



DRAFT

**ENVIRONMENTAL
IMPACT REPORT**

**Exxon Benicia Refinery
Clean Fuels Project**

Lead Agency:
City of Benicia
250 East L Street
Benicia, CA 94510

September 1993

Woodward-Clyde



Woodward-Clyde Consultants
500 12th Street
Suite 100
Oakland, California 94607-4014

93C0336A



THE CITY OF
BENICIA
CALIFORNIA

**CITY OF BENICIA
PUBLIC NOTICE**

**AVAILABILITY OF DRAFT ENVIRONMENTAL IMPACT REPORT
CLEAN FUELS PROJECT AT THE EXXON BENICIA REFINERY**

A Draft Environmental Impact Report (EIR) has been prepared for the Clean Fuels Project at the Exxon Benicia Refinery through the Planning Department of the City of Benicia as the Lead Agency, pursuant to the California Environmental Quality Act of 1970 (CEQA), the CEQA Guidelines and the City of Benicia's policies regarding implementation of CEQA.

The purpose of the Clean Fuels Project is to produce the clean-burning reformulated gasoline mandated by the Federal Clean Air Act Amendments of 1990 and the California Clean Air Act. The intent of the requirements is to reduce vehicle emissions of pollutants that are either toxic to human health, or lead to the formation of photochemical smog.

Exxon proposes to construct six new process units, three auxiliary facilities and to modify existing facilities. The proposed project would be constructed within the existing Benicia Refinery Complex, which occupies a 300-acre site within approximately 850 acres of land owned by Exxon Company, U.S.A. in Benicia, California. The refinery is located approximately 1.5 miles northeast of the downtown Benicia business district at 3400 East Second Street.

The Draft EIR addresses the following potential impacts that could occur when the project is implemented: air quality, public health risk, public safety, noise, surface water hydrology and quality, groundwater and hazardous materials contamination, geology and seismicity, traffic, socioeconomics, land use public services and utilities, visual resources, cultural resources, terrestrial biology.

Copies of the Draft EIR are available for public review at the following locations:

Planning Department	Reference Desk
City Hall	Benicia Public Library
250 East L Street	150 East L Street
Benicia, CA 94510	Benicia, CA 94510
707/746-4280	707/746-4343

All written comments on the Draft EIR should be directed to Kitty Hammer, Senior Planner or Joan Lamphier, Project Manager, and submitted to the Planning Department at the above address. All comments must be received by 5PM on Monday, October 18, 1993.

The public review period for the document will extend for 45-days from September 3 - October 18, 1992. The public hearing to receive oral comments on the Draft EIR has been scheduled for the Planning Commission meeting on Thursday, October 14, 1993 at 7PM in the Council Chambers of City Hall, 250 East L Street, Benicia, California.



DRAFT

**ENVIRONMENTAL
IMPACT REPORT**

**Exxon Benicia Refinery
Clean Fuels Project**

Lead Agency:
City of Benicia
250 East L Street
Benicia, CA 94510

September 1993

Woodward-Clyde



Woodward-Clyde Consultants
500 12th Street
Suite 100
Oakland, California 94607-4014

93C0336A

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
SUMMARY	S-1
1.0 INTRODUCTION	1-1
1.1 PURPOSE OF REPORT	1-1
1.2 REPORT ORGANIZATION	1-1
1.3 SUMMARY OF THE PROPOSED PROJECT	1-2
1.4 REQUIRED PERMITS	1-4
1.5 LEAD AND RESPONSIBLE AGENCIES	1-5
1.6 DECISION TO PREPARE AN EIR	1-5
1.7 SCOPE OF THE EIR	1-6
1.8 EIR REVIEW PROCESS	1-6
2.0 PROJECT DESCRIPTION	2-1
2.1 ORGANIZATION	2-1
2.2 PROJECT LOCATION	2-1
2.3 CHEMISTRY OF PETROLEUM REFINING	2-3
2.3.1 Process Variability	2-12
2.4 THE BENICIA REFINERY AND EXISTING REFINING PROCESS	2-14
2.4.1 Overview of Benicia Refinery	2-14
2.4.2 Process Block	2-15
2.5 PURPOSE AND OBJECTIVES OF THE PROJECT	2-20
2.5.1 Federal and State Reformulated Fuel Requirements	2-21
2.5.2 Purpose of the Reformulated Fuels Regulations	2-21
2.6 CLEAN FUELS PROJECT	2-24
2.6.1 New Process Equipment	2-24
2.6.2 New Auxiliary Facilities	2-29
2.6.3 Modification of Existing Equipment	2-31

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>	
2.6.4	Electric and Gas Utility Requirements	2-32
2.6.5	Water Requirements	2-34
2.6.6	Air Emissions and Controls	2-34
2.6.7	Wastewater Treatment	2-37
2.6.8	Solid and Hazardous Waste Generation and Recycling	2-40
2.6.9	Raw Material Consumption and Product Yield	2-40
2.6.10	Safety Facilities	2-44
2.6.11	Project Construction	2-44
2.6.12	Project Schedule, Workforce, and Construction Hours	2-50
3.0	OTHER RELATED AND CUMULATIVE PROJECTS	3-1
3.1	OTHER PROJECTS AT THE EXXON BENICIA REFINERY	3-1
3.1.1	Exxon MTBE Import Facilities	3-1
3.1.2	Exxon MTBE Unit	3-3
3.1.3	Exxon Nitrogen Oxide Emissions Reduction Projects	3-3
3.1.4	Other Projects at the Benicia Refinery	3-3
3.2	RELATED PROJECTS WITHIN THE CITY OF BENICIA	3-4
3.3	OTHER PROJECTS IN THE REGIONAL AREA	3-4
3.3.1	Shell Refinery - Martinez	3-5
3.3.2	Pacific Refinery - Hercules	3-6
3.3.3	Chevron Refinery - Richmond	3-7
3.3.4	Unocal Refinery - Rodeo	3-8
3.3.5	TOSCO Avon Refinery - Martinez	3-8
3.3.6	C&H Sugar Cogeneration Project - Crockett	3-9
3.3.7	Benicia - Martinez New I-680 Bridge	3-9
4.0	ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION	4-1
4.1	INTRODUCTION	4-1
4.2	LAND USE	4-3
4.2.1	Environmental Setting	4-3
4.2.2	Impacts and Mitigation	4-10



THE CITY OF
BENICIA
CALIFORNIA

**CITY OF BENICIA
PUBLIC NOTICE**

**AVAILABILITY OF DRAFT ENVIRONMENTAL IMPACT REPORT
CLEAN FUELS PROJECT AT THE EXXON BENICIA REFINERY**

A Draft Environmental Impact Report (EIR) has been prepared for the Clean Fuels Project at the Exxon Benicia Refinery through the Planning Department of the City of Benicia as the Lead Agency, pursuant to the California Environmental Quality Act of 1970 (CEQA), the CEQA Guidelines and the City of Benicia's policies regarding implementation of CEQA.

The purpose of the Clean Fuels Project is to produce the clean-burning reformulated gasoline mandated by the Federal Clean Air Act Amendments of 1990 and the California Clean Air Act. The intent of the requirements is to reduce vehicle emissions of pollutants that are either toxic to human health, or lead to the formation of photochemical smog.

Exxon proposes to construct six new process units, three auxiliary facilities and to modify existing facilities. The proposed project would be constructed within the existing Benicia Refinery Complex, which occupies a 300-acre site within approximately 850 acres of land owned by Exxon Company, U.S.A. in Benicia, California. The refinery is located approximately 1.5 miles northeast of the downtown Benicia business district at 3400 East Second Street.

The Draft EIR addresses the following potential impacts that could occur when the project is implemented: air quality, public health risk, public safety, noise, surface water hydrology and quality, groundwater and hazardous materials contamination, geology and seismicity, traffic, socioeconomics, land use public services and utilities, visual resources, cultural resources, terrestrial biology.

Copies of the Draft EIR are available for public review at the following locations:

Planning Department
City Hall
250 East L Street
Benicia, CA 94510
707/746-4280

Reference Desk
Benicia Public Library
150 East L Street
Benicia, CA 94510
707/746-4343

All written comments on the Draft EIR should be directed to Kitty Hammer, Senior Planner or Joan Lamphier, Project Manager, and submitted to the Planning Department at the above address. All comments must be received by 5PM on Monday, October 18, 1993.

The public review period for the document will extend for 45-days from September 3 - October 18, 1992. The public hearing to receive oral comments on the Draft EIR has been scheduled for the Planning Commission meeting on Thursday, October 14, 1993 at 7PM in the Council Chambers of City Hall, 250 East L Street, Benicia, California.



DRAFT

**ENVIRONMENTAL
IMPACT REPORT**

**Exxon Benicia Refinery
Clean Fuels Project**

**Lead Agency:
City of Benicia
250 East L Street
Benicia, CA 94510**

September 1993

Woodward-Clyde



**Woodward-Clyde Consultants
500 12th Street
Suite 100
Oakland, California 94607-4014**

93C0336A



DRAFT

**ENVIRONMENTAL
IMPACT REPORT**

**Exxon Benicia Refinery
Clean Fuels Project**

Lead Agency:
City of Benicia
250 East L Street
Benicia, CA 94510

September 1993

Woodward-Clyde



Woodward-Clyde Consultants
500 12th Street
Suite 100
Oakland, California 94607-4014

93C0336A

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
SUMMARY	S-1
1.0 INTRODUCTION	1-1
1.1 PURPOSE OF REPORT	1-1
1.2 REPORT ORGANIZATION	1-1
1.3 SUMMARY OF THE PROPOSED PROJECT	1-2
1.4 REQUIRED PERMITS	1-4
1.5 LEAD AND RESPONSIBLE AGENCIES	1-5
1.6 DECISION TO PREPARE AN EIR	1-5
1.7 SCOPE OF THE EIR	1-6
1.8 EIR REVIEW PROCESS	1-6
2.0 PROJECT DESCRIPTION	2-1
2.1 ORGANIZATION	2-1
2.2 PROJECT LOCATION	2-1
2.3 CHEMISTRY OF PETROLEUM REFINING	2-3
2.3.1 Process Variability	2-12
2.4 THE BENICIA REFINERY AND EXISTING REFINING PROCESS	2-14
2.4.1 Overview of Benicia Refinery	2-14
2.4.2 Process Block	2-15
2.5 PURPOSE AND OBJECTIVES OF THE PROJECT	2-20
2.5.1 Federal and State Reformulated Fuel Requirements	2-21
2.5.2 Purpose of the Reformulated Fuels Regulations	2-21
2.6 CLEAN FUELS PROJECT	2-24
2.6.1 New Process Equipment	2-24
2.6.2 New Auxiliary Facilities	2-29
2.6.3 Modification of Existing Equipment	2-31

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>	
2.6.4	Electric and Gas Utility Requirements	2-32
2.6.5	Water Requirements	2-34
2.6.6	Air Emissions and Controls	2-34
2.6.7	Wastewater Treatment	2-37
2.6.8	Solid and Hazardous Waste Generation and Recycling	2-40
2.6.9	Raw Material Consumption and Product Yield	2-40
2.6.10	Safety Facilities	2-44
2.6.11	Project Construction	2-44
2.6.12	Project Schedule, Workforce, and Construction Hours	2-50
3.0	OTHER RELATED AND CUMULATIVE PROJECTS	3-1
3.1	OTHER PROJECTS AT THE EXXON BENICIA REFINERY	3-1
3.1.1	Exxon MTBE Import Facilities	3-1
3.1.2	Exxon MTBE Unit	3-3
3.1.3	Exxon Nitrogen Oxide Emissions Reduction Projects	3-3
3.1.4	Other Projects at the Benicia Refinery	3-3
3.2	RELATED PROJECTS WITHIN THE CITY OF BENICIA	3-4
3.3	OTHER PROJECTS IN THE REGIONAL AREA	3-4
3.3.1	Shell Refinery - Martinez	3-5
3.3.2	Pacific Refinery - Hercules	3-6
3.3.3	Chevron Refinery - Richmond	3-7
3.3.4	Unocal Refinery - Rodeo	3-8
3.3.5	TOSCO Avon Refinery - Martinez	3-8
3.3.6	C&H Sugar Cogeneration Project - Crockett	3-9
3.3.7	Benicia - Martinez New I-680 Bridge	3-9
4.0	ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION	4-1
4.1	INTRODUCTION	4-1
4.2	LAND USE	4-3
4.2.1	Environmental Setting	4-3
4.2.2	Impacts and Mitigation	4-10

TABLE OF CONTENTS (continued)

<u>Section</u>		<u>Page</u>
	4.2.3 Cumulative Impacts and Mitigation	4-13
4.3	AIR QUALITY	4-14
	4.3.1 Environmental Setting	4-14
	4.3.2 Criteria Pollutant Impacts and Mitigation Measures	4-33
	4.3.3 Odor Impacts and Mitigation	4-63
	4.3.4 Cumulative Impacts	4-66
4.4	PUBLIC HEALTH RISK	4-72
	4.4.1 Environmental Setting	4-72
	4.4.2 Impacts and Mitigation	4-87
	4.4.3 Cumulative Impacts	4-103
4.5	PUBLIC SAFETY	4-107
	4.5.1 Environmental Setting	4-107
	4.5.2 Impacts and Mitigation Measures	4-120
	4.5.3 Cumulative Impacts	4-145
4.6	NOISE	4-152
	4.6.1 Environmental Setting	4-155
	4.6.2 Impacts and Mitigation	4-162
4.7	SURFACE WATER HYDROLOGY AND QUALITY	4-172
	4.7.1 Environmental Setting	4-172
	4.7.2 Impacts and Mitigation	4-181
	4.7.3 Cumulative Impacts	4-194
4.8	GROUNDWATER AND HAZARDOUS MATERIALS CONTAMINATION	4-198
	4.8.1 Environmental Setting	4-198
	4.8.2 Impacts and Mitigation	4-205
	4.8.3 Cumulative Impacts and Mitigation	4-211

TABLE OF CONTENTS (continued)

<u>Section</u>		<u>Page</u>
4.9	GEOLOGY AND SEISMICITY	4-213
	4.9.1 Environmental Setting	4-213
	4.9.2 Impacts and Mitigation	4-218
	4.9.3 Cumulative Impacts	4-225
4.10	TRAFFIC	4-227
	4.10.1 Environmental Setting	4-227
	4.10.2 Impacts and Mitigation	4-241
4.11	SOCIOECONOMICS	4-272
	4.11.1 Environmental Setting	4-272
	4.11.2 Impacts and Mitigation	4-278
	4.11.3 Cumulative Impacts	4-282
4.12	PUBLIC SERVICES AND UTILITIES	4-285
	4.12.1 Environmental Setting	4-285
	4.12.2 Impacts and Mitigation	4-290
4.13	VISUAL RESOURCES	4-298
	4.13.1 Environmental Setting	4-298
	4.13.2 Impacts and Mitigation	4-299
	4.13.3 Cumulative Impacts and Mitigation	4-308
4.14	CULTURAL RESOURCES	4-309
	4.14.1 Environmental Setting	4-309
	4.14.2 Impacts and Mitigation	4-311
	4.14.3 Cumulative Impacts and Mitigation	4-313

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>
4.15 TERRESTRIAL BIOLOGY	4-314
4.15.1 Environmental Setting	4-314
4.15.2 Impacts and Mitigation Setting	4-315
4.15.3 Cumulative Impacts	4-329
4.16 ENERGY	4-332
4.16.1 Environmental Setting	4-332
4.16.2 Impacts and Mitigation	4-333
4.16.3 Cumulative Impacts	4-335
4.17 GROWTH INDUCEMENT	4-337
4.17.1 CEQA Requirements	4-337
4.17.2 Growth-Inducing Employment Impacts	4-337
4.17.3 Growth-Inducing Population Impacts	4-339
4.17.4 Growth-Inducing Impacts of Refinery Output	4-339
4.18 SIGNIFICANT ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED	4-340
4.18.1 Air Quality	4-340
5.0 ALTERNATIVES	5-1
5.1 INTRODUCTION	5-1
5.2 ALTERNATIVES IDENTIFIED FOR THE PROPOSED PROJECT	5-2
5.2.1 Technology Alternatives	5-4
5.2.2 Down-Sized Project	5-6
5.2.3 Process Only Low Sulfur Crude Oil	5-7
5.3 CONCLUSIONS	5-9
6.0 REFERENCES	6-1

TABLE OF CONTENTS (continued)

<u>Section</u>		<u>Page</u>
7.0	ORGANIZATIONS AND INDIVIDUALS CONTACTED, AND LIST OF PREPARERS	7-1
7.1	ORGANIZATIONS AND INDIVIDUALS CONTACTED	7-1
7.2	LIST OF PREPARERS	7-3
8.0	EIR GLOSSARY	8-1

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>
<u>LIST OF TABLES</u>	
TABLE S-1 CLEAN FUELS NEW AND MODIFIED FACILITIES	S-2
TABLE S-2 POTENTIAL IMPACTS OF THE CLEAN FUELS PROJECT AND MITIGATION MEASURES	S-6
TABLE 2-1 CALIFORNIA AIR RESOURCES BOARD SPECIFICATIONS FOR REFORMULATED GASOLINE	2-22
TABLE 2-2 CLEAN FUELS PROPOSED NEW AND MODIFIED FACILITIES	2-25
TABLE 2-3 ESTIMATED SOLID WASTES GENERATED AND RECYCLED FROM OPERATION OF THE CLEAN FUELS PROJECT	2-41
TABLE 2-4 CHANGES IN RAW MATERIAL USE FROM OPERATION OF THE CLEAN FUELS PROJECT	2-43
TABLE 2-5 PLANNED FIRE FIGHTING SAFETY FACILITIES	2-45
TABLE 2-6 ANTICIPATED MAJOR MATERIAL DELIVERIES AND REMOVALS FOR CONSTRUCTION	2-47
TABLE 4.3-1 BACKGROUND AIR QUALITY DATA FOR THE BENICIA AREA	4-20
TABLE 4.3-2 BAY AREA CRITERIA POLLUTANT EMISSION INVENTORY	4-23
TABLE 4.3-3 SOLANO COUNTY CRITERIA POLLUTANT EMISSION INVENTORY	4-24
TABLE 4.3-4 1992 EXXON REFINERY CRITERIA POLLUTANT EMISSION INVENTORY	4-25
TABLE 4.3-5 BAAQMD EMISSION SIGNIFICANCE LEVELS	4-37
TABLE 4.3-6 SUMMARY OF CRITERIA POLLUTANT EMISSIONS FROM CONSTRUCTION ACTIVITIES	4-39
TABLE 4.3-7 AMBIENT AIR QUALITY STANDARDS	4-43
TABLE 4.3-8 SCREENING THRESHOLD CRITERIA FOR EVALUATING IMPACTS OF POLLUTANT CONCENTRATIONS	4-45
TABLE 4.3-9 EMISSIONS SOURCE TYPES FOR EXXON CLEAN FUELS PROJECT	4-46
TABLE 4.3-10 CRITERIA POLLUTANT EMISSIONS FROM STATIONARY SOURCES (TONS/YEAR)	4-48
TABLE 4.3-11 NITROGEN OXIDES EMISSION CONTROLS FOR COMBUSTION SOURCES	4-50
TABLE 4.3-12 COMPARISON OF MODELED PROJECT CONCENTRATIONS TO SCREENING THRESHOLD CRITERIA	4-54

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>	
TABLE 4.3-13	COMPARISON OF MAXIMUM PROJECT CONCENTRATIONS OF SULFUR DIOXIDE WITH STATE AND NATIONAL AMBIENT AIR QUALITY STANDARDS	4-55
TABLE 4.3-14	VEHICLE EMISSIONS FORM PROJECT OPERATIONS	4-57
TABLE 4.3-15	CRITERIA POLLUTANT REDUCTIONS FROM REFORMULATED GASOLINE IN 1996 (TONS PER YEAR)	4-61
TABLE 4.3-16	INVENTORY OF REGIONAL CRITERIA POLLUTANTS ASSOCIATED WITH PROJECT OPERATIONS	4-62
TABLE 4.3-17	SUMMARY OF ODOR IMPACTS	4-65
TABLE 4.4-1	AMBIENT AIR TOXICS DATA FOR MARTINEZ, VALLEJO, AND THE BAY AREA IN 1992	4-75
TABLE 4.4-2	UNIT RISK FACTORS FOR SELECTED AIR TOXICS	4-77
TABLE 4.4-3	CANCER RISK FOR AMBIENT AIR IN MARTINEZ, VALLEJO, AND THE BAY AREA (PER MILLION)	4-78
TABLE 4.4-4	ACCEPTABLE EXPOSURE LEVELS FOR SELECTED AIR TOXICS	4-80
TABLE 4.4-5	NON-CANCER HAZARD INDEX (HEALTH RISKS) FOR AMBIENT AIR IN MARTINEZ, VALLEJO, AND THE BAY AREA	4-82
TABLE 4.4-6	SUMMARY CANCER RISKS FOR THE EXISTING BENICIA REFINERY	4-85
TABLE 4.4-7	CHEMICALS OF CONCERN	4-90
TABLE 4.4-8	PROJECT SOURCES INCLUDED IN HEALTH RISK ASSESSMENT FOR CLEAN FUELS AND RELATED PROJECTS	4-91
TABLE 4.4-9	SUMMARY OF UNCERTAINTIES IN RISK ASSESSMENT FOR EXXON CLEAN FUELS PROJECT	4-97
TABLE 4.4.10	CANCER RISKS BY CHEMICAL AND PATHWAY FOR EXXON CLEAN FUELS PROJECT	4-99
TABLE 4.4-11	CHRONIC NON-CANCER HEALTH RISKS FOR THE EXXON CLEAN FUELS PROJECT	4-101
TABLE 4.4-12	ACUTE NON-CANCER HEALTH RISKS FOR THE EXXON CLEAN FUELS PROJECT	4-104
TABLE 4.5-1	SUMMARY OF ACCIDENT SCENARIOS AT THE EXISTING BENICIA REFINERY	4-113
TABLE 4.5-2	BENICIA REFINERY-ACCIDENT HISTORY - JANUARY 1990	

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>
	4-116
TABLE 4.5-3	4-125
TABLE 4.5-4	4-126
TABLE 4.5-5	4-127
TABLE 4.5-6	4-128
TABLE 4.5-7	4-129
TABLE 4.5-8	4-131
TABLE 4.5-9	4-136
TABLE 4.5-10	4-140
TABLE 4.5-11	4-144
TABLE 4.5-12	4-146
TABLE 4.5-13	4-147
TABLE 4.5-14	4-148
TABLE 4.5-15	4-149
TABLE 4.6-1	4-153
TABLE 4.6-2	4-157
TABLE 4.6-3	4-163
TABLE 4.7-1	4-178
TABLE 4.7-2	4-179
TABLE 4.7-3	4-182
TABLE 4.7-4	4-185
TABLE 4.7-5	4-189

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>
TABLE 4.7-6 ESTIMATE OF CLEAN FUELS WASTEWATER METALS	4-193
TABLE 4.8-1 SUMMARY OF CHEMICAL TEST RESULTS FOR GROUNDWATER SAMPLES	4-204
TABLE 4.8-2 SOIL AND GROUNDWATER CONDITIONS	4-208
TABLE 4.8-3 SUMMARY OF CHEMICAL TEST RESULTS FOR SOIL SAMPLES IN THE PROJECT AREA	4-210
TABLE 4.9-1 POTENTIALLY SIGNIFICANT EARTHQUAKE SOURCES	4-217
TABLE 4.9-2 MODIFIED MERCALLI INTENSITY SCALE	4-219
TABLE 4.10-1 EXISTING INTERSECTION LEVEL OF SERVICE AND VOLUME/CAPACITY (V/C) RATIO	4-235
TABLE 4.10-2 EXISTING RAMP JUNCTIONS LEVEL OF SERVICE	4-238
TABLE 4.10-3 PROJECTED RAMP JUNCTION LEVEL OF SERVICE DURING THE CONSTRUCTION YEAR PERIOD WITHOUT THE PROPOSED PROJECT	4-248
TABLE 4.10-4 PROJECTED CONSTRUCTION PERIOD INTERSECTION LEVELS OF SERVICE WITHOUT THE PROPOSED PROJECT	4-250
TABLE 4.10-5 PROJECT TRIP GENERATION DURING THE PEAK 6-MONTH CONSTRUCTION PERIOD	4-252
TABLE 4.10-6 FUTURE RAMP JUNCTION LEVEL OF SERVICE WITH THE PROPOSED PROJECT	4-256
TABLE 4.10-7 FUTURE INTERSECTION LEVELS OF SERVICE WITH THE PROPOSED PROJECT	4-259
TABLE 4.10-8 HORIZON YEAR 2000 RAMP JUNCTION LEVEL OF SERVICE	4-269
TABLE 4.10-9 HORIZON YEAR 2000 INTERSECTION LEVEL OF SERVICE	4-270
TABLE 4.11-1 SOCIOECONOMIC CHARACTERISTICS OF THE STUDY AREA	4-273
TABLE 4.11-2 LABOR SUPPLY IN THE BAY AREA, APRIL 1993	4-275
TABLE 4.11-3 LABOR SUPPLY IN BAY AREA COUNTIES - 1990	4-277
TABLE 4.11-4 PROPOSED/PLANNED PROJECTS	4-283
TABLE 4.15-1 CALCULATED NO OBSERVED EFFECT LEVEL IN DIET AND ESTIMATED CHEMICAL INTAKE FOR INDICATOR SPECIES AT EXXON BENICIA REFINERY	4-330

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>
<u>LIST OF FIGURES</u>	
FIGURE 1-1 REGIONAL LOCATION MAP	1-3
FIGURE 2-1 LOCATION OF EXXON'S BENICIA PROPERTY AND REFINERY	2-1
FIGURE 2-2 EXXON BENICIA REFINERY	2-4
FIGURE 2-3 LOCATION OF PROPOSED CLEAN FUELS FACILITIES	2-5
FIGURE 2-4 HYDROCARBON MOLECULES COMMON TO PETROLEUM REFINING	2-6
FIGURE 2-5 RANGE OF HYDROCARBON FRACTIONS PRODUCED FROM FRACTIONATION TOWER	2-8
FIGURE 2-6 CHEMICAL REACTION THAT TAKES PLACE BETWEEN ISOBUTANE AND OLEFINS IN AN ALKYLATION UNIT	2-11
FIGURE 2-7 EXISTING BENICIA REFINERY FLOW DIAGRAM	2-16
FIGURE 2-8 REFINERY FLOW DIAGRAM WITH EXISTING AND PROPOSED PROCESS FACILITIES	2-26
FIGURE 2-9 CLEAN FUELS PROCESS FACILITIES PLOT PLAN	2-27
FIGURE 2-10 EXXON BENICIA REFINERY WASTEWATER TREATMENT FLOW DIAGRAM	2-38
FIGURE 2-11 EXXON BENICIA REFINERY	2-49
FIGURE 2-12 ANTICIPATED PROJECT SCHEDULE	2-51
FIGURE 2-13 DISTRIBUTION OF CONSTRUCTION WORKFORCE OVER TIME	2-52
FIGURE 3-1 LOCATION OF OTHER RELATED AND CUMULATIVE PROJECTS	3-2
FIGURE 4.2-1 GENERAL PLAN LAND USE DESIGNATIONS	4-4
FIGURE 4.3-1 PREVAILING SEASONAL BAY AREA WIND FLOW PATTERNS	4-16
FIGURE 4.3-2 CITY OF BENICIA WINDROSE	4-17

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>
FIGURE 4.5-1 RISK OF UPSET ANALYSIS MATRIX	4-123
FIGURE 4.5-2 RISK OF UPSET EVALUATION METHODOLOGY FIRES EXPLOSIONS, AND TOXIC RELEASES OTHER THAN AMMONIA	4-132
FIGURE 4.5-3 AMMONIA RISK OF UPSET EVALUATION METHODOLOGY	4-133
FIGURE 4.5-4 RISK OF UPSET ANALYSIS MATRIX	4-141
FIGURE 4.5-5 HAZARD SCENARIO RISK RANKING MATRIX FOR WORST CASE CREDIBLE HAZARDS	4-150
FIGURE 4.6-1 NOISE MEASUREMENT SITE LOCATIONS	4-158
FIGURE 4.6-2 SITE A - LONG-TERM NOISE MEASUREMENT AT 382 ALLEN WAY	4-160
FIGURE 4.6-3 SITE B - LONG-TERM NOISE MEASUREMENT AT 37 LA CRUZ	4-161
FIGURE 4.6-4 HOURLY NOISE LEVEL (L_{eq}) CONTOURS	4-166
FIGURE 4.7-1 LOCATION OF DRAINAGE PARCELS AND STORMWATER OUTFALLS	4-173
FIGURE 4.7-2 CLEAN FUELS PROJECT WATER BALANCE	4-188
FIGURE 4.8-1 SOIL AND GROUNDWATER SAMPLE LOCATIONS FOR PROPOSED CLEAN FUELS FACILITIES	4-202
FIGURE 4.9-1 FAULTS OF THE SAN FRANCISCO BAY REGION	4-216
FIGURE 4.10-1 ACCESS AND PARKING AT BENICIA REFINERY	4-228
FIGURE 4.10-2 EXISTING A.M. PEAK HOUR VOLUMES	4-233
FIGURE 4.10-3 EXISTING P.M. PEAK HOUR VOLUMES	4-234
FIGURE 4.10-4 EXISTING AND CUMULATIVE BASE A.M. PEAK HOUR VOLUMES	4-246
FIGURE 4.10-5 EXISTING AND CUMULATIVE BASE P.M. PEAK HOUR VOLUMES	4-247
FIGURE 4.10-6 CUMULATIVE BASE AND PROJECT A.M. PEAK HOUR VOLUMES	4-253
FIGURE 4.10-7 CUMULATIVE BASE AND PROJECT P.M. PEAK HOUR VOLUMES	4-254
FIGURE 4.10-8 HORIZONTAL YEAR 2000 CUMULATIVE P.M. PEAK HOUR VOLUMES	4-267

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>
FIGURE 4.13-1 ELEVATION LOOKING EAST AT REFINERY WITH CLEAN FUELS FACILITIES	4-301
FIGURE 4.13-2 REPRESENTATIVE VIEW OF THE PROPOSED FACILITY FROM EAST FIFTH STREET	4-303
FIGURE 4.13-3 REPRESENTATIVE VIEW OF THE PROPOSED FACILITY FROM PANORAMA DRIVE LOOKING EAST	4-305
FIGURE 4.15-1 UPLAND GRASSLAND FOOD WEB EXXON CLEAN FUELS PROJECT	4-319
FIGURE 4.15-2 AQUATIC FOOD WEB EXXON CLEAN FUELS PROJECT	4-320
FIGURE 4.15-3 CONCEPTUAL SITE MODEL FOR ECOLOGICAL ASSESSMENT	4-321

LIST OF APPENDIXES

APPENDIX A	NOTICE OF PREPARATION AND INITIAL STUDY
APPENDIX B	COMMENTS RECEIVED ON THE NOTICE OF PREPARATION