene source isolation area (i.e., the CPA) and hence accelerate the cleanup of the chlorobenzene plume. Modeling results of the initial wellfield optimization described in the previous section show that such optimization will help to reduce the chlorobenzene plume. A comparison of Figures 3-1 and 3-2 to Figures 5-48 and 5-49 of the Final JGWFS shows that injection at well I7B will help to shrink the chlorobenzene plume in the southwest corner of the Del Amo Site (the panhandle) in the MBFC and Gage. This is due to the establishment of a convergent hydraulic gradient and thus enhanced groundwater flushing toward the chlorobenzene source isolation area (i.e., the Montrose Central Processing Area)[3]. The flushing rates of the modified wellfield are shown in Figures 3-3 and 3-4, which can be compared to those of the original wellfield in Figures 5-46 and 5-47 in the Final JGWFS[4]. This result is consistent with EPA requirements to "Limit adverse migration of existing contamination in ways which may lengthen the remedial action, result in a greater potential risk, or cause spreading of the contamination." (page 5 of the Proposed Plan).

Furthermore, results of the initial optimization wellfield described in Section 2 (Figures 3-5 and 3-6) indicate that there are practically no changes in dissolved TCE/PCE concentrations under this

[3] In the initial optimization modeling, a small chlorobenzene concentration, on the order of 70 ppb, was noticed in a small area with a size approximately one-fifth of a model cell around injection well I7B. The results of this simulation indicate that additional optimization is necessary in the remedial design phase.
[4] In the Final JGWFS, the chlorobenzene simulation does not include the single well proposed in Alternative 4 for the benzene plume containment.

wellfield. This means that this wellfield optimization has no significant adverse impact on the TCE plume given the locations and concentrations of chlorinated sources assumed in the model. In fact, strategic injection in the MBFC benzene plume area in conjunction with the proposed TCE source control measures will very likely create a hydraulic barrier to prevent the TCE plume from migrating from the Trico area. This can be demonstrated by further optimizing the wellfield following adequate characterization of sources of the chlorinated solvents.

360 EPA Response:

The commenter here embarks on a foray into remedial design work. EPA providing a response with the caveat that the purpose and intent of the response is not to pre-determine the remedial design process., and this response shall not limit the outcome of the remedial design.

EPA agrees that the chlorobenzene remedial wellfield may need to be optimized in order to minimize the adverse impacts on migration of TCE and benzene. This optimization, however, is a task of remedial design, and will be performed upon collection of additional data, including data on TCE distribution and sources. The existing model, while appropriate for the relative comparison of conceptual alternatives, is not adequate for optimizing the remedial scenarios. Uncertainties and limitations of the existing model, which prevent the use of this model for reliable estimates of benzene migration from the MBFC Sand into the Gage Aquifer are listed in responses to Comment 2.4 and in Section 5.3.2 and 5.4 of the JGWFS. Therefore, the optimization modeling performed by Respondents cannot be incorporated into the JGWFS.

EPA preliminarily agrees with the general concept of strategic injection of pumped water between the fringe of the benzene plume and the centerline of the chlorobenzene pumping wells as suggested by the Respondents, and believe this approach could be considered in the "optimization" phase of the remedy during the remedial design stage. However, for reasons already discussed in response to earlier comments, EPA does not agree that it is appropriate to "avoid" hydraulic extraction to contain the benzene plume in the MBFC Sand, as the commenter suggests. The greater certainty of containment afforded by hydraulic extraction justifies it.

As with the commenter's comments on optimization with respect to the TCE plume, optimization will take place (including potentially the injection just mentioned) *in addition* to the active hydraulic containment of the benzene plume. At the same time, optimization, as the commenter refers to it (i.e. optimization using simulation with numerical model only), has limitations and can only go so far in that it is based on modeling and is a "paper exercise." Given the complexity of physical conditions associated with the vertical transport of benzene in the MBFC Sand, LBF, and the Gage Aquifer at the Waste Pit

Area, modeling optimization is highly unlikely to provide sufficient basis to obviate the need for active hydraulic containment of the benzene plume in the MBFC Sand in this area. Once again, optimization must be performed in the context of actual testing, implementation, and operation of actual remedial systems.

Reliability of Injection for Hydraulic Control

The EPA has indicated to the Respondents that injection for control of adverse plume movement is less reliable than pumping. It is recognized that injection wells generally are more prone to operational difficulties than pumping wells. However, these difficulties are addressed through straightforward engineering solutions, as has been shown by numerous entities throughout the world, which rely upon injection for various gradient control schemes, to create barriers against seawater intrusion, and for various potable water storage schemes.

Injection is a critical component in the successful operation of the proposed chlorobenzene remedy. In order to achieve the proposed performance requirement for chlorobenzene plume reduction, the remedy must substantially rely on the successful design of the injection components of the remedial system. Consequently, it will be necessary to incorporate sufficient engineering safeguards and redundancies as part of the normal design of injection systems for the chlorobenzene remedy, so that prolonged failure of injection wells does not occur. Even in the event of downtime for repair or maintenance, the resulting hydraulic effects should have negligible impact on the overall and long-term performance of an optimally designed pumping/injection system. Done properly, system optimization, such as those steps discussed herein, should not result in added engineering requirements or engineered facilities over that necessary for the chlorobenzene remedy as proposed.

361 EPA Response:

EPA concurs that injection is a critical component in the successful operation of the remedial action as it relates to the chlorobenzene plume. EPA does not wish to discredit the value of injection as a means of assisting in meeting remedial goals. However, the injection alone would not likely offset the potential adverse migration of benzene due to the hydraulic extraction primarily targeting the chlorobenzene plume, for the following reasons (also see Section 5.3.2 of the JGWFS):

- **There are fewer injection wells than extraction wells on the eastern flank of the chlorobenzene wellfield, which separates chlorobenzene extraction wells from the benzene plume.**
- **These injection wells have lower individual flowrates than extraction wells.**

- **Because of the fewer amount and lower flowrates of injection wells, these injection wells will not likely provide an adequate hydraulic barrier between extraction wells and the benzene plume.**
- **Groundwater modeling results presented by the commenter in association with these comments did *not* indicate that the hydraulic mound would be created by the "optimized" injection wells sufficient to serve as a barrier between the extraction wells and the benzene plume. In fact, from the water level map provided by the commenter it appears that the change in the simulated degree of benzene excursion is due to a reduction (flattening) of the hydraulic gradient; but the gradient is not reversed and a hydraulic barrier is not created.**
- **Although results of transport modeling indicate a decrease in adverse benzene migration due to "optimized" locations of injection wells, these results cannot be considered reliable due to the numerous uncertainties associated with the solute transport parameters of the model and contaminant migration pathways in the LBF, which have already been extensively discussed in earlier responses.**

Based on the above discussion, the degree of certainty that the containment of the benzene plume could be achieved solely by the "optimized" placing of injection wells is low. The hybrid containment of the benzene plume is required in addition to the optimized injection to offset the adverse impacts of chlorobenzene pumping on the benzene plume. The hybrid containment will also be optimized during the remedial design phase to minimize the impact on the benzene plume in the UBF and MBFB Sand, and on the TCE plume.

COMMENT NO. 3.2: REMEDY PERFORMANCE MONITORING

Once the optimized chlorobenzene remedy has been implemented, performance monitoring would be conducted to evaluate the effectiveness of the system. As part of this monitoring, installation of one or more wells in the area of modeling uncertainty would provide the data necessary to monitor the potential migration of benzene in the MBFC or Gage. Benzene migration monitoring would be conducted in a manner which provides timely warning of benzene migration such that contingent measures, such as enhanced in-situ biodegradation or pumping, could be implemented, thus maintaining the objectives of the Proposed Plan.

#362 EPA Response:

The MBFC Sand is the deepest relatively permeable unit above the Gage Aquifer that enables the distribution of contamination to be identified, monitored, and contained (i.e., neither monitoring nor hydraulic containment can effectively occur in the intervening LBF). Therefore, the downward vertical migration of benzene from the MBFC Sand could be monitored only in monitoring wells installed in the Gage Aquifer. By the time the benzene plume is detected in the Gage Aquifer, both the LBF and the Gage Aquifer would be contaminated with benzene (see Section 5.3.2. of the JGWFS). The contamination of the Gage Aquifer and LBF could exacerbate the problem to the extent that might render the implementation of countermeasures (such as containment) ineffective and too costly.

COMMENT NO. 3.3: WHY ENHANCE IN-SITU BIODEGRADATION OF MBFC BENZENE?

The EPA states in the Proposed Plan (page 33) that benzene has been "proven to be highly and robustly biodegradable" in the groundwater. This fact and numerous lines of evidence presented Dames & Moore, 1998a have led the EPA to conclude in the Final JGWFS that the benzene plume in the UBF and MBFB is stable as a result of intrinsic biodegradation and other attenuation mechanisms. The EPA does not make a similarly strong statement with regard to stability of the MBFC benzene. Rather, the EPA concludes "In the area of high concentrations near the waste pits, the benzene distribution in the MBFC is in an apparently stable condition (i.e., appears to be essentially immobile), and its lateral extent from the waste pits is relatively small." In addition, the EPA states that the steep concentration gradients characteristic of the downgradient edge of the MBFC benzene plume are "similar to what has been observed in the overlying water table units and the MBFB."

Because biodegradation of the benzene plume is occurring within the UBF and MBFB, reliance on monitored intrinsic biodegradation as a means of containing the benzene plume within the UBF and MBFB is proposed by EPA. However, because of the uncertain potential for inducing movement of the benzene in the MBFC, the EPA has not adopted monitored intrinsic biodegradation as the containment remedy for the MBFC benzene. The EPA has expressed concern that benzene in the relatively permeable MBFC could move sideways or down, beyond the limits of the TI waiver zone, in response to chlorobenzene pumping.

The Respondents share this concern to a certain degree, and have discussed two reliable methods of ensuring the chlorobenzene pumping will not alter the groundwater flow environment so as to cause benzene to move. These are the primary means by which the goals of the EPA can be achieved without sacrificing the performance of chlorobenzene plume reduction. An additional measure of assurance to increase the long-term effectiveness of containment of the MBFC

benzene, and a method which is complementary to the optimization steps described above, is enhancing the biodegradation of the benzene plume in the MBFC.

Enhanced biodegradation of the MBFC benzene can be accomplished with a semi-passive system that involves the introduction of oxygenated and nutrient-enriched water into the MBFC benzene plume. The fluid would be formulated to induce accelerated aerobic biodegradation of the benzene along a broad reaction front as it migrates slowly through the contaminated zone. The chemically compatible fluid would be introduced at a minimal rate so ambient hydraulic gradients would not be significantly altered and unwanted chemical reactions within the MBFC, which could reduce formation permeability or increase contaminant mobility, would be avoided.

While the Respondents believe the chlorobenzene optimization efforts alone will be sufficient to achieve reliable containment of the MBFC benzene, this additional element would provide an additional factor of assurance for the overall benzene remedy in the following ways:

- It would promote a proven, naturally occurring biological process known to be occurring in the MBFC;
- It would accelerate the reduction of benzene mass by bio-chemically destroying the benzene to harmless by-products;
- It would be compatible with and complimentary to the optimization steps described above for the chlorobenzene plume reduction element of the proposed plan;
- It would be adjustable in terms of the rate of fluid introduction and the chemical formulation of the biodegradation-enhancing fluid; and
- It would be verifiable through monitoring.

363 EPA Response:

It cannot be concluded that enhancing in-situ biodegradation can be more effective than hydraulic containment for the benzene plume in the MBFC Sand. Numerous factors can adversely affect biodegradation rates and, hence, ultimate containment of MBFC Sand benzene with this process. These factors, many of which can be difficult or impossible to control, include:

- **Effective mass transfer of oxygen and nutrients to the lateral and vertical locations where degradation is required without localized extraction to induce hydraulic gradients**

- **Unplanned and rapid uptake of oxygen through abiotic oxidation of naturally occurring reduced compounds such as ferrous iron or sulfide that lowers the effectiveness of injected fluids at stimulating the growth of benzene-degrading microorganisms**

- **The presence of other factors that act as inhibitors to the metabolic activity or growth of benzene-degrading organisms such as the presence of chlorobenzene or high TDS levels**

- **Ecological factors that may negatively impact the growth and success of benzene-degrading organisms, such as more rapid growth of other microorganisms that consume non-aromatic organic compounds and consume oxygen and nutrients more rapidly, thus depleting these essential compounds before benzene-degrading organisms can obtain them for metabolism and growth**

Therefore, while the overall remedy could benefit from the enhanced biodegradation of benzene, this technology cannot be solely relied upon in lieu of hydraulic containment of the benzene plume in the MBFC Sand.

COMMENT NO. 4: SEPARATE RODS SHOULD BE ISSUED FOR EACH SITE.

EPA views the evaluation of remedial alternatives for the chlorobenzene plume, the TCE plume and the benzene plume to be a single technical problem and has indicated that it anticipates writing a single record of decision (ROD) (page 3 of the Proposed Plan). EPA says that subsequent amendments to the ROD may be issued on either a dual-site or site-specific basis.

Work to date has proceeded under separate orders for the Montrose and Del Amo Sites. Respondents have stated their desire to work with the Montrose Respondents in a cooperative atmosphere to resolve technical issues and facilitate sound and productive decisions. See, for example, letter of C.B. Paine to EPA dated June 20, 1995.

At the same time, Respondents have expressed "concerns regarding the appropriateness of a single ROD which would include a remedy or remedies for what ultimately could be a wide range of disparate remedy scenarios." See letter of C.B. Paine to EPA dated June 20, 1996. Both the Montrose and Del Amo Respondents have discussed these concerns in meetings as well as in correspondence.

EPA recognized these concerns in a letter from J.A. Dhont to F. Bachman and C.B. Paine dated February 21, 1996, stating:

> EPA acknowledges that Montrose and the Del Amo Respondents have had some concerns about "joint FS" documents and a "joint ROD" for groundwater, in particular because you may be apprehensive that one party would somehow become liable for cleaning the entire plume at both sites. Please recall that the ROD does not determine who will perform various portions of the remedy, but rather what the remedy will be.

Nevertheless, adopting a single ROD is likely to produce significant practical and legal obstacles to timely implementation. This includes delay in commencement of those aspects of work pertaining to the Del Amo Site which are independent of the TCE source and plume definition, remedy design and performance assessment, and the chlorobenzene remedy optimization, final design and performance assessment (steps 1 through 5) recommended by these comments. These delays would conflict with the policy expressed in the National Contingency Plan that "Sites should generally be remediated in operable units when early actions are necessary or appropriate to achieve significant risk reduction quickly, when phased analysis and response is necessary or appropriate given the size or complexity of the site, or to expedite the completion of total site cleanup." (40 C.F.R. 300.430(a)(2)(A).

Issuing a single ROD, if followed by joint orders, also increases the complexity of enforcement. In particular, issuing a single ROD may reduce the incentive of parties who contributed to the TCE plume to assume burdens commensurate with their responsibility.

There is no technical imperative supporting a decision to issue a single ROD. Optimization modeling demonstrates that with proper wellfield design the chlorobenzene remedy can be conducted without impact on the benzene plume. The remedial activities identified for the chlorobenzene and TCE plumes are substantially distinct from those required with respect to the benzene plume, which is stable and falls within the proposed Technical Impracticability (TI) waiver zone. Optimization modeling further shows that, given the existing performance criteria, optimized wellfield design can maintain hydraulic separation of the chlorobenzene and benzene plumes. It is therefore unlikely that contaminant migration between the sites will interfere with achievement of remediation goals. The design of the respective remedies can proceed on a coordinated but generally independent basis once the optimization modeling is completed, subject to further review after the TCE plume is more completely defined. Construction, maintenance and operation can also proceed independently as long as the performance criteria are met, with appropriate coordination and monitoring during the start-up phase.

If performance standards are not met, EPA has authority to amend the ROD accordingly. This can be done without incurring from the onset the disadvantages of a single ROD. EPA's authority to prevent any party from interfering with the implementation of the remedy on another site is well established without the necessity of incorporating multiple sites into a single ROD or order.

364 EPA Response:

As cited by the commenter, EPA has been and remains aware of the commenter's sensitivities to the implementation of a single ROD. However, EPA does not agree that the groundwater contamination from the two sites is separable, that a single ROD is the most appropriate, nor that it will delay implementation of the remedial action, as the commenter suggests. The following address several points as made by the commenter, roughly in the order made within the comment.

The commenter states that work to date has proceeded under separate orders for the Montrose and Del Amo Sites. This is true. However, for groundwater, EPA more appropriately would have sought to negotiate a single joint order to effect the JGWFS but did not stop work to do so because, at the time that the joint groundwater effort was initiated, Montrose Chemical and the Del Amo Respondents agreed to undertake the effort voluntarily. This was a calculated risk for EPA. While the joint parties ultimately did complete the modeling effort acceptably, they did not complete an acceptable JGWFS report, necessitating EPA's takeover and completion of the work on that document. Thus, while work did proceed under separate orders, this fact does not lend support for separability of the remedial action.

The commenter cites the letter of C.B. Paine to EPA dated June 20, 1996. This letter, and another letter from Shell Oil Company to EPA dated January 14, 1998, present an argument in favor of EPA's issuing separate RODs for groundwater. EPA responded to these letters in a letter dated February 20, 1998, from Keith Takata of EPA to Rand Shulman , Vice President of Shell Oil, laying out its explanation for why EPA believed that a single ROD was appropriate for groundwater at the Joint Site. EPA did not agree with Shell that a "wide range of remedy scenarios" would be implied by a single ROD. EPA also has explained the appropriateness of using a dual-site approach to groundwater in the Section "Context, Scope and Role of the Remedial Action" of this ROD. The contamination at the sites, and the analysis of and implications associated with possible remedial actions for either of the sites, is inextricably related. While portions of the remedial action could be *implemented* in a separate manner, the evaluation leading to remedy selection cannot.

The commenter does not support the supposition that the single ROD will "produce significant practical and legal obstacles to timely implementation," nor state what specific obstacles the commenter envisions. The commenter appears to believe that a site-specific ROD would be preferable to a dual-site ROD because it would, in the commenter's view, allow the commenter to proceed with remedial designs and actions related only to its site (the Del Amo Site), entirely separate from those for the remainder of the Joint Site. The comment states that a dual-site ROD will delay those aspects of the remedial action

"pertaining to the Del Amo Site which are *independent*" [emph. added] **of the additional data gathering and analysis, and remedial design for the other areas of the remedial action.**

This comment is baffling in that it seems to contradict the majority of earlier comments made by the commenter on EPA's proposed plan, which imply (1) that all design work pertaining to the chlorobenzene and TCE plumes should be performed *prior* to any work on the benzene plume, and (2) that only after such work is completed can a remedy for the benzene plume be "finalized." (We note that EPA disagreed with these points.) These earlier comments would suggest that the commenter agrees that there is a profound interrelation among the various plumes and that action on the benzene plume (or, the "independent, Del-Amo action" referred to by the commenter) will be delayed for technical purposes independent of the nature of the ROD. Yet in this comment the commenter says a dual-site ROD would somehow prevent progress on "independent" design aspects.

As EPA has stated and explained earlier in this ROD, EPA believes that remedy selection is not separable and that the technical evaluations leading to it must be performed in a unified vehicle. While it was appropriate for the JGWFS to evaluate the interrelationships among separate actions for each of three plumes, the remedial design will address all requirements of this ROD as a unified whole. The dual-site ROD does not prevent progress on any aspect of this remedial design; in fact, it enhances and simplifies the requirements that must be met by the design.

The dual-site approach is not inconsistent with the NCP. The dual-site groundwater remedial action selected by this ROD is, in fact, an operable unit of the type described at 40 C.F.R. 300.430(a)(2)(A). Moreover, within the context of the unified remedial design, EPA may create phases to the remedial design and action, if appropriate to expedite the remedial action. The commenter does not identify the activities that it believes are "independent" and therefore might be subject to being expedited. However, to the extent that they may exist, there is no reason that a dual-site ROD would prevent the commenter from negotiating an agreement with EPA for their completion. A wide range of enforcement and settlement options for implementing the remedial action are available regardless of whether a dual-site ROD is employed. The dual-site ROD does not place restrictions on these options and will not prevent consistency with the NCP provision cited by the commenter.

The commenter states that optimization modeling shows that the chlorobenzene remedy can be conducted without impact to the benzene plume and that hydraulic separation can be maintained between the benzene and chlorobenzene plume. The commenter also states that it is unlikely that contaminant migration between the sites will interfere with remediation goals. We disagree that "optimization modeling" has been performed adequately to draw these conclusions. The JGWFS model cannot be stretched to the

extreme that the commenter has used it. EPA agrees and this ROD determines that it should be possible to design a remedial action that limits adverse impacts among the plumes, but this is true only if the design accounts for both the benzene and chlorobenzene plumes in a unified manner. EPA disagrees that modeling or any other analysis has shown that the two plumes mentioned are naturally independent such that designs for each plume can proceed without regard for the other. Any design analysis, whether now or in the future, would have to consider all three plumes and have available the benefits of all previous joint analysis already performed. "Contaminant migration between the sites will be unlikely to interfere with remediation goals" only if the remedial action is designed as a whole. EPA agrees that it is possible that construction and maintenance, and possibly some limited aspects of design, *may* be completed in a separate manner, as determined by EPA during those phases.

In actuality, employing a separate (single-site) ROD approach would introduce far more delay and technical and administrative hardship than does the joint (dual-site) ROD. Significant portions of two single-site RODs for groundwater would be redundant. EPA would have to ensure that all aspects of the two RODs were consistent with one another. The same issues of plume interactions and mutual implications of remedial actions would have to be addressed each of two RODs, even though such issues are, at their core, resolved by a single technical analysis. Having proceeded to the present point under a dual-site approach, the remedy can be selected immediately, whereas creating two consistent separate RODs would require a great deal of time. There would be no administrative or technical benefit to creating two RODs, and EPA is unable to identify the "disadvantages of a single ROD" referred to by the commenter in the last paragraph of the comment.

5. Responses to Written Comments Received From PACAAR, Inc.

Preface by EPA:
In this section, EPA summarizes its responses to written comments provided by PACAAR, Inc. PACCAR, Inc. (PACCAR) reports that it is associated with the property located at 120 West 196th Street immediately adjacent to the former Del Amo plant property. The comments refer to the firm Hart Crowser, which served as PACCAR's consultant for the comments.

Where appropriate, responses are given both within the body of a comment as an issue arises, as well as at the end of an overall comment. The commenter's text is shown in normal text. The summary of EPA's response is given in **bold and back-shaded text.**

For ease of reference, the original comments have been numbered, with the exceptions of Sections 5 and 6. Sections 5 and 6 of PACCAR's comments present information and data summaries regarding liability allocation with respect to potential source(s) of TCE and other chlorinated solvents. EPA notes that liability allocation is not part of and therefore is irrelevant to the remedy selection. For brevity, the original text in these two sections is not repeated in the response summary. The text of comments which require a response from EPA are otherwise incorporated verbatim.

The EPA responses are in the same order as the original comments on the following sections listed below:

Section 2	- Groundwater Flow Model
Section 3	- Contaminant Transport Model
Section 4	- Proposed Remedial Approach
Section 5	- Potential Chlorinated Solvents Source Areas
Section 6	- Extent of TCE Groundwater Contamination
Section 7	- Conclusions

2.0 Groundwater Flow Model

This section presents Hart Crowser's comments on the MODFLOW model developed for the Joint Groundwater Feasibility Study (JGWFS). **We conclude that the JGWFS groundwater flow model is inadequately calibrated, primarily because of the assumption of steady-state groundwater flow conditions and the decision to perform only a steady-state calibration.** Accurate model calibration is critical for this site because the modeling data are being used to assess the potential effectiveness of very expensive and prolonged remediation methods which have a distinct potential for spreading chemical constituents into previously uncontaminated areas, including the Gage Aquifer. Specific issues are discussed below.

365 EPA Response:

EPA disagrees that the model is inadequately calibrated for the purposes for which the model has been used. The commenter is correct that model flow calibration can be essential to interpreting modeling results. However, the adequacy of model calibration cannot be evaluated without an understanding of the applications for which the model was developed. No model can be used for all purposes; all models have limitations. A model is not "inadequate" as long as uses of the model are not made which lie outside its acknowledged limitations.

In this case, EPA recognized the limitations of the model for evaluating the *"potential for spreading chemical constituents into ... the Gage Aquifer,"* and did not use the model to evaluate remedial alternatives with respect to the potential for mobilizing contaminants into the Gage Aquifer. Instead, EPA developed criteria for all remedial alternatives that require the minimization of adverse effects of these alternatives on other contaminants, including potential spreading of contaminants into the Gage Aquifer. The optimization of remedial alternatives to achieve these criteria will be performed at the remedial design stage, and will likely require additional, more detailed modeling. The use of the existing numerical model of the Joint Site was limited to the comparative evaluation of the conceptual scenarios to (1) contain and clean (reduce the volume of) the chlorobenzene plume; and (2) contain the benzene plume. In fact, the JGWFS did not solely rely on the model in the evaluation of the benzene plume containment (e.g., the evaluation of the effectiveness of biodegradation to prevent the vertical migration of benzene into the Gage Aquifer). Specifically, the hybrid containment of the benzene plume in the MBFC Sand was proposed by EPA even though the model predicted that the benzene plume could be contained vertically in the MBFC Sand by only intrinsic biodegradation.

With respect to flow calibration, very reasonable root-mean-square head differences were achieved between observed and simulated conditions in every hydrostratigraphic unit simulated, while keeping hydraulic parameters constrained within reasonable site-specific ranges. This is an indicator of good flow calibration. Contrary to the comment, the use of steady-state assumptions in this case is appropriate given the intended and actual uses of the model (see responses to later comments).

The model used in the JGWFS was highly adequate and fully appropriate when used within its limitations. The model was only one tool used by EPA in the remedy selection process; EPA accounted for the limitations of the model and did not use the model outside the confines of its limitations. More specifically, the degree to which the current model is calibrated is considered sufficient for the use of the model in the JGWFS.

2-1 Non Steady-State Groundwater Flow System. There are two issues related to the assumption of steady-state flow:

a) Water levels in the water-bearing zones beneath the site have risen approximately 25 feet since 1965. Data collected by Dames & Moore indicate that water levels rose 2 feet between 1993 and 1996. By definition, this is not steady-state.

366 EPA Response:

As stated in the JGWFS, a rising trend in the groundwater elevations appears to be uniform and similar in all the units of the Bellflower Aquitard and the Gage Aquifer. Therefore, the horizontal and vertical components of hydraulic gradient in these units do not change significantly with respect to time. In addition, the model of the Joint Site is used for the comparative evaluation of remedial scenarios that primarily rely on hydraulic stressing (i.e., pumping and injection) of the aquifers for containment and contaminant removal purposes. The effects of these hydraulic stresses will likely exceed any potential changes in natural gradients that could be caused by rising water levels. Therefore, the ability of the model to predict future changes in natural gradients is not of great importance. Based on the aquifer test data at the Joint Site, the drawdowns and mounding in the remedial extraction and injection wells, respectively, are expected to stabilize in a short period of time (i.e., days to weeks), relative to the duration of the overall remedy implementation (i.e., on the order of 100 years). Therefore, the assumption of steady-state flow is considered appropriate for the simulation of remedial scenarios in the JGWFS.

(b) The modelers note that horizontal groundwater gradients and flow directions have remained roughly constant during the period of the RI. It does not appear that any attempt was made to assess whether different flow directions prevailed during historic operations of the Del Amo and Montrose facilities.

367 EPA Response:

Only limited site-specific water level data are available for the time of operations of the Del Amo and Montrose facilities. It is possible that highly localized pumping from industrial wells that might have been located on the former Montrose and Del Amo facilities historically may have had some effect on local flow directions, although these wells have not been identified. The historic changes in water levels due to historical recharge is not expected to be significant because the West Coast Basin is overlain by the low-permeability fine-grained Bellflower Aquitard, and seasonal changes in the amount of recharge do not significantly affect groundwater levels.

Thus, the accuracy of the contaminant transport model calibration is questionable if different groundwater flow directions and gradients prevailed historically, and vertical water levels are

changing.

368 EPA Response:

EPA is well-aware that the accuracy of the transport calibration is affected by the numerous uncertainties including the historic groundwater flow directions. This is why the transport calibration is referred to as a "quasi-calibration" in the JGWFS. However, the uncertainties associated with the transport calibration do not significantly effect the comparative analyses of conceptual alternatives performed in the JGWFS because these uncertainties equally affected all remedial alternatives. Additionally, the quasi-calibration of the transport portion of the model (i.e., an attempt to reproduce contaminant distributions from the known sources) actually helped to assess the historic flow conditions. A relatively good match between the observed and simulated contaminant distributions achieved by the quasi-calibration of solute transport throughout most of the modeling domain provides some indication that the historic flowfield reproduced by the model is reasonable. As stated in the response to the comment above, EPA does not claim that the degree of transport calibration allows for any use of the model, only that it is sufficient for the purposes to which the model has been used.

2.2 Non-Unique Calibration. The groundwater flow model was calibrated to assumed steady-state flow conditions. In a steady-state model, there are an infinite number of combinations of hydraulic conductivity values that will yield the same head distribution. This means that errors in estimated hydraulic conductivity values cannot easily be detected, resulting in erroneous estimates of groundwater flow rates and subsequent contaminant migration velocities.

369 EPA Response:

The non-uniqueness of solutions to the equations of groundwater flow is typically more significant when solving "inverse" problems (i.e., determination of the hydraulic parameters given a particular flowfield). In the case of the Joint Site, however, values of hydraulic conductivity for the units of concern were thoroughly assessed by numerous aquifer tests and laboratory analyses (JGWFS, Appendix B, Section 2.5, May 18, 1998). Therefore, a number of solutions for the calibration of the model for groundwater flow was limited by the small range of hydraulic conductivity values obtained in the field. Because of a reasonably good agreement between the observed and simulated flowfield that was achieved during calibration using the hydraulic conductivity values estimated in the field, the model is considered adequate for estimating contaminant migration velocities.

The model must be calibrated to transient conditions, e.g., time-drawdown data from one of the aquifer tests conducted at the site or sequential water level data from operation of the

groundwater extraction system at the Mobil Refinery southwest of the site. A transient calibration will improve confidence in hydraulic conductivity estimates. Transient calibration also provides data regarding aquifer storativity which is needed to assess effects of water level rise and drawdown.

370 EPA Response:

As discussed in response to Comment 2-1, a steady-state numerical model is sufficient for simulating remedial alternatives, given conditions at the Joint Site. The simulation of transient conditions does not add any value to the model with respect to the "confidence in hydraulic conductivity estimates," because the existing model is based on the reasonably accurate estimates of these parameters from the aquifer tests. The storativity of the aquifers beneath the site is not a critical parameter for the simulation of the remedial alternatives because drawdowns and mounding in the vicinity of the remedial extraction and injection wells, respectively, will likely stabilize in a short period of time, relative to the duration of the overall remedy. Storativity, while useful to assess a short-term transient drawdown (or mounding), is not necessary in the calculations of the stabilized drawdown (or mounding). Again, the model is being used as one tool among many for a feasibility study, not the optimization of a remedial design or action.

2-3 Vertical Groundwater Flow Poorly Calibrated. Predicting vertical groundwater flow will become critical if groundwater is extracted from the Gage Aquifer. Artificially increasing downward groundwater flow could induce contaminant migration from the Bellflower B and C Sands downward into the Gage Aquifer. Because of the steady-state calibration issue discussed above, the existing model is poorly calibrated with respect to vertical groundwater flow. Vertical groundwater flow rates can only be assessed by pumping one unit and monitoring the response to pumping in adjacent hydrogeologic units. We recommend that the model be calibrated to time-drawdown data from one of the aquifer tests conducted at the site to improve the vertical groundwater flow calibration.

371 EPA Response:

EPA disagrees that the groundwater model is poorly calibrated for the uses that have been made of the model. Because drawdown/mounding caused by the pumping/injection wells will likely stabilize in a relatively short time frame, reasonable estimates of vertical flow can be and have been generated by the steady-state model, given the accurate estimates of vertical hydraulic conductivity performed in the field using the ratio method by Newman and Witherspoon (1972). For this reason, the vertical flow simulated with the existing model is considered reasonable for most of the site, with the exception of a few areas that are identified and discussed in the JGWFS.

EPA agrees that the model is limited in its ability to simulate the vertical migration of contaminants into the Gage Aquifer. These limitations, however, are not caused by the

steady-state nature of the model, but by the uncertainties associated with the sources of contaminants in the MBFC Sand and likely contaminant migration pathways in the Lower Bellflower Aquitard (LBF) which cannot be simulated. For these reasons, EPA does not rely on model simulations for evaluating the potential for vertical migration of contaminants into the Gage Aquifer. Instead, EPA proposes the performance-based hydraulic containment of contaminants in the MBFC Sand to prevent contaminants from migrating into the Gage Aquifer. The commenter should understand that all components of the remedial system will still be subject to optimization during the remedial design phase of the project; the remedial action has not yet been designed. The model was sufficient for the purposes of evaluating and comparing the long-term performance and feasibility of alternatives, however.

2-4 Adequacy of Site Pumping Tests. As a result of time constraints, we were not able to assess the adequacy of existing site pumping test data for use in transient model calibration. In particular, we were not able to determine whether there were sufficient observations to assess response to pumping in different water-bearing zones. These data should be reviewed and additional aquifer tests conducted as needed to address data gaps.

6372 EPA Response:

See responses to Comments 2-1 through 2-3. The procedures used by the modelers for the aquifer tests were appropriate for collecting reliable data on hydraulic conductivity and were approved by EPA. Only a few pump tests performed by Montrose Chemical Corporation used observation wells (i.e., in most tests, drawdowns were measured only in a pumping well), because of the small radius of influence that could be achieved in the low-permeable sediments of the Bellflower Aquitard. Most of these tests, therefore, did not allow for the estimation of storativity. However, as discussed in response to Comment 2-2, the storativity of the aquifer is not considered in the calculations of the steady-state flow, which is sufficient for the purposes of the JGWFS. Additional aquifer testing could be conducted at the remedial design stage, if needed, based on the requirements of the design.

3.0 Contaminant Transport Model

In this section Hart Crowser presents comments on the contaminant transport model developed to support remedial alternative evaluation for the JGWFS. We conclude that the contaminant transport model is inadequately calibrated to support critical evaluation of the proposed remedial alternatives and cannot provide a defensible estimate of the duration of cleanup.

6373 EPA Response:

EPA disagrees with the conclusion that "the transport model is inadequately calibrated to support critical evaluation of the proposed remedial alternatives." This comment does not consider the purpose of the modeling (See Responses to Comment 2). For example, the

model was never intended to "provide a defensible estimate of the duration of cleanup." Instead, the JGWFS considered only the relative rates of approaching to clean up for different scenarios, which were evaluated using the values of pore-volume flushing rates (Section 5 and Appendix B of the JGWFS, May 18, 1998). In fact, few long-term models, if any, are capable of providing reliable estimates of clean-up times because of numerous uncertainties associated with transport parameters and the general difficulty in determining potential spatial and temporal changes in these parameters given the existing technology (although, we admit, many model users inappropriately take such modeling estimates as if they were reliable, anyway).

Few models can be calibrated with a high degree of certainty with respect to contaminant transport. While a reasonable and approximate ("quasi-") transport calibration should be (and was, in this case) performed in a modeling effort, it is unusual that a modeler can claim that highly accurate vertical transport calibration has been obtained for large, complex, and deep aquifer systems because the degree of uncertainty associated with contaminant source terms and release patterns/timing is typically substantial. This model is no exception. The transport calibration is suitable for certain purposes, and not for others. While EPA fully recognizes the limitations of the transport calibration, the accuracy of this calibration is considered to be sufficient for the uses made of the model (i.e., for the relative comparison of remedial alternatives) given the complexity of geologic and environmental conditions at the Joint Site.

3-1 Porosity Variation. A uniform value of 30% was selected for porosity for all layers of the model. In reality, porosity varies with the texture and depositional environment in which the soils were deposited indicating that porosity should vary from unit to unit and possibly from location to location. Although the geotechnical testing data indicate that porosity values greater that [sic] 30% may occur at the site, the effective porosity (pore space capable of transmitting fluid) is likely to be as much as an order of magnitude lower. Lower values for effective porosity increase average groundwater flow velocities for transport. Thus, in our judgment the choosen [sic] porosity of 30% is too high. **Selection of an erroneously high value for porosity could be the primary factor in the modelers' reported difficulty in calibrating the model to the chlorobenzene plume migration distance.** These data should be reviewed and field tests such as groundwater tracer studies should be performed as needed to assess effective porosity.

374 EPA Response:

The selected porosity value of 30 percent is not "erroneously high" when the site-specific data are carefully considered. As described in Appendix B of the JGWFS, the measured total porosity in the soil samples from the Del Amo Site ranged from 36.5 percent to 41.8 percent. Physical tests conducted as part of the MW-20 pilot program showed that effective porosity ranged from 24.1 percent to 50.4 percent. Samples collected at the former Montrose Property indicated that the values of total porosity ranged from 33.7 percent in

the Lynwood Aquifer to 52.1 percent in the Middle Bellflower Muds (MBFM). Therefore, the use of an average value of 30 percent is considered reasonable.

In addition, even if the values of effective porosity are overestimated for some areas of the Joint Site, the effect of this overestimate on the relative comparison of remedial scenarios would be minimal for the following reasons:

1. **The overestimate of effective porosity likely would have an equal effect on all the remedial scenarios.**

2. **All remedial scenarios (other than no-action) included containment of the chlorobenzene plume. Consequently, the rate of uncontained chlorobenzene migration, which could be affected by the potential overestimation of porosity, is not of great importance in the evaluation of the remedial scenarios.**

   We agree that chlorobenzene migration under the no-action alternative could be greater than predicted if true porosity were, in fact, higher. However, the movement of the chlorobenzene plume under no-action was deemed unacceptable; hence, a greater estimate for porosity would not have an appreciable impact on the outcome of the evaluation of remedial alternatives.

3. **In the case of the benzene plume, intrinsic biodegradation is the predominating parameter that controls the rate of benzene migration. Therefore, any potential overestimation of effective porosity is not expected to have a significant effect on the benzene migration.**

3-2 Incorrect Treatment of NAPL Dissolution. The model overestimates NAPL dissolution by using a constant concentration boundary in areas of the site where NAPL is suspected. This assumption by the modelers implies that regardless of the groundwater flow rate, the concentration of constituents dissolving from the NAPL phase remains fixed. Numerous EPA studies and remedial investigations have indicated that this is not the case. At low groundwater flow rates, the dissolved concentration may approach the aqueous solubility of the constituent. At higher groundwater flow rates (i.e., as would occur for progressively more aggressive groundwater extraction scenarios) lower dissolved concentrations will be observed because the rate of diffusion from trapped NAPL phases into groundwater is limited. This is a conservative assumption for risk assessment related to the no action alternative. It is not conservative for remedial design because it overestimates the effectiveness of pump & treat remediation by overestimating the rate at which NAPL dissolves in response to pumping. The EPA should use a transport model designed to simulate rate-limited NAPL dissolution such as MOTRANS or T2VOC.

375 EPA Response:

The commenter fails to observe that all remedial alternatives, other than no action, hydraulically isolate a region surrounding the NAPL which remains contained indefinitely. The effectiveness of the reduction of the chlorobenzene plume is evaluated based on the percent reduction in mass and volume of the portion of the chlorobenzene plume that is isolated from (i.e. *outside)* the containment zone (Section 5 of the JGWFS, May 18, 1998). With the NAPL isolated hydraulically, NAPL dissolution is no longer able to feed the larger dissolved plume with contaminant mass. The evaluation of remedial scenarios for the benzene plume focused only on containment, not reduction, of the plume because the entire plume fell within the containment zone. Therefore, the rate of NAPL dissolution does not affect the evaluation of alternatives in any way.

The statement that "a constant concentration boundary" for NAPL "overestimates the effectiveness of pump and treat remediation" is therefore incorrect. In addition, the existing model was not used for the remedial design, which was apparently misunderstood by the commenter based on the statement that the constant concentration boundary "is not conservative for remedial design." The modeling was used exclusively for the feasibility study-level comparative evaluation of the remedial alternatives. Additional, more detailed modeling may be conducted at the remedial design stage, if necessary. The assumption of the constant concentration source boundary is reasonable for the comparative evaluation of remedial alternatives.

The JGWFS did not make estimates of the time required for the NAPL to entirely dissolve *inside* the containment zone. While the rate of NAPL dissolution will strongly influence *that* time period, the JGWFS appropriately considers the time to be indefinite and it has little implication for the purposes of remedial selection in this case. This remedial action imposes indefinite hydraulic containment of NAPL and dissolved phase cleanup, and can be designed regardless of the rate the NAPL dissolves.

3-3 Incomplete NAPL Characterization. As noted in the JGWFS, existing data to characterize the locations and mass of material present in suspected NAPL are incomplete. It is not clear how EPA will achieve closure on this site unless NAPL areas are delineated. EPA should collect additional data as needed to confirm areal extent of suspected NAPL areas.

376 EPA Response:

The scope of this remedial action addresses hydraulic isolation of NAPL and dissolved phase cleanup. Known and suspected locations of NAPL are considered in the JGWFS and the selection of this groundwater remedial action. The existing data on NAPL are sufficient for assessing the remedial alternatives and evaluating the impracticability of cleaning NAPL-contaminated areas to the MCLs. It is true that insufficient information on NAPL exists to evaluate the potential for NAPL recovery and, as the comment states, to "achieve

closure" on both sites. More detailed characterization of NAPL will be completed by subsequent soil and NAPL feasibility studies that are ongoing at this time and will lead to the selection of additional remedial actions, as necessary.

As noted in the discussion in response to Comment 3-2, "the locations and mass of material present" as well as the rate of LNAPL dissolution do not affect the evaluation of remedial scenarios for the benzene and chlorobenzene plumes. These factors will affect the later studies and remedial selections just mentioned, however.

3-4 Natural Attenuation Inadequately Characterized. The final remedy for this site must rely on natural attenuation (and/or more aggressive source removal, discussed below) or the proposed groundwater extraction system can never be shut down. EPA should conduct site specific natural attenuation evaluations such as those described by Istok et al (1997) to evaluate biodegradation rates for benzene and chlorobenzene [sic] for use in the final remedy for the site and remedial alternatives evaluation. The references cited do not consider recent developments in the study of TCE biodegradation which indicate increased degradation rates are possible in the presence of benzene and petroleum hydrocarbons. More recent literature such as the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water (EPA, 1996) need to be consulted for estimates of biodegradation rates for TCE and chlorinated organics in multiconstituent groundwater plumes.

377 EPA Response:

The remedial action cannot rely on monitored natural attenuation (i.e., monitored intrinsic biodegradation)[1] for cleaning all groundwater to in-situ groundwater (drinking water) standards (ISGS) given the site-specific nature of the multiple NAPL sources at the site (it is assumed that the term "natural attenuation" used in the comment refers to intrinsic biodegradation). As discussed in Appendix E of the JGWFS, "more aggressive source removal" to achieve MCLs in groundwater in NAPL-contaminated areas is not technically practicable (See Appendix E of the JGWFS; May 18, 1998). Therefore, while "the proposed groundwater extraction system" (assuming this refers to the wellfield targeting the chlorobenzene plume outside the containment zone) will be shut down after achieving ISGS levels outside of the TI waiver zone, wells containing the benzene and chlorobenzene plumes within corresponding TI waiver zones will most likely pump indefinitely. Due to the uncertainty associated with the TCE sources, the time frame for operating the source control wells for TCE is not known at this time.

[1]EPA note: Intrinsic biodegradation is a specific form of natural attenuation referred to in this ROD (See Section 7.3 of the Decision Summary). However, the terms *monitored intrinsic biodegradation* and *monitored natural attenuation* are consistent terms in the context of the EPA Policy, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites,* OSWER Directive 9200.4-17, December 1997.

It is noted that "contain indefinitely" is not synonymous with "contain forever" as implied in the comment. Logically, there will come a time at which the need for containment/NAPL isolation will be exhausted; presumably when the mass of NAPL is no longer in the ground (due to long-term dissolution or physical recovery). If significant biodegradation of any of the Joint Site contaminants should exist that could not be estimated reliably or accounted for in the remedy selection, this will affect the actual time that containment pumping will have to remain in place. Such distinctions, however, will come into play during the course of the remedial action, and not at the point of remedy selection.

As EPA discussed in this ROD regarding the potential for intrinsic biodegradation of chlorobenzene, in remedy selection processes the key issue is not whether intrinsic biodegradation exists, but whether it can be *relied upon* as a remedial mechanism. If it cannot, then even if it is occurring to some degree, it will serve to promote the effectiveness of, but cannot obviate the need for, other remedial measures which will have to be implemented regardless.

As stated in the JGWFS, EPA intends to collect more data on the distribution and sources of TCE at the remedial design stage. A reasonable degree of information on intrinsic biodegradation of TCE will be also collected at this time.

EPA will take the information sources cited by the commenter under advisement for the remedial design phase. EPA was aware of the recently reported potential for TCE to biodegrade more quickly in the presence of other hydrocarbons. The remedy selected by this ROD addresses the TCE plume in a performance-based manner (i.e., it must stay contained within the TI waiver zone). Therefore, if intrinsic biodegradation of TCE is enhanced by the coincident degradation of benzene, the TCE may stay within the TI wavier zone and no contingent actions will be necessary. If it does not, then contingent actions will be necessary. The actions selected for TCE in this ROD are consistent with whatever degree of intrinsic biodegradation of TCE may be occurring.

3-5 Biodegradation Over Simplified. The EPA modelers specified a single degradation rate for each constituent modeled. In reality, geochemical conditions vary greatly across the site with strong anaerobic conditions likely in the interior of the benzene and chlorobenzene plumes and aerobic conditions likely on the fringes of those plumes. Because aerobic degradation rates are likely to be an order of magnitude or more greater than anaerobic degradation rates for benzene, the single value selected is likely to be a poor compromise. The situation is reversed for TCE which is unlikely to degrade in the aerobic conditions outside the benzene and chlorobenzene plumes but may experience substantial degradation inside those plumes. The reducing conditions combined with a substantial carbon source (benzene) support mineralization of TCE by cometabolic degradation. The modelers should use spatially varying degradation rates to account for varying geochemical conditions in the water-bearing zones underlying the site.

378 EPA Response:

The statement in the comment that "the EPA modelers specified a single degradation rate for each constituent modeled" is incorrect. Spatially variable biodegradation rates (half-life values) were assigned to benzene based on the calibration of the benzene transport. The benzene half-life used in the model ranged from 100 to 9,000 days as shown on Figures B-2.6a through B-2.6d, Appendix B of the JGWFS. Due to reasons listed in Section 2.7.4 of Appendix B of the JGWFS, intrinsic biodegradation of chlorobenzene was assigned to zero.

One conceptual simulation was performed for the TCE no-action scenario. For this limited simulation, which did not affect the evaluation of remedial alternatives, a literature value for half-life of TCE was used in the model. The data on the TCE distribution and sources, however, are not sufficient for any meaningful evaluation of the site-specific TCE biodegradation rates. The TCE scenario, which is proposed in the JGWFS, is performance-based, and does not preclude any further optimization after more information is collected at the remedial design stage, including information on the TCE biodegradation.

3-6 Possible Incorrect Treatment of Dispersion. In the introduction to Appendix B the authors noted that the upstream finite difference solver preserves mass balance and minimizes numerical dispersion. MT3D's finite difference solver does minimize mass balance error, but it is notorious for having numerical dispersion problems with sharp contamination fronts (such as occur here). The text doesn't say which solver the authors used but if they used the finite difference solver, the model wouldn't be sensitive to small values of dispersion coefficient. The modelers reportedly used a dispersion value of 1 ft but noted that the model was insensitive to this parameter. A larger dispersion coefficient would tend to disperse contaminants (e.g., chlorobenzene farther downgradient than predicted by advective flow alone). Most authors note that dispersion seems to be scale dependent. Based on the EPRI report (Waldrop, 1985), a dispersion value on the order of 30 to 50 feet may be more appropriate. EPA should review which solver was used for the transport modeling and whether a larger value for dispersion coefficient may be appropriate.

379 EPA Response:

The solute transport simulations were performed using the MT3D finite-difference solver. EPA concurs that, while the simulated values of dispersivity are based on the best match between the observed and simulated concentrations achieved during transport calibration of benzene as well as chlorobenzene, the potential underestimation of this parameter, especially in the case of chlorobenzene, is possible. However, the uncertainty associated with the parameter of dispersivity is not of a great concern because it would have an equal effect on all the remedial scenarios. Alternative performance is compared on a relative, not absolute, basis.

In addition, the assumption of the relatively low dispersion for the calibration of the benzene transport model is the conservative approach. The higher value of dispersion would have resulted in the larger benzene historic migration during calibration. Therefore, the smaller values of benzene half-life would have had to be used to offset the effect of

larger dispersion, and to match the simulated results with the observed limited migration of the benzene plume. The use of the smaller half-life for benzene is not conservative, however, for simulating the future conditions (i.e., for "forward" simulations), because it could potentially result in the underestimation of the benzene migration.

4.0 Proposed Remediation

The groundwater remediation alternatives discussed in the JGWFS rely on groundwater extraction to slowly remove organic constituents from the vicinity of suspected NAPL areas. Because the transport models use a constant concentration term to represent NAPL dissolution, they cannot be used to represent NAPL removal or estimate the duration of cleanup. Because the transport models oversimplify and use nonsite-specific data to represent biodegradation processes, they cannot be used to assess natural attenuation. As a result, the groundwater flow/contaminant transport modeling described in the JGWFS can only be used to qualitatively assess plume containment and the relative effectiveness of different groundwater extraction schemes in cleaning up groundwater outside of the suspected NAPL areas. Aggressive destruction/removal of NAPL combined with carefully documented and/or enhanced natural attenuation are crucial to developing a realistic closure plan for the JGW site. EPA should aggressively pursue evaluation of these approaches.

Specific comments on the remedial alternative evaluation are presented below.

380 EPA Response:

EPA concurs that the model can only be used "to qualitatively assess plume containment and the relative effectiveness of different groundwater extraction schemes in cleaning up groundwater outside of the suspected NAPL areas." As discussed in response to Comment 3, the model was never intended to "represent NAPL removal or estimate the duration of cleanup." Again, it is noted that the scope of this remedial action is hydraulic isolation of NAPL and dissolved phase cleanup outside the containment zone. The rate of NAPL dissolution does not influence the alternatives framed under this approach. EPA is in fact aggressively pursuing the evaluation of alternatives for NAPL recovery and this will be the subject of a second phase of remedy selection related to groundwater.

If the term "realistic closure plan " refers to the selection of this groundwater remedial action, the statement that "aggressive destruction/removal of NAPL" is critical for developing of this remedy is incorrect. The remedy for groundwater can be developed assuming that the NAPL sources will be contained, and the subsequent soil and NAPL feasibility study and remedy selection processes will determine whether and to what extent the NAPL sources could be recovered (removed). As discussed in Appendix E of the JGWFS, the existing data on NAPL are sufficient, however, for recognizing the technical impracticability of cleaning these sources to ISGS levels (e.g. MCLs). Therefore, the TI waiver for LNAPL and DNAPL sources was proposed by EPA for this remedial action.

EPA concurs with the commenter's statement that groundwater models cannot be used to assess natural attenuation[2] (i.e. intrinsic biodegradation) in the absence of other factors such as geochemical evidence, monitoring data, etc. The data on the biodegradation of the benzene plume are sufficient, however, to consider the intrinsic biodegradation of benzene for the containment-only purposes in the remedy selection. The commenter will note that the Del Amo Groundwater RI Report and the JGWFS considered multiple lines of evidence, including those cited by the commenter, before concluding that monitored natural attenutation (i.e. monitored intrinsic biodegradation) of benzene could be relied upon as a remedial mechanism for the benzene plume. EPA did not merely use the model for this purpose.

4-1 Inconsistent Reliance on Mass Transfer Mechanisms. Section 4 of the JGWFS presents inconsistent reliance on contaminant mass transfer mechanisms. Specifically, aggressive NAPL destruction/removal technologies such as in situ oxidation are ruled out in Table 4-5 because "mass transfer limitations of heterogeneous aquifer prevent distribution of oxidizing agents to contaminated zones". The retained remedial technology, groundwater extraction and treatment is implicitly a mass transfer limited process particularly in heterogeneous aquifers.

381 EPA Response:

Under extraction conditions, mass transfer is toward extraction wells, hence containing contaminants and effecting their ultimate removal. Under in-situ oxidation conditions, mass transfer of oxidant toward contaminant is significantly more difficult to effect with hydraulic injection mechanisms than mass transfer of contaminant toward an extraction well. Additionally, once an oxidant is consumed or otherwise lost, the contaminant mass may still exist and continue to affect groundwater. Other limitations of in-situ oxidation at the Joint Site are explained in Section 4.3.1.3 of the JGWFS. These limitations suggest that in-situ oxidation is not likely to be particularly effective at the Joint Site.

4-2. New Remedial Technologies Ignored. As noted above, the JGWFS ruled out aggressive NAPL destruction/removal technologies such as in situ oxidation. Without considering new in situ oxidation technology developments (e.g., see Levin et al, 1997), groundwater recirculation and treatment wells (Schrauf et al, 1994), and sparging/soil vapor extraction.

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[2]EPA note: Intrinsic biodegradation is a specific form of natural attenuation referred to in this ROD (See Section 7.3 of the Decision Summary). However, the terms *monitored intrinsic biodegradation* and *monitored natural attenuation* are consistent terms in the context of the EPA Policy, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites,* OSWER Directive 9200.4-17, December 1997.

382 EPA Response:

Once again, the commenter fails to observe that NAPL recovery/destruction is not within the scope of this remedial action. NAPL is being hydraulically contained and dissolved-phase contamination outside the containment zone is being cleaned up.

If the commenter intended that EPA evaluate the technologies mentioned for *dissolved phase* cleanup of the entire contaminant distribution, then EPA did consider these technologies and they were appropriately rejected for this purpose. Groundwater recirculation and treatment wells are referred to as "vacuum-vaporizing wells" in the text of the JGWFS. As discussed in the JGWFS, groundwater recirculation and treatment (i.e., vacuum-vaporizing wells) is not expected to be effective due to the significant extent of groundwater contamination (covering several square miles and occurring to a depth of up to 400 feet bgs and across several aquitards). The significant vertical extent of contamination in conjunction with the presence of the low-permeable units (i.e., aquitards) would prevent in-situ recirculation of injected groundwater, which is an essential aspect for the performance of this technology. The costs of employing the technology over so large an area would be prohibitive.

EPA is open to considering such technologies with respect to NAPL recovery at the sources, to be evaluated in the second phase remedy selection processes.

4-3 Failure to Evaluate Potential Mobilization of Onsite/Offsite Plumes. Aggressive groundwater extraction could mobilize groundwater contamination identified at other sites north and west of the JGW site such as those identified at the Douglas facility. EPA should evaluate potential effects on other groundwater contamination sites in the vicinity, possibly with assistance from the RWQCB to identify sites.

383 EPA Response:

The potential effects of the remedial alternatives on other existing groundwater contamination have been taken into consideration by the JGWFS. For this very reason, the development criteria for the remedial alternatives require the minimization of the potential adverse effects of remedial actions on other contaminants. Injection of treated water back into the aquifer in conjunction with the containment of the benzene plume in the MBFC Sand, and source control actions for TCE, are aimed to achieve compliance with these criteria. Additional remedy optimization will be performed at the remedial design stage, if needed, upon the collection of the additional data on contaminant distribution and sources within the radius of influence of remedial wellfields at the Joint Site. EPA concurs with the commenter that coordination with the RWQCB is essential and that attention to possible interferences from the sources mentioned (including McDonnel Douglas) should be paid during the remedial design and action. Should interference occur, EPA has authorities which it can, at its discretion, use to mitigate the interference.

4-4 Failure to Acknowledge Potential Operational Issues. The JGWFS noted the potential for groundwater extraction to cause undesirable migration of the contaminant plumes but did not discuss potential operational issues as a consequence of operating multiple pumping and injection wells in multiple aquifers. Balancing groundwater extraction and injection is likely to be more difficult than indicated by the numerical model. Treatment of contaminated groundwater may alter groundwater chemistry sufficiently to cause precipitation or fouling problems in the reinjection wells. EPA should identify and discuss options for addressing potential operational issues. A treatability study or examination of operational issues at similar facilities, e.g., the treatment system at the Mobil refinery southwest of the site may be appropriate.

384 EPA Response:

Operational issues were evaluated in the JGWFS with respect to the implementability and cost criteria. The JGWFS acknowledged that fouling of injection wells could cause operational problems, which would affect the cost and implementability of injection. As discussed in Sections 6, 7, and 8 of the JGWFS, ancillary technologies would be evaluated and applied for the expressed purpose of reducing the potential for fouling of injection wells. Testing of such ancillary technologies, including determining optimal concentrations of polyphosphate to prevent fouling, will be conducted during the remedial design stage. EPA agrees that balancing hydraulic extraction and injection, and maintaining injection rate, present challenges in remedial design and action which are not reflected by the model. Again, the model was not the only tool used by EPA in performing the JGWFS. Despite the challenges noted, EPA believes the remedial action is feasible. The commenter is referred back to the JGWFS for more information on these topics.

The commenter's suggestion to review the operational issues at the Mobil refinery is well taken and will be considered in the remedial design phase. Treatability studies, as necessary, can be performed during the remedial design phase.

4-5 Failure to Evaluate Effect of Water Level Rise. There is no discussion of how rising water levels may affect operation of the proposed groundwater extraction and injection system. Rising water levels will increase the transmissivity of the water table zone in direct proportion to the increase. Increasing transmissivity will lead to reduced effectiveness of groundwater containment systems or a need to increase groundwater extraction rates. A rising water table could also mobilize contaminants currently bound in soil above the water table.

385 EPA Response:

The potential effects of future water level rises are expected to be minimal, compared to stresses imposed to the natural flowfield by the extraction and injection wells. However, these effects will be further evaluated during the remedial design phase, if deemed necessary. The goal of a feasibility study, as the name implies, is to assess feasibility and

not to perform a design. The proposed remedial alternatives are conceptual with respect to the number of wells, pumping rates, and locations, and could change upon the full consideration of the remedial design issues.

4-6 No Evaluation of Duration of Cleanup. As noted previously, the JGWFS model cannot be used to evaluate the duration of cleanup. EPA should implement aggressive source removal technologies and perform monitoring and analysis as needed to develop an estimate of the cleanup duration. EPA should also have a plan in place for procedures if TI wavers are approved for NAPL areas at the site.

386 EPA Response:

Again, the groundwater remedial action is being evaluated and selected in two phases. The present phase does not evaluate NAPL recovery/removal; it addresses hydraulic isolation of NAPL and dissolved phase cleanup. As such, source removal (NAPL recovery) technologies are not pertinent to the present effort. The TI waiver referred to by the commenter is, in fact, approved with the selection of this remedial action. The requirements, contingencies for transgressions of containment, etc. are all evaluated and incorporated in this remedial action.

In the case of the Joint Site and the JGWFS computer model, development of a reliable absolute estimate of cleanup duration is not feasible and therefore not appropriate at this time. Even increasing the model's sophistication would not erase the uncertainties inherent in the long-term modeling of these complex systems. Also, it is unlikely that the increased data needed to support more sophisticated assessments would be available. The model could, of course, produce values for "total cleanup time." However, EPA believes it is disingenuous to represent that estimate as the cleanup time because the uncertainty associated with it is too high. There are too many uncertainties in both existing and future conditions to make a modeling estimate reliable over a time frame on the order of centuries.

The amount of time for all NAPL to be dissolved so that NAPL isolation is no longer necessary is the most uncertain, and EPA has not modeled this value. The cleanup duration for this is "indefinite." The time to achieve reduction of the plume outside the containment zone is likely to be on the *order* of a century.

5.0 Potential Chlorinated Solvents Source Areas

In this section PACCAR presents a summary of available data on TCE and other chlorinated solvents in soil and groundwater at the following sites:

- Trico
- Del Amo Site

- American Polystyrene (formerly AMOCO)
- Douglas Aircraft Company
- Lawson Chemical

[Note: the original information supplied by PACCAR is not repeated here.]

387 EPA Response:

EPA acknowledges the need for collecting additional data on chlorinated solvents, including distribution and sources of TCE. The additional data will be collected during the remedial design phase before finalizing the design of the TCE remedy. The information provided by PACCAR will be reviewed by EPA, and considered during the remedial design stage for the development of additional data collection programs.

6.0 Extent of TCE Groundwater Contamination

[In this section, PACCAR presents the results of the review of two reports.

These two reports are the groundwater RI for Del Amo Site dated May 15, 1998, prepared by Dames & Moore and the final groundwater feasibility study dated May 18, 1998, prepared by CH2M HILL for EPA. The original text supplied by PACCAR is not repeated here for brevity.]

388 EPA Response:

See response to Comment 5.0 above. The existing TCE data are considered sufficient for the conceptual and performance-based approach to the remedial action components for TCE presented in the JGWFS. However, this approach will be further optimized during remedial design upon collection of additional data.

7.0 Conclusions

7.1 The following conclusions have been drawn about the proposed remedy.

The groundwater flow model used by EPA has the following deficiencies:

7.1.1 The groundwater flow system is not steady-state. Water levels have risen 25 feet since 1965 and 21 feet between 1993 and 1996. In addition historic groundwater flow directions and gradients are unknown; and

389 EPA Response:

See responses to Comments 2 through 2.3.

7.1.2 Vertical groundwater flow was poorly calibrated. The ability to predict vertical flow is critical if groundwater is extracted from the Gage Aquifer.

390 EPA Response:

See response to Comment 2-3.

7.2 The following conclusions have been drawn about the contaminant transport model:

7.2.1 The effective porosity values used are too high;

391 EPA Response:

See Response to Comment 3-1.

7.2.2 NAPL dissolution rates are overestimated, resulting in an overestimate of the effectiveness of pump and treat remediation;

392 EPA Response:

See Response to Comment 3-2.

7.2.3 Natural attenuation has been inadequately characterized. This is important because the final remedy will depend on natural attenuation; and

393 EPA Response:

See Response to Comment 3-4.

7.2.4 Biodegradation has been oversimplified. The single degradation rate used for each constituent does not appropriately reflect the variation in geochemical conditions across the site.

394 EPA Response:

See Response to Comment 3-5

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7.3 The following conclusions pertain to the proposed groundwater remedial strategy:

7.3.1 The proposed remedial approach ignores developments in aggressive remedial technologies such as in situ oxidation.

395 EPA Response:

See response to Comment 4-2

7.3.2 In addition the potential to mobilize onsite and offsite plumes does not appear to be adequately addressed. Specifically contaminant plumes at Douglas Aircraft and International Light Metals which are to the northwest of Del Amo have not been addressed.

396 EPA Response:

See Response to Comment 4-3.

7.3.4 The effect of rising water levels on the groundwater extraction and injection system have not been evaluated, and most importantly no duration of cleanup has been developed.

397 EPA Response:

See Response to Comment 4-5.

7.3.5 Inadequate details about the basis for TCE plume remediation have been provided. What is the basis for using 9 extraction wells and 1 injection well in the B Sand in the TCE/PCE areas, etc?

398 EPA Response:

The absence of full characterization does not preclude the FS-level development of the remedial scenario for TCE. The proposed source-control remedy for TCE is based on the limited data on TCE distribution, and is therefore conceptual and performance-based as explained in the JGWFS. The performance-based remedy specifies general remedial actions (i.e., pump-treat-inject), and assumes that the remedy will be optimized at the remedial design phase to achieve the required performance. The number, locations, and pumping rates for the TCE source-control scenario were specified only for the preliminary order-of-magnitude cost estimate based on the general understandings of the hydrogeologic conditions and fate and transport of TCE. Because the TCE-remedy component is the same for all remedial alternatives, the cost of the TCE remedy does not affect the relative comparison of the remedial alternatives and selection of the final remedy. As stated in the JGWFS, the TCE remedy may be modified at the remedial design phase, as necessary, upon collection of additional data.

7.3.6 Failure to acknowledge potential operations issues.

399 EPA Response:

See Response to Comment 4-4.

7.4 The following comments are provided pertaining to the existence of potential source areas:

7.4.1 We strongly believe that the EPA needs to evaluate the impact on known and potential TCE source areas adjacent to the Joint Sites, before implementing an aggressive pump and treat program with no defined end point.

400 EPA Response:

See Response to Comment 4-3. EPA concurs that the sources and extent of chlorinated solvents at the Joint Site need to be further assessed prior to the design of the Joint Site remedy. However, the existing data are sufficient for the feasibility-study-level evaluations such as the comparative evaluation of different remedial alternatives. The selected remedy for the dissolved contaminants at the Joint Site, such as pump-treat-inject approach for the (1) containment of dissolved contaminants, (2) containment of the chlorobenzene and TCE sources (i.e., DNAPL), and (3) removal of the chlorobenzene mass, will not likely change based on the potential findings on TCE distribution and sources.

7.4.2 Completely define the sources of TCE/PCE in this area in light of the discrepancies noted in concentration of TCE/PCE in soil vs. groundwater, prior to implementing groundwater remediation for the Joint Sites. There is reason to believe that additional sources may exist in the area of concern.

401 EPA Response:

See Response to Comment 7.4.1.

7.4.3 Inadequate soil sampling and groundwater quality data exist for the former "pits and trenches" located on the northwestern portion of the Del Amo Site. This area should be further investigated.

402 EPA Response:

Additional investigation will be performed as part of the ongoing RI/FS process for soils and NAPL at the Del Amo Site that may include the Pit and Trench Areas.

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