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Charnock Initial Regional  
Response Activities (CIRRA)

TASK 6.11 (b)  
ANALYSIS OF ALTERNATIVES DETAILED  
EVALUATION REPORT  
Charnock Sub-Basin  
Los Angeles, California

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19 November 2001

**VOLUME I  
REPORT**

*submitted to:*

California Regional Water Quality Control Board  
Los Angeles Region

*and*

U.S. Environmental Protection Agency  
Region IX

*on behalf of:*

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Shell Oil Products Company  
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**LIST OF ACRONYMS AND ABBREVIATIONS**

AF	Acre-foot
AFY	Acre-feet per year
AL	Action Level
AOP	Advanced Oxidation Process
AOT	Advanced Oxidation Technology
AQMD	Air Quality Management Districts
BACT	Best Available Control Technology
BAT	Best Available Treatment Technology
BMP	Best Management Practices
BRAG	Bingswanger/Realty Advisory Group
BTEX	Benzene, toluene, ethylbenzene, and xylene
CAA	Clean Air Act
CAL H&SC	California Health & Safety Code
CARB	California Air Resources Control Board
CCC	Criterion Continuous Concentration
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIRRA SOW	Charnock Initial Regional Response Activities Scope of Work
CIRRA	Charnock Initial Regional Response Activities
CMC	Criterion Maximum Concentration
COBH	City of Beverly Hills
COSM	City of Santa Monica
CTR	California Waste Toxics
CUP	Conditional Use Permit
CUPA	Certified Unified Program Agency
CWA	Clean Water Act
DHS	Department of Health Services
DWSAP	Drinking Water Source Assessment Plan
EBCT	Empty Bed Contact Time
EBEP	Enclosed Bays & Estuaries Plan
EBF	Electronic Borehole Flowmasters
EDR	Existing Demand Rate

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**LIST OF ACRONYMS AND ABBREVIATIONS**  
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GAC	Granular Activated Carbon
GRA	General Response Activities
GRA1	First General Response Activity
IDR	Increased Demand Rate
IWD	Industrial Waste Discharge
IWD	Industrial Waste Discharge
LA RWQCB	Los Angeles Regional Water Quality Control Board
LACFCD	Los Angeles County Flood Control District
LARWQCB	Los Angeles Regional Water Quality Control Board
LPGAC	Liquid Phase Granular Activated Carbon
LPGAC	Liquid Phase Granular Activated District
MCL	Maximum Contaminant Level
MCLs	Maximum Contaminant Levels
MGD	Million Gallon per Day
MODFLOW	Models to simulate groundwater flow paths
MtBE	Methyl tertiary-Butyl Ether
MTU	Michigan Technological University
MTZ	Mass Transfer Zone
MWD	Metropolitan Water District
NBWs	North Basin Wells
NEEP	Northern Environmental Products of West Lebanon, New Hampshire
NEPA	National Environmental Policy Act
NOM	Natural Occurring Materials
NPDES	National Pollutant Discharge Elimination System
NPV	Net Present Value
NTR	National Toxics Rule
O&M	Operations & Maintenance
OBIG	Olympic Boulevard Industrial Corridor
OEHHA	Office of Environmental Health Hazard Assessment
OS1-XL	Open Space extra Limited Height District
OSM	Operating Standard Methods
PAN	Property Assessor Number
PCAs	Possible Contaminating Activities

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**LIST OF ACRONYMS AND ABBREVIATIONS**  
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PFD	Process Flow Diagram
PV	Present Value
RaoA	Required Analysis of Alternatives
RO	Reverse Osmosis
RP	Remediation Treatment Plan
SA/AOC	Stipulated Agreement & Administrative Order on Consent
SCAQMD	South Coast Air Quality Management District
SCWC	Southern California Water Company
SMWD	Santa Margarita Water District
SOW	Scope of Work
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
tBA	tertiary-Butyl Alcohol
THMs	Trihalomethanes
TIN	Triangular Irregular Network
TMDLs	Total Maximum Daily Loads
TSS	Total Suspended Solids
UICP	Underground Injection Control Program
USDW	Underground Source of Drinking Water
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tanks
UV	Ultra violet
VOCs	Volatile Organic Compounds
VPGAC	Vapor Phase Granular Activated Carbon
WBMWD	West Basin Municipal Water District
WRD	Water Replacement District of Southern California
WRP	Water Replacement Plant
WWC	Western Water Company

## Section 1. Introduction

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This report has been prepared by Kennedy/Jenks Consultants (Kennedy/Jenks) and ENVIRON International Corporation (ENVIRON) on behalf of Shell Oil Company, Shell Oil Products Company, and Equilon Enterprises LLC (Shell) as required by joint agency requirements contained in Attachment A, Scope of Work (SOW), Task 6.11 (b), to the Los Angeles Regional Water Quality Board (LA RWQCB) and the United States Environmental Protection Agency (USEPA) under Stipulated Agreement No. 00-064 and the Administrative Order on Consent USEPA Docket No. RCRA 7003-09-2000-0003 (SA/AOC) (the Agencies).

Task 6 is entitled “Analysis and Recommendation of Alternatives for Drinking Water Response.” The overall purpose of this task is to evaluate and recommend longer-term interim drinking water response measures, which could be implemented to provide the Impacted Parties (COSM and SCWC) with drinking water until the Agencies determine if any further action is necessary.

Task 6.11 is entitled “Analysis of Interim Alternatives Reporting.” The SOW for Task 6.11 requires the submittal of:

- (a) General and Interim Response Alternatives and Screening Evaluation (subtask 6.1), which was submitted on 6 September 2000.
- (b) Analysis of Alternatives Detailed Evaluation Report (subtasks 6.2 through 6.10), which is the content of this report.

The Agencies require the Drinking Water Analysis of Alternatives Detailed Evaluation Report (Drinking Water RAoA) to include a detailed analysis of alternatives and recommended alternative for interim provision of drinking water. The Agencies specified that the Drinking Water RAoA is to consider the following four General Evaluation Criteria (where applicable):

- overall protection of human health and the environment,
- attainment of response objectives,
- control of sources of release, and
- compliance with standards.

Any interim response measures proposed as a viable alternative must meet, at a minimum, these four general criteria and then must be compared using the following six Decision Factors:

- long-term reliability and effectiveness,
- reduction of toxicity, mobility, or volumes of wastes,
- short-term effectiveness,
- implementability,

- cost, and
- community acceptance.

## 1.1 Background

On 6 September 2000, Shell submitted the Task 6.1 report entitled “General and Interim Response Alternatives Identification and Screening Evaluation,” which proposed four selected general interim response measures for detailed evaluation:

- restore Charnock Well Field,
- relocate the drinking water wells from the Charnock Well Field (located in the Charnock Sub-Basin) to a less impacted area of the Santa Monica Basin,
- obtain alternate drinking water supplies from outside the Santa Monica Basin, and
- resource allocation/basin management.

The report considered the four General Evaluation Criteria in determining potentially appropriate technologies.

In a letter dated 11 January 2001, the Agencies conditionally approved the Task 6.1 report and directed Shell to commence the detailed analysis of alternatives for restoration of municipal drinking water supplies in the Charnock Sub-Basin under Tasks 6.2 through 6.11 of the CIRRA Scope of Work. The Agencies required Shell to divide the drinking water alternatives into the following three groups:

- alternatives involving provision of drinking water derived from outside the Charnock Sub-Basin (replacement water),
- provision of drinking water produced from the Charnock Sub-Basin, and
- a combination of replacement water and Charnock Sub-Basin water.

The Agencies also imposed six conditions on Shell’s detailed analysis of alternatives; namely,

- inclusion of Agencies-specified alternatives to be analyzed,
- sensitivity analysis on assumptions for each alternative,
- analysis of the effect of implementation timing on each alternative,
- effect of each alternative on pumping rates,
- identification of the most appropriate treatment technology(ies) for each alternative involving wellhead treatment and
- compare details of each alternative to develop a recommendation for the remedy best satisfying the goals and criteria set forth in the CIRRA SOW.

The Agencies 11 January 2001 letter required Shell to submit this Analysis of Alternatives report by 9 August 2001. Subsequently, the Agencies (by letter dated 13 August 2001) extended the submittal date to 19 November 2001 to give Shell time to address additional issues identified during alternatives development with the Agencies and the Impacted Parties.

Subsequently, the list of alternatives requiring analysis has evolved as the result of clarification letters, monthly CIRRA meetings, the 7 and 21 June 2001 over-the-shoulder technical meetings, and the 19 and 22 June 2001 modeling conference calls among Shell, the Agencies, and the Impacted Parties. The alternatives presented in this report have been discussed by all parties in these meetings and letters and are deemed in compliance with the four General Evaluation Criteria. Key correspondence includes ENVIRON letters dated 12 February 2001 and 31 August 2001, and the Agencies 13 August 2001 letter. This report incorporates input from the Agencies and the Impacted Parties on the analysis of alternatives.

## 1.2 Report Organization

This report has been organized in the following manner:

**Section 1**, Introduction, presents the introduction, project background, general organization of the report and limitations

**Section 2**, Approach, discusses responsibilities of the responding parties preparing this Drinking Water RAOA and the approach taken to satisfy the requirements of the SOW defined in Tasks 6.2 through 6.10 and their presentation in the Task 6.11 Report;

**Section 3**, General Response Actions Identification and Screening, summarizes the identification and screening of the general response actions as presented in the September 2000 submittal as required by Task 6.1;

**Section 4**, Detailed Descriptions and Analysis of General Response Actions, presents detailed descriptions of the following actions:

- Institutional Controls
- Plume Control
- Water Replacement Alternatives
- Wellhead Treatment Alternatives, and
- Treatment Plant Site Evaluation and Selection

This section also discusses the following subjects in support of the general response alternatives:

- Regulatory and Permitting Requirements for the Treatment Technologies
- California DHS Policy Memorandum 97-005 Issues for the Treatment Technologies and the Water Replacement Actions, treatment constituent analysis, the monitoring of treated water, human health risk assessments associated with plant failure or alternative water supplies
- Selection of the Optimum Wellhead Treatment Technology

- Treatment Plant Effluent Management Options

**Section 5**, Response Alternative Descriptions, presents a detailed description of the 29 interim response alternatives, descriptions of the various alternative components, groundwater monitoring, regional remediation and a discussion of the background and development of estimated costs for all identified alternatives;

**Section 6**, Comparative Analysis of Alternatives, presents a comparative analysis of the interim response alternatives; and

**Section 7**, Recommended Response Alternative, summarizes the results of the evaluations and comparisons conducted in Sections 3 through 6 to conclude with the selection of a recommended response alternative.

Tables and Figures are numbered according to the report sections where they are introduced and are presented collectively at the end of the body of the report, as are appendices.

### 1.3 Limitations

This report was prepared by Kennedy/Jenks and ENVIRON (collectively called CONSULTANTS) for sole beneficiary use by Shell. This report represents the Consultants' professional opinion and judgment, which are dependent upon information obtained during the performance of consulting services. The conclusions were based in part on information supplied by others, the accuracy or sufficiency of which have not been independently verified by the Consultants.

Any opinions of aquifer or technology performance presented are the results of our evaluation of conditions as they exist at the time of the study and may not apply in the future as conditions change. Changes in applicable environmental standards, practices, or regulations may also occur in the future that impact the opinions presented. The Consultants are unable to report on or accurately predict events that may impact the project in the future whether occurring naturally or caused by the actions of others.

Any opinions on cost related items, such as for the purchase of water, capital construction, operations and maintenance, and the cost of money also represent the Consultants' professional opinion and judgment of conditions as they exist at the time of the study and may not apply in the future when any of the response activities are initiated.

Furthermore, the Consultants and Shell are not responsible for any claims, any and all liabilities, demands, penalties, forfeitures, suits, and the costs and expenses incident thereto that may arise from unauthorized distribution or use of the report for other than its intended use.