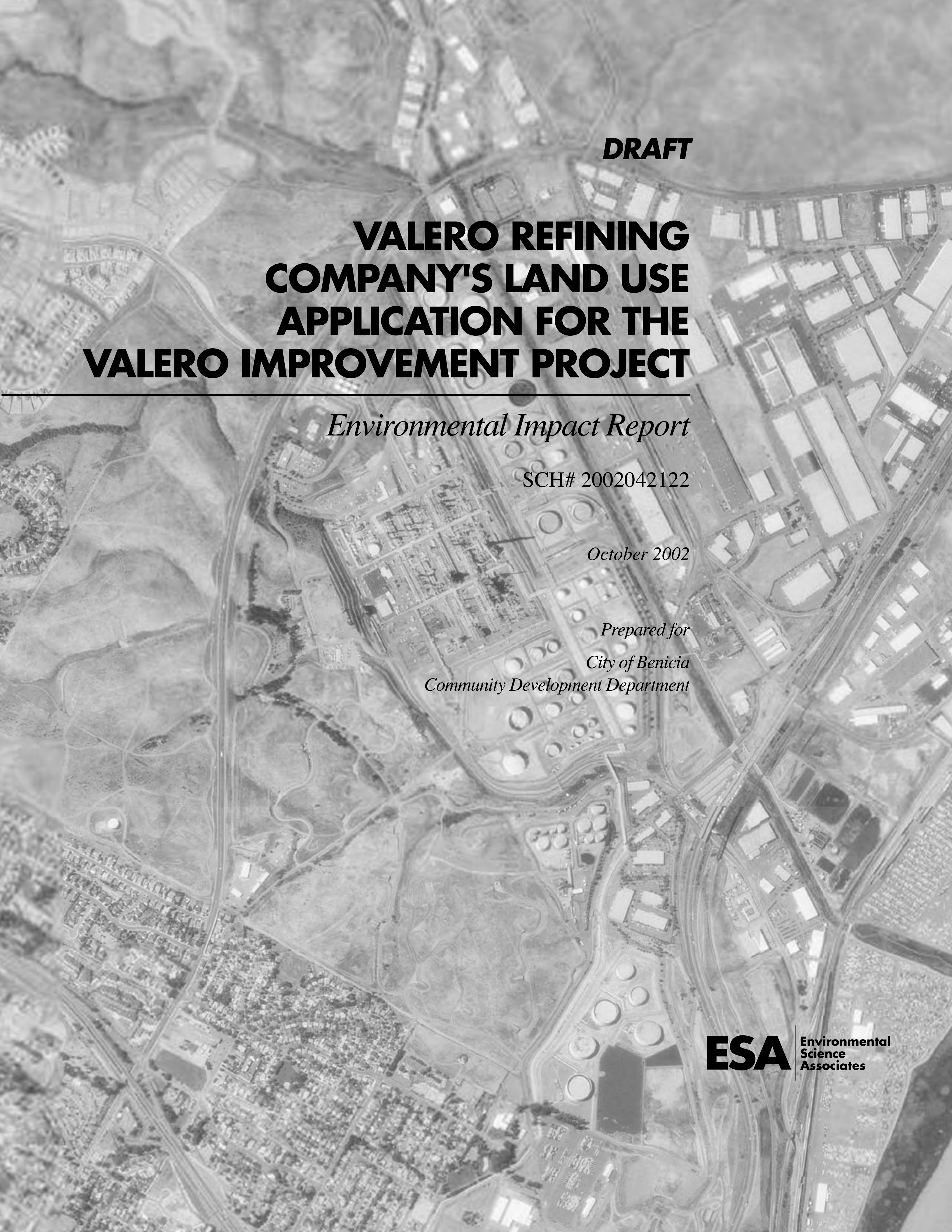


DRAFT

VALERO REFINING COMPANY'S LAND USE APPLICATION FOR THE VALERO IMPROVEMENT PROJECT

Environmental Impact Report

SCH# 2002042122

October 2002

Prepared for

City of Benicia
Community Development Department

ESA | Environmental Science Associates

DRAFT

VALERO REFINING COMPANY'S LAND USE APPLICATION FOR THE VALERO IMPROVEMENT PROJECT

Environmental Impact Report

SCH# 2002042122

October 2002

Prepared for

City of Benicia
Community Development Department

225 Bush Street, Suite 1700
San Francisco, California 94104
(415) 896-5900

436 14th Street, Suite 600
Oakland, California 94612
(510) 839-5066

8950 Cal Center Drive, Building 3, Suite 300
Sacramento, California 95826
(916) 564-4500

4221 Wilshire Boulevard, Suite 480
Los Angeles, California 90010
(323) 933-6111

2685 Ulmerton Road, Suite 102
Clearwater, Florida 33762
(727) 572-5226

700 Fifth Avenue, Suite 4120
Seattle, Washington 98104
(206) 442-0900

1751 Old Pecos Trail, Suite O
Santa Fe, New Mexico 87505
(505) 992-8860

ESA Environmental Science Associates

202115

TABLE OF CONTENTS

ENVIRONMENTAL IMPACT REPORT FOR VALERO REFINING COMPANY'S LAND USE APPLICATION FOR THE VALERO IMPROVEMENT PROJECT (VIP)

Page

Page

Page

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

CHAPTER 1
INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

This Environmental Impact Report (EIR) is an informational document intended to disclose to the public and decision-makers the environmental consequences of the proposed Valero Benicia Refinery's Valero Improvement Project. This document assesses the environmental impacts due to the project, as well as the cumulative environmental impacts in the vicinity of the project area. This document is based upon the application (as amended) of Valero to the City of Benicia and an Initial Study of this application and also the Bay Area Air Quality Management District (BAAQMD) application. This document is intended as an information document that, in itself, does not determine whether a project will be approved, but aids in the local planning and decision-making process.

1.2 PROJECT OVERVIEW

The Valero Improvement Project (VIP), the project, proposes a series of modifications and additions to the refinery. The project would modify existing and install new refining equipment. All units would be located within the refinery boundaries, generally placed among similar existing equipment. When operating, the VIP would add fewer than 20 new regular employees at the refinery. The VIP would implement a series of modifications and additions that are focused on four objectives.

1. Provide ability to process lower grades of raw materials[1].
2. Provide flexibility to substitute raw materials – crude oil instead of gas oil.
3. Optimize operations for efficient production of clean burning fuels.
4. Mitigate project-related impacts to avoid detrimental effects on the community.

The VIP would modify and install typical refining equipment -- piping, heat exchangers, instrumentation, catalytic reactors, fractionation equipment, pumps, compressors, furnaces, tanks, and their associated facilities. These changes would include installation of new facilities as well as minor changes to existing facilities. The components of the project include the following:

- Pipestill modifications to increase crude oil processing capacity by approximately 25%
- Fluid Catalytic Cracker Unit Feed Flexibility modifications to process different feeds
- Coker Unit modifications to process additional feed
- Increased refinery capacity to remove and recover sulfur
- Flue Gas Scrubber to reduce emissions from the main stack
- Additional hydrogen production to support hydrofining and hydrocracking

1 As used in this document, the term "raw materials" is defined as crude oil and gas oil feedstocks.

- Hydrofining optimization changes
- Modifications to maximize hydrocracking, alkylation, and reforming capacity
- Adding a Guard Reactor to the Hydrotreater
- Modifications to optimize fractionation processes
- New and modified existing combustion sources
- Use of additional water
- Modifications to the wastewater treatment facility
- Added support facilities and infrastructure
- Added new crude tankage
- Import and export changes

Chapter 3 describes the proposed project and recent and on-going projects in great detail, explains the relationship between the VIP and cumulative projects underway or proposed in the vicinity of Valero, discusses the regulatory context of the proposed project, and describes in detail the individual elements of the proposed project.

Valero would implement the project in a series of steps, starting in 2003 and that, if all components are built, construction would be completed in about 2009. The result would be that the refinery would be able to continue to efficiently produce clean burning fuels in the California market and would remain economically competitive into the future.

1.3 KEY AREAS OF ENVIRONMENTAL CONCERN

This study examined the potential impacts of the proposed project. All of the topics in the current California Environmental Quality Act (CEQA) Checklist were studied: Aesthetics, Air Quality, Biological Resources, Cultural Resources, Energy, Geology and Soils, Hazards and Hazardous Materials, Hydrology and Water Quality, Land Use and Planning, Noise, Public Services, Transportation/Traffic, Utilities and Service Systems.

Based on the Initial Study prepared for the VIP and comments received during scoping, the City has determined that the VIP will not result in impacts to

- Agriculture Resources
- Mineral Resources
- Population and Housing
- Recreation

Accordingly, those topics were not studied further in this EIR.

1.4 ORGANIZATION OF THE DOCUMENT

This document is organized into the following chapters:

- <u>Chapter 1 – Introduction</u>

- <u>Chapter 2 – Summary of Environmental Impacts</u>: Summarizes environmental impacts that would result from implementation of the proposed project. The summaries indicate the level of significance of those impacts.

- Chapter 3 – Project Description: Provides a detailed description of the proposed project, including its location, background information, major objectives, and technical characteristics.

- Chapter 4 – Environmental Settings, Impacts and Mitigation Measures: Contains an analysis of environmental issue areas. Discussion of each issue area is divided into: a) the setting, which describes environmental conditions and regulatory information; b) the standards of significance for determining the degree or level of potential environmental impacts for each issue; c) potential impacts, which indicate the environmental effects that are anticipated from the proposed project, and d)mitigation.

- Chapter 5 – CEQA Statutory Sections: Provides discussions of various California Environmental Quality Act mandated considerations including significant unavoidable environmental impact, cumulative and beneficial impacts that would result from the proposed project, and growth inducing impact.

- Chapter 6 – Alternatives: Describes the alternatives to the proposed project and lists their associated environmental effects.

- Chapter 7 – Report Preparation: Lists report authors by section and City staff that assisted with the preparation and review of the EIR as well as agencies and organizations consulted.

- Chapter 8 – Glossary and Acronyms: Presents definitions of terms used throughout the report. For some terms, expanded definitions are included to further assist the reader’s understanding of refinery processes in general and specific to Valero. A list of acronyms used in the report is included as well.

To assist the reader of this document, several summaries of the proposed project, expected project impacts, and mitigation measures have been prepared. Chapter 1 presents a quick overview of the proposed VIP. This information is covered in great detail in Chapter 3 with the physical components of the project fully described in Section 3.4. If the reader needs a primer on refinery operations and terms used in this document, the reader should review Section 3.3 and Chapter 8, Glossary and Acronyms. Chapter 2 summarizes project impacts and proposed mitigation measures with Chapters 4, 5 and 6 presenting the full analysis of environmental impacts and mitigation measures.

1.5 USE OF THIS DOCUMENT BY AGENCIES

In accordance with the CEQA, as amended, the City of Benicia must consider the environmental implications of the project prior to determining whether to grant or deny the request for a Use Permit for the proposed project. The City will use this EIR when considering this application for a Use Permit. Other agencies that may rely on this EIR when considering approvals for the project include the San Francisco Regional Water Quality Control Board; the Bay Area Air Quality Management District (BAAQMD), and Caltrans.

1.6 PERMITS AND APPROVALS

The VIP will require permits and approvals before project construction and operation can begin. Among them are Use Permit and building permits from the City of Benicia, and Authority to Construct and Authority to Operate approvals from the BAAQMD. Any changes in the National Pollutant Discharge Elimination System (NPDES) permits would require approval from the San Francisco Regional Water Quality Control Board (RWQCB). A Caltrans encroachment permit may be needed to implement the traffic mitigation measure.

CHAPTER 2
SUMMARY OF ENVIRONMENTAL IMPACTS

2.1 SUMMARY OF IMPACTS OF THE PROPOSED PROJECT

This section provides a summary of the environmental impacts of the proposed Valero Improvement Project (VIP), as developed during this analysis. These impacts of the proposed project and the mitigation measures that are included as a part of the proposed project have been extracted from the analyses and evaluations presented and discussed in detail in Chapters 4, 5 and 6 of this document. To assist readers with a brief overview of the results of the analysis contained in this document Section 2.2 presents summary statements of impacts from each environmental area of study. Each summary statement is a formal statement of impact and proposed mitigation as well as level of significance before and after mitigations are applied. This information is presented in tabular form in Table 2-1.

The information in Table 2-1 is arranged in four columns: 1) environmental impacts; 2) level of significance without mitigation; 3) adopted or recommended mitigation measures; and, 4) level of significance with mitigation measures applied.

2.2 REVIEW OF PROJECT IMPACTS

2.2.1 AESTHETICS, VISUAL QUALITY, LIGHT AND GLARE

Although noticeable changes in aesthetics and visual quality would occur, the aesthetic, visual and glare impacts of the VIP would be less than significant. No mitigation would be required.

- The new equipment and facilities of the VIP could be seen from public view corridors such as I-680, a designated scenic corridor.
- Operation of the proposed new scrubber stacks could create vapor plumes visible to surrounding residents and motorists.
- The proposed development would introduce new lighting on-site.
- The VIP and other Valero Refinery projects would expand the industrial appearance of the overall refinery complex.

Other cumulative projects, together with the VIP and other Valero Refinery projects, would combine to alter the general appearance of the southeast portion of the City.

2.2.2 AIR QUALITY

The construction and implementation of the VIP would lead to impacts on both the local and regional air quality. The VIP would lead to two potentially significant impacts.

- Local air quality impacts would occur primarily due to fugitive dust and emissions during construction activities. This would be a potentially significant impact. However, mitigation measures proposed as part of the project would reduce the impact to a less than significant level.

- Operational emissions would add to the regional pollutant loading in the air basin. With the implementation of mitigation measures, operational impacts of the VIP on the regional and local air quality would be reduced to a less than significant level.

2.2.3 BIOLOGICAL RESOURCES

The VIP would cause no potentially significant, unmitigatable biological impacts.

Potential direct, on-site impacts are associated with construction of crude oil tanks in non-jurisdictional wetlands at the Crude Oil Tank Farm:

- Potential disturbance of western pond turtle and California red-legged frog.

- Potential disturbance of special status and protected native birds (e.g., tricolored blackbird and Suisun song sparrow) during the breeding season.

- Potential indirect, off-site impacts to sensitive, mostly migratory, aquatic organisms are associated with discharges into the Suisun Bay and Carquinez Strait:

- Potential impacts to special status fisheries.

- Potential cumulative impacts to special status fisheries also could occur with additional water discharges from other non-refinery industrial projects, together with refinery projects.

Mitigation measures that could be incorporated into the proposed project would reduce potential impacts at the Tank Farm retention ponds to less than significant levels, while NPDES permit conditions would reduce potential impacts to sensitive, mostly migratory, aquatic organisms in the Suisun Bay and Carquinez Strait to less than significant levels.

2.2.4 CULTURAL RESOURCES

Although the previously conducted surveys revealed no new cultural resources and, consequently, no impacts of the VIP were identified, the potential for impacts does exist because construction could disturb currently unknown or unidentified cultural resources. This potentially significant impact would be reduced to less than significant by standard mitigation measures and legal requirements.

There are no cumulative impacts as a result of the other non-refinery projects.

2.2.5 ENERGY

The VIP would not encourage activities that result in the use of large amounts of fuel or energy, nor would the VIP use fuel or energy in a wasteful or inefficient manner. The overall impact of the project on energy resources would be less than significant.

- VIP modifications would increase overall electrical energy consumption at the refinery by approximately 23 MW and natural gas consumption by 9.6 million standard cubic feet per day. This increase would be less than significant.

- Other projects at the refinery would add another 7 MW of electricity demand, for a cumulative total increase of 30 MW in use at the refinery. The first unit of a new on-site cogeneration facility will generate 51 MW, sufficient electrical power for the existing refinery operations, but not for the additional 30 MW demand of the Refinery's combined planned projects. The net effect of the cumulative refinery projects would be a net 21 MW reduction in electrical demand for more than 91% of the time and a net 30 MW increase for the less than 9% of the time that the cogeneration unit is not operating. These cumulative changes in energy demand would be less than significant.

2.2.6 GEOLOGY, SOILS, AND SEISMICITY

Several potential impacts related to geology, soils, and seismicity are identified for the Valero Improvement Project. Each of these impacts would be reduced to less than significant by prescribed mitigation measures. Effects that could occur as a result of the implementation of the Valero Improvement Project are:

- Seismic groundshaking could result in injuries to persons or in structural damage.
- Facilities would be exposed to expansive soils and natural settlement.
- New tanks in the crude storage tank area could affect the stability of slopes along the perimeter berms of Lake Lund, Lake Lee, and Lake Spalding.

There are no cumulative impacts that result from the Valero Improvement Project and the other, cumulative, refinery and non-refinery projects.

2.2.7 PUBLIC HEALTH

Public exposure to toxic air contaminant (TAC) emissions from the VIP can result in health risks. However, the incremental health risks from the project are extremely small when compared to typical day-to-day health risks. Since the predicted health risk increments from the VIP are less than the significance thresholds, the impacts are less than significant. No additional mitigation measures would be required.

2.2.8 PUBLIC SAFETY

The risks to public safety from potential accidents from the VIP are low, and the impacts from plausible accidental releases would be less than significant. No additional mitigation measures would be needed.

2.2.9 HYDROLOGY AND WATER QUALITY

All hydrology and water quality effects related to the implementation of the Valero Improvement Project would be less than significant No mitigation is required.

- The wastewater retention area would be reduced due to the proposed addition of crude oil tanks. Process wastewater and storm water flows would increase. The facilities would be required to meet capacity requirements established by the Regional Water Quality Control Board;
- Solids and pollutants would increase in wastewater effluent discharge and storm water runoff to the Suisun Bay and Suisun Marsh due to increases in process wastewater and construction activities. Discharges would be required to meet discharge requirements established by the Regional Water Quality Control Board;
- Construction activities associated with the Valero Improvement Project would not adversely effect surface water quality;
- The addition of impervious surfaces associated with the Valero Improvement Project would not adversely effect groundwater resources; and,
- The cumulative effect of increased metal and chemical loading in effluent discharge to surface water bodies would not constitute a significant increase to total local and regional discharges.
- The hydrological effect on flooding of the VIP and other refinery projects are not cumulatively considerable because the storm water runoff into the Lower Sulphur Springs Creek drainage area would essentially be the same whether or not the proposed VIP is implemented.

2.2.10 LAND USE, PLANS AND POLICIES

All land use effects of the Valero Improvement Project either would be less than significant or would result in no impact. No mitigation is required.

- Project construction may result in temporary secondary impacts to adjacent industrial uses and nearby residences.
- The project would not conflict with established plans, policies and ordinances.
- The project would not potentially divide an established community.

The project would not affect a habitat conservation plan or natural community plan.

2.2.11 NOISE

The project would impact the ambient noise environment during both the construction and operational phases of the project.

Since the VIP would be located on refinery property, project-related noise impacts would primarily be to offsite residential receptors located to the west and south of the refinery. Existing daytime ambient noise levels at these residential receptors are in the order of 41 – 70 dBA, L_{eq}. Using the noise level of 60 dBA for speech interference for construction activities and noise level performance standards in the Benicia General Plan as the basis for significance thresholds for operational activities, the proposed project would lead to the following potentially significant impact

Noise during construction of the proposed project would temporarily increase the ambient noise levels at the residential receptors to levels above those specified in the Benicia General Plan. This impact would be mitigated to a less than significant level with the incorporation of the proposed mitigation measures.

2.2.12 PUBLIC SERVICES

The review confirms the conclusions of the Initial Study that all effects related to the implementation of the VIP would be less than significant. No mitigation would be required.

- The VIP would not adversely affect the ability of the Benicia Fire Department to provide fire suppression and emergency response services to the refinery or other parts of the City.
- The VIP would not adversely affect the Benicia Police Department's ability to provide police protection services to the project site and City as a whole.
- Implementation of the proposed project would not adversely affect the ability of the Benicia Unified School District to adequately provide educational services to residents of Benicia.
- The proposed project would not substantially degrade the quality of existing park and recreation facilities or require the provision of new or expanded facilities.
- The proposed VIP would not adversely affect other public services such as libraries or hospitals.

2.2.13 TRANSPORTATION

As determined by ESA, the construction phase of the VIP during the major turnaround (which includes both the turnaround and the VIP construction traffic) at the Valero Refinery would generate 3,696 average daily trips including 455 a.m. peak hour trips and 455 p.m. peak hour trips.

- The proposed construction phase of the VIP would result in a potentially significant impact to the a.m. peak hour operations of I-680 northbound off-ramp/Bayshore Road during initial project construction in 2004.
- The impact at I-680 northbound off-ramps/Bayshore Road can be mitigated by implementation of Mitigation Measure 4.13.1 which includes the provision of traffic

control personnel at the impacted intersection during the a.m. peak hour. If the traffic control officer were to be used, the level of service at the intersection would be LOS B (11.0 seconds of delay). The forecast queue length would almost be reduced in half from 625 feet to 340 feet (or 14 vehicles).

- The construction of the VIP would contribute traffic volumes to one of the I-680 ramp junctions (Industrial Way) that are already forecast to operate at LOS F in 2004 without the project. However, the VIP's contribution would be less than significant.

Operation of the VIP would add approximately 20 new employees, generating approximately 20 new a.m. peak hour trips, and 20 p.m. peak hour trips. This amount is insignificant when compared to the 2025 baseline traffic volumes at the study area intersections and ramp junctions.

2.2.14 UTILITIES AND SERVICE SYSTEMS

The implementation of the Valero Improvement Project would increase refinery raw water demand. A detailed Water Study has been prepared that documented the City's current and future water demands and the current and future water supply sources. The Water Study concluded that the current and future demands, including the VIP project, could be met with existing supplies in normal years, but that the water supplies would not be sufficient to meet future demands, with or without the VIP, in dry years. The Water Study concluded that planned future water supplies could meet all planned future demands, including the VIP, and identified the sources of supply currently being developed, including the costs, time frames for implementation, and permits, entitlements, and other approvals. Should the City not obtain or not be able to develop the additional water supplies, the future increased refinery demand for raw water would result in a significant impact to the City water supply during dry years. Some planned water supply projects would alleviate dry-year water shortages and some would provide mitigations that would reduce both the VIP and cumulative water impacts to less than significant. Implementation of the City's water conservation ordinance, if needed, would help to alleviate water shortages.

The VIP would have less than significant effects on the other utilities and services systems:

- The Valero Improvement Project would not cause wastewater effluent discharges to exceed wastewater quality limitations of the Regional Water Quality Control Board.

- Implementation of the proposed project would not substantially increase the amount of wastewater treated at the City of Benicia's wastewater treatment plant.

- The proposed project would slightly increase the routine disposal of spent catalyst and sludge from the refinery wastewater treatment plant.

No mitigation would be required for effects on other utilities and services systems.

TABLE 2-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
1. Aesthetics, Visual Quality, Light and Glare			
Impact 4.1-1: The VIP would add new equipment and facilities to developed, industrial portions of the refinery. These new facilities, which could potentially alter the visual character of the setting, could be seen from public view corridors such as I-680, a designated scenic corridor. This would be a less than significant impact.	Less than Significant	None Required	
Impact 4.1-2: Refinery operations could cause flaring events. This impact would be less than significant.	Less than Significant	None Required	
Impact 4.1-3: Operation of the proposed new scrubber could create vapor plumes visible to surrounding residents and motorists. This impact would be less than significant.	Less than Significant	None Required	
Impact 4.1-4: The proposed development would introduce new lighting on-site. This impact would be less than significant.	Less than Significant	None Required	
Impact 4.1-5: The reasonably foreseeable projects at the Valero Refinery would expand the industrial appearance of the overall complex. However, none of the changes associated with individual projects would be expected to substantially affect visual resources. As such, the projects would be expected to produce a less than significant cumulative visual quality impact.	Less than Significant	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.1-6: Other non-refinery cumulative projects, together with the VIP and other Valero Refinery projects, would combine to alter the general appearance of the southeast portion of the City. However, none of the changes would be considered to substantially impact visual resources. As such, the cumulative projects would be expected to produce a less than significant visual impact.	Less than Significant	None Required	
2. Air Quality			
Impact 4.2-1: Construction activities associated with project construction would generate short-term emissions of criteria pollutants, including suspended and inhalable particulate matter and equipment exhaust emissions. This would be a potentially significant impact.	Significant	Mitigation Measure 4.2-1a: During construction, Valero should require the construction contractor to implement the following dust control procedures to maintain project construction-related impacts at acceptable levels; this mitigates the potential impact to less than significant.	Less than Significant
		Mitigation Measure 4.2-1b: To mitigate the equipment exhaust emissions, the project sponsor should require its construction contractors to comply with specified requirements:	
Impact 4.2-2: Operational activities associated with the implementation of the proposed project could lead to increase in regional air pollutant emissions into the air basin. This would be a potentially significant impact.	Significant	Mitigation Measure 4.2-2: As a condition of approval of the use permit for the VIP, Valero must implement the Light Ends Rail Rack Arm Drains project described in Section 3.6.1.3 of this document.	Less Than Significant

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.2-3: Operational activities associated with the implementation of the proposed project could lead to increase in odorous emissions. This would be a less than significant impact.	Less than Significant	None Required	
Impact 4.2-4: The proposed project, along with other ongoing and approved projects would lead to a net reduction in emissions relative to the baseline levels. This would constitute a net air quality benefit.		None Required	
3. Biological Resources			
Impact 4.3-1: Potential disturbance of western pond turtle and California red-legged frog could occur during construction at the Tank Farm retention pond site. This impact would be made less than significant by Mitigation Measure 4.3-1.		Mitigation Measure 4.3-1: Unless protocol surveys during the period November 15 through May 15 establish that the retention ponds are not occupied by either species, the modification of any Tank Farm retention pond should be preceded by a period of at least six months during which the pond is drained and minimal water allowed to collect in the basin.	Less than Significant
Impact 4.3-2: Potential disturbance of special status and protected native birds (e.g., tricolored blackbird and Suisun song sparrow) during the breeding season could occur at the Tank Farm retention ponds. This impact would be made less than significant by Mitigation Measure 4.3-2.		Mitigation Measure 4.3-2: Construction at the Tank Farm would be limited to the non-breeding season for most birds, *i.e.*, all work would occur September through February.	Less than Significant

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.3-3: Potential impacts to special status fisheries could occur with additional water discharges into Suisun Bay or from increased ship traffic associated with increased refinery capacity. The Suisun Marsh Protection Plan (BCDC, 1976) requires that the disposal of wastewater from any existing outfall follow the permit conditions from water quality oversight agencies. Therefore, by continued compliance with the discharge requirements of the refinery's NPDES permit this impact is less than significant.	Less than Significant	None Required	
Impact 4.3-4: Potential impacts to special status fisheries could occur with additional water discharges from other non-refinery industrial projects, together with cumulative refinery projects. By continued compliance with the discharge requirements of the refinery's NPDES permit this impact is less than significant.		None Required	
4. Cultural Resources			
Impact 4.4-1: Construction of the refinery modifications may cause substantial adverse changes to the significance of currently unknown cultural resources. This impact would be less than significant with application of mitigation measure 4.4-1.		Mitigation Measure 4.4-1: Pursuant to CEQA Guidelines 15064.5 (f), "provisions for historical or unique archaeological resources accidentally discovered during construction" should be instituted. Therefore, in the event that any prehistoric or historic subsurface cultural resources are discovered during ground disturbing activities, all work within 50 feet of the resources shall be halted and Valero shall consult with a qualified archaeologist or paleontologist to assess the significance of the find. If any find is determined	Less than Significant.

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
		to be significant, representatives of Valero and the qualified archaeologist and/or paleontologist would meet to determine the appropriate avoidance measures or other appropriate mitigation. All significant cultural materials recovered shall be subject to scientific analysis, professional museum curation, and a report prepared by the qualified archaeologist according to current professional standards.	
5. Energy			
Impact 4.5-1: Operation of the VIP facilities would increase electricity consumption. This impact is less than significant.	Less than Significant	None Required	
Impact 4.5-2: Operation of the VIP facilities would increase natural gas and other fuels consumption. This impact would be less than significant.	Less than Significant	None Required	
Impact 4.5-3: Implementation of the VIP along with other projects at the Benicia Refinery will result in a net reduction in electrical demand during normal operating conditions, when the cogeneration unit is operating, and an increase in demand when the cogeneration unit is not operating. This impact would be less than significant.	Less than Significant	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
6. Geology, Soils, and Seismicity			
Impact 4.6-1: In the event of a major earthquake in the region, seismic ground shaking could potentially injure persons at the project site due to structural damage or structural failure. Ground shaking could potentially expose persons and property to seismic-related hazards, including localized liquefaction, related ground failure and seismically-induced settlement. This impact would be made less than significant by mitigation measure 4.6-1a through 4.6-1e.		Mitigation Measure 4.6-1a: Seismic design consistent with current professional engineering and industry standards should be used in construction for resistance to strong ground shaking, especially for lateral forces. The implementation of the seismic design criteria as required by the California Building Code would reduce the potential for structural failure, major structural damage, and loss of life, and reduce the primary effects of ground shaking on structures and infrastructures to generally acceptable level. At a minimum, the California Building Code requirements or a more stringent building code should be followed during design and construction of all elements of the Valero Improvement Project. Additional requirements recommended by the project California Certified Engineering Geologist or Geotechnical Engineer, based on site-specific studies and specific project requirements, should be followed and become part of the project specifications. Mitigation Measure 4.6-1b: Appropriate grading and design, in accordance with the California Building Code requirements or a more stringent standard, should be used to reduce the secondary effects of ground shaking on structures and infrastructure. Subsurface site conditions should be investigated for all project facilities to identify poor foundation materials that may be susceptible to the effects of liquefaction, lateral spreading, and	Less than Significant

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
		differential settlement. Poor foundation materials should be removed prior to construction or be subjected to ground improvement techniques. In addition, deep pile foundations should be driven through the poor foundation soils and into more competent materials.	
		Mitigation Measure 4.6-1c: Structural fill placed during the construction of the Valero Improvement Project should be designed to reduce fill settlement with keyways and subsurface drainage, and adequately compacted (i.e., Minimum 90 percent compaction as defined by American Society for Testing and Materials (ASTM D1557)).	
		Mitigation Measure 4.6-1d: All structural foundations, above-ground utilities, and underground utilities should be designed to accommodate estimated settlement without failure, especially across transitions between fills and cuts.	
		Mitigation Measure 4.6-1e: Final design of the proposed improvements should be made in conjunction with a design-level geotechnical investigation submitted to the City of Benicia for review prior to issuing any grading or construction permits.	
Impact 4.6-2: Proposed foundation construction could be subjected to the geologic hazards related to expansive soils and natural settlement. This impact would be made less than significant by mitigation measures 4.6-1a through 4.6-1e.		Mitigation Measure 4.6-2: Implementing Mitigation Measures 4.6-1a through 4.6-1e for the design and construction of all Valero Improvement Project components would reduce this impact to a less than significant level.	Less than Significant

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.6-3: Construction of additional treatment units in the crude storage tank area and/or wastewater treatment plant area could potentially adversely effect the stability of slopes along the retention pond perimeter berms. This impact would be made less than significant by mitigation measure 4.6-3.		Mitigation Measure 4.6-3: To reduce potential slope instability hazards related to static and dynamic forces in the retention pond areas, a slope stability analysis of the retention pond perimeter berms should be conducted by a licensed professional engineer. All recommendations should be used in the design and construction of the tanks and submitted to the City of Benicia for review.	
7. Public Health			
Impact 4.7-1: Public exposure to toxic air contaminant (TAC) emissions from the VIP would result in an increase in health risks. The increases in health risks are the result of exposure to both carcinogenic and non-carcinogenic substances. However, the increases would be less than significant.	Less than Significant	None Required	
Impact 4.7-2: The proposed project, along with other ongoing and approved projects would lead to a net reduction in emissions of TACs which are responsible for public health impacts. The reduction in TAC emissions would constitute a net improvement in health risks, and the impact would be less than significant.	Less than Significant	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
8. Public Safety			
Impact 4.8-1: Possible accidental releases of acutely hazardous substances that might result from the VIP were evaluated, and none were found to cause an unhealthful offsite impact or would not occur within the expected 30 year life of the plant. The impacts would therefore be less than significant.	Less than Significant	None Required	
Impact 4.8-2: Other industrial projects in the region are located too far away from the refinery to cause potential cumulative public safety impacts. In most cases, impacts from fires, explosions, or toxic gas releases are limited to the property fenceline or near the fenceline. Also, the probability of an accidental release occurring from a cumulative project at the same time that an accident would occur at the VIP would be extremely low. Therefore, cumulative impacts would be less than significant.	Less than Significant	None Required	
Impact 4.8-3: As stated in the transportation impacts section above, the MTBE phase-out project will result in the elimination of two marine visits per month, thus resulting in a reduction of marine vessel trips to the refinery. Therefore cumulative public safety impacts related to marine transportation will be less than significant.	Less than Significant	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
9. Hydrology and Water Quality			
Impact 4.9-1: In combination, additional processed wastewater and storm water runoff resulting from components of the project could potentially exceed the maximum hydraulic capacity of the system and exceed the capacity of the wastewater treatment retention area. This impact would be less than significant.	Less than Significant	None Required	
Impact 4.9-2: The proposed additional crude throughput and the additional wastewater associated with new and modified process units would increase the mass loading in the wastewater stream. The Wastewater Treatment Plant is required to adequately treat the increase in the mass loading so as not to exceed the limits required in the NPDES permit for the refinery's discharge. This impact would be less than significant.	Less than Significant	None Required	
Impact 4.9-3: The increase of crude throughput and the potential processing of a lower grade of crude would result in increased solids loading to the wastewater system. A portion of these solids are treated onsite within the Coker Unit and a portion is accumulated as a processed sludge that is disposed offsite. This impact is less than significant.	Less than Significant	None Required	
Impact 4.9-4: Depletion of groundwater supplies due to the increased impervious surface area could potentially decrease groundwater resources. This impact is less than significant.	Less than Significant	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.9-5: Depending on the particular component of the proposed project, varying amounts of wastewater would be generated by construction activities. This wastewater could contain entrained sediment, petroleum constituents, or other contaminants generated during the construction operations. Provided the applicant adheres to the grading and construction plan and city policies and programs this impact is less than significant.	Less than Significant	None Required	
Impact 4.9-6: Wastewater treatment facilities are located in the 100-year floodplain and new facilities would be subject to flooding. This impact is less than significant.	Less than Significant	None Required	
Impact 4.9-7: The accumulative wastewater and storm water flows from the project and other refinery and non-refinery projects would increase pollutant discharges to the Bay. This would be a less than significant impact.	Less than Significant	None Required	
Impact 4.9-8: Cumulatively, the storm water generated from the VIP, together with other refinery projects and the storm water generated from other non-refinery projects may potentially have a downstream flooding effect. This would be less than significant.	Less than Significant	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
10. Land Use, Plans and Policies			
Impact 4.10-1: Construction of new refinery components and on-site improvements may result in intermittent impacts to adjacent industrial uses and nearby residences due to traffic congestion, air emissions, noise increases, view disruptions and public safety. This impact is less than significant.	Less than Significant	None Required	
Impact 4.10-2: The project would not conflict with established plans, policies and ordinances in Benicia. No impact would occur.	No Impact	None Required	
Impact 4.10-3: The project would not potentially divide an established community. No impact would occur.	No Impact	None Required	
Impact 4.10-4: The project would not affect a habitat conservation plan or natural community plan. No impact would occur.	No Impact	None Required	
11. Noise			
Impact 4.11-1: Construction activities would intermittently and temporarily generate noise levels above existing ambient levels in the project vicinity over the duration of the construction period. This potentially significant impact would be reduced to a less than significant level with the implementation of Mitigation Measure 4.11-1.	Significant	Mitigation Measure 4.11-1: Over the duration of pile driving activities, Valero should require the construction contractor to implement the following mitigation measures: To reduce the potential for noise impacts from pile driving, alternate methods of driving should be used, if feasible. Alternate measures may include pre-drilling of piles, the use of more than one pile driver to lessen the total time required for driving piles, and other measures. Pile driving activities should limited to daytime hours between 7 a.m. and 7 p.m., on weekdays. Pile driving shall be prohibited during weekends, state and federal holidays. Valero would also	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
		designate a construction complaint manager for the project for the duration of the construction activities.	
Impact 4.11-2: Operational noise associated with the VIP could increase at nearby noise receptors. This impact would be less than significant.	Less than Significant	None Required	
Impact 4.11-3: The proposed project together with proposed and planned future development at the Valero refinery could result in cumulative increase in noise levels. This impact is less than significant.	Less than Significant	None Required	
12. Public Services			
Impact 4.12-1: Implementation of the proposed project would not affect the Benicia Fire Department's ability to provide adequate fire suppression and emergency medical services to the project site and City as a whole. No impact.	No Impact	None Required	
Impact 4.12-2: Implementation of the proposed project would not affect the ability of the Benicia Police Department to provide police protection services to the project site and City as a whole. No impact.	No Impact	None Required	
Impact 4.12-3: Implementation of the proposed project would not affect the ability of the BUSD to adequately provide educational services to residents of Benicia. No impact.	No Impact	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.12-4: The proposed project would not degrade the quality of existing park and recreation facilities or require the provision of new or expanded facilities. No impact.	No Impact	None Required	
Impact 4.12-5: The project would not affect other public facilities. No impact would occur.	No Impact	None Required	
13. Transportation			
Impact 4.13-1: The proposed construction phase of the VIP would result in a potentially significant impact to the a.m. peak hour operations of I-680 northbound off-ramp/Bayshore Road in the 2004 plus project scenario. This impact can be mitigated to a less than significant level by implementation of Mitigation Measure 4.13-1.	Significant	Mitigation Measure 4.13-1: Since this significant impact would be temporary and only occur for a period of approximately 45 days, there are several measures that can be applied to improve intersection levels of service without the installation or construction of additional transportation facilities (e.g., lane widening, traffic signal installation, etc.). Implementation of these measures would effectively reduce the a.m. and p.m. peak hour construction traffic volumes at the project site.	Less than Significant
Impact 4.13-2: The proposed construction phase of the VIP would result in a contribution of construction traffic volumes to one of the I-680 ramp junctions which are already forecast to operate at LOS F in the baseline (i.e., without project) condition. However, when the 2004 baseline and 2004 plus project ramp volumes are compared at the impacted ramps, the project's contribution would be nominal. Although not required for Impact 4.13-2, implementation of Mitigation Measure 4.13-1 would further alleviate any project impacts.	Less than Significant	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.13-3: According to the Project Description, the minimal build out operational phase of the Valero Refinery is anticipated to generate 40 new daily trips, 20 new a.m. peak hour trips, and 20 new p.m. peak hour trips.	Less than Significant	None Required	
14. Utilities and Service Systems			
Impact 4.14-1: The Valero Improvement Project would increase demand for raw, untreated water from the City of Benicia in excess of the baseline refinery demand anticipated in the UWMP. In the future, the City's overall water demand may exceed available supplies from current sources in dry years. This impact would be significant. This impact could be altered to be less than significant if the City were to obtain additional water supplies or if the City were able to implement planned future water supply programs and projects. Some of these measures are beyond City control and some are within the control of the City and Valero. Because one or more of these planned water supply programs is considered likely to result in sufficient water to meet planned demand, including the VIP demand, the impact of the VIP increase would be less than significant.	Less than Significant	Mitigation Measure 4.14-1a. The City would continue to move forward with obtaining the future water supplies as identified in the Water Study, the UWMP, and the 1996 Water System Master Plan.	
		Mitigation 4.14-1b. The City of Benicia would continue to implement General Plan Program 2.36.A to pursue reuse of reclaimed wastewater where feasible, and the Valero Refinery would accept and use reclaimed water from a City reclamation project.	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.14-2: The Valero Improvement Project would increase the amount of wastewater and the pollutant loading of the wastewater processed at the refinery's wastewater treatment plant. This would be reduced to a less than significant impact by the wastewater treatment processes that meet the discharge limitations of the NPDES permit.	Less than Significant	None Required	
Impact 4.14-3: The Valero Improvement Project could increase the amount of wastewater treated at the City of Benicia's wastewater treatment plant. This impact would be less than significant.	Less than Significant	None Required	
Impact 4.14-4: The Valero Improvement Project would increase routine disposal of spent catalyst and of sludge from the refinery wastewater treatment plant. This impact would be less than significant.	Less than Significant	None Required	

TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.14-5a: The Valero Improvement project, together with the Cogeneration Project and other refinery projects would increase demand for raw, untreated water from the City of Benicia in excess of the baseline refinery demand anticipated in the UWMP. Together with other future, non-refinery projects, the VIP would make a significant contribution to the cumulative shortfall in City water supply in dry years. This impact is potentially significant. This impact could be altered to be less than significant if the City were to obtain additional water supplies or if the City were able to implement planned future water supply programs and projects. Some of these measures are beyond City control and some are within the control of the City and Valero. Because one or more of these planned water supply programs is considered likely to result in sufficient water to meet planned demand, including the VIP demand, the impact of the VIP increase would be less than significant.	Less than Significant	None Required	
Impact 4.14-5b: The VIP, together with other refinery projects, would increase the quantity of pollutants and the amount of wastewater processed at the refinery wastewater treatment plant. This would be a less than significant impact due to NPDES discharge limitations.	Less than Significant	None Required	

**TABLE 2-1 (continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR THE BENICIA VALERO IMPROVEMENT PROJECT**

Environmental Impact	Significance before Mitigation	Mitigation Measures	Significance after Mitigation
Impact 4.14-5c: The VIP, together with other refinery and non-refinery projects within Benicia, could increase the amount of wastewater treated at the City wastewater treatment plant. This cumulative impact would be less than significant because the refinery contribution would be less than significant.	Less than Significant	None Required	
Impact 4.14-5d: The VIP would increase the refinery's routine disposal of spent catalyst and sludge from the refinery wastewater treatment plant at the Keller Canyon landfill. The VIP contribution to the cumulative waste disposed at the landfill would be less than significant.	Less than Significant	None Required	

CHAPTER 3

PROJECT DESCRIPTION

3.1 PROJECT OVERVIEW AND LOCATION

3.1.1 INTRODUCTION AND OVERVIEW

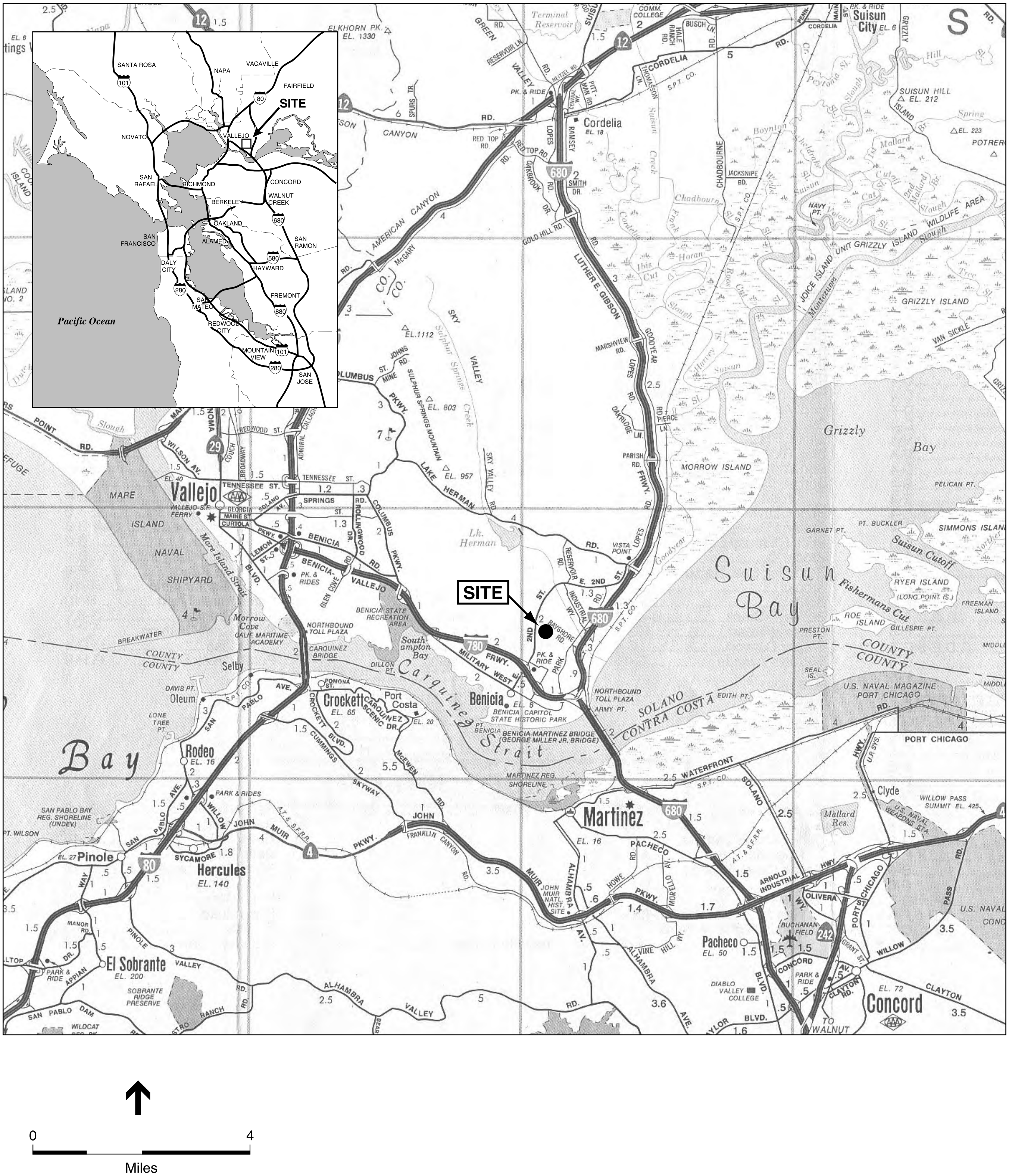
The Valero Benicia Refinery, purchased from Exxon in 2000 by the Valero Energy Corporation, was originally built in 1969. Since originally constructed, the Benicia Refinery has undergone modifications and upgrades. The Valero Benicia Refinery currently processes a limited range of raw materials to produce clean burning gasoline and other fuels for the California market. The Valero Benicia Refinery produces 10% of the gasoline used in California and 25% of the gasoline used in the San Francisco Bay Area. Approximately 70% of the refinery's product is gasoline; other products include diesel, jet fuel, fuel oil, propane and asphalt. The refinery is limited by its BAAQMD permit to processing a maximum crude oil feed rate of 135,000 barrels per day.

The Valero Improvement Project (VIP) proposes a series of modifications and additions to the Valero Benicia Refinery. The project would modify existing and install new refining equipment. All units would be located within the refinery boundaries, generally placed among similar existing equipment. When operating, the VIP would add fewer than 20 new regular employees at the refinery. Valero would implement the project in a series of steps, starting in 2003. If all project components were to be built, construction would be completed by about 2009.

3.1.2 LOCATION

The Valero Benicia Refinery is located in southern Solano County, along the northern edge of the Suisun Bay in a low range of coastal hills. See Figure 3-1, *Regional Location*. The proposed project is generally located within the eastern portion of the City of Benicia, at 3400 East Second Street. The refinery lies in a general north-south orientation near Interstate 680. The Union Pacific Railroad serves the refinery and the refinery dock provides access to transport by ship.

The refinery occupies approximately 331 acres of the 800-acre Valero property; the rest of the property is undeveloped. The refinery is located on the northeast side of the Valero property. The project would include changes within the approximately 46-acre refinery process block, located east of East Second Street between East Second Street and Park Road, and at the approximately 50-acre crude tank farm located between Park Road and I-680. The project would also result in changes at the refinery wastewater treatment plant, located east of the process



SOURCE: Environmental Science Associates

Figure 3-1
Regional Location

block, between I-680 and the Union Pacific tracks. In addition, there would be increased shipping operations at the refinery dock, located on the Carquinez Strait between the Benicia-Martinez Bridge and the Port of Benicia wharf. The lands and facilities of the existing Valero Benicia Refinery are shown in Figure 3-2, *Valero Benicia Refinery*.

3.2 PROJECT OBJECTIVES AND COMPONENTS

3.2.1 PROJECT OBJECTIVES

The Valero Benicia Refinery is a modern refining facility that currently processes a limited range of raw materials to produce clean burning gasoline and other fuels for the California market. The Valero Improvement Project, also called the VIP, would implement a series of modifications and additions that are focused on four objectives.

1. Provide ability to process lower grades of raw materials[1].
2. Provide flexibility to substitute raw materials – crude oil instead of gas oil.
3. Optimize operations for efficient production of clean burning fuels.
4. Mitigate project-related impacts to avoid detrimental effects on the community.

These changes would take place over several years and would include installation of new facilities as well as minor changes to the existing facilities.

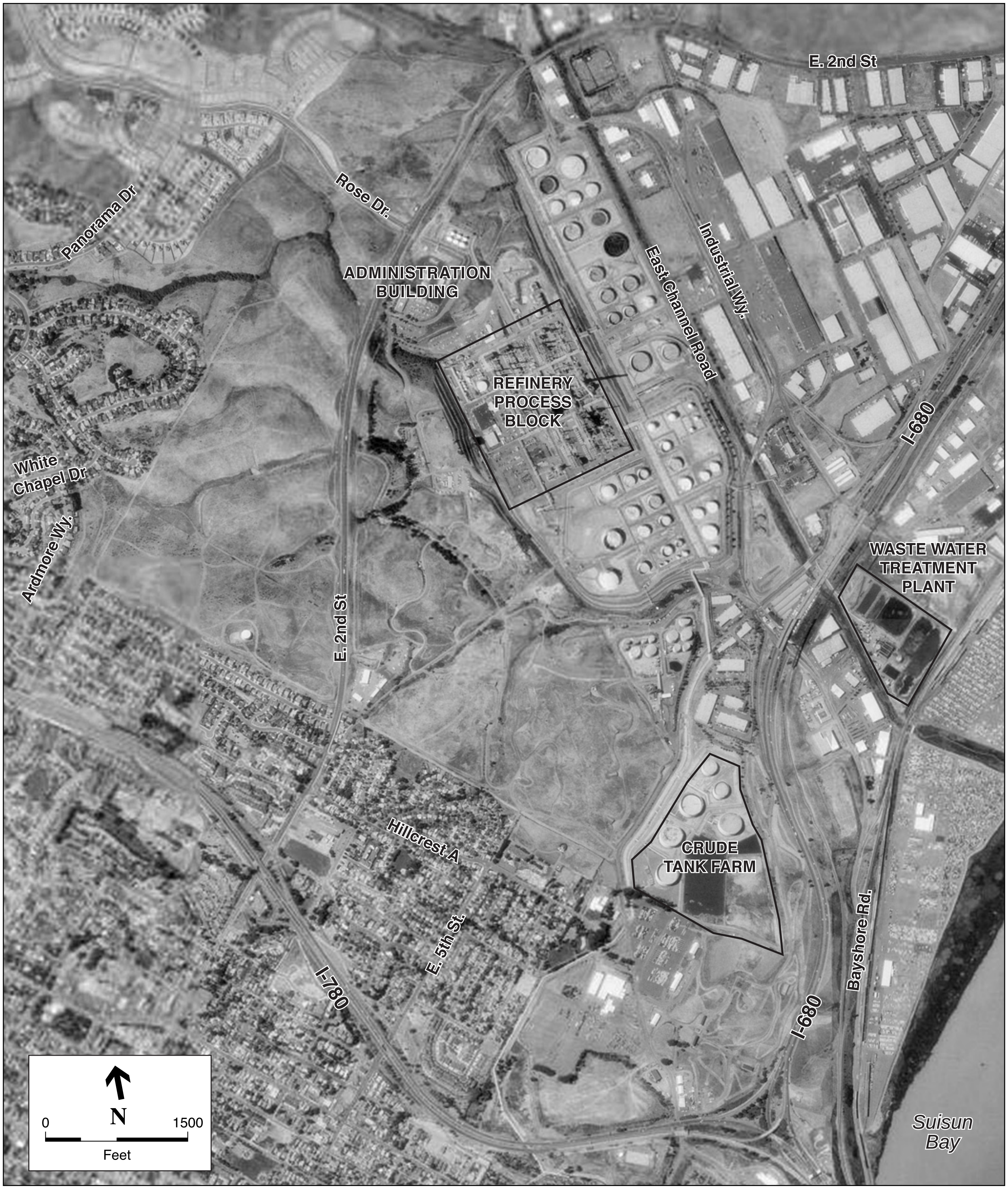
As a result of the project, the refinery would be able to continue to efficiently produce clean burning fuels in the California market and would remain economically competitive into the future. The refinery would be able to process a higher percentage of lower grades of crude oil than it presently can process and the refinery would have enhanced flexibility to substitute between crude and gas oil, the two refinery feedstocks. The project would increase the maximum crude oil feed rate now permitted by BAAQMD by about 25% annually. However, the project is expected to result in only a 10% increase in gasoline production capacity. This result is expected because a reduction in gas oil processing would be called for if crude oil processing were to increase substantially.

3.2.2 PROJECT COMPONENT LIST

Valero has applied for permit approval of a project comprised of a number of components whose implementation would provide greater flexibility in refinery operations. The primary goal is to allow Valero to process mixes of crude oils that have not previously been processed in Benicia. These crude oils each have different characteristics, and the project components reflect Valero’s planned approach to successfully deal with the differing characteristics of these other crude oils.

This project would modify and install typical refining equipment -- piping, heat exchangers, instrumentation, catalytic reactors, fractionation equipment, pumps, compressors, furnaces, tanks, and their associated facilities. These changes would include installation of new facilities as

1 As used in this document, the term “raw materials” is defined as crude oil and gas oil feedstocks.



SOURCE: Environmental Vision

Figure 3-2
Valero Benicia Refinery

well as minor changes to existing facilities. The components of the project include the following:[2]

- Pipestill modifications to increase crude oil processing capacity by approximately 25%
- Fluid Catalytic Cracker Unit Feed Flexibility modifications to process different feeds
- Coker Unit modifications to process additional feed
- Increased refinery capacity to remove and recover sulfur
- Flue Gas Scrubber to reduce emissions from the main stack
- Additional hydrogen production to support hydrofining and hydrocracking
- Hydrofining optimization changes
- Modifications to maximize hydrocracking, alkylation, and reforming capacity
- Adding a Guard Reactor to the Hydrotreater
- Modifications to optimize fractionation processes
- New and modified existing combustion sources
- Use of additional quantities of water
- Modifications to the wastewater treatment facility
- Added support facilities and infrastructure
- Added new crude tankage
- Import and export changes

Each of the components of the VIP is discussed in detail in Section 3.4.3.

3.3 EXISTING VALERO REFINERY

3.3.1 INTRODUCTION

A number of technical terms are used in the refining industry and at the Valero Benicia Refinery to describe the operations and equipment that are in use there. Selected definitions and descriptions of these terms are presented in Chapter 8, *Glossary and Acronyms*.

A petroleum refinery exists to make useful end-products from crude oil. All crude oil consists of a mixture of hydrocarbons, molecules that consist of hydrogen and carbon atoms that are combined in different sizes, shapes, and degrees of complexity. The smallest and simplest hydrocarbons, gases such as propane and methane, contain only a few atoms of hydrogen and carbon. Gasoline and diesel fuel have somewhat larger hydrocarbon molecules, while very large hydrocarbons are solids such as paraffin, asphalt and tar.

These petroleum end-products include:

- Propane or Liquefied Petroleum Gas (LPG)
- Jet Fuel
- Diesel Fuel
- Motor Gasoline
- Fuel Oil
- Carbon Black Oil
- Asphalt

[2] Valero identifies the first five components listed below as the Main Stack Components, since their exhausts would go to the refinery's main stack.

Other important refinery end-products include Coke and Sulfur.

3.3.2 EXISTING VALERO REFINERY PROCESSES AND EQUIPMENT

All of the feeds to the refinery are either consumed in the refinery processes or sold as products. The product mix, or product assortment, and the specifications of the products may vary over time and the feedstocks that are available also will vary. Therefore, the refinery must be able to process the basic feedstocks that are purchased and also be able to produce different products from those feedstocks. To operate profitably, the refinery must have some units that break down large hydrocarbons to smaller ones, some units that combine small hydrocarbons into larger ones, and still other units that change the properties of the hydrocarbons in crude oil without making the molecules larger or smaller. The refinery removes sulfur and nitrogen from the oil in the refining process before combining various refinery feedstocks. Much of the sulfur and nitrogen removed from the crude oil is converted to products that can be sold or used in the refinery processes. Basically, none of the crude oil is wasted.

To make products for consumer consumption, a refinery must maintain a degree of flexibility in how crude oil is processed. Flexibility is important for refineries such as Valero that do not own oil reserves and must purchase oil on the open market where the grade or characteristics of available crude varies depending on what is commercially available.

Making products from crude oil requires both energy from combustion of fuel gas and energy in the form of electricity to run the refinery process units. Some of the energy needed to run the refinery is obtained by burning some of the gases produced in the refining process. Most of the electricity and some of the steam for operating the refinery would be produced at the refinery's cogeneration plant (scheduled to commence operation this fall). The balance of the fuel used is natural gas and electricity that is purchased from local public utilities.

The refinery processes use raw water and recycled water in their operations. The refinery also uses raw water in heat exchangers and cooling towers. In turn, the refinery generates a variety of wastewaters that are treated on the refinery site before reuse or discharge to the treatment plant and then from there to Suisun Bay.

3.3.2.1 GENERAL REFINERY PROCESSES

The goal of a petroleum refinery is to make useful products from crude oil. Each crude oil has its own unique composition. A refinery that proposes to process a number of different crude oils must have equipment that is capable of transforming each of the varying crude oil mixtures into a desired set of products whose market demand may fluctuate. At Valero's Benicia facility, the company now purchases crude oil from several sources. Since different crudes have different characteristics, the refinery equipment must have enough operating flexibility to produce the full range of refinery products from these varying crude oil feedstocks. In addition to trying to make as much high-value product as possible from each crude oil mixture, the refinery has to treat the impurities that are also in each crude oil, both to meet stringent petroleum product specifications and to comply with environmental regulations.

Crude oil contains many different hydrocarbon molecules representing many potential products such as propane, butane, gasoline, jet fuel, diesel oil, fuel oil, wax, and asphalt. Each refinery product is a part, or fraction, of the mixture of compounds in crude oil, but crude oil does not naturally contain a very large volume of high-demand fuel products such as gasoline, diesel, or jet fuel. Typically, a barrel of crude oil may contain 20% or less of the hydrocarbons that make up gasoline.

Since the refining process must produce fuels with relatively homogenous components, there must be a separation step. Fractionation, or distillation, is the processing step utilized in the refinery to separate these different components. For instance, when crude oil is initially processed, it is fractionated to separate the lighter components, like propane and butane, from heavier components, like diesel oil, or even pitch, which is the residual material from the vacuum distillation column of the pipestill. The process requires that the oil be heated up to its boiling point and circulated through a fractionation tower. This tower will have internal equipment, usually multiple trays that will allow the liquid to cascade slowly down the tower while the vaporized oil is slowly rising to the top of the tower. As the oil circulates, the lighter components are drawn off the top of the tower and the heavier components are drawn off the bottom of the tower.

In addition to physical characteristics, which enable fractionation, the chemical properties of hydrocarbon molecules depend on their molecular structures. Four classes or types of hydrocarbon molecules found in crude oil mixtures -- paraffins, olefins, naphthenes, and aromatics -- have differing chemical properties. The proportions of these four hydrocarbon classes in a crude oil are important indicators of the amounts of desired products that can be made from that crude oil.

A chemical process commonly used to produce more gasoline from each barrel of crude oil is called cracking. Cracking converts some of the larger molecules of heavy oils into smaller molecules that are desirable components of gasoline. Refineries use a variety of cracking processes to produce high-value products, e.g., propane or liquefied petroleum gas (LPG), jet fuel, diesel fuel, gasoline, fuel oil, carbon black oil, and asphalt. The specific method used depends on the characteristics of the crude oil or hydrocarbon feed processed at the refinery and on product demands. Most hydrocarbon molecules are not easy to crack without applying high heat and pressure; however a catalyst can allow that cracking to occur under lower pressures, making the process easier to control and the reaction vessel less expensive to build.

The heaviest molecules in crude oil end up as a feedstock for another cracking process that takes place in the fluid coker. In the coker these large hydrocarbon molecules are transformed into naphthas and coke, a solid composed mainly of carbon. The solid coke is separated from the naphthenes and the coke is sold and shipped to buyers for use as an industrial fuel.

In addition to hydrocarbon cracking, refineries also use a reforming process to produce more gasoline. In a reforming process, the molecular structures of the feed hydrocarbons are altered to become more valuable hydrocarbon compounds. Three reforming processes used at the Valero refinery are: catalytic reforming, alkylation, and dimersol processing. The catalytic reforming process changes paraffins, which have low octane numbers, into naphthenes, isoparaffins, and aromatics, which have much higher octane numbers. The Alkylation process combines isobutene and olefins to produce isoparaffins called alkylate. Alkylate has a high octane number and is an ideal gasoline blending stock. The Dimersol unit transforms propylene, an olefin produced in the cat cracker, into iso-olefins such as isohexane. This iso-olefins product, called diamate, has a high octane number and is a gasoline blending stock.

Removing the impurities present in the incoming crude oil mixtures requires special processing. The main impurity that must be removed is sulfur. Hydrotreating, or hydrofining, is a process that uses a catalyst to remove sulfur bound into the hydrocarbon feeds. Hydrofining removes nitrogen as well as sulfur. These impurities are separated from the petroleum liquid cuts and are sent to a sulfur recovery unit for conversion into a saleable product.

The hydrogen necessary for hydrofining and other uses is manufactured on-site in a hydrogen reformer, a catalytic reactor where methane gas from the refinery is treated with steam. A complex, integrated refinery requires substantial quantities of hydrogen to maintain operating processes.

The major refinery impurity, sulfur, is processed in a sulfur recovery unit, where the hydrogen sulfide from hydrofiners is converted to molten sulfur in special process equipment. The molten sulfur, a refinery byproduct, is sold for industrial use.

In addition to sulfur and nitrogen, crude oil contains water, inorganic salts, and metal compounds. All of these impurities, if not properly controlled, can corrode process equipment, interfere with refinery processes, lower product quality, and pollute the environment. The refinery has to deal with undesirable by-products of the conversion of crude oil to gasoline, coke and other petroleum products. These by-products end up as gases or as wastewater. The Valero refinery has installed and operates extensive facilities to treat its wastewater before discharging it to the Suisun Bay.

3.3.2.2 VALERO REFINERY PETROLEUM PRODUCT FLOW

In 2001, the Valero Benicia Refinery operated at an annual average crude oil throughput of approximately 128,300 barrels per day. The refinery processed a variety of crude oils, consisting primarily of Alaskan crude oils received by tanker and heavier crude oils from the San Joaquin Valley, received by pipeline. Gas oil, the other refinery feedstock, is received by tanker.

The basic breakdown of the refinery's production for 1999, for 2000 and for 2001 is shown below.

	Daily Quantity Produced (thousand barrels / day)		
Type of Product	**1999**	**2000**	**2001**
Gasoline	92	114	109
Jet Fuel/Diesel	19	19	23
Fuel Oils	2	2	1
Other Products	40	43	44
Total Yield of Products	153	178	177

The total yield of products is higher than the amount of crude oil fed to the refinery because refinery processes convert the heavy portions of the crude oil to gasoline and add hydrogen to the oil, thereby decreasing the density and increasing the total volume of the product. In addition, materials such as butanes, purchased FCCU feedstocks and natural gas are introduced during the refining process resulting in some increase in the product output.

The existing major facilities at the Valero Benicia Refinery include the following units:

Petroleum Processing Units

- Pipestill
- Fluid Catalytic Cracker
- Fluid Coker
- Hydrocracker
- Reformers
- Hydrofiners
- Fractionation Facilities
- Furnaces (combustion sources)

Refinery Support Units

- Sulfur Recovery Trains
- Hydrogen Trains
- Wastewater Treatment Plant

The locations of the major existing facilities are shown in Figures 3-3 and 3-4, *Refinery Process Unit Locations* and *Crude Oil Tank Farm*.

In the following descriptions, organized and presented by process unit and presented in the order above, all of the input feedstocks, intermediate streams, and final products are all referred to by the local names used at the refinery. The descriptions that follow assume that the reader is familiar with these feedstocks and products and the basic refining terms presented in Chapter 8, *Glossary and Acronyms*.

Pipestill

Operation

The first unit in which incoming crude oil is processed is the Pipestill Unit. In the atmospheric fractionation column of the Pipestill Unit, the crude oil is heated and distilled or separated into six output streams called fractions. In order, from the lowest boiling point (lightest) fraction to the highest boiling point (heaviest) fraction, these fractions are called:

- Virgin naphtha
- Jet fuel
- Diesel
- Light atmospheric gas oil
- Heavy atmospheric gas oil
- Atmospheric residual oil

SOURCE: Environmental Vision

Figure 3-3
Refinery Process Unit Locations

N

SOURCE: Environmental Vision

Figure 3-4
Crude Oil Tank Farm

Virgin naphtha, jet fuel and diesel, the three lightest fractions from the Pipestill Unit, are fed to three separate hydrofiners, two of which produce finished products, jet fuel and diesel fuel. All remaining fractions are sent to other refinery units for further processing. The Light Atmospheric Gas Oil is fed to the Hydrocracker. The Heavy Atmospheric Gas Oil fraction is fed directly to the Fluidized Catalytic Cracker Unit (FCCU). The Atmospheric Residual Oil is sent to the vacuum fractionation column of the Pipestill Unit, where it is further separated into three fractions, in order of increasing boiling points and increasing hydrocarbon molecule size, as follows:

- Light vacuum gas oil
- Heavy vacuum gas oil
- Pitch

The Light Vacuum Gas Oil is then fed directly to the FCCU. The Heavy Vacuum Gas Oil is processed first at the Catalytic Feed Hydrofiner and is then fed to the Fluid Catalytic Cracker Unit. The heaviest Pipestill Unit output fraction, Pitch, is fed to the Fluid Coker.

Equipment

The major elements of the Pipestill are an atmospheric fractionation column and a vacuum fractionation column, as well as two furnaces (F101 and F102) that together produce approximately 520 million Btu per hour to operate the Pipestill. As fuel, these furnaces use the carbon monoxide gas that is produced in the FCCU and in the Coker Unit as well as a gas that is similar to natural gas, but which is produced within the refinery. The maximum Pipestill feed rates now permitted by BAAQMD are 135,000 barrels (one barrel is 42 gallons) per day, both for the daily average rate and for the annual average rate.

Fluidized Catalytic Cracker Unit

Operation

The Fluidized Catalytic Cracker Unit (FCCU) is designed to break large hydrocarbon molecules into smaller ones, thereby to convert more of the crude oil to gasoline blending stocks. The FCCU input feedstocks come from the heavier fractions from the Pipestill Unit. The Heavy Atmospheric Gas Oil and Light Vacuum Gas Oil fractions from the Pipestill Unit are fed directly to the FCCU. The Heavy Vacuum Gas Oil fraction from the Pipestill and the Heavy Coker Gas Oil fraction from the fluid Coker are fed to the Cat Feed Hydrofiner before being processed in the FCCU.

The refinery also imports a purchased gas oil fraction that is a byproduct of the initial crude oil fractionation at other refineries and then processes it in the FCCU.

The fractionated output streams from the FCCU are:

- Pentanes (hydrocarbons with 5 carbon atoms)
- Light Cat naphtha
- Heavy Cat naphtha

- Light gas oil
- Olefins (hydrocarbons with unsaturated carbon-carbon bonds)

The Pentanes are treated to become gasoline blending stock and Light Cat Naphtha fractions are sent to the Light Cat Naphtha hydrofiner where they are processed into gasoline blending stocks. The Heavy Cat naphtha fraction is sent to the Heavy Cat Naphtha Hydrofiner and then becomes a gasoline blending stock. The Light Gas Oil is sent to the Hydrocracker. Olefins are the feeds to the Alkylation Unit and the Dimersol Unit, both of which are catalytic reformer units.

Equipment

The FCCU includes a reactor section and a regenerator section. The actual total FCCU feed rate varies in response to refinery requirements, with typical feed rates of 61,000 to 72,000 barrels per day. The maximum feed rates permitted by BAAQMD are 77,200 barrels per day (daily) and 74,100 barrels per day (annual average).

Fluid Coker

Operation

Pitch, the feed to the Fluid Coker, has the highest boiling point of any fraction of crude oil separated in the Pipestill. In the Fluid Coker these very large hydrocarbon molecules are cracked into smaller ones and into coke, a granular form of carbon. There are four product fractions:

- Naphtha
- Light Coker Gas Oil
- Heavy Coker Gas Oil
- Coke

The Light Coker Gas Oil is fed to the Hydrocracker. The Heavy Coker Gas Oil and naphtha are sent to the Cat Feed Hydrofiner to remove sulfur and then to the FCCU. The coke is sold as a refinery product.

Equipment

The Fluid Coker Unit includes a reaction vessel, burner, internal piping, furnaces, cyclone separators, gas compressor, instrumentation, heat exchangers, air blower and fractionator/scrubber to separate and direct the reaction products formed in the Coker. The current production capacity of the Coker permitted by BAAQMD is 39,600 barrels per day.

Hydrocracker

Operation

The hydrocracker is one of the process units that manufacture gasoline blending stocks from the heavier fractions of crude oil. The feedstocks to the hydrocracker including Light Atmospheric Gas Oil from the Pipestill Unit, the two lightest streams from the Fluid Coker and the Light Gas Oil stream from the FCCU, are all fed to the hydrocracker with added hydrogen gas. In the hydrocracker, large hydrocarbon molecules in the feed streams are broken into smaller molecules.

The output from the hydrocracker reactor is separated into two streams in a fractionator column. The lighter output stream, with the lower boiling point, called Light Hydrocrackate, is further processed to reduce benzene content and remove the heaviest portion for recycle back to the HCU feed. The majority become a gasoline blending stock. The heavier output stream, with the higher boiling point, is sent to the Catalytic Reformer for further processing.

Equipment

The BAAQMD permitted maximum throughput for the Hydrocracker is 40,000 barrels per day and the BAAQMD permitted total firing rate of the furnace is 185 million Btu/hour. The gas turbine firing rate is 132.4 million Btu/hour.

Reformers

Operation

Three catalytic reforming processes are used at the refinery to upgrade the proportions of desirable hydrocarbons in the feedstocks and to produce finished products. In each case, the reforming produces a gasoline blending stock as an output stream. The Catalytic Reformer converts some of the naphthas sent to it from the Virgin Naphtha Hydrofiner and from the HCU into aromatic hydrocarbons or into cyclic hydrocarbons with the additional production of hydrogen gas. The product of the reformer is called reformate and is a high value gasoline blending stock. The Alkylation Unit is fed an olefin fraction from the FCCU. Those olefins are reacted with isobutane to produce alkylate, a high value gasoline blending stock. The Dimersol Unit also is fed an olefin fraction from the FCCU. The propylenes in that feed are reacted to produce iso-olefins, such as isohexane. The resulting stream is a finished high-octane gasoline blending stock, called dimate.

Equipment

The Catalytic Reformer (Powerformer) includes furnaces, reactors, coolers, hydrogen separator and fractionation equipment. The BAAQMD permit sets a maximum throughput of 39,800 barrels per day and furnace firing rates that total 551 million Btu/hour. The Alkylation Unit includes a chiller, reactor, acid separator, caustic wash and fractionation equipment. The BAAQMD permitted maximum throughput is 22,800 barrels per day and the gas turbine firing rate is 132.4 million Btu/hour. The Dimersol Unit has a BAAQMD permitted maximum throughput of 5,000 barrels per day.

Hydrofiners

Operation

Six primary hydrofiner units are used to remove the sulfur and nitrogen compounds from many different feedstocks. At the Valero Benicia Refinery, the hydrofiners are designated by the name of the feedstock, so by this convention, the hydrofiners treating Virgin naphtha, jet fuel and diesel, the three lightest (lowest boiling point) fractions from the Pipestill Unit, are called:

- Naphtha hydrofiner
- Jet fuel hydrofiner
- Diesel hydrofiner

The output of the Naphtha Hydrofiner is piped to a fractionating column, where it is further separated into three fractions. The lightest fraction is sold as propane or liquefied petroleum gas. The middle fraction, light virgin naphtha, after further treatment, becomes a gasoline blending stock. The heavy virgin naphtha, the fraction with the highest boiling point, is sent to the Catalytic Reformer for further processing.

Both Jet fuel and Diesel are finished products after being hydrofined.

The remaining three hydrofiners process three input and output streams of the Fluid Catalytic Cracker Unit. The Cat Feed Hydrofiner removes sulfur and nitrogen compounds from one of the Pipestill output fractions, Heavy Vacuum Gas Oil, which is then directed to the Fluid Catalytic Cracker Unit for further processing, as described above. The Light and the Heavy Cat Naphtha streams are two of the five output streams from the FCCU. After hydrofining in the Light Cat Naphtha Hydrofiner and the Heavy Naphtha Hydrofiner, respectively, both become gasoline blending stocks.

The hydrogen sulfide and the ammonia that the hydrofiners remove from these feedstocks are sent to the Sulfur Recovery Unit for treatment.

Equipment

Each hydrofiner typically has a reactor, a furnace and fractionation equipment. The BAAQMD permitted maximum daily feed rates range from 14,000 barrels per day for the diesel Hydrofiner to 41,400 barrels per day for the Cat Feed Hydrofiner. BAAQMD permitted furnace firing rates range up to 62 million Btu/hour, for the Naphtha Hydrofiner, with a total of 181 million Btu/hour for all 6 primary hydrofiners.

Sulfur Recovery Train

Operation

Sulfur is one of the principal impurities that must be removed from refinery products. Hydrotreating and hydrofining are processes in which petroleum fractions are combined with hydrogen, heated and then passed over a special catalyst bed to remove the sulfur and nitrogen that are bound in hydrocarbons of the feed. In separate reactions with hydrogen, the sulfur forms hydrogen sulfide gas and the nitrogen forms ammonia vapor. These undesirable gases are physically separated from the petroleum cuts and then both gases are sent to a Sulfur Recovery Unit.

In order to separate the undesirable gases, hydrogen sulfide gas is contacted with a special solution of amine, methyldiethanolamine (MDEA), which preferentially absorbs the hydrogen sulfide from the other components of the incoming refinery gas feed. The hydrogen sulfide-rich solution is removed to a separate vessel and then heated with steam. Heat removes, or strips, the hydrogen sulfur oxides from the solution. The resulting amine solution, from which most of the sulfur has been removed, is cooled and recycled back for reuse. In the Sulfur Recovery Unit, a process called the Claus Process is used to recover the sulfur; the hydrogen sulfide-rich vapor is oxidized, or burned, in either air or a more concentrated oxygen gas mixture, to become sulfur dioxide and then it is converted to molten sulfur. The molten sulfur, a by-product of the refining process, is sold and shipped from the refinery by truck to industrial chemical manufacturing plants.

Valero completes sulfur processing in a Tail Gas Unit that removes residual sulfur from the exhaust of the Sulfur Recovery Unit. The Tail Gas Unit then vents the treated exhaust to the atmosphere.

Equipment

The units include scrubbers and coolers, a regenerator tower, furnaces, blowers, pumps and piping, Claus Process units, and equipment to handle and ship the molten sulfur. In addition, the two Claus Process units have a common tail gas unit. There are three sulfur recovery unit trains at the refinery, with a combined present sulfur processing capacity of 320 tons per day.

Hydrogen Trains

Operation

Hydrogen is produced at the refinery primarily by the controlled reaction of steam and refinery gases in a Catalytic Reformer. Hydrogen is also produced in other reformer process units. The hydrogen gas is in a mixture with oxides of carbon, such as CO_2. The hydrogen is separated from the gas mixture by contact with a fluid that preferentially absorbs the CO_2, and leaves the hydrogen.

Hydrogen is used at the refinery in several processes, especially hydrofining, and in hydrocracking. Because hydrofining is a sulfur removal process, the quantity of hydrogen used is related to the amount of sulfur that must be removed from the product. The ability of the refinery to process high sulfur materials depends upon having an adequate supply of hydrogen. Also, hydrogen is essential to the operation of the hydrocracker, which affects the gasoline production capacity of the refinery.

Equipment

The equipment in the refinery that produces most of the hydrogen gas is called a hydrogen train; there are two hydrogen trains at the refinery. Each train includes equipment such as a Catalytic Reformer, furnaces, scrubber tower, piping, pumps and heat exchangers. The current hydrogen production rate at the refinery is 160 million standard cubic feet per day (SCFD), compared to the permitted maximum or 164 million standard cubic feet per day. The hydrogen plant furnaces are permitted by BAAQMD for a maximum firing rate of 1,210 million Btu/hour.

Wastewater Treatment

Operation

Many of the various impurities that are contained in the crude oil feedstocks end up in wastewater. The Valero Benicia Refinery has installed complex facilities to treat the refinery's wastewater[3] before discharging it into Suisun Bay through an outfall. The wastewater treatment plant includes surge tanks and retention ponds, a chemical pre-treatment unit, Corrugated Plate Separators, Induced Static Flotation units, an Activated Sludge unit, holding ponds and an outfall. A schematic diagram of the Valero Benicia Refinery wastewater treatment plant is provided in Figure 3-5, *Wastewater Treatment Plant*.

The plant treats three refinery wastewater streams: oily water sewer effluent, oily wastewater containing benzene, and stripped sour water.

The oily water sewer effluent flows into one of two surge tanks in the treatment plant. During a rainstorm, the first flush of runoff also flows into the surge tanks and then into the stormwater retention pond. Water from the stormwater retention pond then flows into the treatment plant. The oily wastewater containing benzene flows to diversion tanks in the treatment plant where it mixes with the oily water sewer effluent.

Wastewater first passes through Corrugated Plate Separators in the treatment plant. These units provide gravity separation of oil and suspended solids from the wastewater. The oil and the solids that are removed by the Corrugated Plate Separators are then returned to the refinery for processing and the wastewater is then directed to Induced Static Flotation units, which further remove oil and suspended solids remaining in the effluent after treatment in the Corrugated Plate Separators.

An organic polymer is added to the wastewater before it enters the Induced Static Flotation units to coagulate oily solids. These coagulated solids are then floated to the surface of the water by small nitrogen bubbles. The floating material is skimmed from the surface and returned to the refinery for processing. The remaining effluent, which contains about 10 to 15 parts per million (ppm) oil and 20 to 30 ppm solids, is then discharged to the activated sludge unit of the wastewater treatment plant.

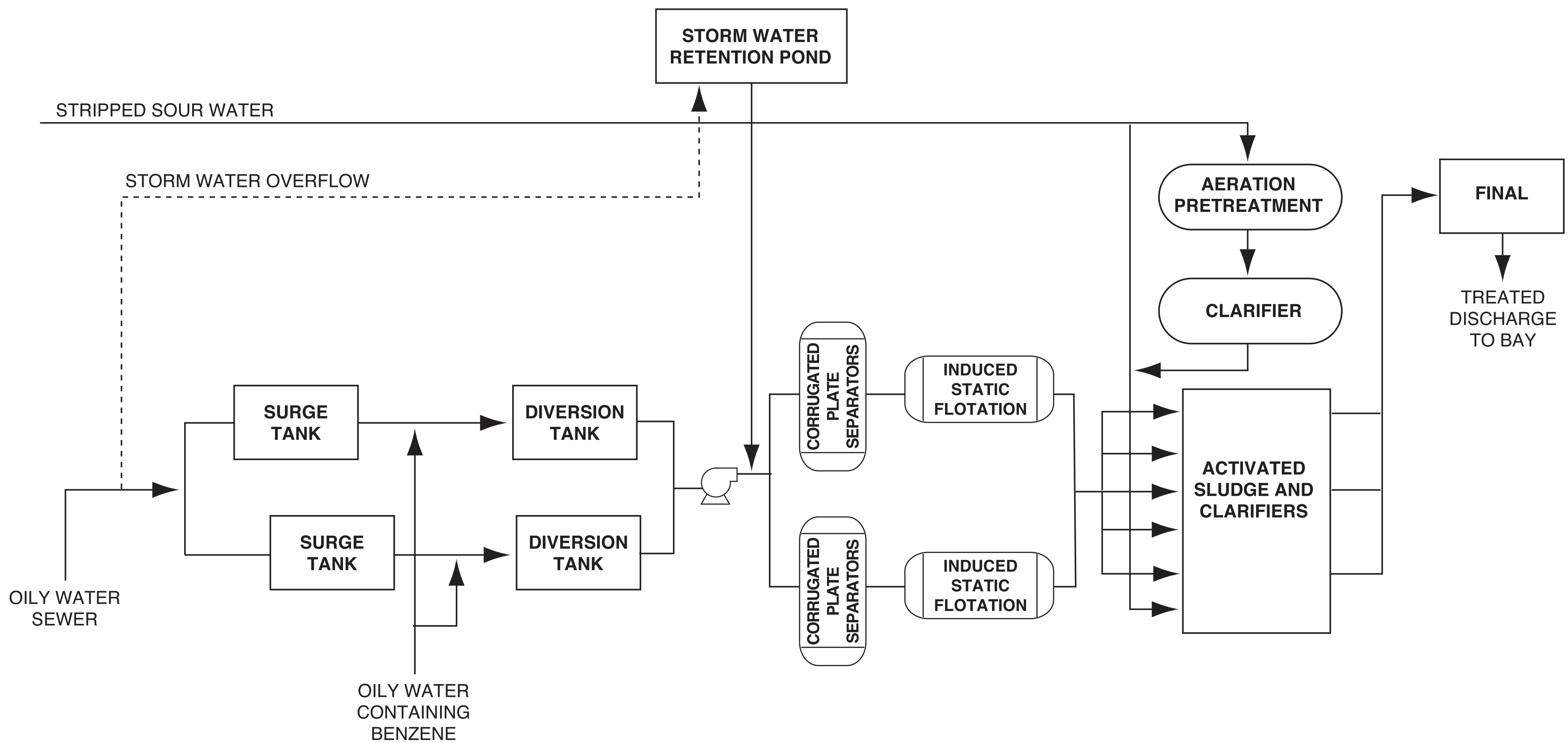
The wastewater treatment plant's Activated Sludge unit has three aeration cells and three clarifiers that operate in parallel. The aeration cells contain microorganisms that digest the suspended and dissolved organic material in the wastewater. After digestion, the wastewater from the aeration cells is then sent to the clarifiers, where the microorganisms settle to the bottoms of the clarifiers and are gathered and recycled back into the aeration cells. The clear water from the tops of the clarifiers flows first to a holding pond and later is sent to the outfall for discharge to Suisun Bay.

[3] Valero's RWQCB NPDES permit No. CA0005550 includes the proposed diversion and treatment of wastewater from the Huntway Asphalt Refinery. See section 4.9 *Hydrology and Water Quality*. A copy of Valero's RWQCB NPDES discharge permit can be found on the RWQCB's website at www.swrcb.ca.gov./~rwqcb2.

A portion of the stripped sour water from the refinery is sent to a chemical sewer pretreatment unit where aeration and microorganisms reduce the total organic carbon (TOC) in the water. Effluent from the chemical sewer pretreatment unit then flows to a clarifier where the pretreated water is separated from the microorganisms by gravity. The resulting biomass is gathered, dewatered and returned to the refinery for processing, while the pretreated water is then sent into the Activated Sludge unit of the wastewater treatment plant.

Equipment

The wastewater treatment plant includes surge tanks and retention ponds, a chemical pre-treatment unit to treat stripped sour water, Corrugated Plate Separators, Induced Static Flotation units, an Activated Sludge unit with three aeration cells and three clarifiers, holding ponds and an outfall.



SOURCE: Woodward-Clyde Consultants

Figure 3-5
Wastewater Treatment Plant

3.4 PROJECT COMPONENTS

3.4.1 INTRODUCTION

The proposed Valero Improvement Project includes a number of new and modified facilities that are intended to enable Valero to meet the project objectives listed in Section 3.2.1. The expected locations of the project's major components are shown in Figure 3-6, *Expected Locations of VIP Major Components – Process Block* and Figure 3-7, *Expected Locations of VIP Major Components* - *Crude Oil Tank Farm.* During the time frame of the VIP, Valero would also be constructing other approved, but yet unbuilt, as well as unapproved facilities (assuming they are approved) that were either analyzed in separate CEQA documents, or were otherwise exempt from City approvals, permits and environmental review. In the context of producing reformulated gasoline and other products, Valero wants to be able to respond to market conditions and retain flexibility. Valero wishes to permit all of the new equipment and modifications now, but plans to construct the individual components, as necessary, generally on the schedule described in Section 3.5.1. Valero may alter the schedules and Valero may not construct some units if conditions are not favorable. However, for the purposes of this environmental impact analysis, all of the new units that may be built have been identified and included in this analysis. Environmental controls or measures are linked to each process unit.

The function and the relationships of each of the proposed project components to Valero's existing and other future facilities are shown in Figures 3-8, *Project Component Overview* and Figure 3-9, *Refinery Flow Diagram*. Engineering details will not be completed for several years. However, these descriptions are sufficient to identify the nature of the planned facilities and to assess any potential impacts from the project.

3.4.2 FEED STOCK DISCUSSION

The refinery currently imports and processes two primary raw materials – crude oil and gas oil. Currently, about 30% of the refinery feedstocks are lower-grade raw materials, with higher levels of sulfur and higher heavy pitch content. The VIP changes would allow the refinery to purchase and process additional volumes of lower-grade raw materials (crude oils or gas oils). In general terms, the refinery would be able to increase this percentage to about 60%, raising the average sulfur content of the imported raw materials from current levels of about 1 - 1.5% up to future levels of about 2 - 2.5%.

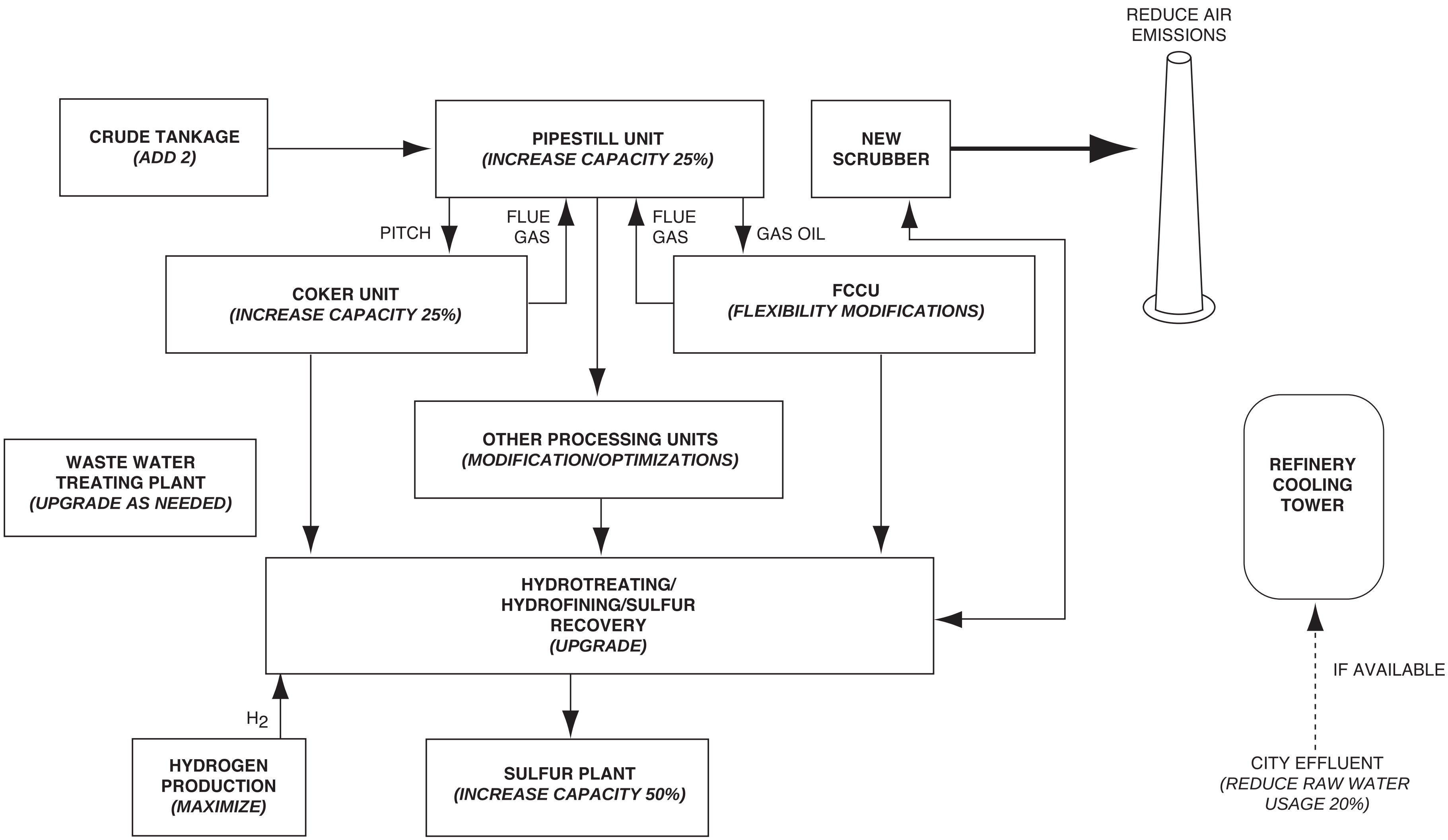
With the increase in maximum crude rate, there would also be an opportunity for the refinery to reduce processing of gas oil when economics favor the substitution of crude oil. Although the project would result in a nominal increase of about 25% in crude oil processing capacity that increase in capacity is expected to result in only a 10% increase in gasoline production. This is because a reduction in gas oil processing would be called for to keep the refinery operations balanced.

SOURCE: Environmental Vision

Figure 3-6
Expected Locations of the
VIP Major Components - Process Block

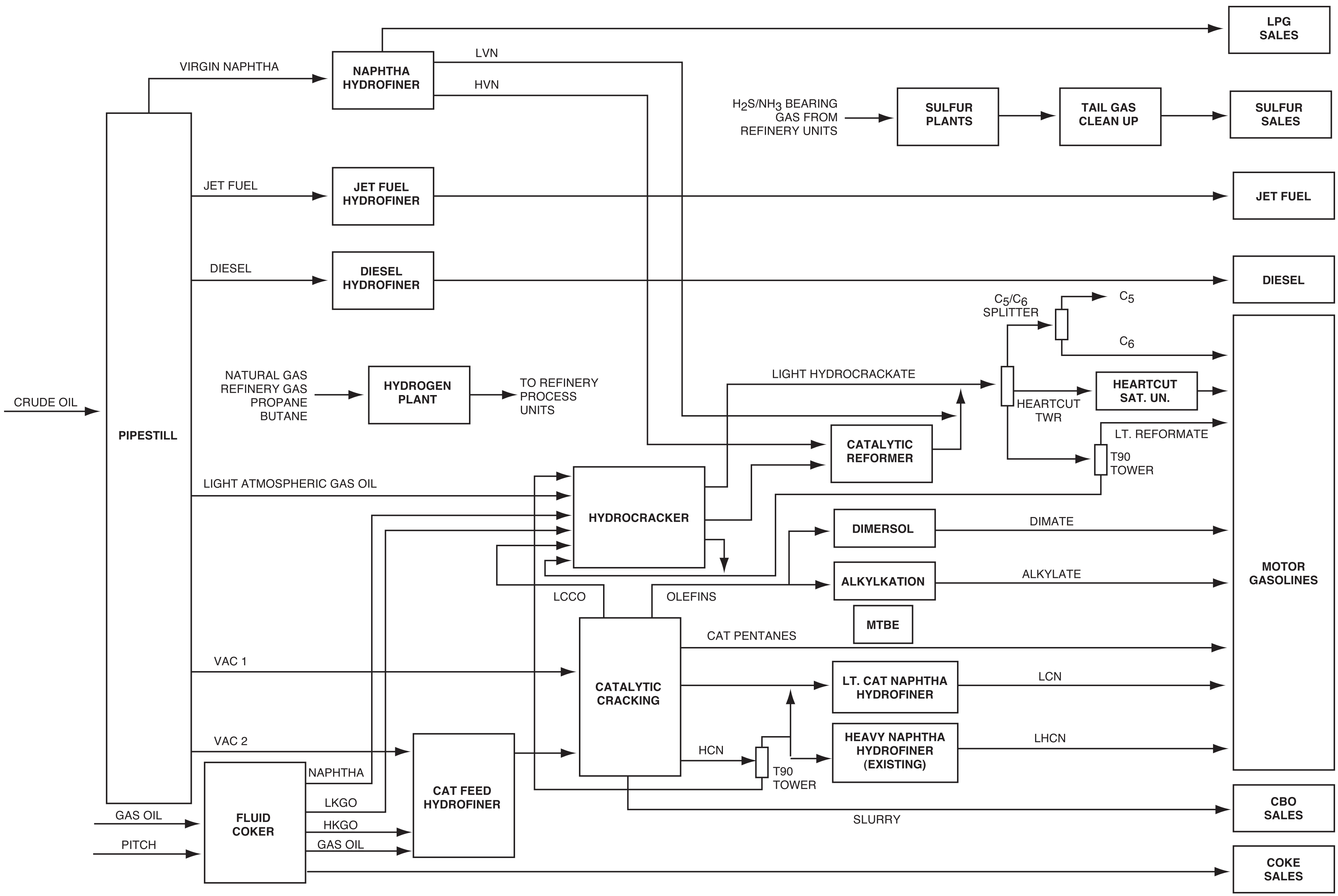
SOURCE: Environmental Vision

Figure 3-7
Expected Locations of the
VIP Major Components - Crude Oil Tank Farm



SOURCE: URS

Figure 3-8
Project Component Overview



SOURCE: Woodward-Clyde Consultants

Figure 3-9
Refinery Flow Diagram

It should be further noted that any increase in gasoline production capacity would be contingent upon the availability of optimum crude blends to meet the refinery's capabilities. The refinery purchases crude and gas oil in the market place, and the optimum blends are not always available. The proposed project provides the refinery with the flexibility to utilize diverse qualities of raw materials, especially the lower priced ones that are higher in sulfur content, but it does not necessarily imply that there would be an increase in gasoline production.

The implications of the differences in crude oil and variations in feedstocks with respect to the operation and equipment changes for the affected refinery units are described and discussed under the descriptions of the project components in Section 3.4.3 that follows. Furthermore, the material changes in the environmental effects that would result from processing the different feedstocks are described in detail in Chapter 4, *Environmental Setting, Impacts and Mitigations*, of this document.

3.4.3 THE VIP COMPONENTS

For each of the VIP components, the relation to the project objectives, a description of current operation, the VIP's proposed changes in operation and equipment (including prominent physical features) and schedule are presented below. Dimensions of the facilities typically are provided only for components of substantial size. All dimensions given are approximate, as final designs for these facilities have not been completed. For most facilities, the location is noted or discussed if it is not close to the related existing facilities. The schedule for each component typically describes essential steps in construction or the relationship to refinery maintenance turnarounds[4], instead of fixed dates, since construction of any component may be delayed or foregone. The best available information on schedule is contained in Section 3.5.1. In the event that the schedule, operational considerations, dimensions of the components or their locations are critical to identifying or mitigating a potential environmental impact of the project, these considerations will be discussed in the related impact analysis or mitigation discussion. Simplified process and flow diagrams (Figures 3-8 through 3-18) identify materials to be processed and produced by new or modified units, as highlighted in Figures 3-6 and 3-7.

See Table 3-1, *VIP Components* for a brief overview of the project components, including physical and operational characteristics, and relationships with other components of the VIP.

3.4.3.1 EXPANDED PIPESTILL CRUDE OIL PROCESSING CAPACITY

<u>Introduction</u> *Expanding the crude oil processing capacity would provide ability to process lower grades of raw materials and provide flexibility to substitute raw materials – crude oil instead of gas oil in the manufacture of products. It also would help optimize operations for efficient production of clean burning fuels.*

4 A refinery turnaround is a scheduled maintenance action during which some or the entire refinery is shut down. Thus, a turnaround is a suitable time to install new equipment. See Section 3.6.1.1, *Maintenance Activities*.

TABLE 3-1
VIP COMPONENTS

VIP	Main Stack Components					Other Optimizing and Supporting Components									
Section Ref.	**3.4.3.1**		**3.4.3.2**	**3.4.3.3**	**3.4.3.4**	**3.4.3.5**	**3.4.3.6**	**3.4.3.7**	**3.4.3.8**	**3.4.3.9**	**3.4.3.10**	**3.4.3.11**	**3.4.3.12**	**3.4.3.13**	**3.4.3.14**	**3.4.3.15**
VIP Component	**Increase Pipestill Crude Oil Processing Capacity**	**Crude Oil with High Sulfur Content**	**FCCU Feed Flexibility**	**Coker Expansion**	**Increase Sulfur Removal and Recovery Capacity**	**New Main Stack Flue Gas Scrubber**	**Additional Hydrogen Production Capacity**	**Hydrofining Optimization**	**Maximize Hydrocracker, Alkylation / Dimersol and Reforming**	**Hydrotreater Guard Reactor**	**Modifications to Separations Processes for Optimization**	**New and Modified Combustions Sources**	**Water Source**	**Wastewater Treatment**	**Support Facilities and Refinery Infrastructure**	**Additional Crude Tankage**
Description of Equipment and Operations	Pumps, piping and instruments to upgrade Pipestill unit capacity in two steps: 1.Upgrade capacity to 150,000 BPSD. 2.Upgrade capacity to 165,000 BPSD.	Increased percentage of Sulfur in crude oil feedstocks.	Modify equipment, transfer lines, slide valve, heat exchangers. Modify FCCU internals. New regenerator requirement. New, higher feed rate, possibly more than 75,000 BPSD. Possible new catalyst – deSOx. More Oxygen required from O_2 generator. More Oxygen required from generator/ blower.	Upgrade coker gas compressor and piping. Fractionator / scrubber, instrumentation. Upgrade coker internals . Increase feed rate to 35,000 BPSD.	Add new regeneration tower, amine heat exchangers, amine pumping equipment. Modify existing scrubber tower internals. SRU Upgrade - new O_2 generator, modify existing sulfur thermal reactors, sulfur handling pumps, heat exchangers, piping and pumps. Tail Gas Unit Upgrade - new piping, heat exchanger.	New flue gas scrubber – uses a regenerative amine process. New scrubber tower and regenerator tower, solution storage tanks, heat exchanger, pipes, pumps, instrumentation. Modify two existing furnaces and add a new, third furnace. Add low NOx burners.	New Pressure Swing H_2 unit for internal streams. Modify existing reformer internals, piping, pumps, heat exchangers. New absorbent, MDEA.	Install new, larger catalyst reactors. Add new virgin naphtha hydrofiner. Install new pumps and piping.	Replace pumps, piping drums and heat exchangers. Modify vessel internals. Optimize for new feed. Tower components.	New reactor vessel, with connecting piping.	12 new separation columns. New pumps, piping, drums, heat exchangers.	New types of crude and increased throughput will require more heat. Increase firing rates of existing gas turbines, steam boilers, and process heaters.	Use fresh water until recycle water is available. Pipeline to carry water. Possibly, water treatment equipment at Refinery.	Equipment needs not known now. Possibly, new aeration basins and equalization pond, a new clarifier, metals recovery process, filters and deoiler surge tank .	Increase steam generation. Add storage for up to 1,300,000 barrels. Tank heaters to lower viscosity of heavy crudes. Coke Silo modifications. Possibly, new boiler feed water Reverse Osmosis unit.	Add one or two new floating roof tanks.
Equipment Location	Near Pipestill Unit.	N/A	Within FCCU boundary.	At present location.	Throughout Process Block Area.	In Pipestill Unit area, near main stack.	PSA near existing compressors; others at present locations.	New equipment close to equipment it replaces.	New equipment adjacent to existing equipment	As close as possible to existing Hydrotreater.	Throughout main process area.	Near existing furnaces, in main process area.	Pipeline from City treatment plant to cooling towers.	Within wastewater treatment area.	West side of process block.	In crude tank farm area.
Equipment Dimensions (approximate)	Shorter than adjacent existing tall equipment.	N/A	Lower than adjacent existing tall equipment	No change in equipment height	Regenerator tower - approx. 100' tall and 10' diameter. Oxygen compressor - 50' to 100' tall, 50' long, 50' wide.	Scrubber tower - about 150' to 200' tall and 25' diameter. Regenerator column - approx. 100' tall, 10' diameter.	PSA unit would not extend above existing support catwalks. Other equipment unchanged.	New hydrofiners may be taller than present units.	Lower than existing adjacent tall equipment.	Approx. 40' high structure.	3 towers 250' to 250' tall, 3 towers 100' to 200' tall, 6 towers less than 100' tall.	New furnaces similar in height to existing units - approx. 40' tall.	Size unknown. No tall structures.	Size unknown. No tall structures.	Coke silo dimensions similar to existing.	Approx. 50' above grade, 200 - 350' diameter.
Component Initial Installation.	2004 Turnaround: Pipestill tie-ins, Furnace F102A (or F102A tie-ins).	N/A	2004 Turnaround: FCCU Internals, Blower ducting.	2004 Turnaround: Coker internals, Blower ducting.	2004 Turnaround: Sulfur Plant modifications for Oxygen injection, Amine system tie-ins.	2004 Turnaround: Scrubber slide gates.	PSA - end 2004, MDEA afterward, as needed.	As needed.	As needed.	Tie-ins during 2004/2006 Turnaround.	As needed.	As needed.	Wastewater reuse depends on City Project schedule	As needed.	As needed.	As needed.
Estimated Date of Completion	F102A - end 2004.	N/A	Complete - end 2004.	Complete - end 2004 (unless delayed to 2006 Turnaround).	Amine system, as needed. O_2 generator, end 2004 (unless delayed to 2006 Turnaround).	Complete - end 2004.	End of 2009.	End of 2009.	End of 2009.	End of 2004/2006.	End of 2009.	End of 2009.	Depends on City Project schedule.	End of 2009.	End of 2009.	End of 2009.
Interim Operation	Some Main Stack components of the VIP may ultimately be deferred or deleted. Some Main Stack components could be partially operational before the Scrubber is in operation. Specifically, the crude rate for the refinery pipestill could be raised above the current level and/or the additional air blower could be utilized to the FCCU or Coker Unit.						Some of the Other Optimizing and Supporting components of the VIP may ultimately be deferred or deleted. If situations arise that prevent the Main Stack Components from being implemented, there may still be some of the other components that could be implemented. For those components that are not Main Stack components, interim operations could differ little from operations under the full VIP.									
Interim Operation Notes	Pipestill crude rates greater than 150,000 barrels per day would require the furnace reconfigurations and a new furnace (see 3.4.3.5).		FCCU Feed Flexibility and/or Coker Expansion – to the extent that the third blower is fully utilized – could require the Scrubber.													
Interim Control Without Main Stack Scrubber	To assure that operation of Main Stack components could not result in an interim air quality impact, Valero proposes a BAAQMD permit condition to require Main Stack emissions to remain below previously demonstrated emission levels. Valero proposes that the refinery would not operate more than 1,096 days at crude rates above 135,000 barrels per day or with the third air blower in operation without installing and commissioning the Main Stack Flue Gas Scrubber.						No interim controls needed. Operations do not depend on the Main Stack Scrubber for emission control.									
Primary Long Term Control	Scrubber (3.4.3.5)	Scrubber (3.4.3.5) Source (3.4.3.11) Sulfur (3.4.3.4)	Scrubber (3.4.3.5)	Scrubber (3.4.3.5) Facilities (3.4.3.15)	None.	Use recycled water when available. (3.4.3.12)	None.	None.	None.	None.	None.	Limit emissions to existing permit amount. New source controls limit emissions.	Use recycled water when available.	None.	None.	Permit limits.

SOURCE: Valero, 2002

> *The proposed modifications to the Pipestill unit would allow for the processing of a higher flow rate of incoming crude petroleum and the desired flexibility to process crude oil that has higher sulfur content.*

Current Operation

Incoming crude oil from storage tanks at the refinery is heated to distill and to separate the crude oil mixture of hydrocarbons into streams, or fractions, with similar physical characteristics. These separated fractions are then directed to other processing areas, or units, in the refinery to continue their transformation from the incoming petroleum mixture to finished products.

Currently, Gas Oil is used as an input feedstock that goes directly to the Fluid Catalytic Cracking Unit. In contrast to crude oil, Gas Oil is a material that has been previously processed in a refinery and is one of the heavier fractions resulting from the initial distillation and separation of crude oil.

Proposed Changes

Operational Changes. Presently, the Pipestill unit is permitted by BAAQMD to process a maximum feed rate of 135,000 barrels per day (one barrel is 42 gallons) of crude oil. With the full implementation of the VIP, the Pipestill operations would be permitted by BAAQMD for processing a maximum annual average 165,000 barrels per day. Valero would increase the Pipestill processing rate in steps, depending on the status of other refinery modifications and upgrades that are part of the VIP, as well as the characteristics of the available crude oils.

Equipment Changes. To accomplish the increase in Pipestill processing capacity, existing equipment would be upgraded or replaced. The Pipestill internals would be modified to effectively process the increased flow rate. In addition to modifying the Pipestill itself, other equipment such as pumps, piping, and instruments would be upgraded and new heat exchangers could be added.

Specific changes or equipment identified for replacement include the following: 1) Increased use of the heat exchanger for the Atmospheric Distillation unit, 2) Pipestill crude feed pump, 3) Modification of the internals of Pipestill condensate reflux drum, and 4) Larger piping to carry the Light Atmospheric Gas Oil and the Heavy Atmospheric Gas Oil sent to other units.

Also, for the Pipestill to process crude rates greater than approximately 150,000 barrels per day, the furnace reconfigurations and addition of a new furnace, as described under Section 3.4.3.5, *New Main Stack Flue Gas Scrubber*, would be required.

Schedule. Valero expects to increase the Pipestill capacity in steps. The first step would increase the capacity from the present 135,000 barrels per day to about 145,000 to 155,000 barrels per day. The second would increase capacity to a permitted daily average of 180,000 barrels per day and an annual average maximum of 165,000 barrels per day.

3.4.3.2 FCCU FEED FLEXIBILITY

<u>Introduction</u> *The VIP would modify the existing Fluid Catalytic Cracking Unit (FCCU) to improve its effectiveness in processing the heavy components of incoming petroleum (crudes) to be used at the refinery. The equipment modifications would provide more operational flexibility in this refinery unit. The modifications would allow the FCCU to operate at a nominal process rate of 75,000 barrels per day or higher on occasion, as compared to the present rate of 72,000 barrels per day.*

<u>Current Operation</u>

The FCCU operates by mixing a fluid powder-like catalyst with heavy oil components at elevated temperatures and pressures. The process breaks these larger, heavy oil molecules into the smaller molecules that are blended into gasoline products. The catalyst is separated from the smaller oil molecules in centrifugal separators, called "cyclones", inside the FCCU vessels. The separated catalyst is drawn continuously from the FCCU reactor and circulated to a regeneration vessel where the catalyst is reactivated by burning the carbon deposits off the surface of the catalyst.

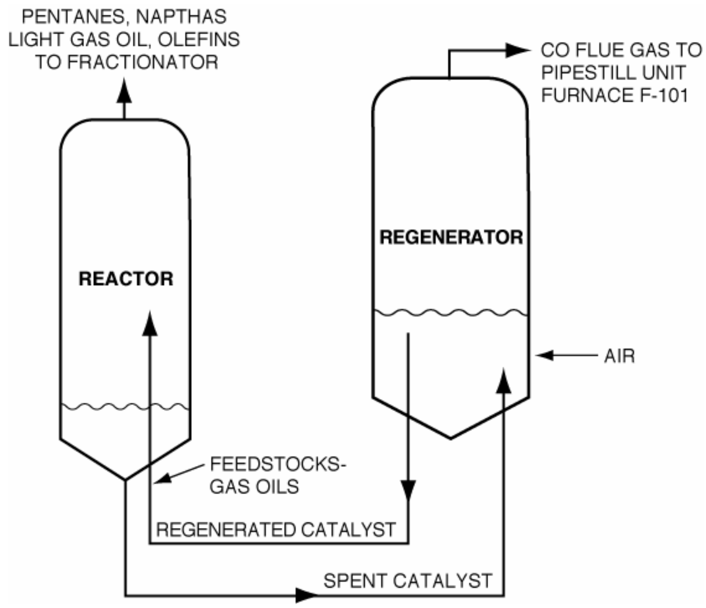
<u>Proposed Changes</u>

<u>Operational Changes</u>. Processing the proposed new FCCU input feedstocks would require that more air be provided to the regenerator, to burn more carbon from the catalyst. Operation of the FCCU unit would be adjusted to use this additional air more efficiently than can be done at present. The FCCU modifications would provide the ability to use a catalyst additive (DeSOx catalyst) to reduce the amount of sulfur dioxide (SO_2) in the regenerator gas before it is burned in the Pipestill furnaces.

The total FCCU feed rate varies in response to refinery requirements, with typical feed rates of 61,000 to 72,000 barrels per day. Valero proposes to develop the flexibility to process heavier feedstocks and to increase the feed rate to an average of up to 75,000 barrels per day[5] (but higher under some conditions) and there would be only minor changes in product yield relative to past, demonstrated rates. For these reasons, the project requires only minor modifications to the fractionation equipment[6] that lies downstream of the FCCU. See Figure 3-10, *Fluid Catalytic Cracker Unit Process*.

5 The maximum FCCU feed rates now permitted by BAAQMD are 77,200 barrels per day (daily average) and 74,100 barrels per day (annual average). With the project, those rates would become 80,000 and 77,000 barrels per day, respectively.

6 These are also known as the "Cat Light Ends fractionation" facilities.



Valero Improvement Project EIR / 202115 ■
Figure 3-10
Fluid Catalytic Cracker Unit Process

Equipment Changes. The proposed FCCU modifications include changes to the regenerator equipment, the transfer lines, slide valves, and to the fractionation towers. The changes in the regenerator equipment consist of a new riser, feed nozzles, internal air grid, and stand pipe. The planned changes in the equipment would be inside the existing vessels.

As described in Section 3.4.3.3, *Coker Expansion*, part of the air flow from an existing Coker air blower, C901A, would be diverted to the FCCU regenerator and oxygen from new oxygen generation facilities (described in Section 3.4.3.4, *Increased Sulfur Removal and Recovery Capacity*) would be made available for injection into the FCCU regenerator.

Modifications to other FCCU equipment include piping, pumps, instrumentation, and heat exchangers. The piping modifications include a revised feed distribution system, expansion joints, and slide valve configuration.

Schedule. The modifications to the internal FCCU equipment are scheduled for the upcoming major turnaround, because the FCCU vessels must be empty to install new equipment. The changes to the FCCU piping, pumps, instrumentation, and heat exchangers are presently scheduled to follow the major turnaround. It is not expected that these changes could be brought into operation immediately, because they require other support equipment and emission controls to process heavy sour crudes. However, under very limited circumstances, these changes could be utilized.

3.4.3.3 COKER EXPANSION

<u>*Introduction*</u> *A key characteristic of the new petroleum crude blends to be processed at the Valero Benicia Refinery is a higher percentage of heavier hydrocarbons than in the crude mix now processed at the refinery. In addition, Valero proposes to develop the flexibility to increase the average production rate in the refinery. The Coker is a part of the refinery that transforms the heaviest hydrocarbon compounds into smaller, more useable compounds. Valero would modify equipment in the Coker to operate at a higher production rate to process the increased fraction of pitch that results from the higher throughput of heavier crudes.*

<u>Current Operations</u>

The refinery's existing Coker Unit currently operates with the heaviest portion of crude oil to convert, or "crack", using heat, the heavy compounds into smaller compounds in a process called thermal cracking. To accomplish this cracking, the Coker Unit circulates granular coke, a solid carbon material similar to coal, in with the feedstock of heavy hydrocarbons. After being partially burned, the coke provides a high temperature surface for the reactions that make the desired smaller hydrocarbons. Following the reaction, centrifugal ("cyclone") separators are used to separate the solid coke from the Coker reaction products, which in turn, are sent to a fractionator that separates and extracts the desired reaction products for use.

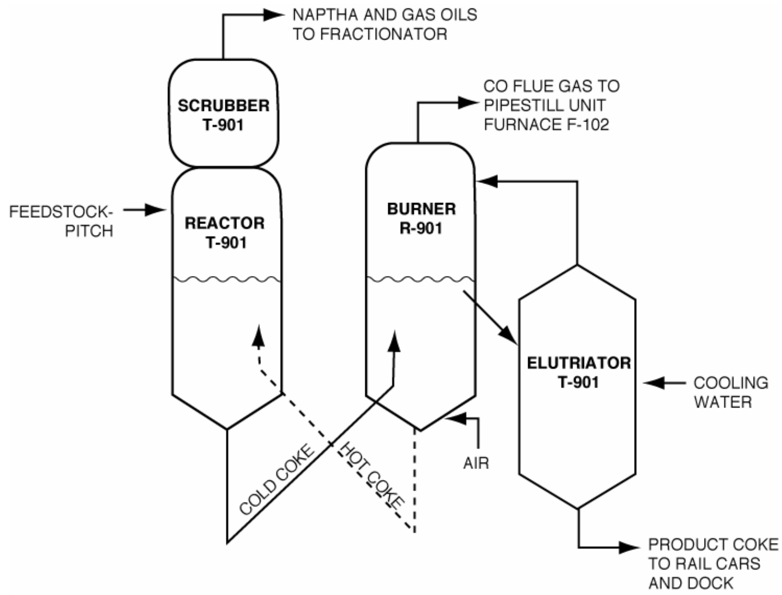
<u>Proposed Changes</u>

<u>*Operational Changes*</u>. Valero proposes no fundamental operational changes for the Coker. Rather, the proposed changes would increase the production capacity of the Coker from the existing heavy feed capacity of approximately 30,000 barrels per day to a new heavy feed capacity of up to approximately 35,000 barrels per day. Valero proposes to supply more air to the Coker, to improve the ability to separate solid coke from Coker reaction products, and to increase fractionation efficiency and accommodate the higher processing rates in the Coker. See Figure 3-11, *Fluid Coker Process*.

The Coker modifications, once implemented, would increase the heavy feed capacity of the unit and would improve the ability to separate the individual Coker reaction products – naphtha and gas oils.

<u>*Equipment Changes*</u>. The proposed equipment changes to the Coker reactor include the installation of additional cyclone separators. A new air grid that distributes air evenly inside the Coker burner would be installed to support the higher operating rates.

Other Coker equipment that would be modified are the fractionator/scrubber, gas compressor, piping upgrades, instrumentation, Coke drums, heat exchangers., and the Coker air blower. All modifications would be designed to accommodate the higher Coker processing rates.



Valero Improvement Project EIR / 202115 ■
Figure 3-11
Fluid Coker Process

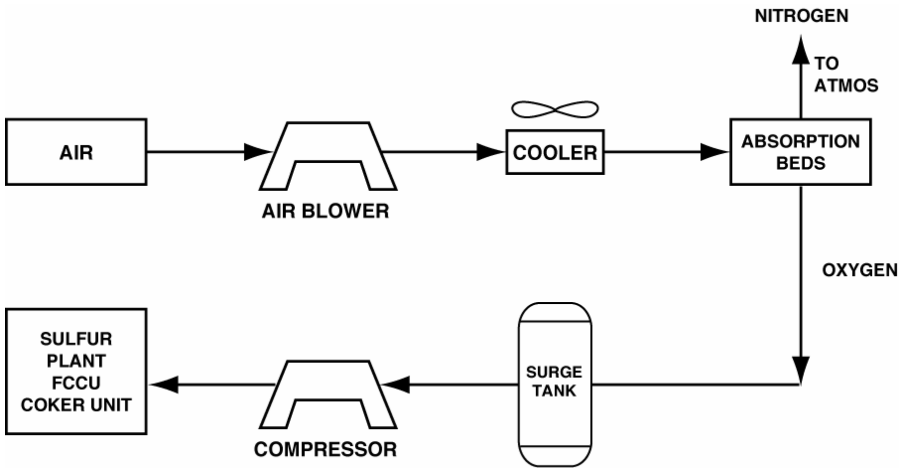
Fractionation modifications include: tray replacement with shed rows, additional pump-around capacity, relocated mid-pump-around draws, and redesigned fractionator liquid-gas distributors. These fractionation modifications are intended to accommodate higher flow rates and additionally to provide better separation of the products (–naphtha and gas oils) formed in the Coker.

The Coker gas compression facilities would also be upgraded to allow higher flow rates.

Several changes are proposed for the Coker air blower. Since the present air blower, C901A, is proposed to be shared with the FCCU regenerator[7], Valero proposes to use the present standby Coker air blower, C901B, to provide air to the Coker and, also, to convert the steam turbine driver to an electric driver. In the case that the C901B blower does not provide sufficient air to the Coker, Valero proposes to augment Coker air with oxygen from the new O_2 generator.[8] See Figure 3-12, *Oxygen Generator Package Unit*.

Schedule. The equipment changes that require modifications to the inside, or internals of the Coker and the Coker unit equipment, namely the addition of cyclones and air grids, the changes to the Coker gas compressor, the changes to the Coker air blower and its associated piping, are planned to be completed during a turnaround.

7 See Section 3.4.3.2 FCCU Feed Flexibility.
8 Described in Section 3.4.3.4, Increased Sulfur Removal and Recovery.



Valero Improvement Project EIR / 202115 ■

Figure 3-12
Oxygen Generator Package Unit

Those portions of the work that are intended to optimize the unit operation would be constructed outside of the turnaround.

3.4.3.4 INCREASED SULFUR REMOVAL AND RECOVERY

Introduction *The VIP would enable the refinery to process lower cost petroleum feedstocks (crudes) that could contain up to twice the sulfur content of the crudes presently processed at the refinery. Thus, there would be an increased amount of sulfur in the refinery streams. The refinery needs to modify or upgrade the existing sulfur removal equipment to increase the ability to process the increased amount of sulfur that results from the higher throughput of sour crudes.*

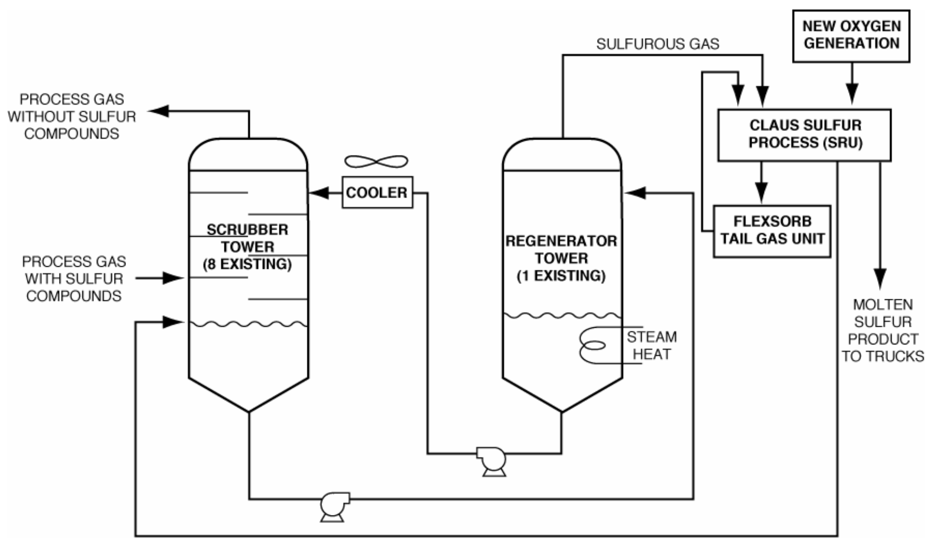
Current Operations

At present there are several existing scrubbing systems in the refinery that, like the proposed Main Stack Scrubber, use an amine to remove sulfur from gaseous and liquid streams. After the sulfur compounds are removed by an amine system, they are transferred to the refinery's existing Sulfur Recovery Unit (SRU). This unit converts the extracted sulfur compounds into elemental sulfur for export as a byproduct. The SRU uses the Claus Process to convert SO_x into molten elemental sulfur. That elemental sulfur is trucked from the refinery and sold to an offsite chemical plant, as a byproduct.

Presently, Valero completes sulfur processing in a Tail Gas Unit (TGU), which removes residual sulfur after SRU processing prior to venting the treated exhaust to the atmosphere. The TGU would require relatively minor modifications after the SRU expansion to optimize its operation and to treat the increased output of the modified SRU.

Proposed Changes

Operational Changes. The primary changes in the existing sulfur removal operation relate to the increased quantities of sulfur that would be processed. With the anticipated higher levels of sulfur in the new crudes, these existing sulfur removal systems would be upgraded to provide sufficient capacity to process the increased quantities of sulfur in each barrel of crude. Valero proposes to modify the existing SRU to increase the processing capacity of the unit. See Figure 3-13, *Sulfur Removal and Recovery Process*.



Valero Improvement Project EIR / 202115 ■

Figure 3-13
Sulfur Removal and Recovery Process

The existing amine solution sulfur extraction systems would have to absorb more sulfur, so the pumping rate would increase, as would the required amine solution regeneration rate and the related rate of heating and cooling of the amine solution. To insure sufficient contact time for the amine solution to absorb sulfur, more scrubbers may be required.

Valero estimates that with the full build out of the VIP and operation at the higher throughput rate with the higher sulfur concentration in the crudes, the Sulfur Recovery Unit (SRU) would need to be able to process approximately 480 tons per day of sulfur, an increase of about 50% over the present capacity of 320 tons per day. In the Claus Process used in the SRU, sulfur is oxidized to SO_x using the oxygen available in the air. The refinery's capability to combust and produce the elemental sulfur would be limited by the amount of air that can be injected with existing refinery air blowers. Because air is only about 21% oxygen, with the remainder essentially inert nitrogen, increased combustion can be achieved without substantially increasing the air blower flow rates by increasing the percentage of oxygen in the air. By injecting oxygen, the sulfur combustion would still take place, but with lower gas flow velocities in the SRU equipment.

Valero expects that the existing Tail Gas Unit (TGU) can provide the capacity for the VIP increased sulfur content. However, the TGU support equipment may need minor modifications to optimize the process.

Equipment Changes. Valero plans on modifying the insides of the scrubber towers of the existing amine systems to circulate faster in order to carry the sulfur away from the vaporized oil streams. By modifying the dimensions and flow openings of the scrubbing tower trays, amine solution would be able to flow more quickly across the tower trays and down the tower. Valero anticipates that several new scrubbing towers would be required to operate in conjunction with the existing scrubbing towers to allow more efficient contact and longer contact time for the amine to absorb sulfur. Each scrubbing tower would be approximately 100 ft in height and 10 feet in diameter, not including the associated piping and equipment, and would be located throughout the refinery's main process area.

In addition to the scrubbing tower modifications, Valero estimates that new, larger pumps and piping would be installed to increase the flow rate of amine solution.

Heating the sulfur-bearing amine solution separates the sulfur from the solution. The amine solution is then cooled and thereby is regenerated and ready to absorb sulfur again. Increasing the flow rate of amine solution would require additional heat exchangers for heating and cooling, as well as additional associated piping. Valero anticipates a new regenerator tower would be installed and run concurrently with the existing regenerators to effectively regenerate the additional flow of amine solution. The new regenerator tower would be approximately 100 feet in height and 10 feet in diameter, not including the associated piping and equipment, and would be located near the existing regenerator. Valero plans to install a new oxygen generator to provide the oxygen needed to combust the increased amount of sulfur that would be produced in the VIP operations. The package system would be approximately 50 to 100 ft in height and 50 feet by 50 ft in plan, not including the associated piping and equipment, and would be located next to the existing nitrogen generator at the north end of the process block. See Figure 3-12, *Oxygen Generator Package Unit*.

Modifications planned for the Tail Gas Unit equipment include the installation of larger piping, new heat exchangers, and new instrumentation to optimize processing requirements. This equipment would be installed at the existing unit.

Schedule. The installation of new equipment and the modifications and upgrades to the existing sulfur recovery equipment are likely to occur at various times during the VIP implementation period. Valero would evaluate when each component must be operational based on the effect of each individual component on the control of sulfur emissions. The schedule also may depend on the scheduling of the refining of crude oil blends with higher sulfur content.

3.4.3.5 NEW MAIN STACK FLUE GAS SCRUBBER

Introduction *The VIP modifications to the refinery would enable the processing of additional lower cost heavy petroleum feedstocks (crudes) with higher sulfur. One characteristic of these crudes is that they could contain about 4% sulfur, up to twice the average sulfur content of the crudes presently processed at the refinery. Though these crudes are not necessarily new to the refinery, there would be more of them processed. Thus, there could be an increased amount of sulfur emitted from the Main Stack of the refinery. To treat and reduce the sulfur oxides emitted from the Main Stack, Valero proposes to install a new sulfur emission removal scrubber.*

Current Operation

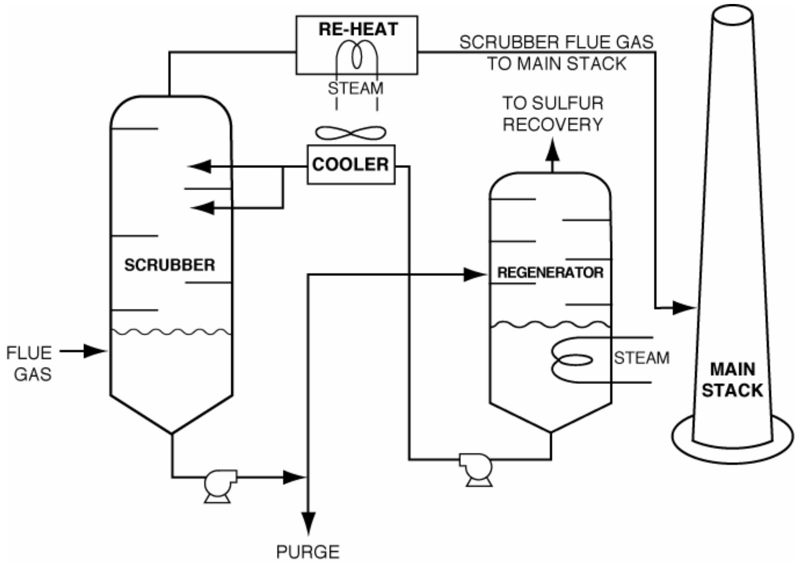
The refinery does not have a flue gas scrubber. Currently, the main stack is used to collect and exhaust combustion gases from several sources at the refinery, the FCCU, the Coker and the Pipestill. Concentrations of Sulfur Oxides (SO_x) in exhaust gases are controlled at the refinery by a number of methods, primarily by limiting the sulfur content of the basic feedstocks and thus by limiting the concentrations and quantities of sulfur that must be removed.

Various processes are now used at the refinery to remove sulfur compounds from liquid and gaseous process streams. These sulfur compounds are then sent to the existing Sulfur Recovery Unit (SRU) for conversion to elemental sulfur.

Proposed Changes

Operational Changes. Valero proposes to install a new scrubber. This scrubber consists of equipment in which exhaust gases are placed in contact with a liquid chosen so that a specific chemical constituent in the exhaust gases, in this case SO_x, is absorbed into the liquid. Emission scrubbers are a proven technology for reducing air pollutant levels in exhaust gas streams.

In the case of the proposed Main Stack Scrubber, a chemical solution would absorb the SO_x produced when refinery gas is burned. To optimize the removal of SO_x from the furnace flue gases, the flue gas temperature must be reduced prior to scrubbing. The Scrubber would use a regenerative amine process. Amine solution would be sprayed into the scrubber so that it has a large surface area to contact the sulfur-bearing furnace flue gases to remove sulfur oxides. The amine solution that contains the sulfur oxides would then be collected and pumped to a regenerator tower where it would be boiled, using steam heat, to liberate the sulfur oxides from the amine solution. The regenerated solution would be reused in the scrubber, while the sulfur oxides would then be routed to the existing sulfur plant for conversion to elemental sulfur (see Figure 3-14, *Flue Gas Scrubber Process*).



Valero Improvement Project EIR / 202115 ■
Figure 3-14
Flue Gas Scrubber Process

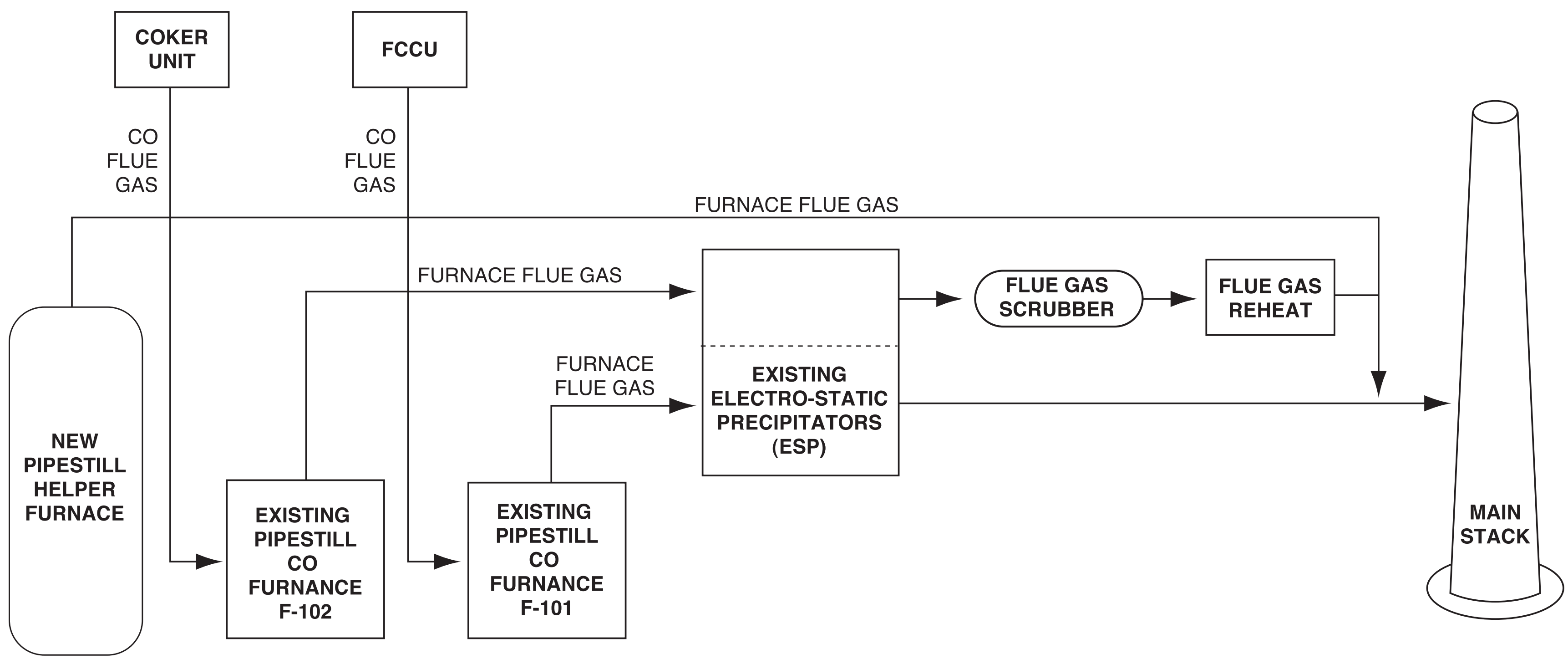
The gas that flows through the scrubber would then be exhausted through the refinery's existing main stack, which would continue to be used. No new exhaust stack would be required, although a new exhaust stack heater may be added, which would reheat the flue gas downstream of the scrubber to minimize visible water-vapor plumes that could be emitted from the Main Stack. The basic relationship between the scrubber and other Main Stack components is shown in Figure 3-15, *Main Stack Scrubber and Furnace Configuration*.

The SO_x recovered within the regenerator would be sent, as are other sulfur compounds, to the existing Sulfur Recovery Unit (SRU) for conversion to elemental sulfur, a refinery by-product.

Some of the Main Stack components could be partially operational prior to the time that the Scrubber is in operation. Specifically, the crude rate for the refinery pipestill could be raised above the current level and/or the additional air blower could be utilized to the FCCU or Coker Unit. To assure that this could not result in interim air quality impact, Valero has proposed to the Bay Area Air Quality Management District that it include a permit condition to require that Main Stack emissions be controlled to remain below previously demonstrated levels. The District has confirmed its intent to impose this condition, along with other conditions.[9]

Main Stack Scrubber Equipment. The Main Stack Scrubber equipment would include the scrubber tower, the regenerator tower, blowers, small onsite storage tanks for the scrubber solution, air fin heat exchangers, furnace, shell and tube heat exchangers, pumps, piping, structural steel, and instrumentation. The scrubber tower would be the largest piece of

9 Doug Hall, Sr. Engineer, BAAQMD, Personal communication, August 8, 2002.



SOURCE: URS

Figure 3-15
Main Stack Scrubber and Furnace Process

equipment, a cylindrical scrubber vessel having approximate dimensions of 150 to 200-ft in height by 25-ft in diameter. The regenerator tower would be a smaller cylindrical vessel, but with approximate dimensions of 100-ft in height by 10-ft in diameter. Other pieces of equipment would be much smaller in scale than either the scrubber or regenerator.

The new Scrubber equipment would be installed close to the existing refinery main exhaust stack. Valero would locate the equipment within the existing Pipestill Unit plot, adjacent to the main stack, and to locate some of the associated equipment across the refinery street to the east of the existing main stack.

To reduce flue gas temperature prior to scrubbing, Valero would modify two existing furnace boxes and install a third furnace box upstream of the scrubber. This new furnace also would be located in the Pipestill Unit, adjacent to the two existing furnace boxes.

The Scrubber would use a regenerative amine process. Pumps, piping and a storage tank would be required to store and process the Amine solution.

Although designed to make substantial reductions in air emissions of SO_x, the Scrubber also is expected to allow additional NO_x emissions reductions by absorbing excess ammonia that is not consumed in the Thermal DeNOx System. If detailed design data indicates that the Thermal DeNOx System reductions by the scrubber would not be adequate to meet the refinery's NO_x targets, low-NO_x burners would be installed on the Powerformer Furnaces F2901-4 to keep the total refinery NO_x emissions in compliance.

Maintaining the amine scrubbing solution would require added (makeup) water use and also would produce wastewater. Valero proposes to use reclaimed water for makeup water, if available. Otherwise, it would use the same water that is used for the refinery's cooling tower makeup. Annual average water consumption for the scrubber) is expected to be about 150 gallons per minute or 0.22 million gallons per day.

The Main Stack Scrubber process would be designed to minimize its effect on the refinery's wastewater treatment operation. To maintain control of the chemistry of the amine solution, a purge water stream must continuously remove undesirable compounds that would otherwise build up within the scrubber. In the preliminary design of the project, Valero estimates that this purge stream would be a flow of about 50 gallons per minute. To prevent the purge water from entering the refinery wastewater system, Valero proposes to consume it fully in other refinery equipment; an example would be to use the scrubber purge to cool the product coke at the Coker Unit.

Schedule. During the major turnaround, Valero plans to install the Scrubber slide gates that will allow on-line commissioning of the Scrubber. Installation of the rest of the Scrubber would follow the major turnaround, with completion of the Main Stack Scrubber installation by the end of 2004. However, it is possible some project components required to make the Main Stack Scrubber operational will not be completed until the 2009 refinery wide turnaround. The new sulfur removal equipment (see Section 3.4.3.4) appears to be needed before the highest sulfur crudes can be processed at the Valero Benicia Refinery.

3.4.3.6 ADDITIONAL HYDROGEN PRODUCTION CAPACITY

Introduction *Additional hydrogen would be needed to support the increased hydrofining and hydrocracking operations proposed in the VIP.*

Current Operation

Hydrogen is produced by the controlled reaction of water and refinery gases followed by the separation of the hydrogen from the oxides of carbon, such as CO_2. The separating, or purifying, of hydrogen from the gas mixture is accomplished by contacting the gas mixture with a fluid that preferentially absorbs the CO_2, and leaves hydrogen. The equipment in the refinery that produces hydrogen gas is called a hydrogen train. The hydrogen produced is used in many refinery units.

Proposed Changes

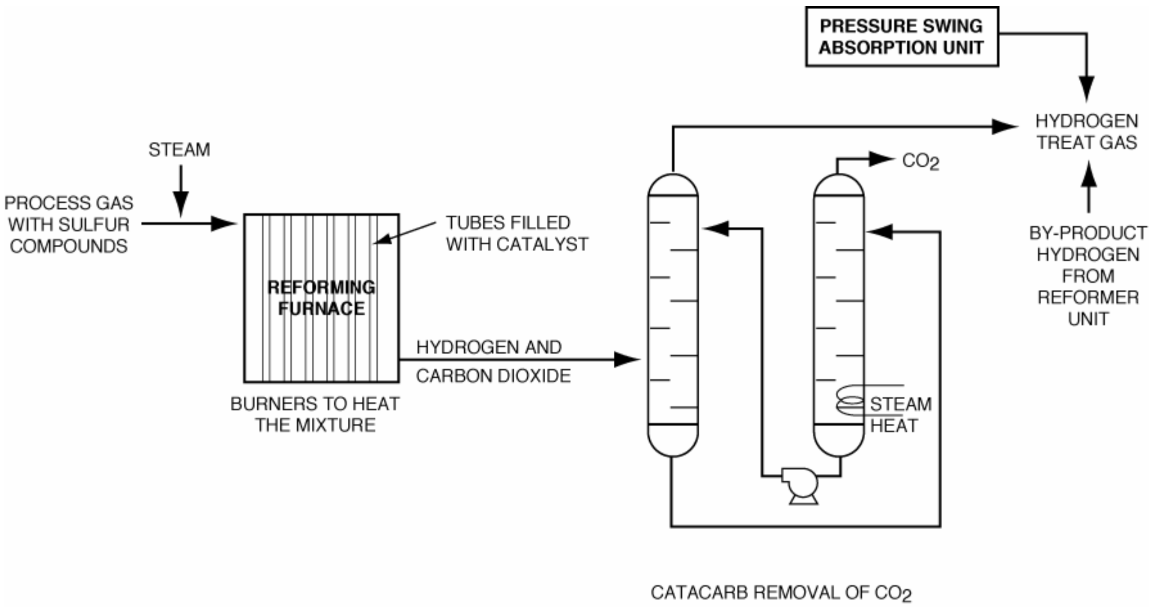
Operational Changes. Because more hydrogen would be needed to treat the higher sulfur content of the new crudes, Valero proposes to increase hydrogen production from the present 160 million standard cubic feet per day (SCFD) to approximately 190 million standard cubic feet per day.

Valero proposes to develop the flexibility to operate the existing equipment to improve the purity of the hydrogen produced. Valero plans to add a hydrogen absorber to supplement the hydrogen increases obtained by changing operation conditions of the existing hydrogen production trains. See Figure 3-16, *Hydrogen Production Process*.

Equipment Changes. To meet the need for additional hydrogen production, the existing processes would be optimized and modified to maximize production. To increase production in the existing two hydrogen trains, Valero plans to switch to a new, more efficient CO_2 absorption fluid, whose chemical name is abbreviated as MDEA. This upgrade was originally proposed and permitted for the Clean Fuels Project, but was not completed. This upgrade would be implemented in the VIP. Using MDEA, Valero plans to produce hydrogen with a purity of about 98%.

Switching absorption fluids would require several hardware modifications, including changing or modifying the tray and packing material inside the tower. Also requiring modification for the new absorption fluid would be piping, pumps, tower internals and heat exchangers. Valero also proposes to upgrade control instrumentation.

In addition to switching to MDEA, Valero may make additional changes to the equipment to obtain a further increase in the amount of hydrogen produced. Valero is considering changing the product being heated in the top, or convection section, tubes in the top of two furnaces (F301 & F351). Instead of heating water to form steam as is presently done in the convection section of the furnace, Valero would use it to pre-heat the feed coming into the radiant section of the



Valero Improvement Project EIR / 202115 ■
Figure 3-16
Hydrogen Production Process

furnaces so that additional hydrogen can be created. This change in service would involve piping changes and the replacement of the existing tubes in the reformer. If, when the detailed design of this system is prepared, it is determined that this change in not feasible, then a separate pre-reforming furnace and/or steam-heated exchanger would be used.

In addition to these modifications, the refinery's naphtha reforming unit, called the Powerformer Unit, would be modified to maximize hydrogen production. These changes would include use of a different catalyst to preferentially produce additional hydrogen in the reforming process. The Powerformer vessels, heat exchangers, pumps, and piping would be modified

Also, Valero plans to add a Pressure Swing Absorber (PSA) to purify the hydrofining tail gas stream that is blended into refinery fuel. The Pressure Swing Absorber unit uses the differential absorption of hydrogen on a special sieve to collect hydrogen from the tail gas unit at one pressure and then discharges the concentrated hydrogen gas at another pressure. The Pressure Swing Absorber is a skid-mounted stand-alone equipment unit. In addition, Valero would install the interconnecting piping.

Schedule. Valero proposes to install the tie-ins for the Pressure Swing Absorber to existing piping during a turnaround, while the Pressure Swing Absorber itself would be installed later. The modifications to the existing hydrogen train equipment and Powerformer modifications would be made later in the VIP.

3.4.3.7 HYDROFINING OPTIMIZATION

<u>*Introduction*</u> *Because Hydrofining removes sulfur from hydrocarbons, upgrading the existing Hydrofining units would improve the ability to control the sulfur content of products and to reduce sulfur emissions. Improving the efficiency of the sulfur removal of the hydrofiners is important to the refinery to meet product specifications.*

<u>Current Operation</u>

Hydrofining, also called hydrotreating, is a process where hydrogen is mixed with petroleum in the presence of heat and a catalyst to remove sulfur from the petroleum. The sulfur is removed from the petroleum products and the sulfur reaction products are stripped out as a gas. The Valero Benicia Refinery presently operates several hydrofining units.

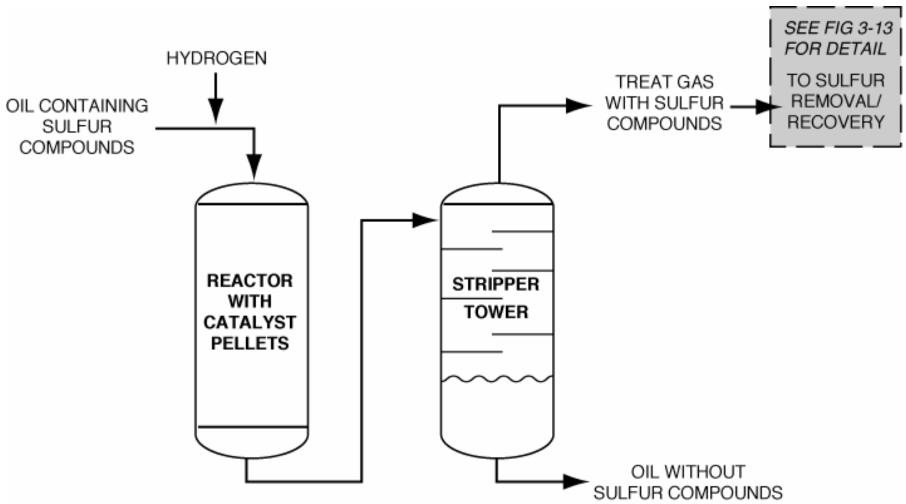
Hydrofining units operate with a batch of catalyst until the catalyst ages to the point that the desired amount of sulfur removal is not achieved. At that time, the unit is shut down and the spent catalyst is removed from the reactor and replaced with fresh catalyst. The length of time between catalyst changeouts therefore depends on the amount of sulfur in the petroleum mixture.

To consume the hydrogen gas, the refinery now directs excess hydrogen from one hydrofiner unit to another unit for use, but the quality of the hydrogen mixture degrades as the hydrogen is consumed. This cascading of the hydrogen-mixture results in uneven qualities of the hydrogen-mixture among the hydrofiner units. If excessive hydrogen is used in hydrofining, it can lower the octane rating of the gasoline, which would then require additional processing for the refinery to make high-quality, high-octane gasoline.

<u>Proposed Changes</u>

<u>*Operational Changes*</u>*.* To adjust to increased sulfur in the new refinery petroleum feedstocks, Valero proposes to modify existing hydrofining units to improve their sulfur removal efficiency while minimizing the hydrogen consumed in hydrofining. One of the modifications planned for hydrofining is to increase the effective amount of desulfurization catalyst in use at the refinery. Valero would evaluate a number of possible changes to hydrofining operations in order to maintain the same length of time between shutdowns to renew catalysts. Some of these options are: 1) changing the feed streams to individual hydrofiners, 2) changing the hydrogen distribution piping so that the hydrogen content of the gas mixtures delivered to each hydrofining reactor is optimized, 3) adding new hydrofining reactors, 4) enlarging the catalyst capacities of the hydrofining reactors, and 5) operating hydrofining reactors at higher temperatures or higher hydrogen content than at present. See Figure 3-17, *Hydrofining Process*.

<u>*Equipment Changes*</u>*.* Changing the input feed streams to hydrofining reactors would involve installing pumps and piping to carry the existing feed streams to different hydrofiners. An example of this option is rerouting the coker naphtha feedstock from the Cat Feed hydrofiner, where it is presently treated, to the Hydrocracker hydrofiner; this would require piping changes.



Valero Improvement Project EIR / 202115 ■

Figure 3-17
Hydrofining Process

The processing of certain new crudes at Valero could affect the routing of the products to be hydrofined. For example, the processing of one particular new crude raw material would result in additional flow and sulfur load to the Virgin Naphtha Hydrofiner. For that particular crude, Valero's initial analysis indicates that a larger reactor vessel would be advantageous. However, for another, different, new raw material, the amount of additional flow would not require a larger reactor vessel, but only adjustments to operating temperatures and pressures. In summary, the composition of the new raw materials would determine the specific changes needed to operate the refinery. Therefore, the Valero technical staff would assess the optimal changes to the refinery hydrofining units to provide sufficient flexibility to run new raw materials with different characteristics.

Hydrogen distribution piping would also be changed and instrumentation and heat exchangers would be upgraded.

Valero proposes to install additional or larger catalyst vessels to provide more desulfurization catalyst for some of these units. The intent is to provide sufficient catalyst to last until the scheduled turnaround, when it could be replaced without disrupting production.

Schedule. Most of these modifications would be optimizations that would be made later in the project. Valero proposes to make the changes in the hydrofining equipment outside of the major turnaround.

3.4.3.8 MAXIMIZING HYDROCRACKER, ALKYLATION / DIMERSOL, AND REFORMING CAPACITY

Introduction *Valero proposes to increase the processing rate of the Hydrocracker by about 3,000 barrels per day to a level of about 40,000 barrels per day. In addition, Valero proposes to optimize the operations of the secondary gasoline component production units, which consist of the Hydrocracking Unit, the Alkylation Unit, the Dimersol Unit and the Reforming Unit. This component of the VIP also provides the refinery with the flexibility to process different raw materials based on their yield characteristics.*

Current Operations

In the present configuration, the hydrocracker uses hydrogen from the hydrogen plant and petroleum input streams from the pipestill, from the fluid coker, and from the cat cracker to upgrade the petroleum to better gasoline blending stocks or to condition selected output fractions for further processing in the catalytic reformer, alkylation and dimersol units.

Once the planned changes in the “Alkylation Unit Modifications Project” are completed in 2003, the Alkylation Unit is not likely to undergo any major modifications (see also Section 3.6.1.3). At that point, the unit would be operating with segregated propylene and butylene feed to maximize efficiency.

The Dimersol Unit, which operates in parallel with the Alkylation Unit, is nominally designed for a rate of 5,000 barrels per day.

The Naphtha Reforming Unit is designed to process low octane naphthas and to reform them into aromatics with improved octane ratings. During this process, hydrogen is liberated from the naphtha and is used in the refinery treat gas system, which is part of the hydrogen train.

Proposed Changes

Operational Changes. Valero proposes to concentrate hydrogen in a Pressure Swing Absorber and use this recovered hydrogen in the Hydrocracker, see Section 3.4.3.6. The added hydrogen would permit a petroleum input fraction that is currently directed to the FCCU to be processed and upgraded in the hydrocracker instead.

In the event that the Alkylation unit is not able to process economically all the available propylenes, an increase in Dimersol Unit throughput to as high as 7,000 barrels per day would be needed. This option would provide needed operational flexibility.

As different crude blends are processed in the refinery, there is a potential that additional low octane naphtha would be produced, requiring that the Naphtha Reforming Unit’s operation be maximized. There are also situations when market demand could call for additional volumes of premium grade gasoline, which require higher octane components. Thus, the proposed project includes facilities to sustain the maximized production of this unit.

Equipment Changes. Valero plans to modify some of the existing Hydrocracker internal parts to provide capacity for the processing rate increase, along with the pumps and piping required to transport the input stream to the Hydrocracker.

Minor piping and pump modifications to improve the reliability of the Alkylation Unit and to minimize the use of chemicals are likely to be considered. The focus of these changes would also address improved fractionation.

The Dimersol Unit may require some minor modifications to piping and pumps in order to increase the Dimersol Unit throughput to as high as 7,000 barrels per day.

The Naphtha Reforming Unit's equipment would include primarily piping, pump upgrades, and modifications to heat exchangers for additional duty. The reforming furnace design is adequate, though it may be operated at higher rates than has been historically typical.

Schedule. Valero plans to implement some of the modifications for the Hydrocracker in the 2003 time frame. Most other optimizations are likely to occur in 2005-2009.

3.4.3.9 HYDROTREATER GUARD REACTOR

Introduction *Installing a guard reactor*[10] *on the feed to the hydrotreater would extend the useful life of Hydrotreater catalyst because the guard reactor would protect the main reactor catalyst from the build-up of flow-restricting particles.*

Current Operations

As now configured, the hydrotreater does not have a guard reactor. During normal hydrotreater operation, particles of carbon that are formed in the charge heater plug the porous bed of the catalyst that is located inside the hydrotreater reactor. As the catalyst bed becomes plugged, the efficiency of the hydrotreater degrades. Currently, the catalyst degrades too quickly and Valero must shut down the hydrotreater and recondition or renew the catalyst before the next scheduled turn-around. These hydrotreater shutdowns adversely affect other refinery operations as the other units are still in operation when the hydrotreater must be brought down.

Proposed Changes

Operational Changes. By installing a new "guard" reactor upstream of the main hydrotreater, this new reactor would filter out most carbon particles before they reach the main hydrotreater reactor. When the catalyst bed in the guard reactor becomes plugged, Valero would isolate the guard reactor from the hydrotreater and then shut down the guard reactor. This main hydrotreater would remain operating while the guard reactor catalyst is reconditioned and the guard reactor is brought back on stream.

[10] Also referred to as the "Cat Feed Hydrotreater Guard Reactor."

Equipment Changes. A new hydrotreater reactor and piping, including bypass valves and piping would be installed. The new reactor would be no larger than the existing hydrotreater reactor and would be located in the main process area, adjacent to the existing hydrotreater, to minimize the length of the interconnecting piping.

Schedule. Valero proposes to install the tie-ins to existing piping during a turnaround. Valero would then install the new guard reactor later.

3.4.3.10 MODIFICATIONS TO SEPARATIONS PROCESSES FOR OPTIMIZATION

Introduction *Processes and equipment are used throughout the refinery to separate mixtures of hydrocarbon into individual fractions, or products. The separation equipment is designed to be sufficiently flexible to separate products and for the varying mixtures of incoming crude oils with their individual characteristics. Valero proposes to install more separation equipment to optimize their operation and to provide greater flexibility in the VIP.*

Current Operations

There are three commonly used separation processes used in the refinery. These are called fractionation, scrubbing, and stripping. These processes are discussed in the glossary, Chapter 8, Glossary and Acronyms. Separation equipment in which these separation processes are carried out are cylindrical vertical towers of varying sizes depending on the design basis of the particular separation. Because of the large number of separation towers used in the Valero Benicia Refinery, separation towers are some of the most visible types of equipment seen from outside the refinery. There are 70 towers in the main process block of the refinery; 5 are about 200-250 feet tall, 15 are about 100-200 feet tall, and 50 are 100 feet or less tall. The function of these towers is to separate the hydrocarbon mixtures into fractions, which may be finished products, blending stocks or feeds for other process units. After separation, these fractions are piped to product storage tanks for final blending or to downstream equipment for further processing.

In several downstream processing units, incoming mixtures are chemically transformed into desired new compounds; subsequently, fractionators also are used to separate these into individual products, as well.

Proposed Changes

Operational Changes. With the changes in feed stock characteristics anticipated after the VIP modifications and with the intention to optimize the existing processes, Valero proposes to make adjustments to the fractionation separations in operating units throughout the refinery. Most adjustments would be made without changes in facilities, but some adjustments would require replacement or addition of equipment. While the specific adjustments have not gone through detailed design, the overall scope of the changes to the fractionation equipment are generally known so that potential impacts of these changes can be identified and assessed.

Equipment Changes. The internal equipment in the fractionation towers and the external piping connections would be reviewed and, in some cases, modified. Modifications of fractionator tower interior equipment would consist of exchanging the internal trays for trays with a higher efficiency and of changing the tray dimensions. Other fractionating tower internal equipment that may be modified includes liquid distributor piping and tray baffles.

In some cases, Valero anticipates adding new fractionation and stripping towers or expanding the size of existing towers in order to make a substantial improvement in the capability to separate components. The new towers, with their associated piping, heat exchangers, instruments, and pumps, would be comparable in design to the ones currently operating in the refinery. At this time, Valero plans on adding up to 12 new fractionating and stripping towers; 3 are about 200 - 250 feet tall, 3 are about 100 - 200 feet tall, and 6 are 100 or less feet tall. The new towers are planned to be installed in the main processing block area, where the existing fractionating towers are located.

Additional equipment changes include modifications to the furnaces to increase the heat provided to the towers. Furnaces and heat exchangers can be used to increase the temperature of the crude oil to improve the separation of the product in fractionation columns or towers. Additional pumps would be used to increase the circulation rates in the towers to improve separations.

Schedule. Valero plans to implement these modifications for the Fractionation improvements throughout the duration of the VIP.

3.4.3.11 NEW AND MODIFIED COMBUSTION SOURCES

Introduction *Combustion sources and their burners may need to be modified to emit lower oxides of nitrogen or to meet the requirements of new process conditions. Valero will require additional and modified combustion sources because more heat will be required by the VIP modifications. The VIP would require more heat provided by combustion because more oil products will be processed than at present and because the VIP new crude blends will consist of heavier components which require more heat for processing, such as fractionation, than the present crude blend.*

Current Operations

Combustion of refinery gas is used throughout the refinery to transform crude oil to finished products. Combustion provides heat that is used in process furnaces to heat petroleum streams, in gas turbines to operate mechanical equipment and in boilers to make steam. The combustion sources are located inside the main process area.

Proposed Changes

Operational Changes. Combustion sources for several previously described VIP components, the FCCU Feed Flexibility, the Coker Expansion, and the Sulfur Recovery Unit Expansion, are planned to be modified to use more air or to increase oxygen for use in combustion.

In some specific cases Valero is evaluating if the furnace should be used to heat other streams than are presently heated, for example, if a petroleum product should be heated in the convection, or second, section of the furnace instead of steam.

Other than the above, the additional changes would be that the combustion sources, the refinery's existing gas turbines, steam boilers and process furnaces would be required to increase their fired heat rate to a level above typical historic rates, but within their design capacity and demonstrated operation levels. The estimated total VIP additional firing rate would be approximately 400 million Btu/hr.

Equipment Changes. The combustion takes place in burners. Some burners would be modified to reduce emissions. During the detailed design phase, minor modifications to selected boilers and furnaces may be identified as being required. These modifications may include installation of emission control equipment (e.g. low NO_x burners on Pipestill and Powerformer furnaces), improved thermal insulation, or process tube pass configuration for improved efficiency.

For some applications, Valero would consider installing a new furnace rather than modifying the existing furnace, e.g. the Hydrogen Reforming furnace.

The modified or new combustion equipment would be located in the same place as the equipment it replaces or very close to the present location.

Schedule. Valero plans to implement the new and modified combustion sources throughout the duration of the VIP.

3.4.3.12 WATER USE

Introduction *The VIP will increase the refinery's consumption of water. Although additional raw water from the North Bay Aqueduct would be used if there is no other suitable source, Valero proposes to employ reclaimed reuse water from the City of Benicia as the source of incoming water for refinery cooling towers, when such water becomes available.*[11]

Current Operations

Refineries use water for many purposes. The biggest use is to supply refining processes with cooling water and with water for steam. One of the places water is used in the refinery for cooling is in the cooling towers, in which water is evaporated to then be circulated through the heat exchanger. At present, Valero uses approximately 5 MGD of City of Benicia water from the North Bay Aqueduct for all refinery applications. Valero's use of City raw water could increase when the Valero Cogeneration Project goes online, until Valero has fully implemented the water

[11] Valero has proposed to support the City's efforts to develop a wastewater reuse system project. It is expected that the City's project would involve additional treatment (probably filtration and reverse osmosis) of the effluent. Valero intends to provide an easement to allow transfer of the reuse water to the refinery via pipeline. The City's water reuse project is separate from the VIP and would be developed and permitted independently by the City of Benicia. For more information, see Section 3.6.2.3, *City of Benicia Wastewater Reuse Project*.

conservation mitigation measures imposed by the California Energy Commission in approving the Cogeneration Project.

Proposed Changes

Operational Changes. The VIP would increase overall refinery water use by 150 gpm, which is 0.216 MGD or 242 acre-feet per year. Use of this additional City raw water from the North Bay Aqueduct will require no operational changes at the refinery.

However, Valero also proposes to use treated water from the City of Benicia's wastewater treatment facility for use as the input to the cooling towers when and if this water becomes available. It is estimated that reuse water could offset the use of at least 1 to 1.5 million gallons of water per day of North Bay Aqueduct water. Until such treated water becomes available, Valero would use raw water obtained from the City of Benicia.

Because the reclamation of the wastewater would be a City of Benicia project and reclamation is not a part of the VIP, the analysis of the VIP is based on the increased use of City raw water from the North Bay Aqueduct.

Equipment Changes. Use of additional City raw water from the North Bay Aqueduct will require no equipment changes at the refinery.

Were the City to undertake reclamation of its municipal wastewater, modifications would be required at the City's existing Wastewater Treatment Plant. New water treatment equipment and a dedicated pipeline would be needed on the refinery property. If the City's wastewater reuse project were to be implemented, then the refinery may install additional water purification equipment, a reverse osmosis (R.O.) process, for later applications.

Schedule. The scheduled implementation depends on the City of Benicia's Reuse Water availability. See Section 3.6.2.3 for information on the status of the City of Benicia Wastewater Reuse Project.

3.4.3.13 WASTEWATER TREATMENT

Introduction *The VIP could increase the wastewater load to the refinery's wastewater treatment facilities. Modifications to these facilities may be needed to control discharges to levels that meet the San Francisco Regional Water Quality Control Board (RWQCB) requirements.*

Current Operations

Valero treats all refinery wastewater in processing equipment located close to the water effluent outfall that discharges into Suisun Bay. Treatment in this processing equipment allows the effluent discharge to meet the state discharge regulations. In the future, the refinery also will begin to treat the discharge from the adjacent the Huntway Asphalt Refinery, recently purchased by Valero. See also Section 3.6.1.3, *Planned Independent Refinery Projects / Activities*.

The responsible agency for the refinery wastewater discharge is the RWQCB.

Proposed Changes

Operational Changes. Valero expects only a minor increase in flows and increase in levels of contaminants to be removed as a result of the VIP. Valero anticipates that it may be necessary to make some modifications to the existing wastewater treatment processing, although the extent of the modifications depends on the National Pollutant Discharge Elimination System (NPDES) permit conditions to be imposed by the RWQCB.

Equipment Changes. Depending on the stipulations of new wastewater discharge permit and the detailed design considerations needed to meet these stipulations, existing equipment would be modified or replaced. At this time, Valero anticipates that the equipment to be upgraded may include new Aeration Basins to increase the capacity of the existing Biox Process, new Clarifier Tanks downstream of the Aeration Basins, a new Equalization Tank located adjacent to the Diversion Tanks, Filters, a Metals Removal Train, and a new DeOiler Surge Tank. See Figure 3-18, *Wastewater Treatment Plant Modifications*.

Schedule. Valero would meet the schedule set by the RWQCB to meet wastewater discharge limitations.

3.4.3.14 SUPPORT FACILITIES AND REFINERY INFRASTRUCTURE

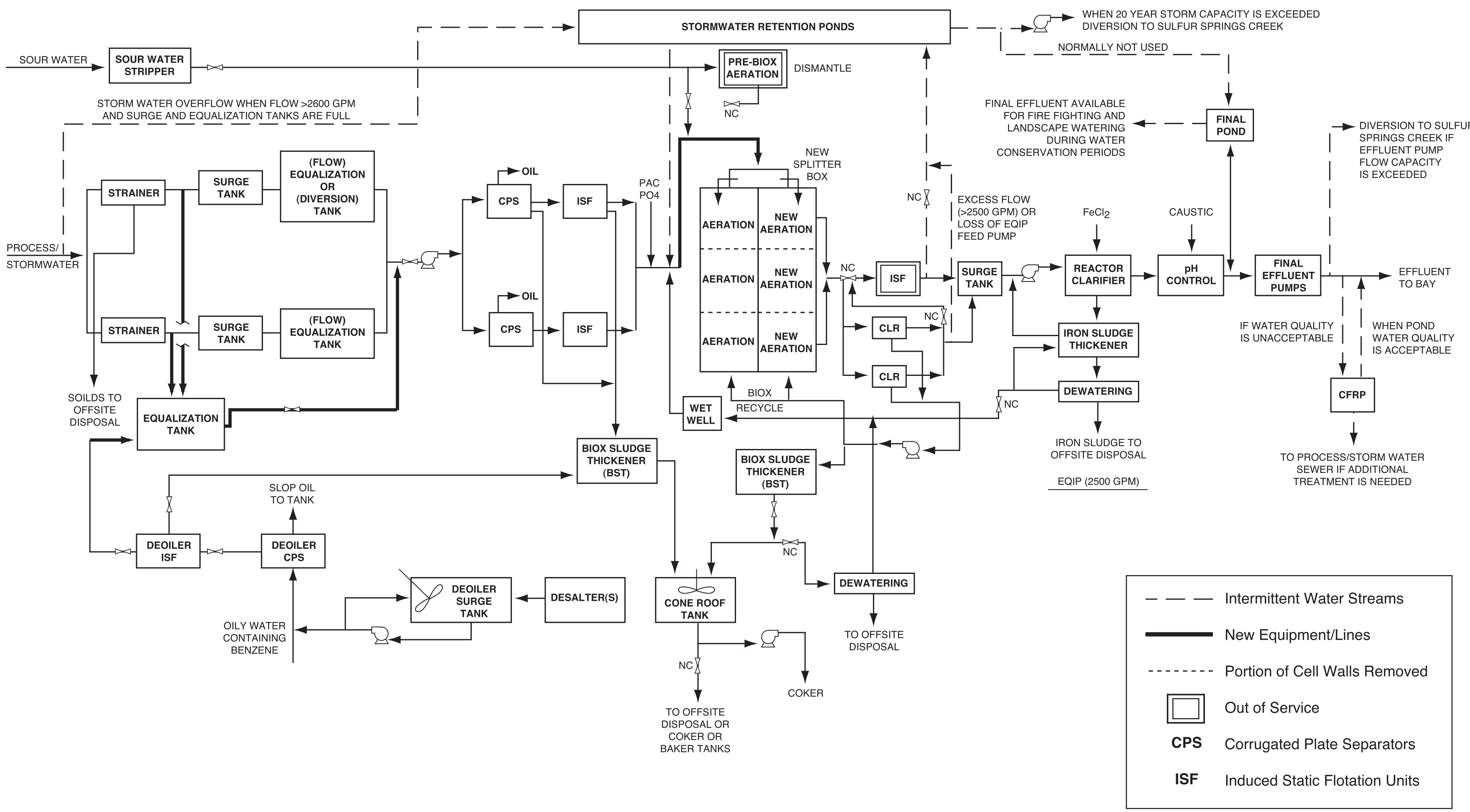
Introduction *The operation of the VIP would require certain additional infrastructure and support facilities.*

The refinery has many support processes, most of which would not require modification to support the operation of the VIP. However, the following areas are expected to require modification.

Tank Heaters. Several tanks that would store heavy feedstocks would need to be fitted with steam heating equipment. By heating the heavy oil, the viscosity would be reduced enough to allow more efficient pumping.

Coke Silos. The existing onsite coke loading silos, located at the west edge of the process block, would be upgraded to handle the increased coke production rate.

Boiler Feed Water. An additional reverse osmosis module, similar to one currently being installed in the refinery for the Cogeneration Unit, may be installed in the raw-water treatment unit to provide additional high purity boiler feed water, if needed in the latter phases of the project. (See also Section 3.4.3.12, *Water Use*.)



SOURCE: URS

Figure 3-18
Wastewater Treatment Plant Modifications

3.4.3.15 ADDITIONAL CRUDE TANKAGE

<u>*Introduction*</u> *In order to be more flexible in segregating and blending the petroleum mixes used as starting material for the refinery processes, new crude storage tanks would be added in the tank farm, the area where the existing tanks are located.*

<u>Current Operations</u>

Crude oils or refinery products to be processed in the refinery are transported to the Benicia refinery by ship or by pipeline. These starting materials are pumped into special storage tanks. The starting material from these tanks is then drawn to process in the refinery. The tanks at the Valero Benicia Refinery are called floating roof tanks because the top of the tank floats on the top of the petroleum stored in the tank. Floating roof tanks are used because the design limits the volume of airspace above the liquid into which volatile hydrocarbon constituents can evaporate and thereby reduces emissions of hydrocarbons from the refinery.

<u>Proposed Changes</u>

<u>*Operational Changes*</u>*.* To provide flexibility, Valero proposes to add new crude oil storage tanks. These new storage tanks would allow Valero flexibility in the segregating and blending of feedstocks to be processed in the refinery.

<u>*Equipment Changes*</u>*.* Valero proposes to install one or two additional floating roof crude tanks (with capacity of up to 900,000 barrels for one, or 650,000 barrels each for two) within the Crude Oil Field tankage area. The new tank design would include a second containment bottom with an indicator to identify leaks before they reach the underlying soil. Also, the firewall area would be constructed to contain 100% of the contents of the single largest tank for secondary containment in the event of catastrophic failure of a tank. The dikes of the ponds at the tank farm site would be realigned.

<u>Schedule</u>. The tanks would be installed as they are needed.

3.4.3.16 IMPORT AND EXPORT LOGISTICS

<u>*Introduction*</u> *The increased import of crude oil and gas oil and export of refinery products will result in increases in surface transportation.*

<u>Current Operations</u>

Crude oils or refinery products to be processed in the refinery are transported to the Benicia refinery by ship or by pipeline. Most products are exported by pipeline.

<u>Proposed Changes</u>

<u>*Operational and Equipment Changes*</u>*.* Most of the transportation changes will be operational, requiring changes to the numbers of and scheduled frequencies of shipments. The projected net

changes in the numbers of trips and delivery schedules of incoming raw materials and outgoing products follows:

Type of Transport	Change	Estimated Magnitude
1. Crude and Gas Oil dock movements	+	12 ships per year
2. Coke exports over dock	+	12 ships per year
3. Product exports via pipeline sales	+	
4. Truck exports of propane and sulfur	+	11 trucks per day.
5. Truck deliveries/shipments of other materials	+	5 trucks per day.
6. Rail Car exports of butane	+	1 rail car per day.
7. Rail Car imports of isobutane	-	1 rail car per day.
8. Rail Car exports of coke to dock area	+	5 rail cars per day.

Schedule. The changes in deliveries would occur as necessary to serve the needs of new or modified equipment, feedstock changes, and production changes during the time frame of the VIP.

3.5 CONSTRUCTION OF THE PROPOSED PROJECT

Construction of the proposed Valero Improvement Project would not require the demolition of any existing refinery facilities. However, grading, transport of materials, and building and installation of new equipment would be required. The construction schedule, construction areas, demolition, grading, materials and services, and labor force are discussed below. Some aspects of the construction plan may change slightly as the plan is finalized.

3.5.1 SCHEDULE

The Main Stack Components are the heart of the VIP in that they are necessary in order to accomplish the first two objectives of the project – that is, they provide the flexibility to utilize lower priced raw materials and to substitute different raw materials as feeds for refinery processes. These Main Stack Components include the Expanded Crude Oil Processing Capacity, the FCCU Feed Flexibility Modifications, the Coker Expansion, and the Sulfur Removal and Recovery Capacity equipment. Also considered a Main Stack Component is the Scrubber, which is to be installed to limit the air emissions associated with the other Main Stack Components.

These Main Stack Components will all require that at least some portions of their equipment be installed during one of the refinery turnarounds, which typically last about a month. The FCCU Feed Flexibility and the Expanded Crude components require that some facilities be installed during the refinery-wide turnaround, which occurs only once every 5 years. The next refinery-wide turnarounds are currently planned for February 2004 and then again in 2009. The installation of some of the equipment of the other Main Stack Components will require either the refinery-wide turnaround or else a smaller turnaround that is now planned for 2006. Not all parts of these components must be installed during the actual turnaround period. Only that hardware to be placed inside the major vessels, along with the tie-in valves and slide gates that allow on-line commissioning at a later date, will be installed. Following the turnaround period, the completion of the work can take up to nine months before the equipment will be ready to begin operation. Accordingly, the installation sequence is presented as Valero's current planning basis, although there are many factors that could result in changes and adjustments to this schedule.

This construction and implementation schedule must consider the project-specific design, construction, and equipment delivery constraints, but the schedule also must consider the basic refinery operating decisions that relate to the characteristics of the raw materials that become available in the market place. For instance, if sour crudes do not carry as high a price discount as expected, less sour crude will be purchased and some of the sulfur removal equipment will be deferred. If heavy crude oil prices are not discounted as expected, less heavy crude will be purchased and some of the Coker Expansion facilities may be deferred.

With these potential schedule-altering factors in mind, Valero currently plans the following implementation sequence for the VIP.

<u>2004 Refinery-wide Turnaround</u>

- Install internal components of FCCU Flexibility Modifications.
- Install Air Blower ducting for on-line commissioning of 3rd air blower.
- Install New Furnace F102A or tie-ins to allow on line commissioning.
- Install Scrubber slide gates to allow on line commissioning.
- Install Sulfur Plant combustor modifications (2) for future oxygen injection, (or plan for one or both to be delayed to 2006).
- Install amine circulation system tie-ins to allow on line capacity increase.
- Install Coker Expansion internal components (or plan for 2006).

<u>By Year End 2004</u>

- Complete all FCCU Flexibility Modifications.
- Complete New Furnace F102A installation.
- Complete Main Stack Scrubber installation.
- Complete oxygen generator for Sulfur Plant (unless delayed to 2006).
- Complete capacity increase facilities for amine circulation, as needed.
- Complete Coker Expansion facilities (unless delayed to 2006).
- Startup equipment to allow initial steps in increasing sour feedstock.

If all facilities requiring the refinery-wide turnaround cannot be installed in 2004, some components may be deferred until 2009. There is the potential that some of the Main Stack Components could be partially operational prior to the time that the Scrubber is in operation. Specifically, the crude rate for the refinery could be raised above the current level and/or the additional air blower could be utilized to the FCCU or Coker Unit. To provide certainty that this would not result in an interim impact, Valero has proposed to the Bay Area Air Quality Management District that it include a permit condition that requires, in these situations, that Main

Stack emissions be controlled to stay below previously demonstrated levels. The District has confirmed its intent to impose this condition, among others.

The remaining components of the VIP, other than the Main Stack Components, will be designed and installed throughout the 2003 – 2009 period. For instance, the hydrogen production facilities are expected to be implemented in several steps. The likely first step will involve the installation of the PSA equipment. Subsequent steps, i.e. substitution of MDEA for CO_2 removal, would take place later in the period. The PSA installation could begin in 2003 and by 2004 could provide the hydrogen necessary for either higher Hydrocracker Unit rates, or for additional hydrofining, as dictated by daily operating conditions. Similarly, if a raw material is identified as economically attractive, but would benefit from implementation of part of the Fractionation Optimization component, then that part of the project would proceed, independent of other VIP activities.

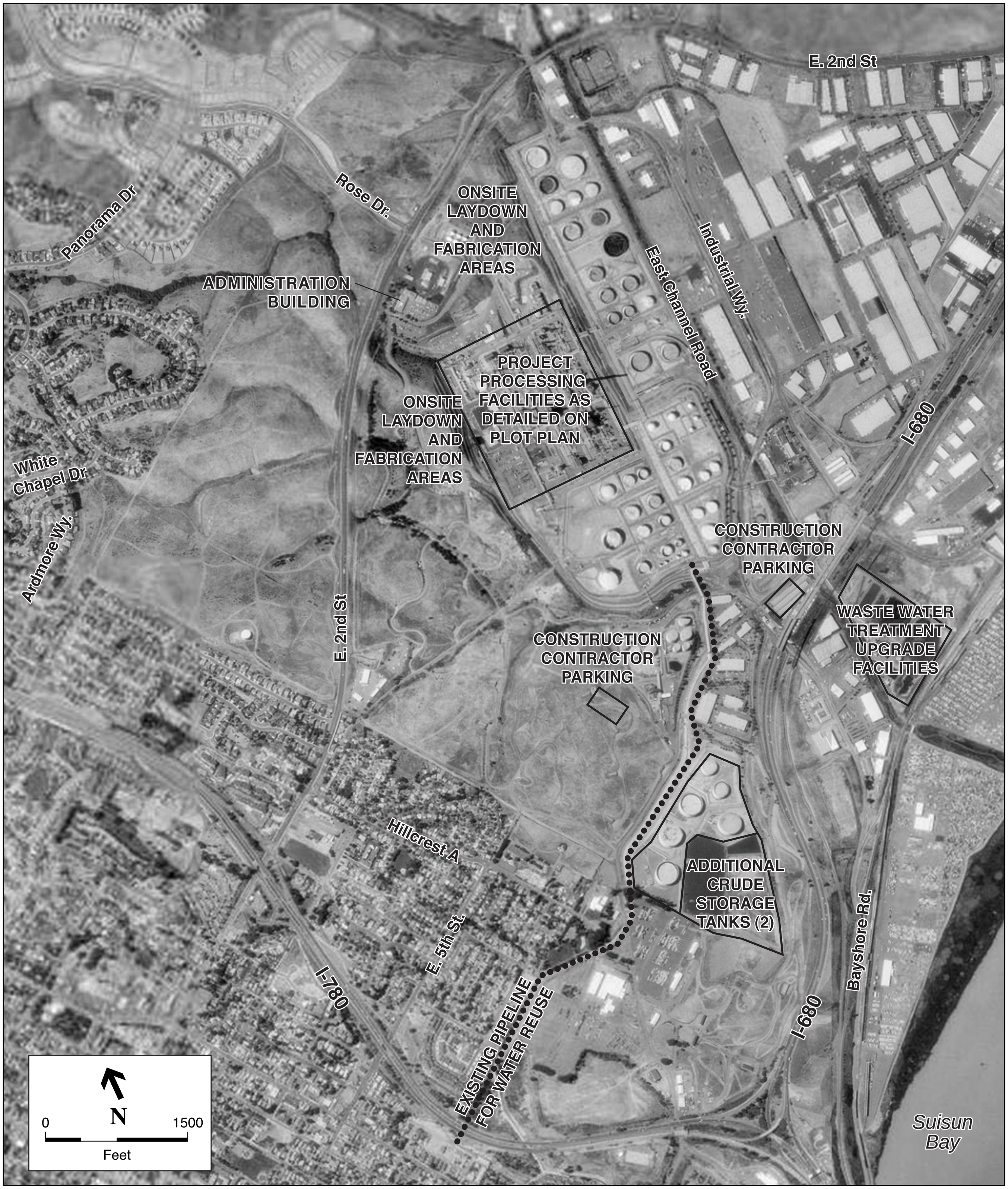
In summary, the components of the project can be roughly divided in two groups - the Main Stack Components and the other optimizing and supporting components. The Main Stack Components are targeted for installation during 2004 and are tied closely to turnaround schedules. The other optimizing and supporting components are to be implemented throughout the project period from 2004 through 2009. Many factors can influence the ultimate schedule for the components.

The application states that some components of the VIP may ultimately be deferred or deleted. If situations arise that prevent the Main Stack Components from being implemented, there may still be some of the other components that could be implemented. However, within the group of Main Stack Components, the Scrubber cannot be deleted if the FCCU Feed Flexibility, Coker Expansion, and/or the Expanded Crude Oil Processing Facilities are fully implemented – at least, to the extent that the third blower is utilized or to the extent that the crude rate is increased above about 150,000 barrels per day. This is the case because the Scrubber is needed to mitigate the emissions from these components.

3.5.2 CONSTRUCTION AREAS

Most construction would take place in the process block. Fabrication and laydown areas are existing disturbed areas and are shown in Figure 3-19, *Construction Activity Areas*.

It is anticipated that during the highest construction activity periods, 2003 through 2004, a nearby warehouse facility would be rented in the Benicia Industrial Park to facilitate materials receiving activities and to ensure an orderly material delivery to the construction site. This is the same warehousing approach used for the Clean Fuels Project. The exact location in the industrial park is not known, but it would require delivery trucks to exit from Interstate 680 and truck transfers into the refinery would be through refinery Gate 4. See also Figure 4.13-1, *Transportation Networks* for refinery gate locations.



SOURCE: Valero Refinery

Figure 3-19
Construction Activity Areas

3.5.3 DEMOLITION, EXCAVATION AND GRADING

No existing equipment must be demolished in order to construct the proposed project. An estimated 20,000 cubic yards of soil would be excavated for the project, with the majority associated with the two new storage tanks and dike realignment. No soil would be imported for the project, and no soil would be exported from the site except if it were legally required to dispose of contaminated soil to a Class I [hazardous] waste facility. At this time, the quantity of soil that would have to be sent to a Class I facility is not known. The remainder of the soil would be used on-site.

3.5.4 CONSTRUCTION TRAFFIC AND PARKING

Construction worker parking would be at the locations indicated in Figure 3-19. If additional workers are required and parking spaces are not available, Valero would rent off-site parking in the Industrial Park and use buses to transport workers to and from the work site.

Valero proposes to manage traffic in cooperation with the City of Benicia using the same procedures that were used with the Clean Fuels Project and the Cogeneration Project. The traffic management mechanisms proposed include work hour staggering, traffic directors, and use of temporary signs. Valero proposes to hold regular meetings with the City Traffic Engineer and representatives from the Police Department and Public Works Department to ensure that proper results are maintained.

3.5.5 CONSTRUCTION LABOR FORCE

The total refinery construction workforce is expected to peak at about 2,000 workers in the refinery-wide turnaround in 2004; about 350 of those workers will be associated with the VIP. The average daily construction work force for the VIP would be about 200. The construction workforce would include cement finishers, ironworkers, pipefitters, welders, carpenters, electricians, riggers, painters, operators, and laborers.

The average total estimated manpower required over the seven -year project construction is expected to be approximately 1.7 million worker-hours.

3.6 RELEVANT CUMULATIVE PROJECTS

The proposed project would not be the only large construction activity at or in the vicinity of the refinery during the term of the Project. At the same time that the proposed VIP would be under construction, other normal maintenance activities, including refinery turnarounds, also would be undertaken. The most important of these maintenance activities would be the major turnaround scheduled for the first quarter of 2004. Construction of two separate projects, the Cogeneration Project and the MTBE Phase Out Project, are expected to be essentially complete prior to the VIP construction.

In the near future, the refinery would undertake the construction of other, independent, projects. These independent projects include:

Alkylation Unit Modifications
Selective Hydrogenation Facilities
Light Ends Rail Rack Arm Drains
BAAQMD Regulation 9 Rule 10 NO_x Alternative Compliance Plan
Treatment of wastewater from the Huntway Asphalt Refinery

These projects would be part of the cumulative development context for assessing the cumulative environmental impacts of the proposed VIP. Project construction worker forecasts include these projects.

Finally, several other large projects by other sponsors also could be underway in the vicinity of the Valero Benicia Refinery; their construction could overlap that of the proposed VIP. The larger of these other projects would be the construction of the Benicia Bridge, south of the refinery. Another project, which may occur during the VIP, is the development of the Seeno Benicia Business Park, immediately east of the refinery. A third separate project, the City of Benicia's Wastewater Reuse Project, also could be in development. A fourth project, the Southampton Tourtelot Development in Benicia, could be under construction at that time, as well.

No other projects that might also contribute to cumulative impacts in some environmental topics are known to be under way outside the boundaries of the refinery. However, cumulative regional growth is accounted for in the traffic and air quality analysis.

Consideration of all of these projects, primarily the construction-related effects of these projects, is important in that there may be a potential for some of these traffic effects to be individually or cumulatively considerable. For traffic effects, the number of construction workers, and hence the levels of construction traffic, is of primary importance. For all refinery projects, the estimate of the number of construction workers during a major refinery turnaround, the refinery's peak construction period, includes all other construction workers on the site at that time. Because all of these construction activities occur at the refinery at once, Valero has indicated that the total construction worker impact can be assessed and Valero will mitigate the impact.

The above individual projects are described here in some detail so that each reader can understand each project and its potential to interact with the proposed VIP. Cumulative impacts are discussed in Section 5.2, *Cumulative Impacts*.

3.6.1 RECENT AND ON-GOING REFINERY PROJECTS

The refinery has undergone a number of changes since it was built, and changes are a part of the normal operational cycle of the refinery. Such changes occur as a result of normal maintenance activities necessary to keep the refinery operating, in response to changes in regulatory requirements imposed on the refinery, and in projects intended to respond to market conditions and to improve the efficiency of the refinery operations.

3.6.1.1 MAINTENANCE ACTIVITIES

Operation of the refinery requires substantive on-going maintenance activities. Maintenance is needed so that all refinery process units operate within their design parameters, especially for emissions, and to assure that products meet quality and quantity goals. Regular maintenance is essential to the overall safe operation of the refinery. The relationship of maintenance activities to refinery operational reliability and safety are discussed in Section 4.7, *Public Health* and 4.8 *Public Safety*.

In addition to the on-going activities, scheduled maintenance actions, called turnarounds, are also necessary. The term “turnaround” refers to the period of time when refinery equipment is not available to process feedstocks, as opposed to refinery equipment’s typical 24 hour a day, 365 day a year operation. There are a number of reasons to schedule a period when equipment would be out of operation. Some of these reasons are:

- To inspect the internals of refinery vessels
- To clean pipe and vessel internals
- To upgrade existing refinery equipment and vessels
- To renew catalysts in vessels which do not use continuous regeneration
- To make connections for new equipment being installed at the refinery
- To perform maintenance on critical equipment
- To repair and renew piping and equipment before they fail.

Turnarounds are termed major when significant portions of the refinery are shut down; minor turnarounds may affect only certain units, or parts of the total refinery.

Refinery turnarounds affect production. Therefore, refinery staff plans carefully, so that work would be accomplished quickly in a turnaround and that process units can be started up again as soon as possible. The planning includes insuring all necessary supplies and equipment are on site and available when needed. Refinery maintenance and technical staff as well as additional contract maintenance staff work in shifts around the clock to minimize the duration of a turnaround.

Turnarounds may take place every year, but the refinery usually plans major turnarounds to occur several years apart to maximize the overall production of the refinery. At the Valero Benicia

Refinery, major turnarounds occur at 5-year intervals and minor turnarounds typically occur at 2-year intervals. A major refinery maintenance turnaround is scheduled at the refinery for the first quarter of 2004, during which all processing will be shutdown for about 4 to 5 weeks. A minor refinery maintenance turnaround is scheduled for the first quarter of 2006, during which about half of the refinery's equipment is shut down for about 4 weeks. The next major turnaround is scheduled for 2009. These turnarounds are part of the refinery's normal, ongoing maintenance program and do not require City permits or environmental review.

A major turnaround offers the chance to change other equipment and processes in the refinery during that scheduled downtime. Thus, the turnaround schedule becomes the controlling factor when planning and scheduling upgrades or other major changes to the process equipment at the refinery.

3.6.1.2 CURRENT AND ON-GOING REFINERY PROJECTS

The Cogeneration Project and the MTBE Phase Out Project are two major projects near completion.

Of the two current and on-going refinery projects, the California Energy Commission has exclusive jurisdiction over the Valero Cogeneration Project, while the BAAQMD has the sole permitting authority over the MTBE Phase Out Project. Thus, the City has no discretionary approval authority over either of these projects.

Cogeneration Project

Valero undertook the cogeneration project in response to the statewide energy crisis. The California Energy Commission in October 2001 approved this project and construction of the first power train is nearly complete. Details of the project and of the environmental impacts of the Cogeneration Project are presented in the California Energy Commission Staff Assessment[12], Amendments[13] and the Final Decision.[14] A summary[15] of the project follows.

The Valero Cogeneration Project is located on a 2-acre site entirely within the existing refinery. All electric transmission and pipelines lie within the refinery complex and are underground. The project is intended to provide steam to be used in refinery processes and electric power to fully support refinery operations, with excess power sold to the state electric power grid. As needed, power would be drawn from the grid.

The completed two phase Valero Cogeneration Project would have two GE gas-turbine generators, each providing a maximum rated electrical power output of 51 MW. The gas-turbines would burn refinery gas, a refinery by-product, with natural gas as an alternative or back-up fuel.

12 *California Energy Commission*, Valero Cogeneration Project, Staff Assessment (SA), August 2, 2001.
13 *California Energy Commission*, Valero Cogeneration Project, Amendments to the Staff Assessment, August 17, 2001.
14 *California Energy Commission*, Commission Decision P800-01-026, October 2001
15 The summary is abstracted from the CEC documents cited above.

Both gas-turbine generator units are expected to operate continuously. Emission controls[16] on the gas-turbines will control NO_x emission to 2.5 parts per million (ppm), while SO_x and PM-10 would be controlled by using natural gas or sulfur-limited refinery fuel gas. The 12 kV electricity generated is sent through underground cables to the new Valero switch house at the existing PG&E 230kV/12kV substation at the refinery. From the substation, the power can be routed within the refinery or exported to the state power grid.

The cogeneration project also has two Heat Recovery Steam Generators to produce superheated steam at 600 pounds per square inch (psi) for use in refinery processes. The Steam Generators would enable the shutdown of at least three existing package boilers at the refinery. The project includes a three-cell cooling tower. For power plant cooling, the project would initially use 314 acre-feet annually of fresh inland water, provided by the City of Benicia in addition to water for the refinery. Additional new equipment includes chillers, fuel gas compression facilities and pipeline, and instrumentation, piping, and wiring, and associated support equipment, as well as a new control room.

Estimated overall project water use (0.28 MGD), primarily for the cooling tower and for gas turbine injection, is 5.6% of refinery use (5 MGD). As mitigation for this use, Valero agreed to approval Condition WATER RES-2, which states that "Within 30 months (from **October 31, 2001**), the project owner would implement a wastewater reuse and/or water use reduction program that would fully offset the amount of water used by the project, using either refinery wastewater or City of Benicia's treated wastewater."

Cogeneration Project Phasing and Construction

The project construction is in two phases. Construction of Phase 1 began in October 2001, with construction of the first gas-turbine generator and heat recovery steam generator now expected to be complete in August 2002, with plant testing to follow. Full-scale operation is planned to begin in September 2002. A second 51 MW gas-turbine generator was planned, with an operational date in December 2002, however, Valero is still evaluating the economics of that second gas-turbine generator. As a condition of the Energy Commission Certification, Phase 1 (51 MW) of the Valero Project must be on line by no later than December 31, 2002. If Valero elects not to construct Phase 2 of the Valero Project, it may forfeit its certification for Phase 2. However, for the purposes of the cumulative analysis, both are assumed to be constructed.

The construction period is approximately 12 months, with two construction phases associated with the construction of each of the combustion turbine generators. The experience from Phase 1 construction provides the best estimate of the worst-case effects of Phase 2 construction, as follows. The maximum work force associated with Phase 1 was about 150 workers for over a three-month period. Limited overtime and second shift work took place. The average work force was between 75 to 100 workers. Assuming a worst case of no construction worker ridesharing, the average work force generated between 150 to 200 daily trips (75 to 100 round trips) and the peak work force generated 300 daily trips (150 round trips).

16 A water injection / aqueous ammonia Selective Catalytic Reduction (SCR) system. The SCR system will use the refinery's existing ammonia storage and distribution system.

MTBE Phase Out Project

The MTBE Phase Out project was undertaken in response to the Governor's order requiring removal of MTBE from gasoline. Project construction is now underway. Details of the MTBE Phase Out Project and of its environmental impacts are presented in the EIR for that project.[17] A summary of the project, abstracted from the Draft EIR, follows.

> "The MTBE Phase Out Project eliminates the importation, production, storage, and blending of methyl tertiary butyl ether (MTBE) at the Valero Benicia Refinery (the refinery), as mandated by the Governor of California in Executive Order D-5-99. Blending facilities for ethanol will be implemented at the refinery, and existing refinery process facilities will be modified for reformulation of the gasoline blendstock to meet California Phase 3 Reformulated Gasoline (CaRFG3) specifications. The proposed modifications are summarized below:
>
> - MTBE Unit Shutdown. MTBE unit equipment will be shut down, except for the fractionation tower, which will be converted to a debutanizer. As part of the shutdown, Valero will eliminate the importation, storage, and blending of MTBE.
> - Light Cat Naphtha Hydrofiner Improvements. Add a recycle pump and modify stripper tower internal equipment to remove sulfur from recycled naphtha.
> - Cat Naphtha Splitter Modifications. Replace tower internal equipment to provide better fractionation performance.
> - Naphtha Rerun Facilities. Reroute existing pumps and piping to allow recycling of naphtha to existing hydrofiners.
> - Sulfur Analyzers. Install on-line analyzers to monitor sulfur levels in naphthas.
> - C5 Debutanizer. Use the existing fractionation tower in the MTBE unit to remove butane and minimize the vapor pressure of gasoline blending stock.
> - Dimersol Unit Reliability. Modify heat exchangers and pumps to minimize downtime and provide sustainable operation.
> - Ethanol Blending Facilities. Use existing methanol rack and tank to receive and store ethanol, construct pipeline from the methanol tank to the existing pipeline that connects to the Marketing Terminal, and install two new blending skids at the Marketing Terminal.
>
> The proposed project would result in a net reduction in the use of electricity, steam, raw water, wastewater, and raw materials at the refinery. The project will not increase solid waste generation, solid waste disposal, or product yield, and the project will not increase the permanent workforce.
>
> Construction on the project began in June 2001, as authorized by the Authorities to Construct provided by the Bay Area Air Quality Management District. Project construction is expected to continue until March 2003."

[17] Valero Refinery MTBE Phase Out Project Draft EIR - URS, April 17, 2002.

3.6.1.3 PLANNED INDEPENDENT REFINERY PROJECTS / ACTIVITIES

In addition to the major refinery maintenance turnaround scheduled for the first quarter of 2004 and the minor refinery maintenance turnaround scheduled for the first quarter of 2006, Valero plans other capital projects for construction before, or during the same time frame as the proposed VIP:

Alkylation Unit Modifications
Selective Hydrogenation Facilities
Light Ends Rail Rack Arm Drains
Treatment of wastewater from Huntway Asphalt Refinery

These projects are scheduled to begin between 2002 and 2004. Valero considers these projects to be independent of the proposed Valero Improvement Project. In addition to the three projects above, another independent “project”, the BAAQMD Reg. 9 Rule 10 NOx Alternate Compliance Plan, is now underway; this regulatory project would involve no construction or equipment. None of these independent projects either precipitate a need for or depend upon implementation of the VIP. The City of Benicia has determined that none of these independent projects would require a City use permit as discussed below.

The City of Benicia use permit requirements for projects at the Valero Benicia Refinery are defined under Section 17.98.080 of the Benicia zoning ordinance. Under Section 17.98.080, a use permit is required for an alteration or expansion of a pre-existing refinery use for which a use permit is required. An “Alteration” is defined as: A) A change which costs $20 million adjusted for inflation or which costs an amount equal to or exceeding 25% of the value of the refinery, whichever is less; or B) “A change which substantially alters the character or operation of the existing use…”. An “Expansion” is defined as “enlargement or extension of the use” to an area that it did not previously occupy. The City has reviewed the independent projects and determined that none of them meet the threshold criteria for a use permit as defined in the ordinance. In conducting its review the City also considered whether undertaking a project would necessitate undertaking another project, or if the construction of a project would constitute a commitment to undertake another project so that the two projects should be considered as one for use permit purposes. The City concluded that all of the projects were independent projects for purposes of the use permit. Because none of the projects require a use permit, none of them require environmental review by the City. Where elements of these independent projects would materially alter existing conditions, affect the magnitude of potential impacts, or involve construction and/or new operations at the refinery concurrent with the Valero Improvement Project, they are considered in the cumulative environmental analysis of the VIP. Any portions of on-going projects that would be completed before the VIP starts have been considered as a part of the existing setting and, although not a part of the proposed project, the effects of other on-going refinery projects have been considered in the analysis of the cumulative effects of the project.

Alkylation Unit Modifications

As described in Section 3.3.2.2, *Valero Refinery Petroleum Product Flow*, both the Alkylation Unit and the Dimersol Unit combine various intermediate feed streams at the refinery to produce gasoline components. The Alkylation Unit combines propylene feed with iso-butane. This project will modify the Alkylation Unit to run additional propylene feed. The added capacity will allow propylene feed to be diverted from the Dimersol Unit to the Alkylation Unit, thus providing a potential 2% increase in gasoline production.

Alkylation Unit modifications include new piping to segregate propylene and butylene feed, additional air fin exchanger tubes to expand cooling capacity, internal tray changes in fractionation towers, and additional pumps, piping, heat exchangers, and instruments. An acid wash process will replace the existing caustic wash process, though there will be no net change in acid or caustic consumption. All of the facilities to be modified are located at the existing Alkylation Unit in the process block. Project construction is scheduled to begin in 2002 and be completed in 2003.

The project will have no significant environmental impacts. An authority to construct has been obtained from BAAQMD. The only air emissions associated with the project will be a slight increase in fugitive VOC emissions. The total increase in fugitive VOC emissions from the Alkylation Unit modifications, in combination with the Selective Hydrogenation, will be less than two tons per year. The project will result in no change in noise, visual resources, or fire hazards and will result in an increase in water usage and wastewater generation. Commute traffic increases will occur only during construction, for a maximum of approximately 50 construction workers, with construction completed in 2003. The increase in air pollutants and the increase in construction workers are considered in the evaluation of future traffic and air quality conditions with the VIP. Thus, the cumulative impacts are portrayed.

Selective Hydrogenation Unit

The FCCU accepts heavy feedstocks and breaks their large hydrocarbon molecules into smaller ones, converting them to gasoline blending stocks[18]. The FCCU input feedstocks come from the heavier fractions from the Pipestill Unit and from purchased gas oils. The fractionated output streams from the FCCU are:

- *Pentanes*
- *Light Cat naphtha*
- *Heavy Cat naphtha*
- *Light gas oil*
- *Olefins*

The refinery currently uses a Merox/Minalk sulfur removal process to remove sulfur from the pentane streams produced from the FCCU – also called Cat Pentanes. The Selective

[18] See *Fluid Catalytic Cracking Unit* in Section 3.3.2.2, *Valero Refinery Petroleum Product Flow*, for a description of the FCCU flow processes.

Hydrogenation process would replace the existing Merox/Minalk sulfur removal process. The selective hydrogenation process would move sulfur from the Cat Pentane stream to the Light Cat Naphtha stream, where it would be removed downstream in the Light Cat Naphtha Hydrofiner (see also Section 3.3.2.2 in *Hydrofiners*). The project will not expand the sulfur removal capacity at the refinery, but will reduce octane loss in the Light Cat Naphtha stream. Selective hydrogenation will also convert Olefins to non-fouling species to reduce fouling associated with the two cat naphtha hydrofiners. The additional octane may allow production of additional premium gasoline (versus regular), and the reduced fouling will extend the run lengths of the cat naphtha hydrofiners.

The facilities required for the selective hydrogenation process include a reactor tower (10 feet dia. by 75 feet high), stripper tower (10 feet dia. by 125 feet high), air cooled heat exchangers, pumps, process heat exchangers, piping, drums, and instruments. All equipment will be located at the existing FCCU, in the process block. Construction is scheduled to begin in 2002 and finish in 2003.

An authority to construct has been obtained from BAAQMD. The only air emissions will be fugitive VOC emissions of less than one pound per day. There will be no change in water usage, wastewater generation, chemical usage, fire hazards, or noise. The new towers will be adjacent to five existing taller structures and will match the existing refinery color scheme. Commute traffic increases will occur only during construction, for a maximum of approximately 50 construction workers. The increase in air pollutants and the increase in construction workers were considered in the evaluation of future traffic and air quality conditions with the VIP. Thus, those cumulative impacts are portrayed. The change in visual conditions is examined in the analysis of cumulative aesthetic impacts.

Light Ends Rail Rack Arm Drains

This project would install piping at the light ends rail loading rack. This piping would allow light ends (primarily butane and pentane) products to drain from the loading arms, and consequently be recovered, after rail cars have been filled at the rack. An Authority to Construct has been issued by the BAAQMD. A net reduction in VOC emissions of 16 tons per year is expected to result from this project. Construction requires approximately 25 workers for several months. The decrease in air pollutant emissions and the presence of construction workers are included in the evaluation of future traffic and air quality conditions with the VIP. Thus, the cumulative impacts are portrayed.

BAAQMD Reg. 9 Rule 10 NOx Alternate Compliance Plan

The BAAQMD Reg. 9 Rule 10 NOx Alternate Compliance Plan project involves operations of refinery boilers and furnaces with respect to control of NOx emissions. There is no construction and no new facilities are associated with this project. However, implementation of this project involves regulatory action by the BAAQMD, so the District prepared an EIR[19] that describes the project and its environmental impacts. The City of Benicia has no discretionary authority over

[19] BAAQMD, EIR for Reg. 9 Rule 10.

this project. All of the conditions that would result are included in the air quality analysis for the VIP.

Treatment of Wastewater from the Huntway Asphalt Refinery

Valero treats all of the Valero refinery wastewater in processing equipment located close to the water effluent outfall that discharges into Suisun Bay. The refinery also proposes to treat the discharge from the adjacent Huntway Asphalt Refinery, recently purchased by Valero, at its existing wastewater treatment plant. The regulatory agency for the refinery water discharge is the San Francisco Regional Water Quality Control Board (RWQCB). The refinery's National Pollution Discharge Elimination System (NPDES) permit was renewed on October 16, 2002. It has not yet been determined if changes would be required at the Valero wastewater treatment plant to handle the additional (0.04 million gallons per day) wastewater flows from Huntway. See Section 4.9, *Hydrology and Water Quality*, for more information on the Huntway Asphalt Refinery.

3.6.2 OUTSIDE PROJECTS

In addition to regular maintenance actions and other independent projects that would be undertaken by the refinery, on-going and foreseeable projects by others could be underway at the same time as the proposed VIP.

The largest of these projects by other sponsors would be the construction of the Benicia-Martinez Bridge, south of the refinery. Another potential separate project is the development of the Seeno Industrial Park, immediately east of the refinery. A third separate project, the City of Benicia's Wastewater Reuse Project, also could be under development. The fourth project, the Southampton Tourtelot Development in Benicia, could be under construction, as well.

These projects are described briefly, following.

3.6.2.1 CALTRANS BENICIA-MARTINEZ BRIDGE

Caltrans has proposed to construct a new bridge across the Carquinez Strait between the Cities of Benicia and Martinez. The project is to construct a new bridge across Carquinez Strait at Interstate 680 between the City of Benicia in Solano County and the City of Martinez in Contra Costa County. The proposed alignment is east and parallel to the existing Benicia-Martinez and Union Pacific Railroad bridges. The new bridge characteristics are:

- It will carry northbound traffic,
- Be approximately 8790 feet long (including approach spans) and 83.5 feet wide (including bridge rails),
- Consists of five lanes and 10 foot shoulders,

- Include a new 17-booth toll plaza and Administration Building south of Carquinez Strait in Contra Costa County,
- Reconstruct the I-680/I-780 and I-680/Marina Vista Interchanges to accommodate the proposed bridge and toll plaza, and
- Construct a warehouse and a wetland mitigation site.

The project was originally proposed to begin construction in 1998 with a completion date of 2002, however, for various reasons, the start date slipped to 2000 and construction is currently expected to be completed by 2004 or 2005. Full details of the Caltrans Benicia Bridge Project and of its environmental impacts are presented in the EIS/EIR.[20]

3.6.2.2 SEENO / BENICIA BUSINESS PARK

An application has been filed with the City, so the Benicia Business Park may be considered to be a cumulative project. The following information is contained in the project application as submitted to the City. Although not yet an approved project, the industrial development described in the application is deemed to represent development that might reasonably be expected to begin on that site within the time frame of the VIP construction.

The Benicia Business Park was proposed to occupy 527.5 acres of undeveloped land in the eastern part of the City. The property is bounded on the south and east by East Second Street, on the west by the property line that generally parallels the alignments of West Channel Road and Industrial Way and on the north in part by the City Water Treatment Plant and Lake Herman Road. The project would include 4,094,000 square feet of industrial buildings on 284.8 acres of land, and 490,000 square feet of commercial development on 45.0 acres of land near the intersection of Lake Herman Road and East Second Street. The project also would include new infrastructure – roads, water and wastewater lines, and other utilities – and nearly 170 acres of open space.

Construction of the Benicia Business Park would require excavation of approximately 5 to 8 million cubic yards of soil, with grading balanced on-site. However, some imported fill would be required for utility backfill, roadbeds and similar uses.

Projected employment would be approximately 8,223 employees.

Site development would proceed in 12 phases, with buildout expected within 20 years of the start of construction.

If construction of this project were to occur at the same time as the 2004 or 2009 refinery turnaround, it would likely contribute construction traffic to I-680, the I-680/Lake Herman Road ramps, and various streets in the vicinity of the northern area of the Valero site, and would therefore have a cumulative impact. However, if the project's construction period were not to coincide with the VIP construction, and 2004 and 2009 turnarounds, the cumulative effect of

[20] Caltrans, Supplemental Draft Environmental Impact Statement/Report, April 25, 1995

construction would be minor. Since the project is not yet approved, it is not known when its construction would begin. Regardless of the construction dates, the Benicia Business Park construction traffic would be expected to use the Lake Herman Road interchange to access I-680, so as to minimize traffic interactions between the project and the refinery turnaround (which would use interchanges to the south). Thus, the cumulative construction impacts of the Benicia Business Park with respect to the VIP and turnaround are judged to be relatively small. Cumulative operational traffic effects of the project and all regional growth are included in the Solano Transportation Authority (STA) Travel Demand Model for 2025.

3.6.2.3 CITY OF BENICIA WASTEWATER REUSE PROJECT

Planning for the City's Wastewater Reuse project has proceeded only to the point where the City has a draft Action Plan[21] for that project. The Action Plan describes the potential project and lists the 8 tasks that have been identified as essential to the development and approval of the wastewater reuse project. The following are excerpts from the draft City of Benicia Effluent Reuse Project Action Plan.

> "BACKGROUND
>
> The City of Benicia and the Valero Benicia Refinery wish to reuse as much of the City's wastewater effluent at the refinery as is feasible. Such reuse would reduce the refinery's demand for water from the North Bay Aqueduct. A preliminary analysis prepared by URS Corporation (April 2002) identified several potentially feasible alternatives to use up to three million gallons per day of the City's wastewater treatment effluent (after additional treatment) at the refinery. However, before the City can proceed with design and implementation, a number of issues must be resolved, including the additional treatment that is necessary, the implications for City and refinery wastewater discharge quantity and quality, and the regulatory requirements that may constrain these choices. The purpose of this action plan is to describe the tasks that are necessary to address these issues, to estimate a reasonable timeline for carrying out those tasks, and to identify additional engineering and environmental resources that are likely to be required for this phase of the project development.
>
> TASKS
>
> Task 1. Confirm Recycled Water Use Potential and Water Quality Requirements
>
>> As noted a preliminary evaluation was recently completed, which indicated that up to 3 MGD of recycled effluent could be used at the refinery. Use in cooling towers was identified as the most feasible use, requiring removal of ammonia and hardness. It was noted that if RO treatment is provided, then boiler water use may also be feasible. Specific water quality requirements need to be obtained from the refinery staff, confirmed, and agreed-upon.

[21] Eisenberg, Olivieri, & Associates, City of Benicia Effluent Reuse Project Action Plan, Draft, July 11, 2002.

Task 2. Develop Estimates of Wastewater Discharge Quantity and Quality for Several Scenarios

Based on the defined reuse water quality requirements and existing effluent pollutant concentration data, it will be possible to estimate the projected increase in discharge concentration for several reuse scenarios. Initially, it will be assumed that the additional treatment is carried out at the City's treatment plant site, and that RO treatment is provided with concentrate returned to the NPDES discharge stream, for three reuse alternatives (1 MGD, 2MGD, and 3 MGD). The projected concentrations in the NPDES discharge stream under each scenario will be reviewed to identify constituents that may be projected at levels of concern relative to either existing numerical concentration limits or criteria, or relative to known toxicity levels.

Task 3. Apply for Water Recycling Planning Grant

The State Water Resources Control Board has programs to provide low interest loans for water recycling projects, and grants for planning such projects. The Water Recycling Facilities Planning Program provides grants to cover 50% of planning costs up to a maximum grant amount of $75,000. The feasibility and likelihood of obtaining a planning grant will be investigated. If there appears to be a reasonable chance of obtaining grant funding, an application will be prepared and submitted. The construction loan requirements and procedures will also be investigated, and these may be pursued at a later stage, in conjunction with permitting and final design.

Task 4. Initiate Discussions with Regulatory Agencies

Using the information developed in Task 2 and the currently existing level of project description detail, initiate discussions with the Regional Water Quality Control Board to determine likely regulatory requirements and regulatory feasibility. These discussions should be pursued to a point where there is a reasonable characterization and level of certainty regarding the permitting process and the requirements that must be met, prior to carrying out additional engineering design. As part of this task the Calif. Dept of Health Services (DHS) will also be contacted to confirm their requirements for the proposed reuse, and determine whether DHS will impose any additional project-specific requirements. Any such additional requirements from DHS could add additional tasks and duration to this work plan.

Task 5. Prepare RFP for Design Engineer and Carry Out Preliminary Design

At an early stage in the planning process, a design engineer should be selected and become involved in project development. An RFP will be developed and issued, to select a qualified engineering firm for a phased design project. The first phase will be a preliminary (10%) design that will include definition of process train, component sizing, location and layout, pipeline route and materials, and engineer's preliminary cost estimate. The second phase will be a detailed design and bid package.

Task 6. Permit applications

Using the products of tasks 1 through 4 above, applications will be prepared for necessary discharge permits. These will include a Water Reuse Permit, and probably also NPDES permit amendments from the RWQCB.

Task 7. Environmental Review

An environmental review consultant will be selected to carry out the necessary CEQA/NEPA review. This review will be initiated when the design and the permit requirements have been adequately defined, most likely concurrent with Task 5.

Task 8. Final Engineering Design

When Tasks 1 through 6 are completed, the engineering design and bid package can be completed by an engineering design firm. Another RFP for design work will be necessary unless the entire design effort is included in the potential scope for the RFP that is issued for the preliminary design work."

The current schedule for the action plan indicates that Task 1 will be completed at the end of August 2002, and Task 8, final engineering design will be completed in October 2003. No timetable has been set for construction of the wastewater reuse project, so it is not possible at this time to establish whether the construction of the project would coincide with the construction of the VIP.

However, given the nature and scale of the reuse project, it is possible to determine those general interactions that will occur between the VIP and the Wastewater Reuse project when both are constructed and in operation. Were the timing of the wastewater reuse project to coincide with the refinery turnaround and VIP, cumulative construction traffic impacts, which would be the only potential cumulative effects, would be insignificant because this project is in a different part of the City than is the refinery. The construction workers for the reuse project would use East 5th Street ramps from I-780, and would not add to the surface traffic from the cumulative refinery projects.

3.6.2.4 SOUTHAMPTON TOURTELOT DEVELOPMENT

The final portion of the Southampton housing development, known as the Tourtelot area, located to the northwest of the refinery process area, is expected to be built over a four-year period with an estimated start date of late 2003. The construction of this final portion of the Southampton development has been delayed for several years pending investigation and cleanup of ordnance items remaining from the former use of the property as part of the Benicia Arsenal.

The construction project, consisting of 417 homes, is planned to be built at the rate of 100 homes per year, beginning with the "D-1" area, consisting of 161 homes where street improvements have already been installed, and progressing to areas D-6 and D-7 which will require substantial grading to install infrastructure and create lots. An EIR covering D-6 and D-7 was prepared in 1989 (Final EIR, Southampton Tourtelot Property General Plan Land Use Amendment and

Rezoning, EIP Associates 1989). That EIR also updated a 1977 EIR as it pertained to an additional 745 homes including the D-1 area.

As with the wastewater reuse project, cumulative construction traffic impacts would be the only potential cumulative effects for the Tourtelot development. The cumulative construction traffic impacts of this project would be insignificant because this project also is in a different part of the City than is the refinery. The Toutelot construction traffic would be expected to use the Lake Herman Road interchange to access I-680, and the East 2nd Street interchange to access I-780, so as to minimize traffic interactions between the project and the refinery turnaround (which would use different interchanges). Thus, the cumulative construction impacts of the Southampton Tourtelot development with respect to the VIP and turnaround are judged to be relatively small. Cumulative operational traffic effects of the project and all regional growth are included in the Solano Transportation Authority (STA) Travel Demand Model for 2025.

3.7 PERMITS AND APPROVALS REQUIRED

The City of Benicia Zoning Ordinance, Section 17.32.020, requires a use permit for oil and gas refining. The Valero Benicia Refinery was established prior to the adoption of that requirement and, therefore, future projects at the refinery are reviewed in relation to Section 17.98.070 regarding alteration or expansion of a preexisting use for which a use permit is required. Section 17.98.070 requires a use permit for projects that constitute alteration or expansion of an existing use as defined below:

> "Alteration" is:
>
> A. A change the cost of which equals or exceeds twenty million dollars [adjusted for inflation] or equals or exceeds twenty-five percent of current assessed valuation of the existing facility or structure, whichever is less; or
>
> B. A change which substantially alters the character or operation of the existing use including, but not limited to, hours of operation or scope of activities or services.
>
> "Expansion" is interpreted as enlargement or extension of the use so as to occupy any part of the structure or site, or another structure or site that it did not occupy [before].

The VIP constitutes an alteration of the existing use because its cost, estimated at $140 million, exceeds $20 million adjusted for inflation and because the project will substantially alter the character and operation of the existing use by allowing the refinery to process lower grades of feedstocks and increase production above existing levels.

Thus, under City Ordinance, the VIP would require a land use permit and, because the approval is a discretionary action on the part of the City, environmental review under the California Environmental Quality Act (CEQA) also is required.

In addition to a City of Benicia Use Permit, permits would be required from the Bay Area Air Quality Management District for units included in the VIP. Valero may make separate permit applications to BAAQMD for individual components, or groups of components of the project. The first application was submitted to the BAAQMD on July 22, 2002. The City, as Lead Agency for the EIR, has taken special care to assure that this EIR provides a sound basis for supporting the BAAQMD review of Valero's air permit application.

The facilities in this project are incorporated into the refinery's Regional Water Control Board's NPDES Permit.

It is expected that grading and building permits would be required from the City of Benicia for project components not covered by the annual grading and building permit.

A Caltrans encroachment permit may be needed to implement the traffic mitigation measure.

CHAPTER 4

ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION

APPROACH TO THE ANALYSIS OF IMPACTS

The proposed Valero Improvement Project (VIP) is not just one project but a series or collection of projects at the Valero Benicia Refinery. The VIP has four objectives:

1. Provide ability to process lower grades of raw materials[1].
2. Provide flexibility to substitute raw materials – crude oil instead of gas oil.
3. Optimize operations for efficient production of clean burning fuels.
4. Mitigate project-related impacts to avoid detrimental effects on the community.

To achieve these objectives, the VIP would modify existing and install new refining equipment. The nature of the project as described by the applicant includes substantial flexibility as to whether and how to implement the various project components, and therefore, a range of project variables must be considered in the impact analysis.

PROJECT VARIABLES

Design

Detailed designs of the VIP components themselves are not available, however the general changes in operation and the major pieces of equipment (including prominent physical features) are known. Dimensions are provided only for VIP components of substantial size and those dimensions are necessarily approximate. Information presented in Chapter 3, *Project Description*, is intended to describe the upper bounds for VIP components, considering the maximum equipment sizes and the maximum operational modes for each of the VIP components.

Location

All VIP units would be located within the refinery boundaries, generally placed among similar existing equipment. The locations of VIP components are noted or discussed if those locations are not close to the related existing facilities.

Schedule

Valero would implement the project in a series of steps, starting in 2003. If all of the VIP components were to be built, construction would be completed by about 2009. The schedule for each component typically describes essential steps in construction or the relationship to refinery

---

1 As used in this document, the term “raw materials” is defined as crude oil and gas oil feedstocks.

maintenance turnarounds[2], instead of fixed dates, since construction of any VIP component may be delayed or may be foregone.

Certainty

As is described in Chapter 3, *Project Description,* variations in the final project design, VIP component installation location, and exact VIP implementation schedule introduce a degree of uncertainty into this analysis. For example, Valero has requested that the VIP consider two major project scenarios: one where the Main Stack Flue Gas Scrubber will be built and the other where the Main Stack Flue Gas Scrubber and its associated components may not be built or not fully implemented. As another example, refinery operating modes could differ from those described in Chapter 3, *Project Description,* if the desired raw materials are not available or if some of the VIP components are not installed. The following discussion describes how certainty (or uncertainty) of VIP, as well as the other project variables, were considered.

PROJECT IMPACT ANALYSIS

A refinery consists of process units that cannot operate independently. Changes in the operation of one process unit will result in changes to the operations of other process units. The individual contributions of each affected interdependent refinery component result in an impact of the VIP that is the sum of these individual contributions. Examples of such impacts include visual, air quality, noise and traffic impacts. The analysis in this Environmental Impact Report (EIR) presents the impacts that would result from implementing the full VIP, that is construction and operation of each and every VIP component. In nearly all cases, the analysis of the full project reveals the greatest or worst-case impacts that could occur under any combination of VIP components and leads to the mitigations that would be necessary to reduce those worst-case impacts to less than significant.

In a few instances, however, the worst-case impact for a given environmental issue might not occur under the full VIP, but would occur as a result of one of the project variables. Thus the impact analysis in this EIR also considers the possible effects of the project “variables” – <u>Design</u>, <u>Location</u>, <u>Schedule</u> and <u>Certainty</u> -- in the VIP as proposed, on environmental impacts. If any aspect of these four variables would result in a substantive difference in the environmental impact of the VIP or in the mitigation that might be applied, those aspects are discussed and the individual effects are traced in the appropriate chapters and sections of this EIR. If these variables would not result in an increase in impact or require a material change in mitigation, they may not be discussed.

For example, the absence of the Main Stack Scrubber would reduce the visual impact of the overall VIP but this decrease in impact is not discussed in Section 4.1, *Aesthetics, Visual Quality, Light and Glare,* because the visual impacts are considered insignificant with or without the scrubber. On the other hand, the impacts of the interim operation of the VIP without the Main

2 A turnaround is a scheduled maintenance action during which some or all of the refinery equipment is shut down, so it is a suitable time to install new equipment. See Section 3.6.1.1, *Maintenance Activities.*

Stack Scrubber are discussed in detail in Section 4.2, *Air Quality*, because absence of the scrubber would involve important differences in air quality.

In the event that specific operational considerations, dimensions of the components, equipment locations, and variations in the timing of construction or the absence of any project component were critical to identifying or mitigating a potential environmental impact of the project, these considerations are discussed under the related impact or mitigation presentations in this chapter.

Each of the following impact analysis sections begins with a summary of issues and impacts associated with the area of environmental review considered in that section. The summary is followed by a detailed discussion and analysis of the current environmental setting, regulatory considerations, impacts of the VIP and, where appropriate, mitigation measures. Each section also includes a discussion and evaluation of the cumulative impacts of the project and the other refinery and non-refinery projects that could affect the specific impact issue.

For a number of impact areas, the consideration of the cumulative refinery project impacts is of primary importance and, for some of those impact areas; the assessment of cumulative impacts was made first. If these cumulative effects did not meet the significance criteria, they were considered to be less than significant and, of course, the project effects also would be less than significant.

CUMULATIVE IMPACT ANALYSIS

Cumulative impacts were analyzed by considering the effects of the VIP combined with other concurrent refinery projects and approved or planned projects in the vicinity of the refinery. The identifiable concurrent refinery and non-refinery projects are described in Section 3.6, *Relevant Cumulative Projects*. The cumulative impact analysis considers the interaction of VIP impact and impacts from other projects of the same type, or with the same effects, to create a cumulative impact affecting the same geographic area as that of the VIP impacts. Following the CEQA Guidelines, the extent of the area considered for each cumulative effect was set to be appropriate to that environmental issue.

For cumulative projects within the refinery, information was available to consider these projects at a relatively substantial level of quantitative detail, while for cumulative projects outside the refinery, less project-specific information was available. Thus, the cumulative analysis for those non-refinery projects could not be quantitative. In addition to effects of the identifiable cumulative projects, the cumulative impact analysis also adds outside cumulative effects, such as cumulative traffic growth, to develop the full cumulative analysis.

The results of the cumulative impact analysis are presented at the end of each respective section in this chapter and all cumulative impacts are presented together and considered as a whole in Section 5.2, *Cumulative Impacts.*

4.1 AESTHETICS, VISUAL QUALITY, LIGHT AND GLARE

Although noticeable changes in aesthetics and visual quality would occur, the aesthetic, visual and glare impacts of the VIP would be less than significant. No mitigation would be required.

- ***The new equipment and facilities of the VIP could be seen from public view corridors such as I-680, a designated scenic corridor.***
- ***Refinery operations could cause flaring events.***
- ***Operation of the proposed new scrubber stacks could create vapor plumes visible to surrounding residents and motorists.***
- ***The proposed development would introduce new lighting on-site.***
- ***The VIP and other Valero Refinery projects would expand the industrial appearance of the overall refinery complex.***
- ***Other cumulative projects, together with the VIP and other Valero Refinery projects would combine to alter the general appearance of the southeast portion of the City.***

4.1.1 INTRODUCTION

This section addresses the aesthetic and visual quality issues associated with the proposed Valero Improvement Project (VIP). It includes a description of existing visual conditions and an evaluation of potential aesthetic effects associated with implementing the project. Computer-generated visual simulations illustrating “before” and “after” visual conditions at the project site as seen from six representative public vantage points are included and discussed as part of this analysis. The locations of the visual simulation vantage points were selected in consultation with City staff. Digitized photographs and computer modeling and rendering techniques were utilized to prepare the simulation images, which are based on plans and project drawings provided by the project applicant. Additionally, an assessment of visible steam plume formations associated with refinery operations has been included as part of this analysis.

4.1.2 SETTING

4.1.2.1 REGIONAL SETTING

The northeast portion of the city of Benicia, developed as an industrial park, is the setting for the VIP. The industrial park is in a valley flanked by undeveloped hills located above Suisun Bay. The topography of the area (ranging from 10 feet to 300 feet mean sea level) and the undeveloped Valero property that borders the refinery enhances the visual and physical separation between the industrial park and Benicia’s residential areas.

4.1.2.2 PROJECT SITE

The Benicia Refinery is the dominant visual feature in the Benicia industrial park. The site exhibits complex industrial forms, lines and geometric shapes. The main refinery process and storage areas are located on terraced slopes that descend from East Second Street towards the Carquinez Straight. Refinery structures are painted light colors ranging from yellow-gold to blend with dry season grassland colors to forest green intended to mimic tree color and to blend into the landscape from distant viewpoints. From the main entrance on East Second Street, views include well-maintained administration and training areas with parking areas bordered by trees and shrubs. The process block is visible in the valley below.

The major components of the process block include the 462-foot main stack; crackers and furnaces; cooling towers; natural gas supply lines and other piping; pumps; and other equipment. With the exception of the main stack and the two flares, most of the stacks and coolers are less than 150 feet tall. Some of these structures, such as the main stack, are tall enough to be equipped with night lighting and beacons. In the main process block, the processing units are grouped together, sometimes creating solid walls of mechanical equipment comparable to the size of five- to six-story buildings. The refinery also includes a number of clustered tanks, or “tank farms,” throughout the property, which also contribute to an industrial aesthetic. The utilitarian character and appearance of the refinery produces a strong industrial statement in the landscape that sharply contrasts with the open space and undeveloped hills that virtually surround it.

Flaring

An emergency service flare is a gas flare that combusts only those vent gases that result from sudden and unforeseeable events, including emergency process upsets that require immediate corrective action to restore normal and safe operation. Flares receive the over-pressurization releases from all the refinery units. Flaring could have visual effects, dependent on the size of the flare/plume released from the refinery’s two flare stacks, existing atmospheric conditions, and the time of day (or night) of the event.

The Valero Refinery has compiled data summarizing flare events for the years of 1994-2002. The flare reports describe the date and duration of the event, the size of the observed flare, ambient atmospheric conditions at the time of the event, and any other pertinent information regarding the nature of the flare. In general, recorded flare events occur approximately 9 times a year and were reported if gas was discharged at a rate of 10 million standard cubic feet per day for two hours or more. Additionally, Valero has recorded flare complaints for the years of 2000-2002 indicate the time of the flaring occurrence; however, these complaints do not provide information about flare intensity. Over the last two years, about half the reported flare events occurred during evening hours and the other half occurred during the morning hours.

Water Plume Visibility

Whenever steam is used in manufacturing processes, water vapor plumes are formed. At Valero, steam is generated and used in many process units. Water is also used in cooling and scrubbing processes, leading to the potential for visible plumes to be formed.

A visible plume assessment has been prepared by URS Corporation to characterize typical steam plume formation from refinery process units under current (existing) refinery operating conditions as well as for operating conditions for the VIP.[3] The technical report assessed the potential for the project to create visible water vapor plumes by using state-of-the art modeling techniques standard in the industry. The results of that study have been independently peer-reviewed and are summarized here for inclusion in this document.

The formation of visible water vapor plumes from refinery process units is a function of varying local meteorological conditions, including air temperature, wind speed and atmospheric humidity, as well as variation in the actual refinery process itself. These plumes typically appear either directly emanating from a process unit stack or forming a slight distance away from the process unit stack. Plumes of this type are generally white in color and are typically composed mostly of small, condensed water droplets. If the requisite atmospheric conditions exist (generally low temperature with calm winds and relative high humidity), it is possible for a water vapor plume to form. The plume will remain visible until the water in the plume evaporates into the local air surrounding the plume. The plume will extend away from its formation point flowing downwind in the direction of the local wind flow. As it moves it may spread out both vertically and horizontally dependent again on the existing local meteorological and process unit conditions. In actuality, plume formation / dissipation is a continuous process of creation, movement, and destruction and is typically of short duration. If, during its movement the plume intersects a physical object like a nearby residence or road, it could cause obstructions to visibility.

To evaluate the potential for steam plume formation at Valero a mathematical atmospheric dispersion model (ADMS3) was used to simulate atmospheric dispersion of exhaust gases from operations at Valero. Under existing operating conditions, exhaust gases emitted from the main stack are predicted to be visible as water vapor plumes approximately 4 hours per year, equating roughly to 0.05% of the time (based on 8760 hours in a year). This equates to plumes being visible only during daytime and when fog is not present, for about 1 hour per year. The maximum model-predicted plume length[4] is approximately 190 feet, with an average plume length of approximately 150 feet.

4.1.2.3 PUBLIC VIEW CORRIDORS

The site is in a highly visible location adjacent to a major state highway and Suisun Bay, and other publicly accessible streets and open spaces provide views of the project site. Brief descriptions of key view corridors are discussed below.

I-680

The VIP is not located near any state designated scenic highways and is not subject to any state management requirements. The Caltrans vista point is located at I-680 and Lake Herman Road,

---

3 *Assessment of Visible Steam Plume Formation*, URS Corporation, June 2002.
4 Results of the study are presented in metric units. Lengths are in meters, where one meter is equal to 3.2808 feet.

approximately 3/4-mile northeast of the Valero Refinery. *City of Benicia General Plan* designates the portion of I-680 near the vista point a visual "gateway."

The General Plan also has identified the portion of I-680 between Morrow Lane and the Benicia-Martinez Bridge as a "scenic street and gateway" important for the views of the Hills and Carquinez Strait afforded from the highway. The General Plan indicates that:

> Views along this route establish an initial image of Benicia as a place where a high-quality environment for manufacturing and import/export activities is provided. Industrial activities are contained by natural topographic boundaries within the basin formed by the hills below Lake Herman Road on the north, the slopes above East Second Street to the west, the main ridgeline to the south, and Suisun Bay to the east. When traveling southbound on I-680, motorists experience views of grassy slopes dotted with cattle and oaks on the west and the expanse of Suisun Marsh on the east. At the City limits, views open up on both the east and west sides of the road; however, 'the focus is directly on several large storage tanks on the north side of the main ridge.' (p. 114)

Motorists approaching Benicia from the south on the Benicia-Martinez Bridge have clear views of the refinery storage tanks on the ridges above the industrial basin, but the hills block views of the refinery itself. Most of the refinery is hidden from view from eastbound drivers on I-680 except for partial views of towers and the north flare which are visible between hills near the highway summit west of Lake Herman Road. Beyond the summit, from Benicia's northeast gateway on I-680 near Lake Herman Road, Benicia's entire industrial area and most of the refinery area are visible from this vantage point on I-680. To the east, the topography opens up, expanding the view to include Suisun Bay and Mount Diablo.

Other Public View Corridors

The refinery is visible from other public view corridors not designated within the General Plan. Most of the following viewsheds are shown in visual simulations included in this analysis under the discussion of Impact 4.1-1. From Rose Drive, northwest of the refinery, the foreground view includes the refinery main process block, with views of Mount Diablo across the Carquinez Strait. From the Hillcrest neighborhood near St. Dominic's cemetery at the eastern edge of Southampton there are occasional views of the refinery. Limited views of the refinery are also available from several points along Lake Herman Road. The General Plan designates Lake Herman Road as a scenic street (General Plan, p. 113). From the residential areas to the southwest of the refinery, views are restricted to the first tier of homes because topography and other homes create a visual screen.

4.1.2.4 PUBLIC PLANS AND POLICIES

City of Benicia General Plan

City of Benicia General Plan addresses policies concerning aesthetic qualities for the project site as well as the city in general. The General Plan includes a Community Identity chapter that outlines Benicia's natural and man-made attributes, which lend a sense of place to Benicia and define its visual character. The Community Identity chapter identifies three principal view corridors from which a variety of Benicia's scenic resources can be viewed. These include I-780 between Glen Cove Road and the Benicia-Martinez Bridge; Lake Herman Road and I-680 between Morrow Road and the Benicia-Martinez Bridge. Only the latter of these two viewsheds identified in the General Plan directly applies to this project because the Valero Refinery is visible only within the I-680 view corridor. The stated objectives of the Community Identity Chapter are:

Policy 3.7.1: Ensure that new development is compatible with the surrounding architectural and neighborhood character.

Goal 3.9: Protect and enhance scenic roads and highways.

Policy 3.9.1: Preserve vistas along I-780 and I-680.

Goal 3.12: Improve the appearance of the Industrial Park.

Policy 3.12.1 Encourage additional attractive, quality development in industrial areas.

Solano County Scenic Roadways Element

The Solano County General Plan consists of various elements, including a Scenic Roadways Element. The Scenic Roadways Element was formulated for the purpose of designating a scenic roadway system while accommodating a reasonable, planned level of growth. The primary intent of the Scenic Roadways Element is to, "recognize and respect the distinctiveness of the various non-urban landscapes occurring throughout the county and to reinforce the intentions of the open space and conservation elements now in effect in the county and cities." The Scenic Roadway Element designates Lake Herman Road as a County Scenic Roadway, and Lake Herman Road as a vista point. Views from Lake Herman Road are mainly of rolling grassland, which combines with hilly topography, generally uninterrupted by other vegetative groupings. However within Benicia, views from Lake Herman Road are also urban in nature, with the refinery and other industrial and commercial land uses visible to motorists.

The Scenic Roadways Element includes the following policies, which apply to the VIP:

Policy C.1.a: Avoid locating development on the steeper slopes (15 percent or greater), upper hillsides, hilltops and ridges where such development would be highly visible and discordant with the barren and smooth natural topography.

Policy C.1.b: Soften the contrast between the proposed development and the rolling grassland through the siting of construction on low-lying areas in clustering, provision of sufficient setback from the scenic roadway; and use of building form (low profiles), materials and color subordinate to the surrounding natural environment. These measures together will minimize disruption of natural land forms. Heavy use of berms and planting of semi native vegetation should be encouraged in this design approach to screen buildings, roads and parking from the roadway view.

Policy C.1.c: As a basic design feature, emphasize the contrast between the proposed development and its natural setting through the provision of a substantial setback from the roadway to maintain an open foreground, together with dramatic and sensitive massing of all structures to achieve a focused, compact development configuration.

City of Benicia Zoning Ordinance

The Municipal Code of the City of Benicia has two main zoning ordinance sections related to visual impacts of general industrial development. Section 17.32.030 lists requirements for lot size and setback criteria, and Section 17.108 concerns design review of structures to ensure visual harmony with the surrounding area. Section 17.32.030 prescribes basic land use development requirements for industrial zoned parcels. In general, parcels zoned IG must contain a minimum lot size of 20,000 square feet, have a minimum lot width of 100 feet, are allowed a maximum 75% lot coverage and an floor area ratio (FAR) of 1.0, and must contain at least 10% landscaping on site (Zoning Ordinance, p. 17.32-8 and -9). Section 17.108 is summarized below. Furthermore, projects in the IG zone must comply with the Zoning Ordinance's outdoor lighting performance standards (Section 17.70.240.D.2). These standards specify that lighting "shall be designed and installed to confine direct light rays to the site… Security lighting in any district may be indirect or diffused, or shall be shielded or directed away from adjoining properties and public rights-of-way."

Industrial Design Guidelines

The City of Benicia adopted Industrial Design Guidelines in March 1989. Chapter 17.108 of the zoning ordinance incorporates these guidelines and requires design approval for new development with the exception of single family residences. The City's planning director is authorized to grant design review approval for projects in the General Industrial zoning district. Prior to approval, the planning director is required to make design review findings, which address the following concepts, based on General Plan policies:

- The location and configuration of structures need to be visually harmonious with their sites and with surrounding sites and structures; not unnecessarily block scenic views from other buildings or public parks; and not dominate their surroundings to an extent inappropriate to their use.
- The architectural design of structures, their materials and colors need to be visually harmonious with surrounding development, and with the natural landforms and vegetation of the areas in which they are proposed to be located.
- Plans for landscaping of open spaces must be consistent with the Zoning Ordinance's design review requirements; landscaping plans must provide visually pleasing settings for on-site structures and adjoining/nearby sites; landscaping plans must blend harmoniously with the natural landscape.
- Excessive and unsightly grading of hillsides must be prevented; natural landforms and existing vegetation are preserved where feasible.

- Adequate, safe, and efficient parking and circulation areas must be provided that conform to the design review requirements.

- A functional, efficient, and attractive site design must be provided, which is sensitive to existing uses in the area and to the topography and conditions of the site (Section 17.108.010.A-D).

New development must be consistent with specific design guidelines developed for use within the community, where applicable, and to any specific plan or planned development plan.

4.1.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

The evaluation of visual impact considers potential effects on publicly accessible views. The CEQA *Guidelines* indicate that a project will have a significant effect on the environment if it would:

- have a substantial, demonstrable negative aesthetic effect on a scenic vista;

- substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway;

- substantially degrade the existing visual character or quality of the site and its surroundings; and

- create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

The significance determination in visual analyses is based on consideration of: 1) the extent of change related to project visibility from key public vantage points; 2) the degree of visual contrast and compatibility in scale and character between proposed project elements and the existing surroundings; and, 3) project conformance with public policies regarding visual and urban design quality.

This document also considers visual assessment standards used by the U.S. Department of Transportation Federal Highway Administration. These standards characterize the project in the existing environment by defining two levels of project aesthetics: *relational* and *environmental*. Relational aesthetics focus on the visual relationships of the project with distinct elements of its surroundings. Environmental aesthetics analyze the visual environment of an area, of which the project is a part, and consider the effect of the project on the total visual quality of the area. While not constituting significance criteria, these standards are included in the discussions.

Additionally, for purpose of this analysis, the project would constitute a significant visual impact if it will:

- substantially increase flaring;

- create a water vapor plume that would be a visual obstruction to motorists or pedestrians, causing substantial potentially adverse public health and safety impacts; or,

- cause a substantial increase in plume formation.

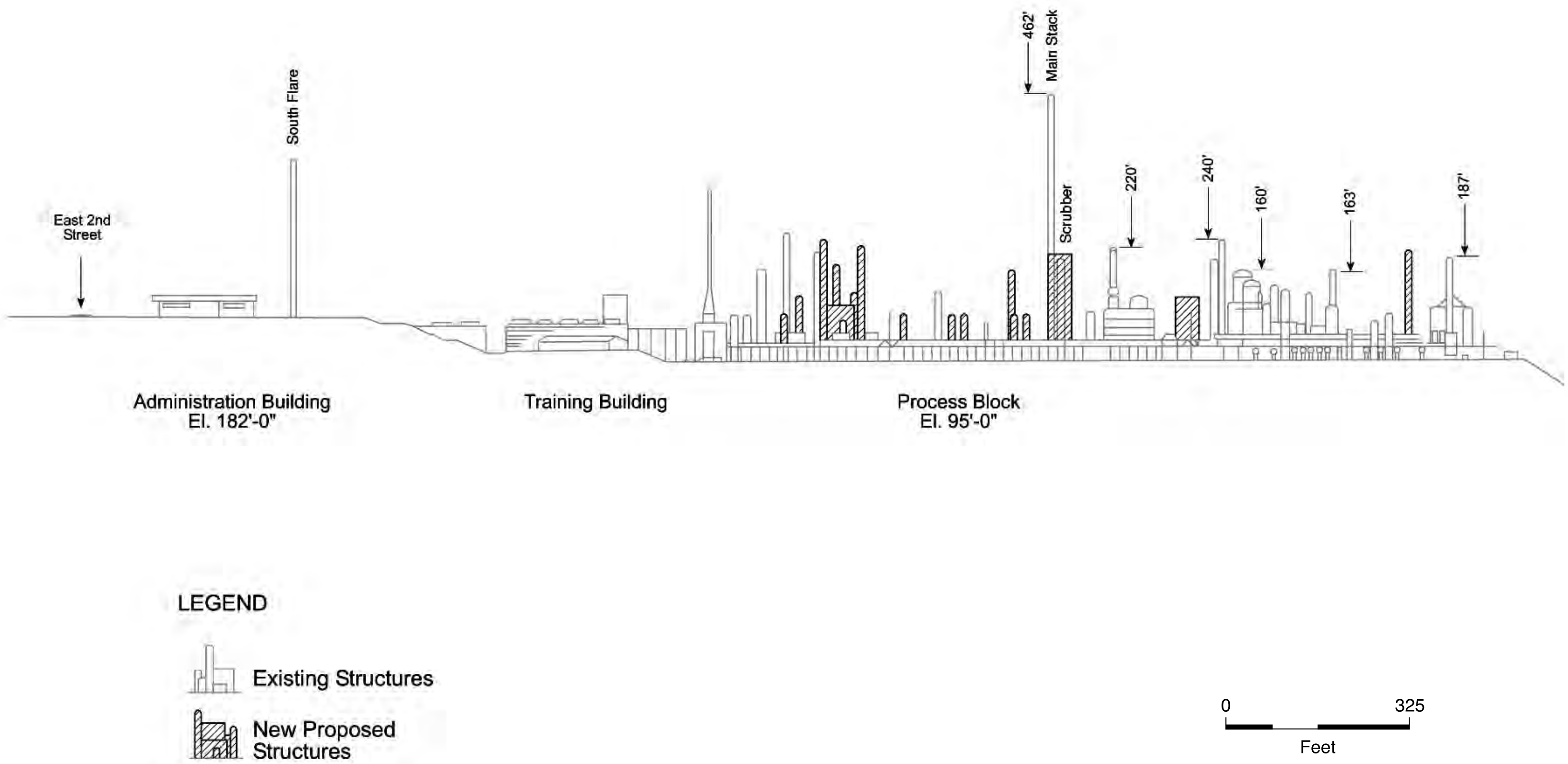
4.1.4 IMPACTS AND MITIGATION MEASURES

Impact 4.1-1: The VIP would add new equipment and facilities to developed, industrial portions of the refinery. These new facilities, which could potentially alter the visual character of the setting, could be seen from public view corridors such as I-680, a designated scenic corridor. This would be a less than significant impact.

The VIP would be constructed and operated entirely within the existing process block area at Valero Refinery, with the exception of the new crude storage tanks to be constructed in the tank farm area, just south of the refinery's process block. Overall, the project would add 20 new structures ranging in height from 50 to 250 feet. The project's tallest towers of 200 to 250 feet (with diameters of 20 feet) would be located near the hydrogen plant units within the process block. Five structures would be between 100 to 200 feet tall and would be located within the pipestill area, flare gas compressor and hydrocraker units. The remaining 12 structures would be 50 to 100 feet tall and would be located throughout the process block area. A sectional schematic of the refinery illustrates the relationship of the proposed structures to the existing refinery facilities (see Figure 4.1-1, *Schematic Section Drawing*).

The scrubber proposed for the process block would be visible from surrounding areas, but would not be out of scale with the existing refinery infrastructure. At a maximum height of 250 feet, the proposed scrubber would be approximately 210 feet shorter than the existing main stack located within the process block. As the average height of the existing refinery towers is 150 feet, the proposed new towers and other equipment would not be substantially out of scale with the refinery equipment currently on site. New towers would be painted green to blend in with the refinery's existing infrastructure. The proposed crude storage tanks would also be constructed within the industrial portion of the project site, in an area adjacent to existing crude storage tanks. The proposed tanks would be painted yellow in keeping with the existing on-site color scheme.

In general, the new facilities proposed as part of the VIP would generally conform to General Plan policies which seek to ensure that new development be compatible with the surrounding architectural and neighborhood character (Policy 3.7.1). On balance, the VIP would also be consistent with the General Plan's Community Identity goals and policies and the Solano County General Plan's Scenic Roadway Element. Further, the project would also not substantially conflict with the Industrial Design Guidelines, because the VIP would be similar in appearance and generally visually harmonious with the existing industrial character of the site; the project would avoid excessive grading or alteration of the existing site topography; and would provide an efficient and functional site design, which incorporates the proposed facilities into areas of the refinery's existing process block.



SOURCE: URS

Figure 4.1-1
Sectional Schematic of the
Valero Refinery, Looking East

The VIP would alter the appearance of the project site and views as seen from adjacent public motorways and other publicly accessible view corridors. The locations of six representative public viewpoints are shown on Figure 4.1-2, *Viewpoint Location Map*. The changes in visual character of the site as seen from these public viewpoints are shown in Figures 4.1-3 through 4.1-8. The images present views of the project as seen from:

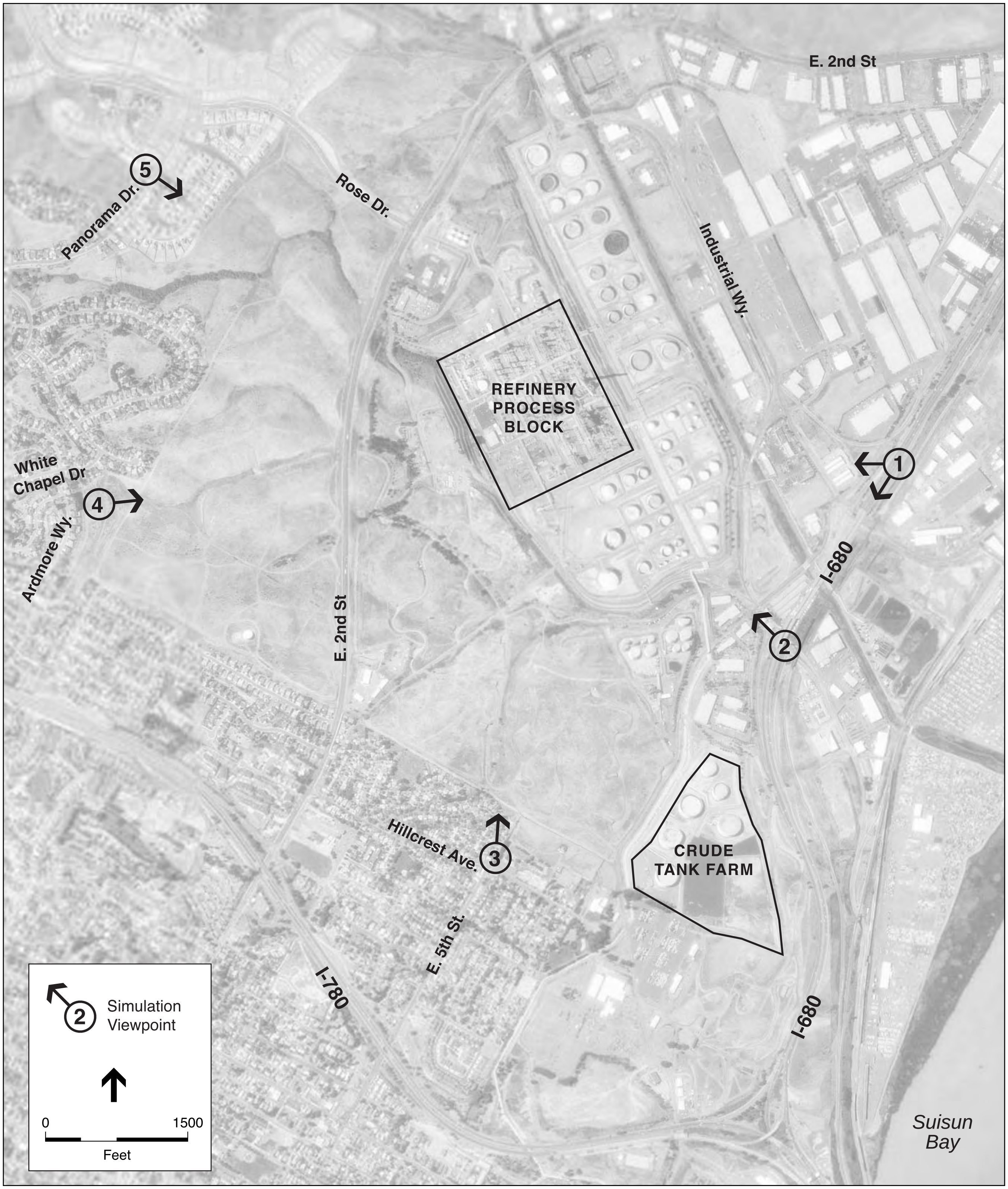
- Southbound I-680 looking southwest (viewpoint 1a);
- Southbound I-680 looking southwest, alternative siting (viewpoint 1a);
- Southbound I-680 looking west (viewpoint 1b);
- Northbound I-680 looking northwest (viewpoint 2);
- East Fifth Street near Hillcrest Avenue (viewpoint 3);
- The public trail near Perth Way and White Chapel Drive (viewpoint 4); and,
- Gallagher Drive at Panorama Drive (viewpoint 5).

The visual analysis of the project's potential visual effects is based on field observations of the project site and surroundings; drawings prepared by project architects; aerial and ground-level photographs of the project area; topographic data obtained from the City of Benicia Public Works Department and from the US Geological Survey; and, project site data provided by Valero[5].

The project site is visible from southbound views on I-680 looking to the south and southwest. Figure 4.1-3 depicts existing views from southbound I-680 looking southwest. Large expanses of roadway dominate the foreground, bordered on either side by shrubs, billboards and other transportation-related signage. The hills rise in the distance and the crude tank farm is visible on the rim of the industrial basin. From this perspective, three large yellow-gold tanks can be seen set against a landscape of slightly rolling hills. These hills contain little vegetation, however some trees exist in front of and between the tanks, and are visible from this viewpoint.

The visual simulation portrays the change to views of the tank farm from this location. With the project, views of the project's additional 2 crude tanks would be available. To the southeast, an additional crude tank would be visible separated from the existing grouping. In the center of the group of tanks on top of the basin, the project's second tank would be visible, albeit it would likely appear as a solid yellow form between the existing tanks visible in the foreground. The bottom image on Figure 4.1-3 depicts the same existing views from southbound I-680 looking southwest. However, the simulation portrays views of the tank farm with the project's proposed new crude storage tanks at an alternate location. Under these viewing conditions, the addition of the proposed storage tanks at the alternate location would appear more clustered than under the VIP. The new tanks would be located further in the distance, adjacent to and behind the existing tanks in the foreground.

[5] S. Hammonds, Personal Communication, May 2002.



SOURCE: Environmental Vision

Figure 4.1-2
Viewpoint Location Map

Viewpoint 1a - Existing view from southbound I-680 looking southwest

Viewpoint 1a - Visual simulation of proposed project with alternative tank location

Viewpoint 1a - Visual simulation of proposed project

SOURCE: Environmental Vision

Figure 4.1-3
Visual Simulation

In general, the construction of the proposed crude storage tanks at either the proposed or the alternate locations would not constitute an adverse change in the visual environment. This determination is based on the fact that these tanks would be of similar construction, size, materials and color as the existing tanks; they would be functionally grouped in an area containing like structures; and, the construction would not require substantial grading.

Figure 4.1-4 shows a westerly view of the refinery's process block and tank storage from the southbound lane of I-680. In the foreground, commercial and industrial uses are visible adjacent to the highway. In the mid-ground motorists see yellow-gold tanks. Further in the distance, the stacks and towers of the refinery's process block are clearly visible. At 650 feet, the main stack is the most visually prominent feature in this view. In the distance, views of the gently rolling hills can be seen between and behind the process block.

With the project, views would be altered by the addition of the scrubber and towers. As shown in the simulation, the most prominent addition to the refinery's "skyline" would be the approximately 200-foot tall tower to the Fluid Catalytic Cracker Unit area. This tower would be visible between the south flare and the main stack. Also visible would be the new stacks and scrubbers (approximately 100-200 feet tall) within the hydrocracking and pipestill units.

Figure 4.1-5 depicts existing views of the project site from northbound lanes of I-680 looking northwest. In these views the concrete freeway separator and adjacent southbound lanes dominate the foreground. In the mid-ground, views of the yellow blending tanks are available along the side of the freeway. Directly behind the blending tanks the refinery's towers rise up from the process block. The main stack is clearly visible at the northern end of the process block. Immediately adjacent to the main stack, the hydrocracker and fluid coker units are visible. On the western edge of the process block, the flare stack can be seen through vegetation. With the project, views of the yellow blending tanks would continue to be available along the side of the freeway. In the mid-ground, the process block would appear slightly more densely developed from this viewpoint with the addition of the proposed new towers and scrubbers. The addition of the towers would be visible to the south of the main stack.

Figure 4.1-6 presents a representative view of the refinery from the Hillcrest neighborhood. This viewpoint shows a northerly view of the existing process block from East Fifth Street near Hillcrest Avenue. Parked cars, yards and driveways dominate views from the center of the street in the foreground. In the mid-ground, the process block appears in the distance, with the tall, slender towers and flare stacks rising from the center of the process block. From this distance, the refinery appears as a coherent and contained operation subsumed by the surrounding landscape.

Undeveloped hillsides are visible in the background behind the stacks in the refinery. With the project, views of the refinery's process block area would remain essentially the same, except for the addition of new towers and stacks clustered near the flare located at the center of the processing area and at the western edge of the process block. The center of the process block, between the north and south flares, would be noticeably more developed, because views of the smaller of the proposed towers (50–100 feet) would be readily available from this viewshed.

Viewpoint 1b - Existing view from southbound I-680 looking west

Viewpoint 1b - Visual simulation of proposed project

SOURCE: Environmental Vision

Figure 4.1-4
Visual Simulation

Viewpoint 2 - Existing view from northbound I-680 looking northwest

Viewpoint 2 - Visual simulation of proposed project

SOURCE: Environmental Vision

Figure 4.1-5
Visual Simulation

Viewpoint 3 - Existing view from East 5th Street near Hillcrest Avenue looking north

Viewpoint 3 - Visual simulation of proposed project

SOURCE: Environmental Vision

Figure 4.1-6
Visual Simulation

Figure 4.1-7 shows the existing view of the refinery from a public trail along the hillside near Perth Way and White Chapel Drive looking east. The hills and vegetation dominate views from this vantage point. In the foreground, the rolling hills taper off to views of part of the refinery's process block located on flat terrain below, approximately 4,500 feet to the north. The refinery's two flare stacks provide visual end points to the north and south, with the main stack and the rest of the process block situated between these flares. Most of the refinery's infrastructure components are not individually discernable from this distance. The refinery appears as a unified industrial complex.

With the project, the natural environment would continue to dominate views from this point. The overall visual effect attributable to the project would be a slight but noticeable increase in development within the footprint of the refinery. Approximately nine cylindrical towers, clustered within the center of the process block would be visible, however views of Suisun Bay in the distance would remain available. The existing horizon line would be retained, and the existing main stack and two flares would continue to be the only built structure to cross the horizon line.

Figure 4.1-8 provides an existing view of the refinery from Gallagher Drive at Panorama Drive looking southeast from the Southampton neighborhood. Views from this vantage point are residential in nature, with the street, homes and adjoining yards, driveways, and trees dominating views in the foreground. The refinery process block area is visible at the terminus of Gallagher Drive about 4,000 feet (roughly .75 mile) to the southeast, set against the hills of the undeveloped open space west of East Second Street in the distance.

Limited views of the tank farm are available between trees from the eastern portion of the Caltrans vista point parking lot. As for the process block, five or six of the tallest towers can be seen from all parts of the parking lot. The view of the rest of the process block is blocked by a Shell station/Carl's Jr. restaurant at the intersection of Lake Herman Road and East Second St. The views of the tank farm are similar to the views southbound on I-680 although more distant and seriously compromised by the intervening trees and a Carl's Jr. sign.

Views of the process area and tank farm are available from about four separate locations along Lake Herman Road. The most expansive view is just above the stop sign at the intersection of Lake Herman Road and East Second Street. This view is similar to the view southbound on I-680 but from a higher elevation and a greater distance. The process area and tank farm from that location are part of a large panorama that includes the Benicia Industrial Park, Suisun Bay, and industrial facilities across the Carquinez Strait in Contra Costa County. The Shell station/Carl's Jr. is in the foreground of this view. The other three viewpoints are glimpses of portions of the process area and tank farm that are visible through gaps in the rolling, grassy hills. The refinery can be seen both east and west bound for 2-5 seconds at 45 mph. The effect is similar to the view from Perth and White Chapel although substantially larger portions of the refinery can be seen from these points. As shown on the viewpoint location map (see Figure 4.1-2), these views are considerably more distant than the other selected viewpoints. While the new tanks and some of the new towers would be visible from these locations, the change would be no more noticeable than at the locations selected for this review.

Viewpoint 4 - Existing view from public trail near Perth Way and White Chapel Drive looking east

Viewpoint 4 - Visual simulation of proposed project

SOURCE: Environmental Vision

Figure 4.1-7
Visual Simulation

Viewpoint 5 - Existing view from Gallagher Drive at Panoramic Drive looking southeast

Viewpoint 5 - Visual simulation of proposed project

SOURCE: Environmental Vision

Figure 4.1-8
Visual Simulation

In general, with the project, only slight increases in development within the refinery's process block would be visible. Tall, slender towers would continue to be visible at the terminus of Gallagher Drive, with views of the hills rising in the distance. From this vantage point, the proposed new towers would appear consistent in height to the existing towers. The existing main stack and the north flare would continue to be the tallest structures visible within the process block.

The proposed equipment would be similar in height to existing equipment, constructed in already industrialized areas on the refinery property, be of the same materials and painted to match the refinery's existing color-scheme, the addition of new equipment and facilities would not substantially alter the industrial character of the area. Because the proposed development would occur within the existing refinery footprint, further development would visually relate to the existing refinery structures and would not obstruct predominant visual elements of the area that include the hills, Suisun Bay, and the vast expanses of the adjacent open or lightly developed areas. The *relational aesthetic* would be consistent, as would the *environmental aesthetic.* Thus, effects related to altering existing viewsheds would be less than significant.

Mitigation: None required.

Impact 4.1-2: Refinery operations could cause flaring events. This impact would be less than significant.

As stated in Section 4.1.2.2, flaring occurs because of over-pressurization in refinery processes and is an unforeseeable and unscheduled event. Flaring is undertaken as a protective measure to prevent uncontrolled release of combustible and toxic gases to the atmosphere. Since 1994, the Valero Refinery has averaged approximately nine flare events each year. Increased flaring depends on the number of refinery unit upsets that result in the need to safely release gases. Implementation of the VIP is not expected to cause an increase in flaring because the equipment changes and additions proposed would not have the potential to increase the number of upsets or the intensity of flaring. While visual and noise effects are associated with flaring, such effects would not likely occur at an intensity greater than currently exists. Thus, effects related to flaring would be less than significant.

Mitigation: None required.

Impact 4.1-3: Operation of the proposed new scrubber could create vapor plumes visible to surrounding residents and motorists. This impact would be less than significant.

The visual plume assessment prepared for the project predicts that visible plumes would occur less than 0.4% of the year (28 hours per year) from the main stack operating under proposed conditions. This constitutes a 24-hour increase in the overall visible plume formation from current operating conditions. Currently visible plume formation occurs approximately 4 hours a year. The model predicted that visible plumes would not touch down on the ground. Three hours of model-predicted visible water vapor plumes would occur annually during daytime no-fog hours, which all would be during either dawn or dusk hours. This predicted frequency would be similar to nighttime fog, which takes a few hours after sunrise to “burn off” or fog that forms at dusk. The remaining 25-hours of plumes would be expected to form during the nighttime hours. Also, all predicted water vapor plumes would occur when the relative humidity would be greater than 99%, conditions when pockets of localized fog would already be likely. Plumes would have a maximum visible length of roughly 850 ft and an average visible length of approximately 250 feet. Depending on atmospheric conditions, these plumes may travel off-site.

The three hours of model-predicted visible daytime steam plumes under project conditions should be compared to the one hour of model-predicted visible water vapor plumes currently visible under existing conditions. These water vapor plumes would appear very thin and would resemble wisps of fog nearly 1,000 feet above the ground over the undeveloped areas surrounding the refinery. Visible plumes would be more likely before 8 a.m. or in the evening, just before dark.

The addition of new visible plumes under project implementation would be a less than significant impact based on: 1) the frequency of expected occurrence (visible plumes would increase from 0.05% of the year to 0.32% of the year); 2) the probability that additional plumes would be visible would most likely occur at times when atmospheric conditions already cause fog and high humidity; and, 3) the height and dispersion of the plume would be elevated far above roadways and would not be expected to interfere with motorists.

Mitigation: None required.

Impact 4.1-4: The proposed development would introduce new lighting on-site. This impact would be less than significant.

The refinery currently illuminates facilities in order for operations to continue throughout the night. The VIP would also include lighting for the same purpose. Security lighting could be installed internally around new equipment and at the perimeter near new equipment. Motorists and residents could notice this new lighting.

Lighting within the refinery would increase as a result of this project, but not exceed performance standards specified in Section 17.70.240.D.2 of the Zoning Ordinance. Structures that would be illuminated would be within existing areas of the refinery, would be surrounded by existing lighted equipment and would not affect adjacent residential or industrial uses. New equipment lighting would be directed appropriately to avoid disturbance to motorists. Area, or flood lighting, is not proposed as part of the long-term operation of this project. Although the project would increase the amount of lighting in the refinery area, the increase would not be substantial and would not affect adjacent uses. This impact would be considered less than significant.

The project proposes structures that would not include large areas of highly reflective material, such as glass or mirror, which would produce glare. Therefore the project would not affect the amount of day time glare in the area.

Mitigation: None required.

4.1.5 CUMULATIVE IMPACTS

Impact 4.1-5: The reasonably foreseeable projects at the Valero Refinery would expand the industrial appearance of the overall complex. However, none of the changes associated with individual projects would be expected to substantially affect visual resources. As such, the projects would be expected to produce a less than significant cumulative visual quality impact.

As discussed in Section 3.6, *Relevant Cumulative Projects*, other projects planned at Valero Refinery are either new or expanded processing units or routine maintenance activities. These projects would be located within the existing refinery complex, and would not expand industrial operations outside the processing, tanks storage, and wastewater processing areas. New processing facilities would be painted the same color scheme of the existing refinery and would not represent any overall significant changes in the industrial appearance of the complex. Some staging and laydown areas used for construction of these foreseeable projects would be visible, and would incrementally add to the overall extent of disturbed, graded areas surrounding the main processing and tank storage facilities, but this impact is not significant.

As discussed in Impact 4.1-1, the project's affect on views from Lake Herman Road would be less than significant. The cumulative development closest to Lake Herman Road would be the Benicia Business Park. Whether or not the Benicia Valero Refinery Improvement Project would be visible from Lake Herman Road, the contribution of the refinery projects to the cumulative impact would be less than significant.

Mitigation: None required.

Impact 4.1-6: Other non-refinery cumulative projects, together with the VIP and other Valero Refinery projects would combine to alter the general appearance of the southeast portion of the City. However, none of the changes would be considered to substantially impact visual resources. As such, the cumulative projects would be expected to produce a less than significant visual impact.

The construction of the other non-refinery cumulative projects, together with all of the reasonably foreseeable projects at the Valero Refinery, would expand the industrial appearance of the overall complex and the southeast portion of the city, as well. The development of the other, non-refinery cumulative projects also would result in visual changes to the vicinity of the refinery.

Construction and operation of the Caltrans Benicia – Martinez Bridge, the Benicia Business Park and/or other large-scale industrial developments within the City, and the City of Benicia Wastewater Reuse Project each would alter the visual character of their sites, as well as altering the overall visual character of the entire area. While noticeable, these visual changes would be less than significant. During construction, staging and laydown areas would be visible, and would incrementally add to the overall extent of disturbed, graded areas in the vicinity, but this cumulative impact would not be significant.

Mitigation: None required.

REFERENCES – Aesthetics, Visual Quality, Light and Glare

City of Benicia, *Exxon Benicia Refinery Clean Fuels Project Draft Environmental Report*, State Clearinghouse No. 93C0336A, September 1993.

City of Benicia, *General Plan*, 1999.

City of Benicia Industrial Design Guidelines, 1989.

City of Benicia Zoning Ordinance, 1987 as amended.

Solano County General Plan, Scenic Roadways Element, 1977.

U.S. Department of Transportation, Federal Highway Administration, *Environmental Guidelines*, November 1999.

URS Corporation, *Assessment of Visible Steam Plume Formation*, June 2002.

Valero Incorporated, project site plans, various dates.

4.2 AIR QUALITY

The construction and implementation of the VIP would lead to impacts on both the local and regional air quality. The VIP would lead to two potentially significant impacts.

- ***Local air quality impacts would occur primarily due to fugitive dust and emissions during construction activities. This would be a potentially significant impact. However, mitigation measures proposed as part of the project would reduce the impact to a less than significant level.***
- ***Operational emissions would add to the regional pollutant loading in the air basin. With the implementation of mitigation measures, operational impacts of the VIP on the regional and local air quality would be reduced to a less than significant level.***

4.2.1 INTRODUCTION

Air quality is a function of both the rate and location of pollutant emissions under the influence of meteorological conditions and topographic features that influence pollutant movement dispersal. Atmospheric conditions such as wind speed, wind direction, and air temperature gradients interact with the physical features of the landscape to determine the movement and dispersal of air pollutants, and consequently affect air quality.

4.2.2 SETTING

This setting description provides an overview of region-specific information related to climate and topography, regulatory context followed by a discussion of plans, policies, and regulations; and existing air quality conditions pertaining to the project area. From a regulatory standpoint the air pollutants of concern in the project area are ozone, carbon monoxide (CO) and particulate matter (PM-10). Since the Valero Benicia Refinery is a source of sulfur dioxide (SO_2) emissions, although sulfur dioxide levels are well within regulatory standards, local levels of SO_2 are of concern as well.

4.2.2.1 CLIMATE AND METEOROLOGY

Valero's refinery is located in the City of Benicia within the San Francisco Bay Area (Bay Area) Air Basin. The Bay Area Air Basin encompasses the nine-county region including all of Alameda, Contra Costa, Santa Clara, San Francisco, San Mateo, Marin and Napa Counties, and the southern portions of Solano and Sonoma Counties. The climate of the greater San Francisco Bay Area, including Benicia, is a Mediterranean-type climate characterized by warm, dry summers and mild, wet winters. The climate is determined largely by a high-pressure system that is almost always present over the eastern Pacific Ocean off the West Coast of North America. High-pressure systems are characterized by an upper layer of dry air that warms as it descends, restricting the mobility of cooler marine-influenced air near the ground surface, and resulting in the formation of subsidence inversions. In winter, the Pacific high-pressure system shifts southward, allowing storms to pass through the region. During summer and fall, emissions generated within the Bay Area can combine with abundant sunshine under the restraining influences of topography and subsidence inversions to create conditions that are conducive to the formation of photochemical pollutants, such as ozone and secondary particulates, such as sulfates and nitrates.

Specifically, the project is located in the Carquinez Strait climatological subregion of the Bay Area. The Carquinez Strait is the only sea-level gap between San Francisco Bay and the Central Valley. Wind flow patterns are controlled by air circulation in the atmosphere, which is affected by air pressure and the variable topography of the coastal areas adjacent to the Carquinez Strait. Prevailing winds in the project area are from the west through the Carquinez Strait. During the summer and fall months, high pressure offshore coupled with low pressure in the Central Valley causes marine air to flow eastward through the Carquinez Strait. Annual average wind speeds in the area are approximately 8 miles per hour, and 9 to 10 miles per hour further east (BAAQMD 1999). Sometimes atmospheric conditions cause air to flow from the east. East winds usually contain more pollutants than the cleaner marine air from the west. In the summer and fall months, this can cause elevated pollutant levels to move into the central Bay Area through the Strait. These high-pressure periods are usually accompanied by low wind speeds, shallow mixing depths, higher temperatures and little or no rainfall.

Temperature fluctuations in Benicia are small because of the strong marine influence on the climate. Temperatures are generally milder near the water, and the daily annual temperature range is small. On certain occasions, offshore continental airflow can bring more extreme variations in temperature. The annual average temperature is estimated at 60 degrees Fahrenheit (°F), ranging from an estimated winter average of 48°F to an estimated summer average of 73°F. The area experiences numerous summer days with temperatures over 90°F.

4.2.2.2 REGULATORY CONTEXT

Criteria Air Pollutants

Regulation of air pollution is achieved through both national and state ambient air quality standards and emission limits for individual sources of air pollutants. As required by the federal Clean Air Act, the U.S. Environmental Protection Agency (U.S. EPA) has identified criteria pollutants and established National Ambient Air Quality Standards (national standards) to protect public health and welfare. National standards have been established for ozone, carbon monoxide (CO), nitrogen dioxide (NOx), sulfur dioxide (SO_2), particulate matter 10 microns or less (PM-10), and lead. These pollutants are called “criteria” air pollutants because standards have been established for each of them to meet specific public health and welfare criteria. California has adopted more stringent ambient air quality standards for most of the criteria air pollutants (referred to as State Ambient Air Quality Standards or state standards). Table 4.2-1 presents both sets of ambient air quality standards (i.e., national and state) and provides a brief discussion of the related health effects and principal sources for each pollutant. As required by the federal Clean Air Act and the California Clean Air Act, air basins or portions thereof have been classified as

TABLE 4.2-1
STATE AND NATIONAL CRITERIA AIR POLLUTANT STANDARDS, EFFECTS, AND SOURCES

Pollutant	Averaging Time	State Standard	National Standard	Pollutant Health and Atmospheric Effects	Major Pollutant Sources
Ozone	1 hour 8 hours	0.09 ppm ---	0.12 ppm 0.08 ppm	High concentrations can directly affect lungs, causing irritation. Long-term exposure may cause damage to lung tissue.	Formed when reactive organic gases (ROG) and NO_x react in the presence of sunlight. Major sources include on-road motor vehicles, solvent evaporation, and commercial / industrial mobile equipment.
CO	1 hour 8 hours	20 ppm 9.0 ppm	35 ppm 9 ppm	Classified as a chemical asphyxiant, CO interferes with the transfer of fresh oxygen to the blood and deprives sensitive tissues of oxygen.	Internal combustion engines, primarily gasoline-powered motor vehicles.
Nitrogen Dioxide (NOx)	1 hour Annual Avg.	0.25 ppm ---	--- 0.053 ppm	Irritating to eyes and respiratory tract. Colors atmosphere reddish-brown.	Motor vehicles, petroleum-refining operations, industrial sources, aircraft, ships, and railroads.
Sulfur Dioxide (SO_2)	1 hour 3 hours 24 hours Annual Avg.	0.25 ppm --- 0.04 ppm ---	--- 0.5 ppm 0.14 ppm 0.03 ppm	Irritates upper respiratory tract; injurious to lung tissue. Can yellow the leaves of plants, destructive to marble, iron, and steel. Limits visibility and reduces sunlight.	Fuel combustion, chemical plants, sulfur recovery plants, and metal processing.
Respirable Particulate Matter (PM-10)	24 hours Annual Avg.	50 $\mu g/m^3$ 30 $\mu g/m^3$	150 $\mu g/m^3$ 50 $\mu g/m^3$	May irritate eyes and respiratory tract, decreases in lung capacity, cancer and increased mortality. Produces haze and limits visibility.	Dust and fume-producing industrial and agricultural operations, combustion, atmospheric photochemical reactions, and natural activities (e.g. wind-raised dust and ocean sprays).
Fine Particulate Matter (PM-2.5)	24 hours Annual Avg.	--- ---	65 $\mu g/m^3$ 15 $\mu g/m^3$	Increases respiratory disease, lung damage, cancer, and premature death. Reduces visibility and results in surface soiling.	Fuel combustion in motor vehicles, equipment, and industrial sources; residential and agricultural burning; Also, formed from photochemical reactions of other pollutants, including NO_x, sulfur oxides, and organics.
Lead	Monthly Quarterly	1.5 $\mu g/m^3$ ---	--- 1.5 $\mu g/m^3$	Disturbs gastrointestinal system, and causes anemia, kidney disease, and neuromuscular and neurologic dysfunction.	Present source: lead smelters, battery manufacturing & recycling facilities. Past source: combustion of leaded gasoline.

NOTE: ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter.

SOURCES: South Coast Air Quality Management District, *1997 Air Quality Management Plan,* November 1996; http://www.arb.ca.gov/health/health.htm.

either "attainment" or "nonattainment" for each criteria air pollutant, based on whether or not the standards have been achieved. Nonattainment areas are also required to prepare air quality plans that include strategies for achieving attainment.

Air quality plans developed to meet federal requirements are referred to as State Implementation Plans (SIPs).

Regulatory Agencies

U.S. EPA is responsible for implementing the myriad of programs established under the federal Clean Air Act, such as establishing and reviewing the national ambient air quality standards and judging the adequacy of SIPs, but has delegated the authority to implement many of the federal programs to the states while retaining an oversight role to ensure that the programs continue to be implemented.

The California Air Resource Board (CARB) is responsible for establishing and reviewing the state standards, compiling the California SIP and securing approval of that plan from U.S. EPA, and identifying toxic air contaminants. CARB also regulates mobile sources of emissions in California, such as construction equipment, trucks, and automobiles, and oversees the activities of air quality management districts, which are organized at the county or regional level. The county or regional air quality management districts are primarily responsible for regulating stationary emissions sources at industrial and commercial facilities within their geographic areas and for preparing the air quality plans that are required under the federal Clean Air Act and California Clean Air Act. These regional air quality plans prepared by Air Quality Management Districts and Air Pollution Control Districts throughout the state are compiled by the CARB to form the SIP. The local air districts also have the responsibility and authority to adopt transportation control and emission reduction programs for indirect and area-wide emission sources. BAAQMD is the regional agency with jurisdiction over the nine-county region located in the San Francisco Bay Area Air Basin. Local councils of governments, county transportation agencies, cities and counties, and various non-governmental organizations also join in the efforts to improve air quality through a variety of programs. These programs include the adoption of regulations and policies, as well as implementation of extensive education and public outreach programs.

Air Quality Plans, Policies and Regulations

Plans and Policies

The project site is located in the Bay Area Air Basin portion of Solano County, which is currently designated "nonattainment" for state and national ozone standards and for the state PM-10 standard (CARB 2000). Urbanized parts of the Bay Area, including the project site, are also designated as "maintenance" areas for the national CO standard. The "maintenance" designation denotes that the area, now "attainment," had once been designated as "nonattainment." The Bay Area is "attainment" or "unclassified" with respect to the other ambient air quality standards. Table 4.2-2 shows the attainment status of the Bay Area with respect to the federal and state ambient air quality standards for different criteria pollutants.

TABLE 4.2-2
ATTAINMENT STATUS OF THE BAY AREA FOR THE STATE AND NATIONAL AMBIENT AIR QUALITY STANDARDS

		Attainment Status	
Pollutant	**Averaging Time**	**State Standards**[1]	**National Standards**[2]
Ozone	8-Hour	---	Unclassified[3]
	1-Hour	Serious Nonattainment	Severe Nonattainment
Carbon Monoxide (CO)	8-Hour	Unclassified[3]	Unclassified[3]/Attainment
	1-Hour	Unclassified[3]	Unclassified[3]/Attainment
Nitrogen Dioxide	Annual Average	---	Attainment
	1-Hour	Attainment	---
Sulfur Dioxide	Annual Average	---	Attainment
	24-Hour	Attainment	Attainment
	1-Hour	Attainment	---
Respirable Particulate Matter (PM-10)	Annual Arithmetic mean	---	Attainment
	Annual Geometric Mean	Nonattainment	---
	24-Hour	Nonattainment	Unclassified[3]
Fine Particulate Matter (PM-2.5)	Annual Arithmetic Mean	---	Unclassified[3]
	24-Hour	---	Unclassified[3]
Lead	Calendar Quarter	---	Attainment
	30 Day Average	Attainment	---

1 California standards for ozone, CO (except Lake Tahoe), SO_2 (1-hour and 24-hour), nitrogen dioxide, and PM-10 are values that are not to be exceeded.
2 National standards other than for ozone and those based on annual averages or annual arithmetic means are not to be exceeded more than once a year.
3 In 1997, EPA established an 8-hour standard for ozone and annual and 24-hour standards for very fine PM-2.5. As of August 2002, the Bay Area Air Quality Management District (BAAQMD) did not have sufficient monitoring data to determine the region's attainment status.

SOURCE: California Air Resources Board, 2000 State and National Area Designation Maps of California; http://www.arb.ca.gov/desig/desig.htm.

As noted earlier, the federal Clean Air Act and the California Clean Air Act require plans to be developed for areas designated as nonattainment (with the exception of areas designated as nonattainment for the state PM-10 standard). Plans are also required under federal law for areas designated as "maintenance" for national standards. Such plans are to include strategies for attaining the standards. Currently, there are three plans for the Bay Area:

- Ozone Attainment Plan for the 1-Hour National Ozone Standard (Association of Bay Area Governments (ABAG) 1999) developed to meet federal ozone air quality planning requirements;

- Bay Area 2000 Clean Air Plan (BAAQMD 2000a), the most recent triennial update of the *1991 Clean Air Plan* developed to meet planning requirements related to the state ozone standard; and

- Carbon Monoxide Maintenance Plan (ABAG 1994) developed to ensure continued attainment of the national CO standard.

BAAQMD, the Metropolitan Transportation Commission (MTC), and ABAG have prepared a Bay Area 2001 Ozone Attainment Plan. This plan is a proposed revision to the Bay Area part of California's plan to achieve the national ozone standard. The plan is being prepared in response to U.S. EPA's partial approval and partial disapproval of the Bay Area's 1999 Ozone Attainment Plan and finding of failure to attain the national standard for ozone. The revised plan was adopted by the Boards of the co-lead agencies at a public meeting on October 24, 2001, but is pending approval from the CARB. This Plan amends and supplements the 1999 Plan and demonstrates attainment of the national ozone standard by 2006.

Federal Regulations for Criteria Pollutants

Standards of Performance for New Stationary Sources

Section 111 of the Clean Air Act, "Standards of Performance of New Stationary Sources," requires EPA to establish federal emission standards for source categories which cause or contribute significantly to air pollution. These standards are intended to promote use of the best air pollution control technologies, taking into account the cost of such technology and any other non-air quality, health, and environmental impact and energy requirements. The EPA has established New Source Performance Standards (NSPS) for several source categories. Some New Source Performance Standards apply to the proposed facility (40 CFR 60). These include New Source Performance Standards for petroleum refinery equipment. The New Source Performance Standards program is implemented by the BAAQMD.

Prevention of Significant Deterioration (PSD)

Prevention of Significant Deterioration regulations were first promulgated by the EPA (40 CFR 52) to prevent air quality degradation in those areas where criteria air pollutant concentrations are below the ambient standards (i.e., attainment areas). The PSD regulations are implemented by the BAAQMD.

Title V Federal Operating Permit (Title V)

Title V of the 1990 Clean Air Act Amendments requires all major sources and some minor sources of air pollution to obtain an operating permit. A Title V permit grants a source permission to operate. The permit includes all air pollution requirements that apply to the source, including emissions limits and monitoring, record keeping, and reporting requirements. It also requires that the source report its compliance status with respect to permit conditions to the permitting authority. Under Title V of the Clean Air Act, any source that emits or has the potential to emit 100 tons per year or more of any criteria air pollutant is a major source and must obtain a Title V operating permit. Title V permits in the Bay Area are issued by the BAAQMD.

BAAQMD Rules and Regulations

The regional agency primarily responsible for developing air quality plans for the southwestern part of Solano County is the BAAQMD. BAAQMD is the agency with permit authority over most types of stationary emission sources in the Bay Area. BAAQMD exercises permit authority through its *Rules and Regulations*. Both federal and state ozone plans rely heavily upon stationary source control measures set forth in BAAQMD's *Rules and Regulations*. In contrast to the ozone plans, the *CO Maintenance Plan* relies heavily on mobile source control measures.

The BAAQMD's New Source Review regulations apply to non-attainment pollutants and apply to all new and modified stationary sources, which are subject to the requirements of this District's best available control technology. The New Source Review regulations also include Prevention of Significant Deterioration (PSD) rules for attainment pollutants. The purpose of the regulations is to incorporate a "no net increase" program required by the California Clean Air Act. The regulation is also designed to ensure that the emission sources will not cause or interfere with the attainment or maintenance of ambient air quality standards.

New Source Review

The BAAQMD's New Source Review (Regulation 2, Rule 2) requirements are either the same or more stringent than federal requirements for stationary sources. New Source Review applies to all new and modified sources requiring an Authority to Construct. The purpose of this rule is to provide for the review of new and modified sources and provide mechanisms, including the use of Best Available Control Technology (BACT), Best Available Control Technology Toxics (TBACT) and emission offsets by which authorities to construct such sources could be granted. The San Francisco Bay Area Air Basin is currently a nonattainment area for state ozone and PM_{10} standards; accordingly, some of the requirements under the BAAQMD's policy are more stringent than federal policy.

Best available control technologies are required for sources that require an authority to construct or a permit to operate, if emissions from a new source or increase in emissions from a modified source has the potential to emit 10 pounds or more per highest day of precursor organic compounds (POC), non-precursor organic compounds (NPOC), nitrogen oxides, SO_2, PM-10 or CO, BACT is required to be applied to any of the above pollutant emissions meeting the required criterion.

The BAAQMD New Source Review regulation requires emission offsets for any new or modified source that produces a cumulative increase in emissions of NO_x or precursor organic compounds (POC) at the ratios shown in Table 4.2-3. For a facility such as Valero refinery with NOx and POC emissions exceeding 50 tons per year on a facility-wide basis, the BAAQMD New Source Review regulation requires emission offsets at a ratio of 1.15:1.0 for emissions from any new or modified source minus onsite contemporaneous emission reductions.

TABLE 4.2-3
REQUIRED OFFSET RATIOS FOR BAAQMD's NEW SOURCE REVIEW

Facility Emissions (tons per year)	Required Offset Ratio POC	Required Offset Ratio NOx
Greater than or equal to 15, but less than 50	1.0 : 1.0	1.0 : 1.0
Greater than or equal to 50	1.15 : 1.0	1.15 : 1.0

SOURCE: *Regulation 2 Rule 2, BAAQMD Rules and Regulations*, Bay Area Air Quality Management District, May 2000.

Any planned major facility that will constitute a new or modified emissions source with a cumulative increase since April 5, 1991 of more than 1.0 tons per year of PM-10 or SO_2, must provide offsets at either a 1.0: 1.0 ratio[1] or another ratio approved by the BAAQMD.

While there is no threshold for providing offsets for CO emissions, modeling requirements are specified for facilities with a cumulative increase of CO emissions in excess of 100 tons per year since the Prevention of Significant Deterioration baseline date of July 17, 1991. Modeling must show that the proposed project will not interfere with attainment or maintenance of the state CO standards.

PSD Requirement

BAAQMD also administers PSD review for new sources that emit criteria pollutants for which the area is currently designated attainment. Exceedance of a PSD trigger level requires a demonstration by modeling that the emissions will not interfere with the attainment or maintenance of any federal ambient air quality standard at the point of maximum impact and will not cause an exceedance of a PSD increment.

The Valero Benicia Refinery is defined as a major source for the purposes of the federal PSD program, as implemented by BAAQMD Regulation 2, Rule 2. PSD requirements apply if proposed modifications to a major source exceed PSD threshold levels for a major modification to a major source. Table 4.2-4 summarizes the pollutant emission increases due to the project as they relate to the PSD thresholds for a major modification to a major source. None of the emission increases due to the proposed project would exceed the PSD major modification threshold levels.

1 Per BAAQMD Rule 2-2-303.

TABLE 4.2-4
PSD APPLICABILITY

Pollutant	NOx	CO	SO_2	PM-10
Project Net Emissions Increase (tons per year)	0.0	0.0	-4,124	0.0
PSD Threshold (tons per year)	40	100	40	15
PSD applicable?	No	No	No	No

[1] In accordance with BAAQMD Rule 2-2-215.2, cargo carriers (i.e., emissions from ships and trains) are not counted when addressing PSD applicability.

SOURCE: *Authority to Construct Application for Valero Improvement Project*, URS Corporation, August 2002.

Major Facility Review

In the Bay Area Title V requirements are implemented by Regulation 2 Rule 6 of the BAAQMD *Rules and Regulations*. Valero refinery is subject to the Operating Permit requirements of Title V of the federal Clean Air Act, and BAAQMD Regulation 2, Rule 6, Major Facility Review because it is a major facility as defined by BAAQMD Regulation 2-6-212. It is a major facility because it has the "potential to emit," as defined by BAAQMD Regulation 2-6-218, of more than 100 tons per year of a regulated air pollutant. Major Facility Operating permits (Title V permits) must meet specifications contained in 40 CFR Part 70 as contained in BAAQMD Regulation 2, Rule 6. The permits contain all applicable requirements (as defined in BAAQMD Regulation 2-6-202), monitoring requirements, record keeping requirements, and reporting requirements. Valero is currently in the process of renewing its operating permits.

Other Applicable BAAQMD Regulations

In addition to the best available control technology, emissions offsets and major source review requirements previously discussed above, numerous other BAAQMD regulations apply to the construction and operation of the proposed project. A summary of applicable regulations is presented in Table 4.2-5; details of the regulations are contained in the *Bay Area Air Quality Management District Rules and Regulations, Volumes 1 and 2*.

City of Benicia General Plan

The General Plan, adopted in 1999, includes specific policies to preserve and enhance existing development and to provide for orderly and appropriate new development of the City of Benicia until approximately the year 2020.

TABLE 4.2-5
BAAQMD RULES AND REGULATIONS APPLICABLE TO THE PROJECT

Regulation and Rule	Title	Part	Title
2 - 1	Permits	300 – 400	Applicability of CEQA
2 - 2	New Source Review	301	BACT Requirements
2 – 4	Emissions Banking	302	Offset Requirement, Precursor Organic Compounds, and Nitrogen Oxides
2 – 9	Intermediate Emission Reduction Credits	303	Offset Requirement, Particulate Matter (TSP), PM-10 and Sulfur Dioxide
		304	PSD Requirement
		305	Carbon Monoxide Modeling Requirements
		306	Non-Criteria Pollutant Analysis
		307 – 312	Denial
		414	PSD Air Quality Analysis
		417	Visibility, Soils and Vegetation Analysis
3	Fees	300	Standards
4	Air Pollution Episode Plan	300	Standards
6	Particulate Matter and Visible Emissions	300	Standards
7	Odorous Substances	300	Standards
8 – 2	Miscellaneous Operations	301	Valves and Flanges
8 – 5	Storage of Organic Liquids	301	Pumps and Compressors
8 – 18	Valves and Flanges at Petroleum Refinery Complexes	301	Pressure Relief Valves
8 – 25	Pump and Compressor Seals at Petroleum Refineries and Chemical Plants	300	Standards
8 – 28	Pressure Relief Valves at Petroleum Refineries and Chemical Plants	301	Limitations on Hydrogen Sulfide
9 – 1	Sulfur Dioxide	300	Standards
		301	
		310	
		313	
9 – 2	Hydrogen Sulfide	1	General Provisions
9 – 3	Nitrogen Oxides from Heat Transfer Operations	12	Petroleum Refineries
9 - 10	Standards of Performance for New Stationary Sources	15	Volatile Organic Compounds (VOC) Liquid Storage Vessels
9 - 11	Hazardous Pollutants	57	Equipment Leaks of VOC in Petroleum Refineries
		66	Petroleum Refineries Waste Water Systems

SOURCE: Bay Area Air Quality Management District, *Rules and Regulations, Volumes 1 and 2*.

Specifically, the Community Health and Safety provisions of the General Plan include:

Goal 4.9: Ensure clean air for Benicia residents.

Policy 4.9.1: Establish whether a significant air pollution problem exists in Benicia and the City's role in resolving it.

Goal 4.10: Support improved regional air quality.

Policy 4.10.1: Support implementation of the BAAQMD Clean Air Plan.

The VIP is consistent with these policies of the General Plan.

4.2.2.3 EXISTING AIR QUALITY

BAAQMD operates a regional monitoring network that measures the ambient concentrations of the six criteria pollutants. Existing and probable future levels of air quality in the project area can generally be inferred from ambient air quality measurements conducted by BAAQMD at its monitoring stations. The major pollutants of concern in the San Francisco Bay Area, ozone, CO, and PM-10, are monitored at a number of locations. The closest monitoring station to Benicia that measures a full range of ambient air pollutants is the Tuolumne Street station in Vallejo. The Tuolumne Street station is located about 6 miles northwest of the Valero refinery and monitors ozone, CO, Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2) and PM-10. Table 4.2-6 shows a five-year summary of monitoring data collected from this station. Table 4.2-6 also compares measured pollutant concentrations with state and national ambient air quality standards.

The BAAQMD operates or received data from seven monitoring stations in the local area. Unfortunately only one other station – Concord, has monitored these same pollutants over the past five years. The seven monitoring stations are as follows:

- Benicia[2] – monitors sulfur dioxide and hydrogen sulfide
- Concord – monitors ozone, CO, nitrogen dioxide, sulfur dioxide and particulates
- Crockett – began monitoring sulfur dioxide in 1999
- Fairfield – monitors ozone
- Martinez – monitors sulfur dioxide
- Pittsburg – monitors ozone, CO, nitrogen dioxide, sulfur dioxide and particulates[3]
- Vallejo – monitors ozone, CO, nitrogen dioxide, sulfur dioxide and particulates

[2] This station is operated by Valero and consists of three sets of sulfur dioxide and hydrogen sulfide stations, one of which is located near the west site boundary of the refinery and two are located on the east site boundary. Note that Valero has operated these stations for many years as required per a BAAQMD permit. Data from the Benicia stations was not available for publication of this document but are on request with the BAAQMD. Note too that data from these stations are reviewed by the BAAQMD as are the monitoring procedures.

[3] Began monitoring particulates in 2000.

TABLE 4.2-6
AIR QUALITY DATA SUMMARY (1997–2001) FOR THE PROJECT AREA

Pollutant	Standard[a]	Monitoring Data by Year 1997	1998	1999	2000	2001
Ozone						
Highest 1 Hour Average (ppm)[b]		0.10	0.12	0.11	0.08	0.09
Days over State Standard	0.09	1	3	4	0	0
Days over National Standard	0.12	0	0	0	0	0
Highest 8 Hour Average (ppm)[b]	0.08	0.08	0.08	0.09	0.06	0.07
Days over National Standard		0	0	1	0	0
CO						
Highest 1 Hour Average (ppm)[b]	20	NA	NA	6.6	6.5	NA
Days over State Standard		0	0	0	0	0
Highest 8 Hour Average (ppm)[b]	9.0	4.9	5.3	5.5	5.1	4.1
Days over State Standard		0	0	0	0	0
Sulfur Dioxide						
Highest 24 Hour Average (ppb)[b]		5	6	7	5	4
Days over State Standard	40	0	0	0	0	0
Days over National Standard	140	0	0	0	0	0
Annual Average (ppb)	30	NA	NA	1.4	1.5	1.0
Particulate Matter (PM-10):						
Highest 24 Hour Average ($\mu g/m^3$) [b]	50	**85.0**	**71.3**	**83.7**	**53.0**	**86.1**
Days over State Standard		3	1	3	1	2
Number of samples[c]		60	61	57	61	24
Annual Average ($\mu g/m^3$)[b]	30	15.5	14.9	15.2	17.0	16.3

[a] Generally, state standards are not to be exceeded and national standards are not to be exceeded more than once per year.
[b] ppm = parts per million; ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter.
[c] PM-10 is not measured every day of the year. "Number of samples" refers to the number of days in a given year during which PM-10 was measured at the Tuolumne Street station in Vallejo.

NOTE: Values in **bold** are in excess of applicable standard. NA = Not Available.

SOURCE: California Air Resources Board, *Summaries of Air Quality Data*, 1997, 1998, 1999, 2000, 2001; http://www.arb.ca.gov/adam.

The Tuolumne Street station in Vallejo was chosen as a representative monitoring station for the Benicia area due to its proximity to Benicia and its full range of monitored pollutants. Furthermore, as shown in the 24-hour maximum sulfur dioxide concentrations (in ppb) below, data from Vallejo and Martinez are very similar in magnitude and Martinez is located near the Shell refinery. The other three stations (Pittsburg, Concord, and Crockett) appear to be influenced by other conditions and are not as representative of Benicia as the Vallejo station.

	Vallejo	Pittsburg	Martinez	Concord	Crockett
1997	5	7	7	7	NA
1998	6	14	7	9	NA
1999	7	9	8	12	34
2000	5	7	5	4	24
2001	4	11	5	4	16

Ozone

Ozone is a respiratory irritant and an oxidant that increases susceptibility to respiratory infections and that can cause substantial damage to vegetation and other materials. Ozone is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving ROG and NOx. ROG and NOx are known as precursor compounds for ozone. Significant ozone production generally requires ozone precursors to be present in a stable atmosphere with strong sunlight for approximately three hours. Ozone is a regional air pollutant because it is not emitted directly by sources, but is formed downwind of sources of ROG and NOx under the influence of wind and sunlight. Ozone concentrations tend to be higher in the late spring, summer, and fall, when the long sunny days combine with regional subsidence inversions to create conditions conducive to the formation and accumulation of secondary photochemical compounds, like ozone.

Based on the data shown in Table 4.2-6, exceedances of the state ozone standard in the project vicinity have occurred on an average of approximately less than two days per year at the Tuolumne Street station in Vallejo with no exceedances for the past two years. There have been no exceedances of the national one-hour ozone standard, but the station has recorded occasional exceedances of the national eight-hour ozone standard. In 2000, CARB inventory data show that average daily emissions of the principal ozone precursors, ROG and NOx, from all anthropogenic (non-natural) sources in Solano County were estimated at 51 and 48 tons respectively, with on- and off-road mobile sources making up about 60% of ROG and 79% of NOx emissions.

Carbon Monoxide

Carbon Monoxide (CO) is a non-reactive pollutant that is a product of incomplete combustion and is mostly associated with motor vehicle traffic. High CO concentrations develop primarily during winter when periods of light winds combine with the formation of ground level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures. When inhaled at high concentrations, CO combines with hemoglobin in the blood and reduces the oxygen-carrying capacity of the blood. This results in reduced oxygen reaching the brain, heart, and other body tissues. This condition is especially critical for people with cardiovascular diseases, chronic lung disease or anemia.

There have been no exceedances of state and national ambient CO standards in the project vicinity over the last five years. CARB inventory data indicate that average daily anthropogenic CO emissions in Solano County were estimated at 254 tons per day in 2000, with on road motor vehicles contributing approximately 77% of that total. Residential fuel combustion, utilities and manufacturing contributed the remainder.

Particulate Matter

PM-10 and PM-2.5 consist of particulate matter that is 10 microns or less in diameter and 2.5 microns or less in diameter, respectively. (A micron is one-millionth of a meter). PM-10 and PM-2.5 represent fractions of particulate matter that can be inhaled into the air passages and the lungs and can cause adverse health effects. Particulate matter in the atmosphere results from many kinds of dust- and fume-producing industrial and agricultural operations, fuel combustion, and atmospheric photochemical reactions. Some sources of particulate matter, such as demolition and construction activities, are more local in nature, while others, such as vehicular traffic, have a more regional effect. Very small particles of certain substances (e.g., sulfates and nitrates) can cause lung damage directly, or can contain adsorbed gases (e.g., chlorides or ammonium) that may be injurious to health. Particulates also can damage materials and reduce visibility.

PM-10 emissions in the project area are mainly from urban sources, dust suspended by vehicle traffic and secondary aerosols formed by reactions in the atmosphere. Particulate concentrations near residential sources generally are higher during the winter, when more fireplaces are in use and meteorological conditions prevent the dispersion of directly-emitted contaminants. In 2000, CARB inventory data show that average daily anthropogenic emissions of PM-10 in Solano County were estimated at 23 tons per day. Of this, about 45% came from road dust, 6% from residential fuel combustion (such as wood-burning stoves and fireplaces) and 15% from construction, demolition and waste burning.

Valero has indicated that from 1998 to the present, they have received 18 inquires / complaints regarding dusting, i.e., deposition of dust or particulate matter on nearby receptors. These complaints usually have been in respect to dusting of cars. Valero has investigated these 18 complaints and has determined that 11 of the 18 dusting incidents were caused by pollen[4], The other 7 of 18 dusting incidents were attributed to refinery sources, such as dust from ploughing fire breaks and coke particles.

[4] Several of these cases were confirmed by lab testing of the dusts.

Other Criteria Pollutants

Sulfur dioxide is a combustion product of sulfur or sulfur-containing fuels such as coal, which are restricted in the Bay Area. SO_2 is also a precursor to the formation of atmospheric sulfate, particulate matter (PM-10 and PM-2.5) and contributes to potential atmospheric sulfuric acid formation that could precipitate downwind as acid rain. The maximum SO_2 concentrations recorded in the project area were well below federal and state standards. The Bay Area is likewise in attainment status with both federal and state SO_2 standards.

Ambient lead concentrations meet both the federal and state standards in the Bay Area and the project area. Lead has a range of adverse neurotoxic health effects, and was formerly released into the atmosphere primarily via leaded gasoline products. The phase-out of leaded gasoline in California resulted in decreasing levels of atmospheric lead. As the project would not introduce any new sources of lead emissions, lead emissions are not required to be quantified by the Bay Area Air Quality Management District and are not further evaluated in this analysis.

The standards for NO_2 are also being met in the project area and the latest pollutant trends suggest that these standards will not be exceeded in the foreseeable future.

4.2.2.4 TOXIC AIR CONTAMINANTS

Toxic air contaminants (TAC) are pollutants that are associated with acute, chronic, or carcinogenic effects but for which no ambient air quality standard has been established or, in the case of carcinogens, is appropriate. TAC impacts are evaluated by determining if a particular chemical poses a significant risk to human health and, if so, under what circumstances. TACs are part of criteria pollutants and are contained in emissions inventories for criteria pollutants. For example, benzene is a TAC and is also a criteria pollutant (a volatile organic compound, VOC) and is included in that criteria pollutant inventory. Also, diesel particulate matter (diesel PM), which is emitted from diesel engines, is a PM-10 criteria pollutant besides being a TAC. The impacts of TAC emissions from the VIP are evaluated separately in the Section 4.7, *Public Health*.

The ambient background of toxic air contaminants is the combined result of many diverse human activities, including gasoline stations, automobiles, dry cleaners, industrial operations, hospital sterilizers, and painting operations. In general, mobile sources contribute more significantly to health risks than do stationary sources (BAAQMD 2000b). BAAQMD operates a network of monitoring stations that measure ambient concentrations of certain toxic air contaminants that are associated with strong health-related effects and are present in appreciable concentrations in the Bay Area, as in all urban areas. BAAQMD estimates that the average lifetime cancer risk from toxic air contaminants in the ambient air in the Bay Area (based on ambient air quality monitoring data for 1999) is 186 cases of cancer per million residents (down from 303 in one million based on 1995 data). Of the pollutants for which monitoring data are available, benzene and 1,3-butadiene (which are emitted primarily from motor vehicles) account for over one half of the average calculated cancer risk (BAAQMD 2000b). Benzene levels have declined dramatically since 1996 with the advent of Phase 2 reformulated gasoline. The use of reformulated gasoline also appears to have led to significant decreases in 1,3-butadiene. Details of project-related increase in TAC emissions and the associated health risks are discussed in detail in Section 4.7, *Public Health*.

4.2.2.5 ODORS

While offensive odors rarely cause any physical harm, they still can be very unpleasant, leading to considerable distress among the public and often generating citizen complaints to local governments and the BAAQMD. Any project with the potential to frequently expose members of the public to objectionable odors would be deemed to have a significant impact. The occurrence and severity of odor problems depends on numerous factors, including the nature, frequency and intensity of the source, wind speed and direction, and the sensitivity of the receptor(s).

Substances present in refinery air emissions, such as H_2S, benzene compounds, acrolein, naphthalene, phenol, methyl mercaptan, SO_2, and toluene, are known to cause unpleasant odors.

BAAQMD Regulation 7 places general limitations on odorous substances, and specific emission limitations on certain odorous compounds such as mercaptans and phenolic compounds (BAAQMD 2000b). The regulation applies when and if the BAAQMD receives validated odor complaints from 10 or more complainants in a 90-day period. Between January 1, 2001 and December 31, 2001 a total of 34 odor complaints were received by the BAAQMD related to Valero refinery (BAAQMD 2001). Of the 34, one was confirmed and 33 were unconfirmed. Also, there were no 10 complaints received within a 90-day period.

In addition, BAAQMD Regulation 9, Rule 2 limits H_2S emissions during a 24-hour period to quantities that do not result in ground-level concentrations greater than 83 $\mu g/m^3$ (on a dry volumetric basis) for a 3-minute average, or 42 $\mu g/m^3$ for a 60-minute average. The state has also established air quality standards to be used by industry as guidelines.

4.2.2.6 SENSITIVE RECEPTORS

Some receptors are considered more sensitive than others to air pollutants. The reasons for greater than average sensitivity include pre-existing health problems, proximity to emissions sources, or duration of exposure to air pollutants. Schools, hospitals and convalescent homes are considered to be relatively sensitive to poor air quality because children, elderly people and the infirm are more susceptible to respiratory distress and other air quality-related health problems than the general public. Residential areas are considered sensitive to poor air quality because people usually stay home for extended periods of time, with associated greater exposure to ambient air quality. Recreational uses are also considered sensitive due to the greater exposure to ambient air quality conditions because vigorous exercise associated with recreation places a high demand on the human respiratory system.

The proposed project is located within the Valero refinery in an area designated for General Industrial uses in the Benicia General Plan. Sensitive uses do not immediately adjoin the developed part of the Valero refinery. In general, the refinery complex is immediately bordered by 470 acres of mostly undeveloped Valero property to the south and west, and general industrial uses to the north and east. Residential uses are located to the south (Hillcrest neighborhood) and west (Southampton neighborhood) of the Valero buffer land boundaries, with the closest residences located approximately 3,000 feet away from the process block of the refinery where the VIP would be constructed. The buffer land separating the neighborhoods from the refinery is designated for General Industrial, Limited Industrial, and General Open Space uses in the Benicia General Plan (City of Benicia, 1999). Areas to the northeast and southeast of the refinery are also non-sensitive land uses, consisting of Interstate 680 and the Benicia Industrial Park.

4.2.3 IMPACTS AND MITIGATION MEASURES

4.2.3.1 SIGNIFICANCE THRESHOLDS

According to the checklist of potential environmental impacts at Appendix G of the State CEQA Guidelines, 14 Cal. Code. Reg. Div. 6, Appendix G, a project would have a significant effect air quality if it would:

- conflict with or obstruct implementation of the applicable air quality plan;
- violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- result in a cumulatively considerable net increase of any nonattainment pollutant (including releasing emissions that exceed quantitative thresholds for ozone precursors);
- expose sensitive receptors to substantial pollutant concentrations; or
- create objectionable odors affecting a substantial number of people.

For project-level impact analysis, BAAQMD provides various thresholds and tests of significance that can be used to determine whether a project would conflict with or obstruct implementation of the air quality plan, violate any air quality standard or contribute substantially to an existing or projected air quality violation or expose sensitive receptors to substantial pollutant concentrations. The project's impact on sensitive receptors is also discussed in Section 4.7, *Public Health*.

For ROG, NO_x and PM-10, a net increase of 80 pounds per day is considered significant, while for CO, an increase of 550 pounds per day would be considered significant if it leads to a possible local violation of the CO standards i.e., if it creates a "hot spot" (BAAQMD 1999). According to the BAAQMD CEQA Guidelines, the project's contribution to cumulative impacts should be considered significant if the project's impact individually would be significant (i.e. exceeds the BAAQMD's quantitative thresholds). For projects that would not result in a significant impact individually, the project's contribution to any cumulative impact would be considered less than significant if the project is consistent with the local General Plan and the local general Plan is consistent with the applicable regional air quality plan. In this case, the applicable regional air quality plan would be the 2000 Bay Area Clean Air Plan.

For the analysis of odor impacts, an exceedance of the standards in the applicable BAAQMD *Rules and Regulations* would be considered to constitute a significant impact. For analysis of H_2S emissions, per BAAQMD Regulation 9, Rule 2, a 60-minute average of 42 $\mu g/m^3$ (micrograms per cubic meter) would be considered the significance threshold. For the analysis of impacts due to an increase in methyl mercaptan emissions, a significance threshold of 4.2 $\mu g/m^3$ would be used.

4.2.3.2 METHODOLOGY

The analysis in this section includes evaluation of both construction and operational impacts of the proposed project and is based on the Air Emissions Calculation report for the project prepared by URS Corporation. ESA has peer reviewed the report and concurs with the assumptions, methodology and calculations used in the estimation of baseline and VIP emissions.

Baseline

In order to determine an impact, the emissions resulting from the project are compared to a baseline. Under CEQA, the project baseline is normally defined as the physical conditions of the environment as it exists at the time of publication of the Notice of Preparation of the project EIR. In the case of air emissions typically a 1-year average based on the previous year's operation is used. Refinery-wide stationary source emissions have been estimated for a 1-year period (May 1, 2001 – April 30, 2002) which would represent the 1-year baseline condition. To analyze the proposed project's impact, the emissions from the refinery due to the implementation of the VIP in future years (2009) are compared to the 1-year baseline emissions. The net change in emissions is then compared to the previously established BAAQMD significance thresholds to determine the significance of the impacts.

For a refinery, emissions averaged over a longer period, such as a 3-year average would more accurately account for the cyclic nature of refinery operations. This is because while refineries tend to operate at capacity for extended periods of time, refineries also undergo periodic multi-week plant-wide shutdowns for scheduled maintenance (referred to as a turnaround) over a multi-year period. In addition, market forces can also cause refineries to vary their capacity (up or down). These factors cause the refinery emissions to fluctuate up and down between years and so a longer period baseline is needed to account for these cycles. Therefore, refinery-wide baseline emissions for stationary sources were developed for a 3-year (1999-2001) period and the average would be used as a second baseline to evaluate project impacts. The BAAQMD also uses a 3-year average as the baseline for permitting purposes.

To determine cumulative impacts of the proposed project, the project's consistency with the Clean Air Plan was determined based on its consistency with the City of Benicia General Plan and the general Plan's consistency with the 2000 Bay Area Clean Air Plan.

Odors

The odor analysis is based on the analysis of potential odor impacts of the project conducted by URS Corporation for Valero. The odor report from URS was peer reviewed by ESA and found to be adequate. The VIP proposes to process a higher percentage of lower grades of crude oil with greater sulfur content than it presently can process. This would increase odorous emissions of reduced sulfur compounds such as H_2S and methyl mercaptan from the refinery. Methyl mercaptan is a sulfur-based compound with a low odor threshold that may potentially be present in higher concentrations in sour crudes relative to the current average crude mix processed at the refinery. Methyl mercaptan emissions would be primarily generated from the crude tank farm. Per crude assay data, no H_2S is present in the crude oil. Therefore, potential for odors impacts from H_2S emissions were analyzed for the main refinery emissions. Odor impacts from these two pollutants have been analyzed and compared to the significance thresholds established previously. The analysis focuses on these two pollutants as they have the lowest odor thresholds with the potential for impacts at very low concentrations.

4.2.3.3 PROJECT CONSTRUCTION IMPACTS

Impact 4.2-1: Construction activities associated with project construction would generate short-term emissions of criteria pollutants, including suspended and inhalable particulate matter and equipment exhaust emissions. This would be a potentially significant impact.

Construction related emissions would be short term, but may still cause adverse effects on the local air quality. Project construction would generate substantial amounts of dust (including PM-10 and PM-2.5) primarily from “fugitive” sources (i.e., emissions released through means other than through a stack or tailpipe) and lesser amounts of other criteria air pollutants primarily from operation of heavy equipment construction machinery (primarily diesel operated) and construction worker automobile trips (primarily gasoline operated).

Construction-related dust emissions would vary from day to day, depending on the level and type of activity, silt content of the soil, and the weather. In the absence of mitigation, construction activities may result in significant quantities of dust, and as a result, local visibility and PM-10 concentrations may be adversely affected on a temporary and intermittent basis during the construction period. The BAAQMD’s approach to analyses of construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions. The District considers any project’s construction related impacts to be less than significant if the required dust-control measures are implemented. Without these measures, the impact is generally considered to be significant.

Construction activities would also result in the emission of other criteria pollutants from equipment exhaust, construction-related vehicular activity and construction worker automobile trips. Emission levels for construction activities would vary depending on the number and type of equipment, duration of use, operation schedules, and the number of construction workers. Criteria pollutant emissions of ROG and NOx from these emission sources would incrementally add to the regional atmospheric loading of ozone precursors during project construction. BAAQMD

CEQA Guidelines recognize that construction equipment emits ozone precursors, but indicate that such emissions are included in the emission inventory that is the basis for regional air quality plans. Therefore construction emissions are not expected to impede attainment or maintenance of ozone standards in the Bay Area (BAAQMD 1999).

Mitigation Measure 4.2-1a: During construction, Valero should require the construction contractor to implement the following dust control procedures to maintain project construction-related impacts at acceptable levels; this mitigates the potential impact to less than significant.

- Water all active construction areas at least twice daily. Watering should be sufficient to prevent airborne dust from leaving the site. Increased watering frequency may be necessary whenever wind speeds exceed 15 miles per hour. Reclaimed water should be used whenever possible.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard (i.e., the minimum required space between the top of the load and the top of the trailer).
- Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
- Sweep all paved access roads, parking areas and staging areas at construction sites daily. Sweep City streets (with water sweepers using reclaimed water if possible) at the end of each day if visible soil material is carried onto adjacent paved public roads.
- If construction activities for any project component or group of components undergoing simultaneous construction will occur on a construction site greater than four acres in area, Valero shall require the construction contractor to implement the following enhanced dust control procedure:
  - Hydroseed or apply (non-toxic) soil stabilizer to inactive construction areas (previously graded areas inactive for ten days or more).
  - Enclose, cover, water twice daily or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.)
  - Limit traffic speeds on unpaved roads to 15 mph.
  - Install sandbags or other erosion control measures to prevent silt runoff to public roadways.
  - Replant vegetation in disturbed areas as quickly as possible.

Mitigation Measure 4.2-1b: To mitigate the equipment exhaust emissions, the project sponsor should require its construction contractors to comply with the following requirements:

- Construction equipment shall be properly tuned and maintained in accordance with manufacturers' specifications.

- Best management construction practices shall be used to avoid unnecessary emissions (e.g., trucks and vehicles in loading and unloading queues would turn their engines off when not in use).
- Any stationary motor sources (such as generators and compressors) located within 100 feet of any residence shall be equipped with a supplementary exhaust pollution control system as required by the BAAQMD and CARB.

Significance after Mitigation: Less than Significant

4.2.3.4 PROJECT OPERATIONAL IMPACTS

Impact 4.2-2: Operational activities associated with the implementation of the proposed project could lead to increase in regional air pollutant emissions into the air basin. This would be a potentially significant impact.

Analysis of VIP with Scrubber

The operational analysis provided below is based on the Air Emissions Calculations report prepared for this project by URS Corporation for Valero. ESA has peer reviewed this report and concurs with the assumptions, methodology and calculations used in the estimation VIP emissions. The report estimated refinery-wide criteria pollutant emissions for stationary sources for the 3-year and 1-year baselines defined earlier. The implementation of the proposed project would lead to a change in emissions from the stationary sources as well as from mobile sources. Emission changes were estimated for all sources affected by the project, including stationary and mobile sources and the results are summarized below.

Stationary Sources

The project would result in a change in emissions primarily from the following stationary sources:

Main Stack

Main stack emissions include emissions from existing process furnaces, the Fluidized Catalytic Cracking Unit (FCCU) and the Coker Unit.

The project will include a number of modifications that will affect emissions from the main stack: a new vacuum furnace; a scrubber; and increased throughput at the FCCU and Coker Unit. The scrubber will be designed to reduce SO_2 emissions from the Coker Unit by at least 96%. The scrubber will also remove ammonia slip generated by the Thermal De-NOx (TDN) system located upstream. This will allow additional ammonia control for greater NOx control, resulting in significant NOx reductions.

The projected NOx emissions assumed that the TDN system will meet the refinery-wide NOx emission limits required by BAAQMD Regulation 9, Rule 10. If the reduction is not attained with

TDN, reductions at other combustion sources will be implemented to provide NOx reduction. The SO_2 reduction was estimated based on a 96% efficiency by the scrubber for 31 tons of sulfur coming out of the Coker Unit per day. FCCU SO_2 mass emissions are expected to be unchanged relative to the current baseline mass rates based on the use of the DeSOx catalyst. Although small reductions of PM-10, volatile organic compounds (VOC) and CO are likely as a result of the VIP, these calculations conservatively assume no reductions for these pollutants. Table 4.2-7 contains a summary of the main stack emissions for baseline and post-VIP conditions. The table also shows the net change in emissions from the main stack due to the VIP relative to the two baselines.

TABLE 4.2-7
ESTIMATED MAIN STACK EMISSIONS

	Emissions (tons per year)				
Source Type	**NOx**	**SOx**	**PM-10**	**VOC**	**CO**
Main Stack – Post-VIP	734	2,706	104	7	277
Main Stack – 3 year-baseline	1,488	6,542	104	7	277
Main Stack – 1 year baseline	834	6,961	105	7	319
Net increase over 3 year baseline	-754	-3,836	0	0	0
Net increase over 1 year baseline	-100	-4,255	-1	0	-41

SOURCE: URS Corporation, *Authority to Construct Application for Valero Improvement Project to the BAAQMD, July 2002; Valero Improvement Project Air Emissions Calculations*, June 2002.

Combustion Sources

Criteria pollutant emissions are generated by the combustion of refinery fuel gas and natural gas at the refinery. The emission rate is generally proportional to the amount of fuel burned in each process furnace, steam boiler or gas turbine. Emissions were estimated separately for twenty-nine sources such as heaters, boilers, and gas turbines that are not exhausted through the main stack complex at the refinery. Incremental emissions from combustion sources were based on a total firing increase due to the VIP of 400 million British thermal units per hour (MMBtu/hr). Table 4.2-8 below contains a summary of the combustion emissions for baseline and post-VIP conditions. The table also shows the net change in combustion emissions due to the VIP relative to the two baselines.

TABLE 4.2-8
ESTIMATED COMBUSTION EMISSIONS

	Emissions (tons per year)				
Source Type	**NOx**	**SOx**	**PM-10**	**VOC**	**CO**
Combustion – Post-VIP	1,273	77	132	56	686
Combustion – 3 year-baseline	1,152	68	126	51	661
Combustion – 1 year baseline	1,165	72	135	52	613
Net increase over 3 year baseline	121	9	6	5	26
Net increase over 1 year baseline	108	5	-2	4	73

SOURCE: URS Corporation, *Authority to Construct Application for Valero Improvement Project to the BAAQMD, July 2002; Valero Improvement Project Air Emissions Calculations*, June 2002.

Storage Tanks

Baseline storage tank emissions were based on tank throughputs and emissions that Valero used in the Toxic Release Inventory (TRI) reporting. Emissions were calculated using the U.S. EPA AP-42 emission algorithms.

Two new crude oil tanks will be installed as part of the VIP, and throughput will increase for several existing tanks. Emissions from the new and existing storage tanks that will be affected by the VIP were calculated using USEPA AP-42 Chapter 7 tank emission algorithms. The USEPA TANKS 4.0 program, which automates AP-42 calculations, was used to estimate emissions from the new crude tanks and existing tanks. Table 4.2-9 contains a summary of the storage tank VOC emissions for baseline and post-VIP conditions. The table also shows the net change in storage tank emissions due to the VIP relative to the two baselines.

TABLE 4.2-9
ESTIMATED STORAGE TANK EMISSIONS

	VOC Emissions (tons per year)				
Source Type	**Post-VIP**	**3-Year Baseline**	**1-Year Baseline**	**Net Increase over 3-Year Baseline**	**Net Increase over 1-Year Baseline**
Storage Tanks	193	187	190	5	3

SOURCE: URS Corporation, *Authority to Construct Application for Valero Improvement Project to the BAAQMD, July 2002; Valero Improvement Project Air Emissions Calculations*, June 2002.

Fugitive Emissions

Fugitive emissions are generated when process liquids or gases leak from valves, flanges, connectors, pumps, and other devices. Due to the nature of the materials used at the refinery, these leaks can contain a high percentage of VOCs. The amount of VOCs that are emitted is determined by the number of components that could leak, the type of material in the piping, and the effectiveness of the leak detection and repair programs in place at the refinery.

Fugitive VOC emissions were based on an estimate of the total number of new valves, pumps, flanges, and connectors that will be required as part of the VIP. Detailed project design has not been completed to allow a refined VIP component count. The total number of components was conservatively estimated, including a large contingency. Component leak rate emission factors were based on California Air Pollution Control Officers' Association (CAPCOA) correlation equations and actual Valero Benicia refinery screening values that have been accepted by the BAAQMD as part of the refinery's 2001 Annual Update. Table 4.2-10 summarizes the fugitive VOC emissions for baseline and post-VIP conditions. The table also shows the net change in fugitive emissions due to the VIP relative to the two baselines.

TABLE 4.2-10
ESTIMATED FUGITIVE EMISSIONS

	VOC Emissions (tons per year)				
Source Type	**Post-VIP**	**3-Year Baseline**	**1-Year Baseline**	**Net Increase over 3-Year Baseline**	**Net Increase over 1-Year Baseline**
Fugitive Emissions	76	73	60	3	16

SOURCE: URS Corporation, *Authority to Construct Application for Valero Improvement Project to the BAAQMD, July 2002; Valero Improvement Project Air Emissions Calculations*, June 2002.

Mobile Sources

To accommodate the increases in imports and exports of crude and other materials, the VIP will increase the number of mobile sources traveling to and from the refinery by the following amounts: 16 tanker trucks per day, 4.4 rail cars per day (one locomotive) and 24 ships net per year. Emissions from these diesel-fired mobile sources have been calculated and are summarized in Table 4.2-11. Total emissions for trucks were estimated assuming a 100-mile travel distance within the San Francisco Bay Area. Emission factors were gathered from EMFAC2000 Version 2.02 for 2009 heavy-duty truck fleet mix. Train emissions were estimated based on emission factors used in a 1991 CARB study and projected locomotive fuel use for the additional rail car movements. Shipping emissions were estimated using the emission factors and fuel consumption data in the MTBE Tanks Project permit application dated 1991.

TABLE 4.2-11
ESTIMATED MOBILE SOURCE EMISSIONS

Source Type	Emissions (tons per year)				
	NOx	Sox	PM-10	VOC	CO
Trucks	9.1	0.2	0.3	0.7	4.9
Locomotives	2.5	0.1	0.1	0.1	0.4
Ships	39.9	16.2	2.4	3.2	5.9
Total	51.5	16.5	2.8	4.1	11.2

SOURCE: URS Corporation, *Authority to Construct Application for Valero Improvement Project to the BAAQMD, July 2002; Valero Improvement Project Air Emissions Calculations*, June 2002.

Table 4.2-12 summarizes total emissions from all affected sources due to the implementation of the VIP. The table also shows future emissions reductions that are expected to occur due to the implementation of the cogeneration project during the same time period as the VIP is expected to be implemented. As these reductions have not already occurred, they have not been included as part of the baseline. Construction of the cogeneration project is underway and is expected to be completed by late 2002, prior to the commencement of the VIP. Therefore, these reductions have been included along with the project emissions in 2009 in order to accurately reflect the “future with project scenario.” As shown in the table, the future with project scenario would lead to a significant increase in VOC emissions with respect to the 1-year baseline. This would constitute a significant impact. Increase in emissions of all other pollutants with respect to both baselines would be less than significant.

As explained in Section 3.6.1.3, Valero plans to proceed with other, independent, capital improvement projects at the refinery during the same time period as it would construct the VIP. Three of these potential future projects, the Alkylation Unit Modifications, the Selective Hydrogenation Facilities, and the Treatment of Wastewater from the Huntway Asphalt Refinery are not anticipated to result in substantial changes to refinery emissions. A fourth, potential future project, the Light Ends Rail Rack Arm Drains project, would result in decrease in VOC emissions. Because Valero has not committed to construct the Light Ends Rail Rack Arms Drain project, that project was not included in the 2009 Future with Project case for purposes of determining whether operational activities associated with the implementation of the VIP could lead to a significant increase in regional air pollutant emissions into the air basin. As shown in Table 4.2-12, construction of this project would, however, reduce the incremental increase in emissions in 2009 over both the one-year and three-year baselines to a less than significant level. Accordingly, the following mitigation measure should be required.

TABLE 4.2-12
ESTIMATED TOTAL VIP EMISSIONS (2009)

Source Type	Emissions (tons per year) NOx	SOx	PM-10	VOC	CO
VIP (with scrubber) Analysis					
Total Emissions – post-VIP	2,058	2,799	240	335	975
Total Emissions – 3 year-baseline	2,639	6,610	231	318	938
Total Emissions – 1 year baseline	1,999	7,032	240	309	932
Net increase over 3 year baseline	-581	-3,810	9	<u>17</u>	37
Net increase over 1 year baseline	<u>60</u>	-4233	-0.6	<u>26</u>	43
Emission reductions associated with Cogeneration Project	-83	0	-4	-2	-214
Post-VIP with Cogeneration Project (Future with project case)	1,975	2,799	236	333	761
Net increase over 3 year baseline – Future with project	-664	-3,810	5	14.99	-177
Net increase over 1 year baseline – Future with project	-24	-4,233	-4	<u>25</u>	-171
BAAQMD Significance Thresholds	15	NA	15	15	100
Significant?	No	No	No	<u>Yes</u>	No
Mitigation Measure					
Light Ends Rail Rack Arm Drains	0	0	0	-16	0
Net increase over 3 year baseline – with mitigation	-664	-3,810	5	-1	-177
Net increase over 1 year baseline – with mitigation	-24	-4,233	-4	9	-171
Significant after mitigation?	No	No	No	No	No
Additional anticipated reductions (Not required):					
MTBE Phase-Out Shipping	-37	0	0	-13	0
Post-VIP with scrubber and Cogeneration Project – with mitigation and other anticipated reductions	1,939	2,799	236	304	761
Net increase over 3 year baseline – with mitigation and other reductions	-701	-3,810	5	-14	-177
Net increase over 1 year baseline – with mitigation and other reductions	-60	-4,233	-4	-4	-171

NOTE: <u>Underlined</u> values are in excess of applicable thresholds. NA = Not Applicable.

SOURCE: URS Corporation, *Authority to Construct Application for Valero Improvement Project to the BAAQMD, July 2002; Valero Improvement Project Air Emissions Calculations*, June 2002.

Mitigation Measure 4.2-2: As a condition of approval of the use permit for the VIP, Valero must implement the Light Ends Rail Rack Arm Drains project described in Section 3.6.1.3 of this document.

Implementation of Mitigation Measure 4.2-2 is not expected to result in any environmental impacts beyond those described in this document.

Significance after Mitigation: Less than significant.

In addition, during the time period that Valero would implement the VIP, Valero also anticipates reduction in emissions due to its phase out of MTBE. Reductions in MTBE Phase-Out emissions are shown in Table 4.2-12 to further disclose anticipated future emissions with the VIP. However, the MTBE Phase-Out emissions reductions are not required to reduce the operational impacts of the implementation of the VIP to a less than significant level. Hence, these reductions have not been treated as a mitigation measure for purposes of this document.

Analysis of VIP Without Scrubber

The VIP installation sequence could result in some facilities operating prior to installation of the Main Stack Flue Gas Scrubber. To assess the impact of this situation, a worst-case operation was analyzed where all other VIP facilities were installed without the scrubber. Valero has described this as an interim operation prior to the start-up of the main stack scrubber and has proposed that the Air District include a 36-month (1,095-day) limitation on this operation without the scrubber.

Stationary Sources

Main Stack Emissions

The full project analysis reflects operation at a maximum proposed crude rate of 165 MB/D, including scrubber installation. In the event that the Main Stack Scrubber has not been installed, a more modest increase in crude rate, to about 150 MB/D, is feasible with minimal facilities. Also, some additional air usage, though not the full 3rd air blower rates, is also feasible without significant changes. The BAAQMD has indicated their intent, under these circumstances, to limit the Main Stack emissions to historically demonstrated levels. Specifically, the District's three-year baseline will be imposed as a required limitation. It must be noted that the District's 3-year baseline is different from the 3-year baseline used in this CEQA analysis as the CEQA baseline uses average emissions data from the past three calendar years while the District's baseline used for permitting uses average annual emissions from June 1999 to June 2002.

In order to comply with this no-increase requirement, and still operate at the slightly higher rates, the refinery will have to manage raw material qualities, utilize deSOx catalyst in the FCCU, and limit operating conditions in the Coker Unit. Thus, in the event that the scrubber has not been installed, there may still be modest increases in crude rates or additional air usage in the Main Stack components, but the main stack emissions will not be allowed to increase.

Combustion Emissions

In the event that the scrubber has not been installed, VIP throughput changes will be constrained to no more than half of the maximum throughput proposed for the VIP with scrubber case. The incremental emission levels for the combustion emissions will also be reduced to be no more than half.

Tank Emissions

In the event that the scrubber has not been installed, the emissions from the two new tanks will be slightly reduced from the listed amounts, but can be conservatively estimated to be unchanged.

Fugitive Emissions

In the event that the scrubber has not been installed, the fugitive emissions from new components will be slightly reduced from the listed amounts, but can be conservatively estimated to be unchanged.

Mobile Source Emissions

In the event that the scrubber has not been installed, the emissions from mobile sources will be no more than half of the listed amounts, because the maximum increase in crude rate will only be half of the amount used to calculate the total mobile emissions.

Table 4.2-13 summarizes total emissions from all affected sources due to the implementation of the VIP except the installation of the scrubber. The table also shows emissions reductions that are expected to occur due to the implementation of the cogeneration project as part of the future with project scenario. As shown in the table, the future with project scenario without the scrubber would lead to a significant increase in VOC emissions with respect to the 1-year baseline. This would constitute a significant impact. Increase in emissions of all other pollutants with respect to both baselines would be less than significant. Implementation of the following mitigation measures would reduce the impact to a less than significant level.

The table also shows that in the event that the scrubber is not installed, there would be an increase in SOx emissions from the refinery over both the 3-year and 1-year baselines. Post-VIP, without the scrubber, SOx emissions would increase by 11 tons over the one-year baseline and by 433 tons over the 3-year CEQA baseline as the 3-year CEQA baseline is lower than the 1-year baseline. The BAAQMD, under such an event would limit SOx emissions from the refinery to the District's 3-year baseline level of 6,835 tons per year. Though this level would be greater than the CEQA 3-year baseline by about 215 tons per year, it would also be substantially lower than the 1-year baseline by about 197 tons per year. Since the BAAQMD does not have a recommended significance threshold for SOx, the increase in emissions over the CEQA 3-year baseline would not be considered a significant impact given that emissions would be restricted to a level well below the 1-year baseline. A reduction of 17 tons per year from the main stack will be required by the BAAQMD as part of Valero's permitting requirements. The additional reductions required to limit emissions to the District's 3-year baseline would result from proper management of raw material qualities, utilization of deSOx catalyst in the FCCU, and by limiting operating conditions in the Coker Unit.

TABLE 4.2-13
VIP NO SCRUBBER ANALYSIS

Source Type	Emissions (tons per year) NOx	SOx	PM-10	VOC	CO
VIP (no scrubber) Analysis					
Total Emissions – post-VIP	2,079	7,043	241	331	937
Total Emissions – 3 year-baseline	2,639	6,610	231	318	938
Total Emissions – 1 year baseline	1,999	7,032	240	309	932
Net increase over 3 year baseline	-560	433	10	13	-1
Net increase over 1 year baseline	81	11	1	22	5
Emission reductions associated with Cogeneration Project	-83	0	-4	-2	-214
Post-VIP with Cogeneration Project (Future with project case)	1,996	7043	237	329	723
Net increase over 3 year baseline – Future with project	-643	433	6	11	-215
Net increase over 1 year baseline – Future with project	-3	11	-3	20	-209
BAAQMD Significance Thresholds	15	NA	15	15	100
Significant?	No	NA	No	Yes	No
Mitigation Measure					
Light Ends Rail Rack Arm Drains	0	0	0	-16	0
Net increase over 3 year baseline – with mitigation	-643	-433	6	-5	-215
Net increase over 1 year baseline – with mitigation	-3	11	-3	5	-209
Significant after mitigation?	No	No	No	No	No
Additional anticipated reductions (Not required):					
Additional Main Stack Reductions	0	-17	0	0	0
MTBE Phase-Out Shipping	-37	0	0	-13	0
VIP without scrubber with Cogen Project – with mitigation and anticipated reductions	1,960	7,026	237	300	723
Change relative to 3-year baseline with mitigation and other reductions	-680	417	6	-18	-215
Change relative to 1-year baseline with mitigation and other reductions	-39	-6	-3	-8	-209

NOTE: Underlined values are in excess of applicable thresholds. NA = Not Applicable.

SOURCE: URS Corporation, Authority to Construct Application for Valero Improvement Project to the BAAQMD, July 2002; Valero Improvement Project Air Emissions Calculations, June 2002; Valero letter to City of Benicia, dated September 16, 2002.

Mitigation Measure: Implement Mitigation Measure 4.2-2.

Significance after Mitigation: Less than significant.

During the time period that Valero implements the VIP, Valero also anticipates reduction in emissions due to its phase out of MTBE. Reductions due to MTBE Phase-Out are shown in Table 4.2-13 to further disclose anticipated future emissions with the VIP. Note that neither the additional main stack reduction of 17 tons per year of SO_2 nor the MTBE Phase-Out reductions are required to achieve the level of insignificance considered in this document. These reductions are listed here because they are planned reductions being provided in response to the BAAQMD's permitting requirements for the VIP.

Impact 4.2-3: Operational activities associated with the implementation of the proposed project could lead to increase in odorous emissions. This would be a less than significant impact.

An odor analysis for the project was conducted by URS Corporation and has been summarized in the following paragraphs. As explained earlier, the primary emissions of concern with respect to odor from the VIP are methyl mercaptan and H_2S. Therefore the analysis focuses on the impacts of those two pollutants.

Impact of H_2S Emissions from the Main Refinery

Sources of H_2S in the main refinery area include the main stack and combustion sources, the Tail Gas Unit (TGU), the Sulfur Recovery Unit (SRU) and fugitive emissions from throughout the refinery. Table 4.2-14 below shows the maximum hourly H_2S concentration due to the implementation of the VIP, from the various sources at the refinery. It is based on the results of the emissions and dispersion modeling conducted for the Health Risk Assessment (HRA) for this project.

TABLE 4.2-14
MAXIMUM PREDICTED HOURLY H_2S CONCENTRATIONS

Source of H_2S Emissions – Post VIP	**Maximum Hourly Concentration** ($\mu g/m^3$)
Main Stack and Combustion Sources	10.25
Tail Gas Unit (TGU)	6.28
Fugitive Emissions	2.74
All Sources	19.3
BAAQMD Significance Threshold	42

SOURCE: URS Corporation, *Authority to Construct Application for Valero Improvement Project to the BAAQMD, July 2002; Valero Improvement Project Air Emissions Calculations*, June 2002.

As shown in the table, the maximum predicted hourly H_2S concentration from all the sources together, due to the implementation of the VIP would be 19.3 $\mu g/m^3$, which is well below the odor threshold of 42 $\mu g/m^3$ for H_2S. It should also be noted that this maximum value conservatively assumes that the maximum impacts for the main stack and combustion sources modeled in the HRA, fugitives and TGU all occur in the same location at the same hour, which is not likely to occur. Therefore the odor impact of project H_2S emissions would be less than significant.

Mitigation: None required.

Impact of Methyl Mercaptan Emissions from the Crude Tank Area

Analysis was conducted assuming that the refinery would process OCS Crude, the crude with the highest methyl mercaptan concentration, 100% of the time. In reality, this is a very conservative assumption, as the refinery would handle all kinds of crudes with varying levels of methyl mercaptan. Using U.S. EPA's TANKS 4.0 program, the total post-VIP VOC emissions from the crude tank farm and the appropriate maximum hourly dilution factor for the crude tanks extracted from the HRA modeling, the estimated methyl mercaptan ground level concentration with the implementation of the VIP would be 0.73 $\mu g/m^3$, well below the threshold of 4.2 $\mu g/m^3$. Therefore, the odor impacts of methyl mercaptan emissions at the crude oil tank area would be considered to be less than significant.

Mitigation Measure: None required.

4.2.4 CUMULATIVE IMPACTS

Impact 4.2-4: The proposed project, along with other ongoing and approved projects would lead to a net reduction in emissions relative to the baseline levels. This would constitute a net air quality benefit.

According to the BAAQMD CEQA Guidelines, any proposed project that would individually have a significant air quality impact would also be considered to have a significant cumulative air quality impact. For any project that does not individually have significant operational air quality impacts, the determination of significant cumulative impact is based on an evaluation of the consistency of the project with the local general plan and of the general plan with the regional air quality plan.

The VIP, as mitigated, would have a less than significant impact on regional air quality. Further, the VIP together with anticipated future projects at the refinery would result in a decrease in emissions. Thus, the project would not contribute to a significant cumulative impact. In addition, the project is consistent with the applicable General Plan and Clean Air Plan as discussed below.

The appropriate general plan for the VIP is the City of Benicia General Plan and the regional air quality plan is the 2000 Bay Area Clean Air Plan. The implementation of the VIP would be consistent with the City of Benicia general plan. The determination of the City general plan's consistency with the Bay Area Clean Air Plan is based on the analysis in the air quality section of the EIR for the City's General Plan. The EIR determined the general plan to be consistent with the Clean Air Plan. Therefore, the VIP would not be considered to have a significant cumulative air quality impact under BAAQMD guidelines for determining the significance of cumulative impacts.

Mitigation: None required.

REFERENCES – Air Quality

Association of Bay Area Governments, Bay Area Air Quality Management District, Metropolitan Transportation Commission, *Proposed Final San Francisco Bay Area Redesignation Request and Maintenance Plan for the National Carbon Monoxide Standard*, July 1994.

Association of Bay Area Governments, Bay Area Air Quality Management District, Metropolitan Transportation Commission, *San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard*, June 1999.

Association of Bay Area Governments, Bay Area Air Quality Management District, Metropolitan Transportation Commission, *Adopted Revised Bay Area 2001 Ozone Attainment Plan,* October 2001.

Bay Area Air Quality Management District, *BAAQMD CEQA Guidelines – Assessing the Air Quality Impacts of Projects and Plans*, December 1999.

Bay Area Air Quality Management District, *Bay Area 2000 Clean Air Plan*, December 2000a.

Bay Area Air Quality Management District. 2000b. *Toxic Air Contaminant Control Program, 1999 Annual Report*, December 2000b.

Bay Area Air Quality Management District. 2001. *Annual Compliance Report - Valero Benicia Refinery*, 2001.

City of Benicia, *General Plan* – Community Health and Safety Element. 1999.

California Air Resources Board. 2000. State and National Area Designations Maps of California, 2000.

URS Corporation, *Authority to Construct Application for Valero Improvement Project to the BAAQMD*, July 2002

URS Corporation, Valero Improvement Project Air Emissions Calculations, June 2002.

4.3 BIOLOGICAL RESOURCES

The VIP would cause no potentially significant, unmitigatable biological impacts.

Potential direct, on-site impacts are associated with construction of crude oil tanks in non-jurisdictional wetlands at the Crude Oil Tank Farm:

- ***Potential disturbance of western pond turtle and California red-legged frog.***
- ***Potential disturbance of special status and protected native birds (e.g., tricolored blackbird and Suisun song sparrow) during the breeding season.***
- ***Potential indirect, off-site impacts to sensitive, mostly migratory, aquatic organisms are associated with discharges into the Suisun Bay and Carquinez Strait:***
- ***Potential impacts to special status fisheries.***
- ***Potential cumulative impacts to special status fisheries also could occur with additional water discharges from other non-refinery industrial projects, together with refinery projects.***

Mitigation measures that could be incorporated into the proposed project would reduce potential impacts at the Tank Farm retention ponds to less than significant levels, while NPDES permit conditions would reduce potential impacts to sensitive, mostly migratory, aquatic organisms in the Suisun Bay and Carquinez Strait to less than significant levels.

4.3.1 INTRODUCTION

This section assesses the potential for the proposed project to result in significant adverse environmental impacts to biological resources. The analysis first defines the range of biological resources potentially exposed to effects. It then determines the project elements which may have measurable impacts on these resources, following the standards of "reasonableness" as per CEQA Guidelines 15151. Finally, it evaluates the impacts to determine if, alone or together, they breach the stated criteria for significance and, if so, whether they can be mitigated to less-than-significant levels.

These analytical steps are described below.

- The habitats on site and adjacent to the project area were visited and described; "special status" (see below) plants and animals associated with these habitats were researched and described; all records of these organisms were identified in an area bounded by the Strait, uplands north of Highway 680, and on the coast between Southampton Bay and Goodyear Slough.
- The specific project components with potential for impacts were determined to be the changes at the approximately 54.33-acre crude Tank Farm located between Park Road and

I-680 – specifically the Tank Farm retention ponds -- and discharges (outfall) from the Benicia Refinery into Suisun Bay and the Carquinez Strait.

- Any modification of the Tank Farm ponds constitute a potentially significant impact; but these may be mitigated by actions such as draining and/or removing vegetation before the start of nesting season (March 15) during the year of construction.

Impacts on aquatic organisms are presumed to be less than significant based on continued compliance with the provisions imposed on the existing wastewater treatment system by National Pollutant Discharge Elimination System (NPDES) Permit No. CA0005550. The Bay Conservation and Development Commission’s (BCDC) Suisun Marsh Protection Plan (BCDC 1976) states that “The present level of wastewater discharge to the Suisun Marsh does not appear to have seriously affected the ability of the Marsh to support desired fish and wildlife species” and such a statement supports reliance on the permit provisions. However, the BCDC Plan is 25 years old, and, to fully inform the City of the status of outfall water quality, Valero should provide a copy of each report of periodic bioassay and other toxicity testing for contaminates as required in Valero’s NPDES permit.

4.3.2 SETTING

4.3.2.1 REGIONAL SETTING

The Valero Benicia Refinery is located in southern Solano County, along the northern edge of the Suisun Bay in a low range of coastal hills. The refinery is located in the Bay Area-Delta Bioregion (as defined by the State’s Natural Communities Conservation Program). This Bioregion is comprised of a variety of natural communities, which range from salt marshes to chaparral to oak woodlands.

4.3.2.2 PROJECT SETTING

Except as noted below for the Tank Farm ponds and blue-line streams, the project area is thoroughly developed with the refinery operational facilities and few biological attributes. Ice plant covers most bare ground in the Main Plant area; a few eucalyptus trees occupy the plant perimeter and hillsides between the Main Plant and the Tank Farm. Open areas are dominated by annual grasses, including wild oats (*Avena sp.*), brome (*Bromus sp.*), and fescues (*Festuca sp.*). Forbes such as Italian thistle (*Carduus pyconcephalus*), wild radish (*Raphanus satinvus*), and anise (*Anethum graveolens*) are intermixed. Other ruderal and aggressive invasive species present are fennel (*Foeniculum vulgare*) and French broom (*Genista monspessulana*). Native species observed in the grasslands (URS 2002) include lupine (*Lupines sp.*), blue dick (*Brodea puchella*) and California poppy (*Eschscholtzia californica*).

Using the term “habitat” very guardedly – since the patches are too small to support a full suite of associated species – habitat types within the project study are the non-native grassland described above, freshwater emergent wetland (and pond), riparian, and estuarine open water.

Freshwater Emergent Wetland and Ponds

The Tank Farm area contains several retention ponds of various sizes, but with areas mostly in the range of 0.1 acre, where water is held prior to discharge. These ponds are regularly manipulated and all are periodically drained, but the larger and more stable ones have a partial border of cattails (*Typha latifolia*) and rushes (*Juncus* spp). Bird use of these ponds can be extensive: on April 9th, 2002, in addition to upland species such as mourning dove (*Zenaida macroura*) and California towhee (*Pipilo crissalis*) the following wetland-associated species were observed:

Black-necked stilt (*Himantopus mexicanus*)
Bufflehead (*Bucephala albeola*)
Red-winged blackbird (*Agelaius phoeniceus*)
Mallard (*Anas platyrhynchos*)
Killdeer (*Charadrius vociferus*)

Riparian

Sulphur Springs Creek crosses the developed portion of the refinery at its northeastern boundary. This area is vegetated with sedge (*Carex*) and rush (*Juncus*) species, common to slow-moving waterways. Sulphur Springs Creek accepts a tributary (Beaver Creek) that has, in the past, been colonized by beavers and river otters (Botti 1993, cited in URS, 2002). There are other drainage swales within the refinery frequently defined by willows (*Salix sp.*), poison oak (*Toxicodendron diversiloba*), and coyote brush (*Baccharis pitularis*).

Estuarine Open Water

The site of the outfall is an industrialized shoreline, but is technically estuarine open water habitat as defined by Harvey (1966): the “drowned river mouth” of the Sacramento-San Joaquin river system. Many species of fish migrate through Suisun Bay waters, and make use of Suisun and other marshes in the area for foraging and rearing habitat.

Special Status Species

Several species known to occur in the project vicinity are protected pursuant to federal and/or state endangered species laws, or have been designated as species of concern by the U.S. Fish and Wildlife Service (USFWS) or species of special concern by the California Department of Fish and Game (CDFG). In addition, Section 15380(b) of the California Environmental Quality Act (CEQA) Guidelines provides a definition of rare, endangered, or threatened species that are not included in any listing. Species recognized under these terms are collectively referred to as “special status species.”

Special Status Species in Suisun Bay

Suisun Bay and its marshes provide essential habitat for the federally threatened delta smelt (*Hypomesus transpacificus*) and Sacramento splittail (*Pogonichthys macrolepidotus*). Other species that occur in the area include the federally endangered winter-run chinook salmon (*Oncorhynchus tshawytscha*), the federally threatened steelhead trout (*Oncorhynchus mykiss*), and the following federal species of special concern: green sturgeon (*Acipenser medirostris*), river lamprey (*Lampetra ayersi*), Pacific lamprey (*Lampetra tridentata*), and longfin smelt (*Spirinchus thaleichthys*).

Special Status Terrestrial Species in the Project Vicinity

ESA compiled a list of special status plant and animal species potentially occurring in the general project vicinity based on information from the USFWS, CDFG's California Natural Diversity Data Base (CNDDB 2001), the California Native Plant Society's (CNPS 2001) Electronic Inventory of Rare and Endangered Vascular Plants, and the Audubon Society's watchlist (Muehter 1998). Evaluations of habitat suitability for special status species were based on field observations and previous environmental documents (Woodward-Clyde, 1993). Previous surveys conducted for the refinery in 1988 and 1991 (Woodward-Clyde 1993) did not identify threatened or endangered species or habitats. Since that time, the status of several species has changed, most notably the California red-legged frog (listed as federally threatened in 1996 [61 FR 25813]). Table 4.3-1 lists all the terrestrial plants and animals considered in this evaluation. From this list, seven terrestrial species were considered as possibly subject to impact, if they are present during construction: California red-legged frog, curved-foot hygrotus diving beetle, California tiger salamander, western pond turtle, tricolored blackbird; Suisun song sparrow, and salt marsh wandering shrew.

4.3.2.3 REGULATORY SETTING

This section briefly describes federal, state and local regulations, permits, and policies pertaining to biological resources and wetlands as they apply to the proposed project.

Biological Resources

Federal Endangered Species Act

The USFWS (jurisdiction over plants, wildlife, and resident fish) and National Marine Fisheries Service (NMFS; jurisdiction over anadromous fish and marine fish and mammals) oversee the federal ESA. Section 7 of the Act mandates that all federal agencies consult with the USFWS and NMFS to ensure that federal agencies actions do not jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat for listed species. The federal agency is required to consult with the USFWS and NMFS if it determines a "may effect" situation will occur in association with the proposed project. The federal ESA prohibits the "take[1]" of any fish or wildlife species listed as Threatened or Endangered, including the destruction of habitat that could hinder species recovery.

1 Take is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct.

TABLE 4.3-1
FOCUSED LIST OF SPECIAL STATUS SPECIES WITH POTENTIAL TO OCCUR IN OR NEAR THE VALERO REFINERY

Common Name *Scientific Name*	**Listing Status[1] USFWS/ CDFG/CNPS**	**General Habitat**	**Potential to Occur**
Federal or State Threatened and Endangered Species			
Amphibians			
California red-legged frog *Rana aurora draytonii*	FT/CSC	Breeds in stock ponds, pools, and slow moving streams with emergent vegetation; adjacent upland habitats are often used outside the breeding season.	**Moderate. Potential habitat exists on-site (Tank Farm Ponds).**
Birds			
California black rail *Laterallus jamaicensis coturniculus*	FSC/CT	Nests and forages in tidal emergent wetland with pickleweed.	**Absent. Nearest occupied/suitable habitat at near Lake Herman Rd and Hwy 680.**
California clapper rail *Rallus longirostris obsoletus*	FE/CE	Nests and forages in emergent wetlands with pickleweed, cordgrass, and bulrush.	**Absent. No suitable habitat.**
Mammals			
Salt marsh harvest mouse *Reithrodontomys raviventris raviventris*	FE/CE	Saline emergent marshlands with dense pickleweed.	**Absent. Nearest suitable/ occupied habitat at Goodyear Slough.**
Plants			
Soft bird's beak *Cordylanthus mollis* ssp. *mollis*	FE/CR/List 1B	Soft-haired bird's beak is found in heavy clay soils of either coastal salt or brackish marshes of northern San Francisco Bay.	**Absent. Nearest occurrence Southampton Marsh. Habitat not present in refinery**.
Other Species Of Concern			
Invertebrates			
Curved-foot hygrotus diving beetle *Hygrotus curvipes*	FSC/--	Found in a variety of aquatic habitats, including vernal pools, stock ponds, and ditches, often in alkaline conditions.	**Moderate. Suitable habitat exists at Tank Farm Ponds.**
San Francisco lacewing *Nothochrysa californica*	FSC/--	Grasslands and a variety of habitats.	**Absent. Suitable habitat does not occur at or near the refinery**.
Amphibians			
California tiger salamander *Ambystoma californiense*	FC/CSC	Wintering sites occur in grasslands occupied by burrowing mammals; breed in ponds, vernal pools, and slow-moving or receding streams.	**Moderate. Suitable habitat exists at Tank Farm Ponds.**

See notes at end of table for explanation of status codes.

TABLE 4.3-1 (Continued)
FOCUSED LIST OF SPECIAL STATUS SPECIES WITH POTENTIAL TO OCCUR IN OR NEAR THE VALERO REFINERY

Common Name *Scientific Name*	Listing Status[1] USFWS/ CDFG/CNPS	General Habitat	Potential to Occur
Other Species Of Concern (cont.)			
Reptiles			
Western pond turtle *Clemmys marmorata*	FSC/CSC	Freshwater ponds and slow streams edged with sandy soils for laying eggs.	**Moderate. Suitable habitat exists at Tank Farm Ponds.**
Birds			
Tricolored blackbird *Agelaius tricolor*	FSC/CSC	Nests in freshwater marshes with dense stands of cattails or bulrushes, occasionally in willows, thistles, mustard, blackberry brambles, and dense shrubs and grains.	**Moderate. Nesting habitat available is available at Tank Farm ponds. Colony at Lake Herman.**
Short eared owl *Asio flammeus*	FSC/--	Nests and forages in grasslands and marshes. Nests in on dry ground in depression concealed by vegetation.	**Absent. Suitable habitat does not occur at or near the refinery.**
Burrowing owl *Athene cunicularia*	FSC/CSC	Nests and forages in low-growing grasslands that support burrowing mammals.	**Absent. Suitable habitat does not occur at or near the refinery.**
Northern harrier (nesting) *Circus cyaneus*	--/CSC	Nests in coastal freshwater and saltwater marshes, nest and forages in grasslands.	**Absent. Suitable habitat does not occur at or near the refinery.**
White-tailed kite (nesting) *Elanus leucurus*	DFG fully protected—CA Fish & Game Code, Section 3511	Nests near wet meadows and open grasslands dense oak, willow or other large tree stands.	**Absent. Suitable habitat does not occur at or near the refinery.**
California horned lark *Eremophila alpestris*	--/CSC	Nests and forages in barren dirt areas, shores, and gravel areas.	**Absent. Suitable habitat does not occur at or near the refinery.**
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	FSC/CSC	Breeds in moist saltmarsh habitats with dense, low cover.	**Absent. Suitable habitat does not occur at or near the refinery**.
Loggerhead shrike *Lanius ludovicianus*	FSC/CSC	Scrub, open woodlands, and grasslands.	**Absent. Suitable habitat does not occur at or near the refinery**.
Suisun Song Sparrow *Melospiza melodia maxillaris*	FSC/CSC	Endemic to Suisun Bay. Inhabits brackish marshes, perching and nesting in stands of bulrush along tidal channels, distribution ditches and permanent ponds where brackish conditions exist and foraging in bulrush and on exposed tidal mudflats.	**Moderate. Habitat (fragmented) along Sulphur Springs Creek. Recorded at Southampton Marsh and Goodyear Slough.**

See notes at end of table for explanation of status codes.

TABLE 4.3-1 (Continued)
FOCUSED LIST OF SPECIAL STATUS SPECIES WITH POTENTIAL TO OCCUR IN OR NEAR THE VALERO REFINERY

Common Name *Scientific Name*	Listing Status USFWS/ CDFG/CNPS	General Habitat	Potential to Occur
Other Species Of Concern (cont.)			
Mammals			
Salt marsh wandering shrew *Sorex vagrans halicoetes*	FSC/CSC	Salt marsh habitat 6-8 feet above sea level, with abundant pickleweed and driftwood.	**Moderate. Suitable habitat exists adjacent to the refinery. Nearest CNDDB location is San Pablo Creek Marsh**.
Plants			
Congdon's tarplant *Hemizonia parryi* ssp. *congdonii*	FSC/--/List 1B	Valley and foothill grassland (alkaline soils)	**Absent. Habitat does not occur; nearest observation NW of Benicia.**
Suisun marsh aster *Aster lentus*	FSC/--/List 1B	Occurs along levees of rivers and sloughs in Suisun and Napa marshes and around Delta islands.	**Absent. Habitat does not occur; nearest observation at mouth of Goodyear Slough**
Carquinez goldenbush *Isocoma arguta*	FSC/--/List 1B	Found along the Carquinez Straits in Solano and Contra Costa counties in alkaline soils, flats, and on lower hills.	**Absent. Suitable habitat does not occur at or near the refinery**.
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	FSC/--/List 1B	Natural edges of estuarine marshes, sloughs, and rivers in the Sacramento – San Joaquin Delta.	**Absent. Suitable habitat does not occur at or near the refinery**.
Mason's lilaeopsis *Lilaeopsis masonii*	FSC/CR/List 1B	Brackish and freshwater marshes.	**Absent. Suitable habitat does not occur at or near the refinery**.

Status Codes:

FEDERAL: (U.S. Fish and Wildlife Service)
FE = Listed as Endangered (in danger of extinction) by the Federal Government.
FT = Listed as Threatened (likely to become Endangered within the foreseeable future) by the Federal Government.
FSC = Federal Species of Concern. May be Endangered or Threatened, but not enough biological information has been gathered to support listing at this time.

STATE: (California Department of Fish and Game)
CE/CT = Listed as Endangered/Threatened by the State of California
CSC = California Species of Special Concern
CR = California Rare Plant Species

CALIFORNIA NATIVE PLANT SOCIETY (CNPS)
List 1B: Plants rare, threatened, or endangered in California and elsewhere

SOURCES: USFWS; CNDDB, 2001; CNPS 2001.

Under Section 9 of the federal ESA, the take prohibition applies only to wildlife and fish species. However, Section 9 does prohibit the removal, possession, damage or destruction of any Endangered plant from federal land. Section 9 also prohibits acts to remove, cut, dig up, damage, or destroy an Endangered plant species in nonfederal areas in knowing violation of any state law or in the course of criminal trespass. Candidate species and species that are proposed or under petition for listing receive no protection under Section 9 of the federal ESA.

Section 10 of the federal ESA requires the issuance of an “incidental take” permit before any public or private action may be taken that would potentially harm, harass, injure, kill, capture, collect, or otherwise hurt (i.e., take) any individual of an Endangered or Threatened species. The permit requires preparation and implementation of a habitat conservation plan that would offset the take of individuals that may occur, incidental to implementation of the project by providing for the overall preservation of the affected species through specific mitigation measures.

Construction and operation of the project does not fall under the jurisdiction of the federal ESA, as no “incidental take” is expected to occur.

Federal Migratory Bird Treaty Act

The Migratory Bird Treaty Act states that without a permit issued by the U.S. Department of the Interior, it is unlawful to pursue, hunt, take, capture, or kill any migratory bird.

California Endangered Species Act

California implemented its own Endangered Species Act in 1984. The state act prohibits the take of Endangered and Threatened species; however, habitat destruction is not included in the state’s definition of take. Section 2090 of CESA requires state agencies to comply with endangered species protection and recovery and to promote conservation of these species. The CDFG administers the act and authorizes take through Section 2081 agreements (except for designated “fully protected species”).

Regarding rare plant species, CESA defers to the California Native Plant Protection Act of 1977, which prohibits importing of rare and endangered plants into California, taking of rare and endangered plants, and selling of rare and endangered plants. State-listed plants are protected mainly in cases where state agencies are involved in projects under CEQA. In this case, plants listed as rare under the California Native Plant Protection Act are not protected under CESA but can be protected under CEQA.

Construction and operation of the project does not fall under the jurisdiction of the CESA, as no “take” for state listed plant or animal species is expected to occur.

California Fish and Game Code

Avian species and their nests are protected under Fish and Game Codes 3503, 3503.5, and 3511.

Construction and operation of the project does not fall under the jurisdiction of these codes, if the project actions are mitigated as described below.

Wetlands

U.S. Army Corps of Engineers and U.S. Environmental Protection Agency Regulation of Waters of the United States, Including Wetlands

The Corps and EPA regulate the discharge of dredged or fill material into waters of the United States, including wetlands, under Section 404 of the Clean Water Act. Projects that would result in the placement of dredged or fill material into waters of the United States require a Section 404 permit from the Corps. Some classes of fill activities may be authorized under general permits if specific conditions are met.

Construction and operation of the project does not fall under the jurisdiction of the Clean Water Act, as no fill of jurisdictional wetlands is expected to occur.

Regional Water Quality Control Board

The federal Clean Water Act requires that the discharge of dredged or fill material into waters of the United States does not violate state water quality standards. Applicants for Section 404 or Section 10 permits must obtain a certification from the state.

Pursuant to the Porter-Cologne Act, each of California's nine regional boards must prepare and periodically update basin plans that set forth water quality standards for surface and groundwater, as well as actions to control nonpoint and point sources of pollution to achieve and maintain these standards. Basin plans offer an opportunity to achieve wetlands protection based on water quality standards. For more information about the water quality regulations and permits that affect the project, see Section 4.9, *Hydrology and Water Quality*.

California Department of Fish and Game Streambed Alteration Agreement

The CDFG regulates activities that would interfere with the natural flow of, or substantially alter, the channel, bed, or bank of a lake, river, or stream. These activities are regulated under the California Fish and Game Code (Section 1601 for public agencies and Section 1603 for private individuals). Requirements to protect the integrity of biological resources and water quality are often conditions of streambed alteration agreements. Requirements may include avoidance or minimization of the use of heavy equipment, limitations on work periods to avoid impacts on wildlife and fisheries resources, and measures to restore degraded sites or compensate for permanent habitat losses.

Construction is not proposed in areas that are subject to Section 1603, as all streams will be avoided by project design.

Other Relevant Plans, Policies and Regulatory Authorities

City of Benicia General Plan Policies

The General Plan, adopted in 1999, includes specific policies to preserve and enhance existing development and to provide for orderly and appropriate new development of the City of Benicia until approximately the year 2020.

Specifically, the Open Space and Conservation of Resources provisions of the General Plan include:

Goal 3.19: Preserve and enhance habitat for special-status plants and animals.

Policy 3.19.1: Protect essential habitat of special-status plants and animal species.

Goal 3.20: Protect and enhance native vegetation and habitats.

Policy 3.20.1: Protect native grasslands, oak woodlands and riparian habitats.

Policy 3.20.2: Restore native vegetation, such as birch grasses and oaks, whenever possible for open spaces of existing developed areas.

The VIP is consistent with the above referenced General Plan policies.

Bay Conservation and Development Commission

The San Francisco Bay Conservation and Development Commission (BCDC) is a state agency with permit authority over the Bay and its shoreline. Their relevant provisions and regulatory authorities are described in Section 4.10, *Land Use*.

Suisun Marsh Protection Plan (SMPP)

The Suisun Marsh Protection Plan (BCDC 1976) regulates the construction of new facilities in protected zones by permitting facility construction, and requires that the disposal of wastewater from the existing outfall follow the permit conditions from water quality oversight agencies. The Suisun March Local Protection Program is the local implementation of the Suisun March Protection Plan. The VIP is located outside the Marsh Protection Area identified in the Suisun Marsh Local Protection Program. While the elements of the proposed VIP are located outside the Marsh Protection Area identified in the Suisun Marsh Local Protection Program, discharge from Valero Refinery's Outfall 001 occurs within the Marsh Protection Area (1,100 feet into Suisun Bay). However, no structural changes to Outfall 001 are proposed as part of the VIP. See further discussion of this topic under Impact 4.3-3 and Section 4.10.2.2, *Project Site Location*.

Baylands Ecosystem Habitat Goals Project

The Goals Project[2] was undertaken in June 1995 to establish a long-term vision for a healthy and sustainable baylands ecosystem. The final report, published in 1999 (Goals Project 1999) enumerated a series of recommendations for habitat protection and restoration. Specifically, for the Suisun Marsh West subregion, it states:

- Restore large areas of tidal marsh in the Hill Slough and Upper Suisun Slough area, and at Morrow Island south of the confluence of Goodyear Slough and Suisun Slough.

[2] The Goals Project was recommended by the Governor's "California Wetlands Conservation Policy" and by the Comprehensive Conservation and Management Plan (CCMP) of the U.S. Environmental Protection Agency's San Francisco Estuary Project. It is also supported by most of the agencies and non-governmental groups with major planning, operational, or regulatory interests in Bay Area wetlands.

- Provide natural transitions to adjacent uplands, with protective buffers wherever possible.
- Enhance managed marsh areas that are not restored to tidal marsh to improve waterfowl habitat.
- Protect and restore tidal marsh at Southampton Bay.

These recommendations are not binding but are also consistent with the General Plan policies referenced above. Because wetlands on site are isolated and of low quality, the project would not conflict with Baylands Ecosystems goals.

CALFED Ecosystem Recovery Goals: The CALFED program of state and federal cooperation in water use was formalized in June 1994 with the signing of a Framework Agreement by the state and federal agencies with management and regulatory responsibility in the Bay-Delta Estuary. The Framework Agreement pledged that the state and federal agencies would work together in water quality standards formulation, coordination of State Water Project and Central Valley Project operations, and long-term solutions to problems in the Bay-Delta Estuary.

The CALFED program has established several ecosystem restoration goals applicable to the Suisun Marsh area:

- Recover 19 at-risk native species and contribute to the recovery of 25 additional species.
- Rehabilitate natural processes related to hydrology, stream channels, sediment, floodplains and ecosystem water quality.
- Maintain and enhance fish populations critical to commercial, sport and recreational fisheries.
- Protect and restore functional habitats, including aquatic, upland and riparian, to allow species to thrive.
- Reduce the negative impacts of invasive species and prevent additional introductions that compete with and destroy native species.
- Improve and maintain water and sediment quality to better support ecosystem health and allow species to flourish.

The project is not inconsistent with any of the CALFED goals, assuming no degradation of water quality. See discussion under Impact 4.3-3.

4.3.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

Conclusions regarding the significance of impacts on vegetation and wildlife resources are based on criteria in the California Environmental Quality Act (CEQA). See the Regulatory Setting, above, for additional discussion of the regulatory controls regarding this project.

Under CEQA, a project would be considered to have a significant effect on the environment if it would:

- Interfere substantially with the movement of any resident or migratory fish or wildlife species;
- Substantially diminish habitat for fish, wildlife or plants; or
- Substantially affect a rare or endangered species of animal or plant or the habitat of the species.

CEQA Section 15380 further provides that a plant or animal species may be treated as "rare or endangered" even if not on one of the official lists if, for example, it is likely to become endangered in the foreseeable future.

4.3.4 IMPACTS AND MITIGATION MEASURES

4.3.4.1 IMPACTS EVALUATED AND ELIMINATED FROM CONSIDERATION

The Tank Farm retention ponds are engineered wetlands and have been continuously maintained; they do not fall under the jurisdiction of either the Corps or CDFG. The drainages (Sulphur Springs and Beaver Creeks), even where they have been channelized, are CDFG regulated in their entirety and portions may fall under Corps jurisdiction as well. However, none of these waters would be adversely affected by the project.

Table 4.3-1 described the following species as having a moderate potential to occur: curved-foot hygrotus diving beetle, California tiger salamander, and salt marsh wandering shrew. Based on the absence of other constituent habitat elements (uplands, dense emergent aquatic or vernal pool vegetation) and the severely fragmented vegetation at and near the retention ponds and coastal portions of the refinery, they are considered absent from the project area of impact.

4.3.4.2 PROJECT IMPACTS

Impact 4.3-1: Potential disturbance of western pond turtle and California red-legged frog could occur during construction at the Tank Farm retention pond site. This impact would be made less than significant by Mitigation Measure 4.3-1.

Marginal to moderate habitat is present in the Tank Farms ponds for both of these species. Although their presence is conjectural at this time, both species are somewhat mobile and may be present immediately before operations begin.

Mitigation Measure 4.3-1: Unless protocol surveys during the period November 15 through May 15 establish that the retention ponds are not occupied by either species, the modification of any Tank Farm retention pond should be preceded by a period of at least six months during which the pond is drained and minimal water allowed to collect in the basin.

A gradual drying of the ponds over a period of approximately two weeks will allow resident animals to depart under conditions not dissimilar from natural ephemeral water bodies. If such pond drying is not possible, the project should adhere to the following mitigation protocols:

- At least 45 days prior to working at the site, Valero should notify City and a City-designated biologist to ensure that no work occurs without appropriate pre-construction surveys 48 hours before work begins. Notification should be in writing and clearly define proposed construction schedule such that pre-construction surveys can be completed.
- The City-designated biologist should be present at all times during construction of the ponds, and as required during construction near non-sensitive areas, as an on-site monitor to detect frogs or pond turtles which may enter the area of disturbance.
- If a California red-legged frog is identified in the project construction zone during pre-construction surveys or construction, no work in the immediate area can begin (or ongoing construction should be halted) until the USFWS Sacramento Field Office is contacted and concurs that the project will not result in harm or harassment to the species. Western pond turtles may be relocated to suitable habitat by the City-designated biologist.

Significance after Mitigation: Less than Significant.

Impact 4.3-2: Potential disturbance of special status and protected native birds (e.g., tricolored blackbird and Suisun song sparrow) during the breeding season could occur at the Tank Farm retention ponds. This impact would be made less than significant by Mitigation Measure 4.3-2.

Mitigation Measure 4.3-2: Construction at the Tank Farm would be limited to the non-breeding season for most birds, *i.e.*, all work would occur September through February.

Limiting construction to the non-reproductive season for most birds would eliminate the need to implement any other mitigation measure, or to conduct monitoring related to this measure. Alternatively, if construction must occur during the breeding season, all vegetation that could be used for nesting would be removed during the September through February period preceding construction.

Significance after Mitigation: Less than Significant.

Impact 4.3-3: Potential impacts to special status fisheries could occur with additional water discharges into Suisun Bay or from increased ship traffic associated with increased refinery capacity. The Suisun Marsh Protection Plan (BCDC 1976) requires that the disposal of wastewater from any existing outfall follow the permit conditions from water quality oversight agencies. Therefore, by continued compliance with the discharge requirements of the refinery's NPDES permit this impact is less than significant.

The proposed additional crude oil throughput, the additional wastewater associated with new and modified process units, and sediment disturbances or ballast water losses from additional shipping in the vicinity, could increase the mass of contaminants in receiving waters. Increases in many contaminants may directly affect sensitive life stages of aquatic organisms or bioaccumulate and affect higher life forms. An increase in contaminants at the project vicinity could adversely affect special status fishes as noted above that live near, migrate through or feed on organisms living in the project vicinity.

The special status fishes noted above would have varying susceptibilities to the contaminants potentially increased from the project. Different species, and different life stages would have varying sensitivity to increased contaminants in Suisun Bay because of their use of the area (e.g., spawning or foraging, compared to migration). Generally, the more immature forms, or reproductive processes of adults, are more easily impacted by the kinds of contaminants that are potentially increased from the VIP. Fish eggs and larvae are particularly susceptible to toxins such as heavy metals, organic hydrocarbons, dioxin, and PCBs. Immature forms are also more likely to feed exclusively on organisms exposed predominantly to such contaminants. As such, special status fishes that are found in the project area for longer periods of time, or exclusively are found in the estuary, such as Delta smelt which spend their entire life cycle in Suisun Bay, would be more susceptible to effects than migratory forms such as salmon and steelhead which occur in the Estuary only briefly during limited migratory periods (see for example Hardy, et al., 1987; Post, 1987). Increases of contaminants into the Suisun Bay from the project would potentially adversely affect sensitive aquatic organisms. Impacts to susceptible special status species – i.e., Delta smelt, longfin smelt, and splittail – could be, following this line of reasoning, considered potentially significant.

The Suisun-San Francisco Bay Estuary receives similar, and a variety of other kinds of, contaminants from a wide variety of sources not limited to industry such as the Valero refinery. Water Quality regulators and fisheries agencies of the area maintain progressive investigations and analysis of these contaminants and their effects on Estuary ecology. The Regional Water Quality Control Board (RWQCB) has indicated that the Suisun Bay area already has elevated levels of many of the contaminants identified as potentially increased by this project. The assimilative capacity of the Estuary is that amount of contamination that can be processed, diluted, or removed without causing adverse affects on water quality. As such, it can be presumed that any increases in contaminants from the Project that would exceed the assimilative capacity of the Estuary would significantly affect sensitive special status species as noted above. Conversely, as long as increases in contaminants are determined to not exceed this capacity, the increases would not cause adverse effects on aquatic organisms, including sensitive special status fishes as noted above.

The current NPDES permit includes limitations on effluent constituents as stated above: “No toxic or other deleterious substances to be present in concentrations or quantities which will cause deleterious effects on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentrations.” Therefore, as long as the additional effluent, as proposed, does not violate this standard, this impact is considered to be less than significant.

However, is described in Section 4.9, *Hydrology and Water Quality*, “the assimilative capacity of the Estuary for additional contaminants that might occur from this action is uncertain.” Because of this uncertainty, the possibility persists that the increases in contaminants from the Project could adversely affect special status fishes. In consideration of this uncertainty and potentially significant impact to special status fishes and the Estuary ecology in general, the NPDES permit for the Valero effluent requires toxicity bioassays for the discharges into the Estuary. The bioassays, using sticklebacks and fathead minnows, routinely determine the level of harm to these specimens representative of the fishes in the Estuary. As long as the effluent does not cause death in the experimental populations above a specified level, the effluent is in compliance and is determined unlikely to significantly impact representative organisms in the aquatic environment. If these conditions continue to be met, the levels of contaminants resulting from the project should not have a significant effect on the more susceptible special status fishes as noted above. Furthermore, as stated in the Bay Conservation and Development Commission's (BCDC) Suisun Marsh Protection Plan (BCDC 1976), "The present level of wastewater discharge to the Suisun Marsh does not appear to have seriously affected the ability of the Marsh to support desired fish and wildlife species," such a statement supports reliance on permit provisions. As the BCDC Plan is 25 years old, and to fully inform the City of the status of outfall water quality, Valero should provide a copy of each report of periodic bioassay and other toxicity testing for contaminates as required in Valero's NPDES permit.

Mitigation: None required.

4.3.5 CUMULATIVE IMPACTS

Impact 4.3-4: Potential impacts to special status fisheries could occur with additional water discharges from other non-refinery industrial projects, together with cumulative refinery projects. By continued compliance with the discharge requirements of the refinery's NPDES permit this impact is less than significant.

The additional wastewater associated with other non-refinery projects, especially industrial development, together with refinery discharges, could increase the mass of pollutants in receiving waters. Those increased levels of pollutants may directly affect sensitive life stages or bioaccumulate and affect higher life forms, such as special status fishes that live near or would feed on organisms living in the vicinity. This impact is considered to be potentially significant.

Although potential increases in pollutants from the cumulative projects could occur, compliance with the discharge requirements of the refinery's NPDES permit could reduce these potential impacts to less than significant. As discussed in Impacts 4.3-3 and 4.3-4, above, the NPDES permitting process provides discharge standards that, when followed, limit this impact to less than significant.

Mitigation: None required.

REFERENCES – Biological Resources

Bay Conservation and Development Commission (BCDC). Suisun Marsh Protection Plan December 1976.

Goals Project, 1999. Baylands Ecosystem Habitat Goals. A report of habitat recommendations prepared by the San Francisco bay Area Wetlands Ecosystem Goals Project. U.S. Environmental Protection Agency; San Francisco, CA/ San Francisco Bay Regional Water Quality Control Board, Oakland, CA.

Hardy, J. T., et al. 1987. "The Sea-surface Microlayer of Puget Sound: Part I. Toxic Effects of Fish Eggs and Larvae." Marine Environmental Research Vol. 23

Harvey, H.T. *Some Ecological Aspects of San Francisco Bay*. Prepared for The San Francisco Bay Conservation and Development Commission. October 1966.

Post, G. 1987. Textbook of Fish Health. TFH publications. Chapter XI: Diseases caused by toxic substances and organic wastes.

URS. *Benicia Valero MTBE Removal Project EIR.* 2002.

Woodward-Clyde Consultants. *Exxon Benicia Refinery Clean Fuels Project*. Prepared for City of Benicia. September 1993.

4.4 CULTURAL RESOURCES

Although the previously conducted surveys revealed no new cultural resources and, consequently, no impacts of the VIP were identified, the potential for impacts does exist.

- ***Construction could disturb currently unknown or unidentified cultural resources. This potentially significant impact would be reduced to less than significant by standard mitigation measures and legal requirements.***

There are no cumulative impacts as a result of the other non-refinery projects.

4.4.1 INTRODUCTION

This section includes a general discussion of the archaeological and culturally sensitive areas within the project area consistent with the protection of potential cultural resources. The regulatory setting is described and then any impacts associated with the VIP and mitigation for these impacts.

4.4.2 ENVIRONMENTAL SETTING

The Valero Benicia Refinery is located in the City of Benicia, which is situated on the northern bank of the Carquinez Straits. The straits represent the entry point for the Sacramento and San Joaquin Rivers into the San Francisco Bay. This locality lies within the San Francisco Bay and the west end of the Central Valley archaeological regions, both of which contain a rich array of prehistoric and historical cultural resources. More specifically, the areas surrounding the Carquinez Strait and Suisun Bay have been occupied for millennia given its abundant combination of littoral and oak woodland resources.

4.4.1.1 PREHISTORIC SETTING

The natural marshland biotic communities along the edges of bays and channels were the principal source for subsistence and other activities during the prehistory of the San Francisco Bay region. Many of the original surveys of archaeological sites in the Bay region were conducted between 1906 and 1908 by N.C. Nelson, which yielded the initial documentation of nearly 425 “earth mounds and shell heaps” along the littoral zone of the Bay (Nelson 1907). From these beginnings, the most notable sites in the Bay region were excavated scientifically, like the Emeryville shellmound (Ala-309), the Ellis Landing Site (Cco-295) in Richmond, and the Fernandez Site (CC0-259) in Rodeo Valley (Morrato 1984). These dense midden sites, such as Ala-309, have been carbon 14 dated to be 2310 ± 220 years old, but other evidence from around the Bay suggests that human occupation in the region is of greater antiquity, or ±5000 B.C. (Davis & Treganza 1959). Many of the earliest sites suggested less emphasis on shellfish than the later middens, but were rather focused on hunting and vegetal food processing.

Of these early midden sites, Sol-236, or the Glen Cove site, is located approximately 6 miles west of Benicia. The attributes of Sol-236 were similar to the Emeryville shellmound, both containing burial interments as well as the abundant molluscan and charcoal ash remains.

As of 2000 B.C., however, the bayshore and marsh-adapted peoples began appearing in the archaeological record. The so-called Berkeley Pattern (2000 B.C. to A.D. 300) reflected a change in socioeconomic complexity and settlement patterns (Fredrickson 1973). This artifact pattern was represented by minimally-shaped cobble mortar and cobble pestle, dart and atlatl, and bone industry. Given the size of these settlements, it is probable that the populations were denser and more sedentary, yet continued to exploit a diverse resource base—from woodland to grassland and marshland, to bayshore resources throughout the San Francisco Bay Area (Bickel 1978; King 1974). Many of the Berkeley traits diffused throughout the region and spread to the interior areas of central California during this time period.

4.4.1.2 ETHNOGRAPHIC SETTING

Much of the artifactual remains attributed to the Berkeley Pattern have been linked to the ancestral Plains or Bay Miwok, a culture that began to spread from the Bay region to the interior of central California, especially the lower Sacramento Valley. It has been posited that the proto-Miwok territory likely occupied the area north of Suisun Bay during this period; however, this area was later relinquished to the Patwin (Bennyhoff 1977 as cited in Morratto 1984: 210). Consequently, the Patwin territory subsumed both sides of the Sacramento River below Stony Creek and from Clear Lake on the west to just above the mouth of the Feather River to the east and extended southward to Suisun Bay, from the Napa River on the west to the edge of the Montezuma Hills (Johnson 1978). The Patwin political organization reflected a tribelet system, with a primary settlement and several satellite villages, each of which had a chief who directed village activities. Economically, the Patwin were hunter-gatherers who exploited the varied microenvironments found within their territory for subsistence. The littoral resources available were heavily utilized, as well as fresh water fish and fowl; acorns were also of vital importance, especially in the inland areas. The Patwin were deft artisans of basketry, which were important for all aspects of food collection, preparation, serving, and storage (Johnson 1978).

4.4.1.3 HISTORIC SETTING

With the construction of Mission Sonoma in 1823, much of the southwestern Patwin were slowly missionized. This precipitated the Euro-American assimilation of the Patwin as well as many of the other tribes that surrounded the Bay Area and Central Valley. The area surrounding Benicia became a portion of Mariano G. Vallejo’s military territory by 1847 with the purchase of Rancho Suscol from the Spanish government in 1844, which included control of the Mission Sonoma. The federal government acquired the Benicia Arsenal between 1847 and 1849, and the Arsenal was in use up to its deactivation in 1963. As a consequence of the Gold Rush period, the population increased in the Sacramento Valley and the region surrounding Suisun Bay and Napa Valley. By 1850, Benicia became a vital metropolis for Northern California that rivaled San Francisco in terms of religious, military, and educational diversity and centrality.

4.4.4.3 METHODOLOGY AND RESULTS

Records Search

A records search of all pertinent survey and site data was conducted at the Northwest Information Center at Sonoma State University on July 31, 2002. The records were accessed by utilizing the Benicia USGS 7.5-minute quadrangle map, Sections 25 and 30, Township 2N, Range 3W and 2W. The review included the refinery site along with a ½ mile buffer that constituted the Area of Potential Effect (APE). Previous surveys and studies and archaeological site records were accessed as they pertained to the APE. Records were also accessed and reviewed in the *Directory of Properties in the Historic Property Data File for Solano County* for information on sites of recognized historical significance. Properties listed in the *National Register of Historic Places*, the *California Register of Historic Resources*, the *California Inventory of Historic Resources* (1976), the *California Historical Landmarks* (1996), and the *California Points of Historical Interest* (1992) were searched from within the APE.

Inventory and Survey Results

A pedestrian survey of the refinery was conducted by URS archaeologists in 2001 (URS 2001). According to this report, the extent of soil disturbance due to grading and contouring impaired the archaeological value and visibility of any extant cultural resources on the site. The survey revealed no prehistoric archaeological resources within the boundaries of the refinery. Given the recency and adequate archaeological rigor of these previous cultural resource surveys and reports, no additional survey work was conducted for the purposes of this EIR.

However, one potential historic resource was identified on site that was designated as P-48-000516, or the Benicia Arsenal Igloo Bunker #C-425 (Dexter 2001). According to Dexter (2001), this building was one of thirty-nine of the “large-sized igloos” built between 1942 and 1943.

A records research report for the Benicia Arsenal recently published by the U.S. Army Corps of Engineers that provides historical context for the use of the complex of Igloo Bunkers (Jacobs Engineering 1999):

> Following the Japanese attack on Pearl Harbor, the Arsenal was assigned the mission of ordnance storage for the Pacific Theater Operations. Ordnance storage remained a major component of the Arsenal’s mission until the late 1940’s, when this assignment was transferred to Sierra Ordnance Depot in Herlong, California. Military structures within Area S include a network of ammunition storage igloos built in 1942-1943. During the 1940’s, the igloos were used largely for storage of artillery projectiles and aerial bombs. Following the change in the late 1940’s of the Arsenal’s mission, the storage igloos in Area S were used for general storage. Available records indicated that the igloos were also used for storage of guided missiles and some radioactive materials in the 1950s and 1960s.

The bunker is located on the south side of Avenue F within the restricted access portion of the refinery property. According to the Dexter (2001) report, the historic setting of the bunker has been irrevocably altered when the refinery was constructed around it in 1969. Further, the report maintains that this resource does not appear to be significant, either individually or as a contributor to any historic district, under any of the National Register of Historic Places (NRHP) or the California Register of Historic Resources (CRHR) criteria; therefore, it was recommended that the bunker be determined ineligible for listing in the NRHP or CRHR. The bunker itself bears no relationship to the larger historical context insofar that it is a part of the Benicia Arsenal (California Historical Landmark No. 176; also listed with the NRHP, NPS-76000534), which is located just outside the refinery APE. However, this bunker may become eligible for the NRHP when other like properties are lost. Nevertheless, the #C-425 Bunker, due to its insufficient historical significance, will not be directly or indirectly impacted by the proposed improvements to the refinery, which are devoted to refining equipment and their associated facilities. The bunker, and others like it, are unrelated to these activities and will therefore not be materially altered.

Native American Consultation

The Native American Heritage Commission was contacted and consulted on August 9, 2002 in order to request a database search for sacred lands or other cultural properties of significance to local Indian peoples. As of the writing of this document, no response has been received. Frequently more specific knowledge of the project site may result from consultation with local Native American individuals and organizations, and a list of contacts is typically returned after a database search is completed. If additional ethnological information reveals that traditional cultural properties will be adversely affected by the proposed project, methods to address its treatment and measures to mitigate adverse effects to those properties will be implemented.

4.4.3 SIGNIFICANCE CRITERIA

STATE REGULATORY SETTING

Based on section 15064.5 and Appendix G of the *CEQA Guidelines*, a project would have significant adverse impacts to cultural resources if the project would:

- Cause a substantial adverse change in the significance of an historical resource as defined in Section 15064.5;
- Cause a substantial adverse change in the significance of an unique archaeological resource pursuant to Section 15064.5;
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature;
- Disturb any human remains, including those interred outside of formal cemeteries.

Section 15064.5 provides that, in general, a resource not listed on state or local registers of historical resources shall be considered by the Lead Agency to be historically significant if the resource meets the criteria for listing on the California Register of Historical resources. This section also provides standards for determining what constitutes a “substantial adverse change” that must be considered a significant impact on archaeological or historic resources.

According to the CEQA Guidelines (Section 15064.5(a)(3)), generally a resource shall be considered “historically significant” if the resource meets the criteria for listing on the California Register of Historic Resources (Public Resources Code SS5024.1 Title CCR, Section 4852). When a project will impact an archeological site, it needs to be determined whether the site is an historical resource, which is defined as any site which:

(a) Is historically or archeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political or cultural annals of California; and

(b) Meets any of the following criteria:

1. Is associated with events that have made a significant contribution to the broad patterns of California’s history and cultural heritage;

2. Is associated with the lives of persons important in our past;

3. Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

4. Has yielded, or may be likely to yield, information important in prehistory or history.

In addition, a resource included in a local register of historical resources, as defined by section 5020.1(k) of the Public Resources Code or identified as significant in an historical resource survey meeting the requirements of section 5024.l(g) of the Public Resources Code, shall be presumed to be historically or culturally significant.

CEQA also requires lead agencies to consider whether projects will impact “unique archaeological resources.” Public Resources Code section 21083.2, subdivision (g), states that “‘unique archaeological resource’ means an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

2. Has a special and particular quality such as being the oldest of its type or the best available example of its type.

3. Is directly associated with a scientifically recognized important prehistoric or historic event or person.”

Local Regulatory Setting

The City of Benicia has designed goals and policies set forth in the *City of Benicia General Plan* (1999) that supports the recognition and preservation of the City’s historic and archaeological resources within its Community Identity element. Goals and policies relevant to the proposed project include:

Goal 3.1: Maintain and enhance Benicia’s historic character.

> Policy 3.1.4: Promote the preservation and enhancement of historic neighborhoods, commercial areas, and governmental districts.

Goal 3.2: Protect archaeological (including underwater) sites and resources.

> Policy 3.2.1: Ensure the protection and preservation of artifacts in known, and as yet unidentified, areas.

In addition, the City has adopted two cultural resource conservation plans, The Downtown Historic Conservation Plan (1992) and the Arsenal Historic Conservation Plan (1993). In essence, these plans are designed to preserve the historic context represented by properties that qualify as historically significant, either individually or collectively, and form the basis for future decisions relevant to that end. The proposed project would not fall under the jurisdiction of the Downtown Historic Conservation Plan or the Arsenal Historic Conservation Plan. The Downtown historic district follows the commercial center of downtown Benicia, and the Arsenal Historic District is approximately 1.5 miles east of downtown Benicia. The refinery is approximately 2 miles north of both district boundaries. However, with respect to both the General Plan goals and the policies, the proposed project would be consistent with the foregoing goals and policies if the following mitigation measures are invoked and maintained.

4.4.4 IMPACTS AND MITIGATION MEASURES

Impact 4.4-1: Construction of the refinery modifications may cause substantial adverse changes to the significance of currently unknown cultural resources. This impact would be less than significant with application of mitigation measure 4.4-1.

Although the previously conducted surveys revealed no new cultural resources, this does not conclusively demonstrate the nonexistence of subsurface cultural resources on the project site. Traditional foot survey methods are constrained due to variation in the natural landscape, such as grass cover and grazing that can obscure surface evidence. If historical resources, unique archaeological resources, or traditional cultural properties do indeed exist on the project site, grading and other construction related activities could cause significant impacts to the scientific value of those resources.

Mitigation Measure 4.4-1: Pursuant to CEQA Guidelines 15064.5 (f), "provisions for historical or unique archaeological resources accidentally discovered during construction" should be instituted. Therefore, in the event that any prehistoric or historic subsurface cultural resources are discovered during ground disturbing activities, all work within 50 feet of the resources shall be halted and Valero shall consult with a qualified archaeologist or paleontologist to assess the significance of the find. If any find is determined to be significant, representatives of Valero and the qualified archaeologist and/or paleontologist would meet to determine the appropriate avoidance measures or other appropriate mitigation. All significant cultural materials recovered shall be subject to scientific analysis, professional museum curation, and a report prepared by the qualified archaeologist according to current professional standards.

If the discovery includes human remains, CEQA Guidelines 15064.5 (e)(1) shall be followed, which is as follows:

(e) In the event of the accidental discovery or recognition of any human remains in any location other than a dedicated cemetery, the following steps should be taken:

(1) There shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:

(A) The coroner of the county in which the remains are discovered must be contacted to determine that no investigation of the cause of death is required, and

(B) If the coroner determines the remains to be Native American:

1. The coroner shall contact the Native American Heritage Commission within 24 hours.

2. The Native American Heritage Commission shall identify the person or persons it believes to be the most likely descended from the deceased Native American.

3. The most likely descendent may make recommendations to the landowner or the person responsible for the excavation work, for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Public Resources Code Section 5097.98, or

(2) Where the following conditions occur, the landowner or his authorized representative shall rebury the Native American human remains and associated grave goods with appropriate dignity on the property in a location not subject to further subsurface disturbance.

(A) The Native American Heritage Commission is unable to identify a most likely descendent or the most likely descendent failed to make a recommendation within 24 hours after being notified by the commission.

(B) The descendant identified fails to make a recommendation; or

(C) The landowner or his authorized representative rejects the recommendation of the descendant, and the mediation by the Native American Heritage Commission fails to provide measures acceptable to the landowner.

Significance After Mitigation: Less than significant**.**

4.4.5 CUMULATIVE IMPACTS

There are no cumulative cultural resource impacts that result from the VIP and the other projects.

REFERENCES – Cultural Resources

Bickel, P.M. 1978. *Changing sea levels along the California coast: anthropological implications.* Journal of California Archaeology 5(1): 6-20.

City of Benicia. 1999. *City of Benicia General Plan: Into the 21st Century.* Prepared by the Benicia Planning Commission.

City of Benicia 1993. *Arsenal Historic Conservation Plan.* Prepared by Cannon Design Group.

Davis, J.T. & A.E. Treganza 1959. *The Patterson Mound: A Comparative Analysis of the Archaeology of Site Ala-328.* Berkeley: University of California Archaeological Survey Reports 47: 1-92.

Dexter, S.D. 2001. Benicia Arsenal Igloo Bunker #C-425, Primary # P-48-000516. California Department of Parks and Recreation Primary Record Form 523A. On File at the Northwest Information Center, Sonoma State University.

Jacobs Engineering. 1999. *Benicia Arsenal Records Research Report. Volume 1.* Prepared for the U.S. Army Corps of Engineers, Sacramento District, Contract Number DACW05-97-D-0038. Sacramento, CA.

King, T.F. 1974. *The evolution of status ascription around San Francisco Bay. In* ?Antap: California Indian Political and Economic Organization. Eds Bean, L.J. and King, T.F. Bellena Press Anthropological Papers. 2: 35-54.

Fredrickson, D.A. 1973. *Early Cultures of the North Coast Ranges, California.* Ph.D. dissertation. Davis: Department of Anthropology, University of California.

Johnson, P.J. 1978. *Patwin. In* Handbook of the North American Indians, Vol 8., Ed by Heizer, R.F., pp. 350-360. Smithsonian Institution: Washington, D.C.

Morratto, M.J. 1984. *San Francisco Bay and Central Coast Region. In* California Archaeology. Ed. Griffin, J.B., Academic Press, Inc.: San Diego.

Nelson, N.C. 1907. *San Francisco Bay Mounds.* University of California Archaeological Survey Manuscripts: 349.

URS Corporation 2001. *Cultural Resources Technical Report. In* Confidential Appendix E to Application for Certification for the Valero Cogeneration Project, Valero Benicia Refinery, Benicia, California.

4.5 ENERGY

The VIP would not encourage activities that result in the use of large amounts of fuel or energy, nor would the VIP use fuel or energy in a wasteful or inefficient manner. The overall impact of the project on energy resources would be less than significant.

- ***VIP modifications would increase overall electrical energy consumption at the refinery by approximately 23 MW and natural gas consumption by 9.6 million standard cubic feet per day. This increase would be less than significant.***
- ***Other projects at the refinery would add another 7 MW of electricity demand, for a cumulative total increase of 30 MW in use at the refinery. The first unit of a new on-site cogeneration facility will generate 51 MW, sufficient electrical power for the existing refinery operations, but not for the additional 30 MW demand of the refinery's combined planned projects. The net effect of the cumulative refinery projects would be a net 21 MW reduction in electrical demand for more than 91% of the time and a net 30 MW increase for the less than 9% of the time that the cogeneration unit is not operating. These cumulative changes in energy demand would be less than significant.***

4.5.1 INTRODUCTION

Petroleum refining is an energy intensive activity, requiring considerable heat to process crude oil into marketable products. For example, heat is required for refining processes such as fractionalization or distillation, where crude oils and other hydrocarbon streams are essentially boiled, and the vapors separated into various process streams. Hydrocarbon cracking, hydrotreating, and other common processes used at refineries require substantial energy consumption due to the high heat rates necessary for reactions to occur. Other equipment such as compressors and pumps also require significant energy to create the high pressures present in reaction vessels and to transfer the crude, process streams, and products between and within the refinery facilities.

Both energy from combustion of fuels and energy in the form of electricity are used to run the refinery process units that turn crude oil into useful products. Some of the energy needed to run the refinery is obtained by burning some of the gases, termed "fuel gases," produced in the refining process. Most of the electricity and some of the steam for operating the refinery will be provided by the refinery's on-site cogeneration plant that is currently under construction. The balance of the fuel used is natural gas and electricity that are purchased from Pacific Gas and Electric (PG&E).

The Valero Benicia Refinery produces 10% of the gasoline used in California and 25% of the gasoline used in the San Francisco Bay Area. VIP modifications would increase overall energy consumption at the refinery; most of the added energy would be used by the modified equipment to produce higher quality gasoline from now unusable, lower quality feedstocks.

One of the objectives of VIP is to optimize operations for efficient production of clean burning fuels. Process optimization will increase the efficiency of those processes. Energy efficiency is recognized as an important cost-saving measure in petroleum refining. Improved energy efficiency supports statewide energy conservation goals (CEQA, Appendix F) and responds to current energy supply concerns.

4.5.2 SETTING

4.5.2.1 REGIONAL SETTING

The Valero Benicia Refinery is a component of the energy infrastructure in the State of California. The refinery currently processes a limited range of raw materials to produce clean burning gasoline and other fuels for the California market. Approximately 70% of the refinery's product is clean-burning gasoline; other products include diesel, jet fuel, fuel oil, propane and asphalt.

Currently, statewide electrical generation demand is 54,248 MW, and estimated daily natural gas use is 6,548 million scf (CEC 2002).

4.5.2.2 PROJECT SETTING

The refinery currently uses approximately 50 MW of electricity. The first unit of the 102 MW Valero Cogeneration Project approved by the California Energy Commission in October 2001 is scheduled for completion this fall. That approximately 51 MW unit will meet the power demand of existing operations and remove that demand from the grid. It is unknown whether Valero currently plans to construct the second unit. Given that uncertainty, this analysis assumes that the second unit will be built, but at an uncertain future time.

The refinery uses natural gas as the marginal fuel when it is not economical to use refinery gas or propane. In addition, natural gas is typically used as a feedstock for the processes that produce Clean Fuels.

4.5.2.3 REGULATORY SETTING

Federal, state, and local governments recognize the importance of energy conservation and have addressed the issue through legislation. In 1978, the Energy Efficiency Standards for Residential and Nonresidential Buildings were established in response to the state mandate to reduce California's energy demand. Now Title 24 provides the baseline design criteria for energy conservation in California. However, most elements of the proposed modifications are not covered by Title 24, which establishes energy efficiency standards for buildings and appliances. The *Solano County General Plan* and *City of Benicia General Plan* do not have energy policies that apply to the proposed project.

4.5.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

Conclusions regarding the significance of impacts on energy resources are based on CEQA criteria. CEQA requires that EIRs include a discussion of the potential energy impacts of proposed projects, with emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy. Significant effects are identified in CEQA Appendix F as those that:

- Encourage activities that result in the use of large amounts of fuel or energy
- Use fuel or energy in a wasteful or inefficient manner

4.5.4 IMPACTS AND MITIGATION MEASURES

The impacts of the VIP on energy resources consist of the energy and energy-related resources used during construction and operation of the planned modifications, as described in Section 3.4, *Project Components.* Energy demand during construction is incidental and not considered significant. The operational impacts include the additional fuel and electricity needed to power the equipment for the proposed expansion project, additional crude oil and natural gas needed as feedstock for the hydrogenation processes that produce Clean Fuels, and the energy needed to transport additional crude and gas oil and export products, including coke, butane, propane and sulfur.

The proposed modifications would expand the use of oil and natural gas. The project would increase crude oil input at Benicia by up to 25% and would allow lower grade materials to be refined there. The expansion in output, however, is in response to anticipated consumer demand and state regulatory requirements, and the proposed project would not be directly responsible for increasing reliance on petroleum resources. Reducing reliance on petroleum in the transportation sector is largely a matter for federal and state policymaking and cannot be implemented in the context of the proposed action.

Refinery operations typically have substantial economic incentive to avoid wasteful energy consumption. One of the purposes of the proposed refinery modification is to optimize operations for the efficient production of clean burning fuels. In response to the need for greater efficiency, the project would include a more efficient pipestill furnace which, when operating with existing furnaces, will save 40 million Btu/hour.

The VIP would increase the consumption of electricity and natural gas as discussed below:

Impact 4.5-1: Operation of the VIP facilities would increase electricity consumption. This impact is less than significant.

The 23 MW electrical demand of the VIP is an increase of approximately 46% above the existing 50 MW energy requirement of the refinery.

Energy is used to process crude oil, and other low quality feed stocks, into petroleum products, primarily gasoline. Due to the cost of refining, nearly all components of crude oil are captured and converted into a marketable product. Energy demand is a substantial cost of refining that is minimized, to the extent feasible, through the conservation and reuse of heat for various petroleum processing streams. The VIP would not result in the inefficient or wasteful use of energy resources.

Mitigation Measure: None required.

Impact 4.5-2: Operation of the VIP facilities would increase natural gas and other fuels consumption. This impact would be less than significant.

The refinery uses natural gas as the marginal fuel when it is not economical to use refinery gas or propane. In addition, natural gas is typically used as a feedstock for refinery processes that produce Clean Fuels.

More natural gas, propane, and/or refinery fuel gas would be needed to handle the additional combustion and heating requirements of the proposed modifications and additional feedstock needs. An estimated 400 million Btu per hour would be used for the increase in the firing rate of the existing gas turbines, steam boilers and process furnaces. This additional 9.6 million scf per day gas requirement, if entirely natural gas, would be less than 0.2% of the State's estimated daily requirement.

Increased product output is in response to anticipated consumer demand and state regulatory requirements for clean burning fuels. The proposed project would not in itself be responsible for increasing reliance on petroleum resources.

The energy needed for rail and truck transport of the additional crude and gas oil and export coke, butane, propane and sulfur would also be less than significant.

Mitigation Measure: None required.

As a part of the project, the VIP would include a more efficient pipestill furnace which, when operating with existing furnaces, will save 40 million Btu/hour, roughly 10% of the increased gas use of the VIP. In addition, a number of components of the VIP would increase the overall efficiency of various refinery processes, whose end products are themselves fuels.

4.5.5 CUMULATIVE IMPACTS

Impact 4.5-3: Implementation of the VIP along with other projects at the refinery will result in a net reduction in electrical demand during normal operating conditions, when the cogeneration unit is operating, and an increase in demand when the cogeneration unit is not operating. This impact would be less than significant.

Valero estimates that up to an additional 23 MW will be needed for the VIP expansion. Valero also will construct other projects that account for an additional 7 MW in energy demand. The increased electrical energy demand for the combined refinery projects would be 30 MW, an increase of 60% over the existing electrical energy requirement of the refinery.

The California Energy Commission approved a total of 102 MW of on-site cogeneration at the refinery, and one 51 MW cogeneration unit is currently under construction. When that unit goes into service, it will remove the refinery's existing 50 MW load from the grid. With that cogeneration unit operating[1], net electrical energy demand would be approximately 21 MW less than current conditions (a 28% reduction). When that cogeneration unit does not operate, the refinery would require approximately 80 MW to meet the combined energy demand of existing facilities and planned improvements (a 60% increase over existing conditions). Thus, at the refinery substation, the PG&E grid would experience a 21 MW reduction in electrical demand for more than 91% of the time and a net 30 MW increase for less than 9% of the time[2]. This infrequent increase in refinery electrical energy demand would be less than significant.

The cumulative electrical and natural gas demands of the other, non-refinery cumulative projects would be served by PG&E. Those projects represent planned development under *the City of Benicia General Plan* and it is PG&E's responsibility to plan for and construct the energy distribution structure and to deliver natural gas and electricity to those developments. Within this context, the net contribution of the refinery's cumulative projects' electricity and gas use to the cumulative energy demand within Benicia would be less than significant.

Mitigation Measure: None required.

REFERENCES – Energy

California Energy Commission, *Staff Assessment, Valero Cogeneration Project*, (01-AFC-05), August 2001.

California Energy Commission, http://www.energy.ca.gov/reports/700-02-003F/2002-05-10_700-02-003F.PDF, 2002.

City of Benicia, *Valero Improvement Project – Initial Study,* April 2002.

City of Benicia, *Benicia General Plan,* June 1999.

URS, Inc., *MTBE PO Draft Environmental Impact Report*, April 2002.

Woodward Clyde Consultants, *Draft Environmental Impact Report, Exxon Benicia Refinery Clean Fuels Project*, September 1993.

---

1 In the California Energy Commission's (CEC) review of Valero's Application for Certification for the Cogeneration facility, Valero expects a 98% reliability factor for the Cogeneration Unit (CEC 2001). The CEC concluded that this reliability is well above the industry norm for similar cogeneration units, 91.5%. However, it is assumed that the cogeneration unit's availability over a year would lie between 91.5% and 98%.

2 These demands can be compared to PG&E's current load of approximately 9320 MW on the regional power grid.

4.6 GEOLOGY, SOILS, AND SEISMICITY

Several potential impacts related to geology, soils, and seismicity are identified for the Valero Improvement Project. Each of these impacts would be reduced to less than significant by prescribed mitigation measures. Effects that could occur as a result of the implementation of the Valero Improvement Project are:

- ***Seismic groundshaking could result in injuries to persons or in structural damage.***
- ***Facilities would be exposed to expansive soils and natural settlement.***
- ***New tanks in the crude storage tank area could affect the stability of slopes along the perimeter berms of Lake Lund, Lake Lee, and Lake Spalding.***

There are no cumulative impacts that would result from the Valero Improvement Project and the other, cumulative, refinery and non-refinery projects.

4.6.1 INTRODUCTION

The purpose of this chapter is to identify and evaluate environmental consequences in regards to geology, soils, and seismicity that would result from the development of the Valero Improvement Project (VIP) at the Valero Benicia Refinery. The VIP includes new facilities and modifications of existing facilities at the refinery. The existing conditions are established by first describing the regional geology and seismicity of Solano County and the San Francisco Bay Area. Next, the soils, geologic units, faults, and geo-seismic hazards at the refinery are discussed. Then, the City, State, and County policies and regulations that pertain to the soil, geologic, and seismic conditions at the refinery, and within the project vicinity, are discussed. Environmental impacts are subsequently determined, based on changes in the existing conditions caused by the VIP.

The purpose of the Impacts and Mitigation Measures section is to:

- Identify potentially hazardous conditions that may affect the proposed project.
- Identify significant adverse impacts of the proposed project.
- Identify mitigation measures.

4.6.2 SETTING

4.6.2.1 REGIONAL SETTING

The Valero Benicia Refinery is located in southern Solano County along the northern edge of Suisun Bay in the natural region of California known as the Coast Ranges geomorphic province. This province is characterized by a series of northwest trending ridges and valleys controlled by tectonic folding and faulting, examples of which include the Suisun Bay to the south, the East

Bay Hills and Briones Hills to the southwest, the Vaca Mountains and Napa Valley to the north, and the Diablo Ranges to the southeast.

Regional basement rocks consist of the highly deformed Great Valley Sequence, which include massive beds of sandstone interfingered with siltstone and shale. Unconsolidated alluvial deposits, artificial fill, and estuarine deposits, including Bay Mud, underlie the low-lying region along the margins of the Carquinez Straight and Suisun Bay. The estuarine sediments found along the shorelines of Solano County are soft, water-saturated mud, peat, and loose sands. The organic, soft, clay-rich sediments along the San Francisco and San Pablo Bays are referred to locally as Bay Mud and can present a variety of engineering challenges due to inherent low strength, compressibility, and saturated conditions. Landslides in the region occur in weak, easily weathered bedrock on relatively steep slopes.

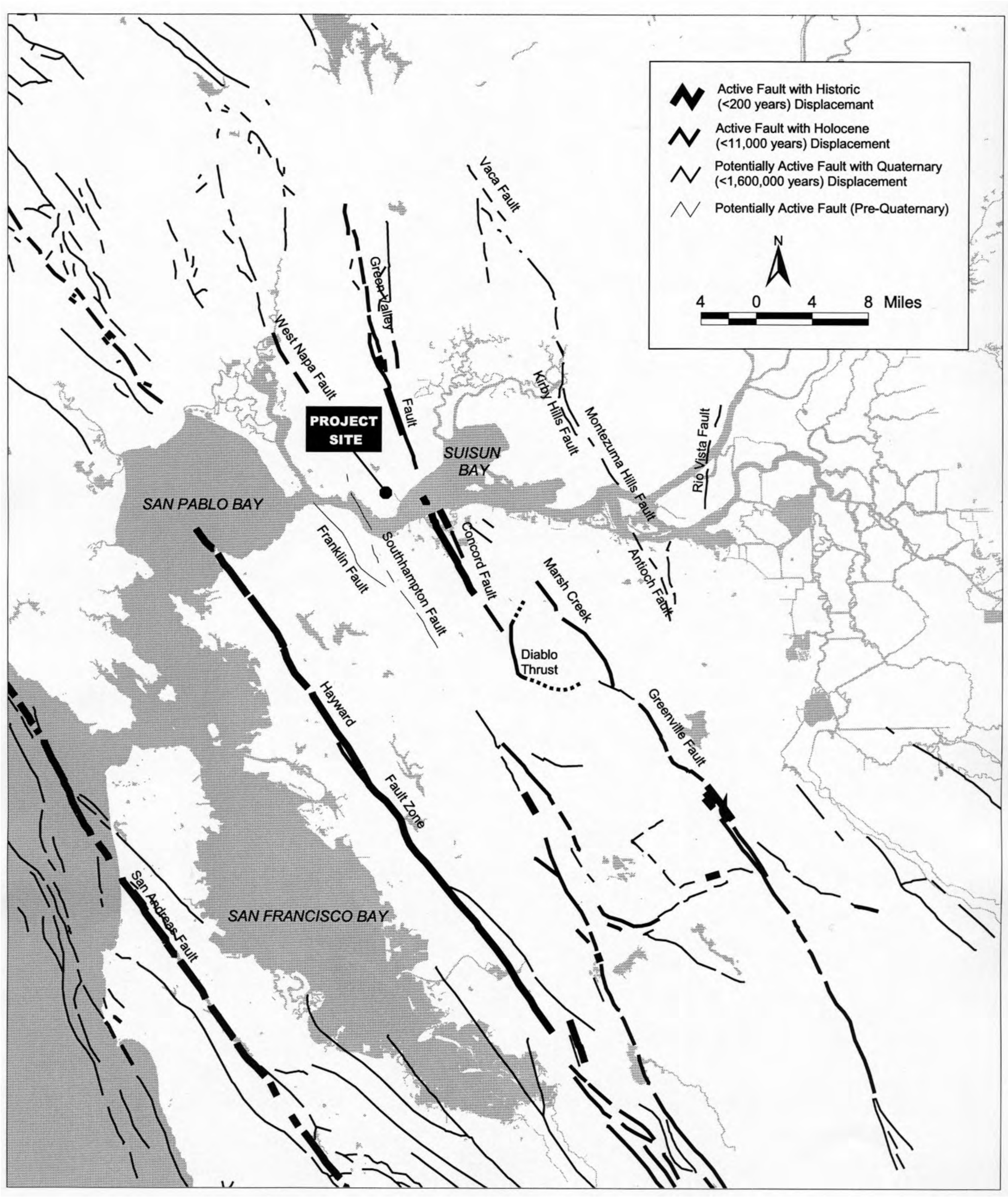
The California Geological Survey (CGS) indicates that no base metal, precious metal, or other economic mineral deposits have been reported from the region surrounding the refinery property (URS 2002). Clay shale within the Great Valley Sequence, used for the manufacture of brick and crushed rock aggregate, is produced from two quarries near Lake Herman, to the northwest of the refinery.

Faults and Seismicity

The refinery is located in the seismically active San Francisco Bay region, which is situated on a plate boundary marked by the San Andreas Fault System and several northwest trending active and potentially active faults (see Figure 4.6-1). Under the Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Act) of 1972 (revised 1994), Earthquake Fault Zones were established by the California Division of Mines and Geology along “active” faults, or faults along which surface rupture occurred in Holocene time (the last 11,000 years). In the Bay Area, these include the San Andreas, Hayward, Rodgers Creek-Healdsburg, Concord-Green Valley, Greenville-Marsh Creek, Seal Cove/San Gregorio and West Napa faults.

Although the refinery could be subjected to damage from movement on any one of the Bay Area Faults, the closest active fault to the refinery is part of the Concord-Green Valley fault zone. The main trace of the Concord-Green Valley fault extends northwesterly approximately 1.5 miles east of the refinery. The Concord-Green Valley fault is capable of generating a Maximum Credible Earthquake (MCE) of moment magnitude 7.1. The U.S. Geological Survey (USGS) Working Group on California Earthquake Probabilities (1999) has assigned a 6% probability of one or more earthquakes of Richter magnitude 6.7 or higher occurring on the Concord-Green Valley fault between 2000 and 2030.

Other smaller faults in the region classified as potentially active by the CGS, include the Southampton and Franklin faults (see Figure 4.6-1). The Southampton Fault, located approximately 3 miles west of the refinery, extends northwest from Nevada Dock, near the town of Port Costa along the south shore of the Carquinez Strait (USGS 1968), to an inferred



SOURCE: California Department of Conservation, Division of Mines and Geology (After Jennings, 1994)

Figure 4.6-1
Active and Potentially Active
Bay Area Earthquake Faults

terminal point in the low-lying hills east of the city of Vallejo. The CGS does not consider the Southampton Fault to be active, nor is it zoned as an Earthquake Fault Zone. The maximum credible earthquake for the Southampton fault has been estimated to be 6.25.

The Franklin Fault, located approximately 6 miles west of the refinery, is a reverse fault that extends from southwest of the Walnut Creek area to an inferred terminal point located near the town of Selby along the south shore of the Carquinez Strait. The CGS does not consider the Franklin Fault to be active, nor is it zoned as an Earthquake Fault Zone. The maximum credible earthquake for the Franklin Fault has been estimated to be 6.5.

Ground movement intensity during an earthquake can vary depending on the overall magnitude, distance to the fault, focus of earthquake energy, and type of geologic material. Areas that are underlain by bedrock tend to experience less ground shaking than those underlain by unconsolidated sediments such as artificial fill. In general, bedrock areas will experience ground shaking of higher frequency, shorter period, and lower amplitude. Structural damage resulting from shaking tends to be worse for structures located on unconsolidated deposits, such as areas underlain by Bay Mud. Earthquake ground shaking may have secondary effects on certain foundation materials, including liquefaction, seismically induced settlement, and lateral spreading.

4.6.2.2 PROJECT SETTING

The refinery was constructed in the late 1960's and occupies three parcels of land in the Benicia Industrial Park, formerly the site of the Benicia Arsenal. The first parcel is the main refinery area. The second parcel is the crude oil storage area and provides crude oil to the main refinery and the third parcel is used for wastewater treatment.

The VIP will be located within the existing refinery property, an area that has been extensively modified by cutting and filling. Neither the natural unconsolidated deposits nor the underlying Great Valley Sequence bedrock is noted for unique or scientifically valuable features, and no such features have been reported from the surrounding region (URS 2002).

Topography

The refinery is located on an east-facing, 200-foot bedrock hill at the northwestern edge of the refinery. Weak bedrock composed of younger continental and marine sedimentary rocks and volcanic rocks underlie this hill slope. Along the southwestern side of the refinery, a south-to-southeast trending alluvial valley and several east-to-west trending tributary valleys dissect this hill. At the eastern side of the refinery, the hill slopes downward to a broader, relatively flat south-to-southwest trending alluvial valley at an elevation of 10 to 20 feet above mean sea level.

The main refinery area is located at the base of the 200-foot hill and slopes downward to the southeast. Elevation ranges from 80 feet to 10 feet across the main refinery area. The crude oil storage area, located south of the main refinery area, rises to an elevation of approximately

156 feet to 180 feet. The wastewater treatment area is located to the east of both of these areas and is in a low-lying area at an elevation of approximately 5 feet.

Subsurface Conditions

The hillsides within the refinery are covered with a varying thickness of stiff clay-rich colluvium. The colluvium accumulates as a result of in-situ weathering of underlying bedrock that is then subject to down-slope movement by soil creep and slope wash. The colluvium at the refinery site is predominantly a highly plastic, expansive clay and sandy clay containing some carbonaceous materials.

These hillsides have been subjected to extensive cut-and-fill excavation during past construction activities. According to previous investigations, excavated native unconsolidated deposits and bedrock were placed as compacted fill, ranging from 18 to 53 feet in topographically low areas, on top of 2 to 13 feet of natural stiff clay that rests on bedrock. The fill material is somewhat well compacted sandy clay, with abundant rock fragments common throughout. In general, the fill is moderately to highly expansive, and is strong and only slightly to moderately compressible (Woodward-Clyde 1993)

A portion of the refinery, including the wastewater treatment area, is located in unconsolidated estuarine and alluvial sediments. Previous investigations have penetrated predominantly clayey materials to depths ranging to about 58 feet, where mudstone bedrock was encountered (Woodward-Clyde 1993). The clays were described as soft to medium stiff and are locally referred to as Bay Mud.

Bay Mud

Bay Mud is an organic-rich, fine-grained sediment deposited on the margins of the San Francisco, San Pablo, and Suisun Bays. The deposits are primarily soft mud and silt, with some shell, peat, sand, and gravel layers. Bay Mud deposits can be separated and described in two distinct deposits.

Older (Lower) Bay Mud deposits are late Pleistocene in age and generally consist of firm, dark greenish grey, silty clay with varying amounts of sand and fine gravel. Older Bay Mud deposits are believed to underlie the younger Bay Mud deposits. Because the older Bay Mud is more deeply buried, it generally contains less moisture than younger Bay Mud and is overconsolidated. The clays range from soft to medium stiff.

Younger (Holocene) Bay Mud, deposited in areas of weak tidal currents and low water turbulence, primarily consists of soft, grey, silty clay. Typically, the deposits are saturated, plastic, and organic-rich.

Faults and Seismicity

The VIP areas are situated in close proximity to the east-dipping Lake Herman fault which runs along the eastern portion of the refinery property. This is a pre-Quaternary fault (displacement before 1.6 million years ago) that is part of the Coast Range thrust system (Graymer 1999). This fault has no geomorphic expression that would suggest that it is an active fault and the CGS does not delineate this as an active fault under the Alquist-Priolo Earthquake Fault Zoning Act. Although the Lake Herman Fault is not active it is not necessarily inactive due to its proximity to active fault zones that, under certain circumstances, can result in sympathetic ground slip (minor movement of an older fault due to strong ground shaking) during a large earthquake. However, sympathetic fault slip on the Lake Herman fault due to a large earthquake would likely be very small and considering its location would not impact the proposed VIP. There is a low potential for sympathetic fault rupture to occur within the life of the project.

Previous seismic information for the Valero refinery indicates that, the site may be subject to high seismic ground motions. For a 10% probability of exceedance in 50 years (equivalent to an earthquake with a 475-year recurrence interval), the expected ground motions at the site would be 1.5g and 0.5g at 0.2 and 1.0 second periods, respectively. A map of deterministic ground motions developed by Caltrans (Mualchin 1996 as referenced in URS 2002) shows that the site may be subject to a peak horizontal acceleration of 0.5g (50% of the acceleration of gravity) from a moment magnitude 6.75 earthquake on the Concord-Green Valley fault. As a comparison, the maximum ground accelerations recorded in San Francisco and Oakland during the 1989 moment magnitude 6.9 Loma Prieta earthquake were about 0.2g. However, the recording sites were located approximately 56 miles from the earthquake epicenter. Ground motions within the Loma Prieta epicentral region were 0.7g (URS 2002).

The Bay Area has experienced many large, damaging earthquakes during historic time. The 1989 moment magnitude 6.9 Loma Prieta earthquake caused widespread damage throughout the Bay Area and produced shaking of Modified Mercalli Intensity (MMI) VI in the area of Benicia. The March 31, 1898, moment magnitude 6.3 Mare Island earthquake resulted in significant damage along the northern shore of San Pablo Bay. This earthquake, which may have occurred on the Rodgers Creek fault, resulted in shaking intensities of MMI VII to VIII in the area of the refinery property. The strongest shaking experienced in the Benicia area during historic time was generated from the April 18, 1906, Great San Francisco earthquake on the San Andreas Fault that generated a moment magnitude of 7.9. This earthquake produced shaking intensities of MMI VIII and IX (URS 2002).

Mineral or Oil Resources

There are no oil, gas, or hydrothermal resources either beneath or adjacent to the refinery property (URS 2002). In addition, no fossil discoveries have been reported on the refinery property or in its immediate surroundings (URS 2002).

Geologic Hazards

Expansive Soil

The formation of soils with expansive characteristics may have formed over the alluvial soils at the refinery. Expansive soils possess a “shrink-swell” behavior. Shrink-swell is the cyclic change in volume (expansion and contraction) that occurs in fine-grained clay sediments from the process of wetting and drying. Structural damage may result over an extended period of time, usually the result of inadequate soil and foundation engineering or the placement of structures directly on expansive soils. Typically, soils that exhibit expansive characteristics comprise the upper five feet of the surface. The effects of expansive soils could damage foundations of above-ground structures, paved roads and streets, and concrete slabs. Expansion and contraction of soils, depending on the season and the amount of surface water infiltration, could exert enough pressure on structures to result in cracking, settlement, and uplift.

Soil Erosion

Soil erosion is the process whereby soil materials are worn away and transported to another area either by wind or water. Rates of erosion can vary depending on the soil material and structure, placement and human activity. The erosion potential for soils is variable throughout the project area. Soil containing high amounts of silt can be easily erodable while sandy soils are less susceptible. Excessive soil erosion can eventually lead to damage of building foundations, roadways and dam embankments. Erosion is most likely on sloped areas with exposed soil, especially where unnatural slopes are created by cut and fill activities. Soil erosion rates can therefore be higher during the construction phase. Typically, the soil erosion potential is reduced once the soil is graded and covered with concrete, structures or asphalt.

Landslides

Landslides may occur on slopes of 15% or less, however, the probability is greater on steeper slopes, with old landslide deposits being the most likely to experience failure. Landslides typically occur within slide-prone geologic units that contain excessive amount of water and are located on steep slopes.

Due to the relatively flat nature beneath the wastewater treatment area, the potential for landslides is low. However, landslides may occur locally in colluvial deposits on hillsides, or within unsupported cut and fill slopes.

Natural Settlement

Natural settlement typically occurs in unconsolidated deposits, such as artificial fill and Bay Mud, over time as a result of increased foundation loads and vibrations from overlying structures. Natural settlement may affect foundations, slabs and pavements.

Seismic Hazards

Seismic hazards include ground shaking, liquefaction, lateral spreading, differential settlement, natural settlement, landsliding, and inundation by encroaching waves (tsunami and seiches). There are no known active faults traversing the refinery property and therefore, fault slip is not considered a potential geologic hazard capable of causing damage to refinery equipment.

Ground Shaking

Strong ground shaking from earthquakes generated by active faults in Solano County and the Bay Area is a significant hazard to the project at the refinery (See Figure 4.6-1). During the life of the project, the refinery is likely to be subjected to at least one moderate to severe earthquake that will cause strong ground shaking.

The severity of ground shaking at a particular site on the refinery resulting from a specific earthquake will depend on the characteristics of the generating fault, distance to the energy source, the magnitude of the event, and the site-specific geologic conditions. In general, bedrock areas will experience ground shaking of higher frequency, shorter period, and lower amplitude. Structural damage resulting from shaking tends to be worse for structures located on unconsolidated deposits, such as an area underlain by Bay Mud. Therefore, ground shaking in the area beneath the wastewater treatment area would likely be amplified due to the occurrence of unconsolidated material.

Liquefaction

Liquefaction is the sudden temporary loss of shear strength in saturated, loose to medium dense, granular sediments subjected to ground shaking. It generally occurs when seismically-induced ground shaking causes pore water pressure to increase to a point equal to the overburden pressure. Liquefaction can cause foundation failure of buildings and other facilities due to the reduction of foundation bearing strength.

The potential for liquefaction depends on the duration and intensity of earthquake shaking, particle size distribution of the soil, density of the soil, and elevation of the groundwater. Portions of the refinery that may be at risk due to the effects of liquefaction include areas that have a high groundwater table and are underlain by loose to medium-dense, granular sediments, particularly younger alluvium and non-engineered (uncompacted) artificial fill. The wastewater treatment area would be at a relatively high risk to liquefaction due to the area’s high groundwater table and underlying unconsolidated sediments. However, the Association of Bay Area Governments, have delineated the main refinery and crude oil storage areas as not being a high risk to liquefaction due to the areas not being situated along existing and filled stream and flood plains or tidal and submerged areas.

Lateral Spreading

Lateral spreading is a ground failure associated with liquefaction and generally results from predominantly horizontal displacement of materials toward relatively unsupported free faces. Unsupported fill slopes can be subject to lateral spreading. Shear and tensile cracking of the ground surface can accompany lateral spreading.

Differential Settlement

Earthquake shaking can produce compaction and densification of dry, uniformly graded, granular material that is loose in consistency. The amount of compaction across an area can vary due to differences in soil types, producing differential settlement. Artificial fill may also be susceptible to differential settlement. Differential settlement can affect existing and proposed foundations, slabs, and pavements.

Tsunamis

Tsunamis (seismic sea waves) are long period waves that are typically caused by underwater disturbances (landslides), volcanic eruptions, or seismic events. Areas that are highly susceptible to tsunami inundation tend to be located in low-lying coastal areas such as tidal flats, marshlands, and former bay margins that have been artificially filled but are still at or near sea level. The Suisun Bay has been determined to be at moderate risk to tsunamis.

An evaluation of tsunami risk was conducted in the Suisun Bay and was based on a tsunami having a wave height or run-up of 20 feet that may arrive at the Golden Gate once every 200 years. Due to attenuation within the bay, a 20-foot wave at the Golden Gate would diminish to a height of approximately 2 feet near the Carquinez Strait. The lowest topographic elevation where VIP components could potentially be located would be approximately 5 feet. This is above the projected wave height, even if the tsunami were to occur at high tide.

Seiche

A seiche is a free or standing wave oscillation(s) of the surface of water in an enclosed or semi-enclosed basin, such as Suisun Bay, that may be initiated by an earthquake. Due to the relatively large size of Suisun Bay with an inlet to the east and an outlet to the west, the hazard of seiche waves is interpreted to be low. In addition, there is no historic record of such waves occurring in Suisun Bay during recent strong earthquakes.

4.6.2.3 REGULATORY SETTING

Alquist-Priolo Earthquake Fault Zoning Act

Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Zones Act) of 1972 (revised in 1994) is the State law that addresses hazards from earthquake fault zones. The purpose of this law is to mitigate the hazard of surface fault slip by regulating development near active faults.

As required by the Act, the State has delineated Earthquake Fault Zones (formerly Special Studies Zones) along known active faults in California. There are no faults that occur at the refinery that have been classified as being in the Earthquake Fault Zone.

California Building Code

State law regarding the construction of public buildings and a large percentage of private buildings is contained in the California Building Code. Title 24, Part 2 of the California Building Code deals with geologic and seismic hazards, other than surface faulting. Chapter 23 of the California Building Code deals with the General Design Requirements, and includes regulations for earthquake-resistant design and construction. The refinery is located within California

Building Code Seismic Zone 4 and is required to follow the most stringent California Building Code design and construction standards. Requirements for excavations, fills, foundations, retaining walls, grading, and earthwork construction are discussed in Chapters 29 and 70 of the California Building Code.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act was developed to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and from other hazards caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit is granted for a site within a Seismic Hazard Zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the project design. The project site has not yet been evaluated by the CGS but it is possible that this area could be zoned as liquefaction or landslide hazard zone.

City of Benicia General Plan

City of Benicia has established goals, policies, and programs in regard to geologic hazards. These are outlined in the Responses to Hazards section of the City of Benicia General Plan (City of Benicia 1999). The following geologic hazard programs are directly related to the VIP:

- Require geotechnical engineering reports to address site stability and building foundation integrity for projects involving substantial grading.
- Develop guidelines for site-specific geologic and geotechnical reports.
- Require peer review of geotechnical engineering reports if it is determined that City staff does not have the technical expertise to review such reports.
- Prepare a planning-level geologic hazards map as new information becomes available.
- Develop a Planning Area database of geologic information for use when making planning decisions and as a resource for the community.

The VIP would include construction grading and would be subject to these requirements, consistent with the City of Benicia General Plan.

4.6.3 SIGNIFICANCE CRITERIA

CEQA defines a significant effect on the environment as a substantial, or potentially substantial, adverse change in the physical conditions within the area affected by the project. According to *CEQA Guidelines*, a project would normally be considered to have significant geology-related impacts if it would:

- Expose persons or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving slip of a known earthquake fault[1], strong seismic ground shaking, seismic-related ground failure, including liquefaction, or landslides;
- Result in substantial soil erosion or the loss of topsoil;
- Be located on strata or soil that is unstable, or that would become unstable as a result of the project, and potentially result in lateral spreading, subsidence, liquefaction, or collapse; or
- Be located on expansive soil[2] creating substantial risks to life or property.

4.6.4 IMPACTS AND MITIGATION MEASURES

Impact 4.6-1: In the event of a major earthquake in the region, seismic ground shaking could potentially injure persons at the project site due to structural damage or structural failure. Ground shaking could potentially expose persons and property to seismic-related hazards, including localized liquefaction, related ground failure and seismically-induced settlement. This impact would be made less than significant by Mitigation Measures 4.6-1a through 4.6-1e.

The VIP would likely experience at least one major earthquake (greater than moment magnitude 7) within the next 30 years. The intensity of such an event would depend on the causative fault and the distance to the epicenter, the moment magnitude, and the duration of shaking.

In accordance with the California Building Code or equivalent, project equipment would be designed to withstand ground acceleration that has a 10% probability of being exceeded in 50 years. The equipment and additional units proposed for the project that would need to meet these requirements can be grouped into the following categories:

- Piping
- Heat exchangers
- Instrumentation
- Catalytic reactors
- Fractionization equipment
- Pumps
- Compressors
- Furnaces
- Storage tanks
- Biox processors
- Wastewater Treatment units

1 Per *CEQA Guidelines*, a known earthquake fault is one that has been delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.

2 Per *CEQA Guidelines*, expansive soil is defined in Table 18-1-B of the Uniform Building Code.

The performance of these categories of equipment and additional units in the refining and chemical industry in earthquakes is discussed below. This information is based on data developed by EQE Engineering Consultants of San Francisco, California, a firm specializing in structural engineering.

It is unlikely that existing or proposed pressure vessels at the refinery would be breached in a strong earthquake. The pressure loads for which these vessels are designed are typically much greater than seismic loads that would be caused by large earthquakes. In addition, the design and construction quality of these vessels is closely controlled through the American Society of Mechanical Engineers (ASME) Pressure Vessel Code. Supports for pressure vessels could be damaged by strong ground shaking, causing leaks where piping connects to the vessel.

Some heat exchangers in the proposed process units would have large weights and would be elevated above the ground. These pieces of equipment could move enough during a large earthquake to cause leaks at pipe connections. Pumps, valves, and compressors are considered to be resistant to seismic damage because of the excellent performance of this equipment at refineries and other industrial facilities in past earthquakes. Operating and start-up loads of pumps and compressors typically exceed the loads caused by ground shaking from an earthquake.

Welded steel piping is very flexible and has performed well in past earthquakes at industrial facilities including the refinery. Problems related to piping are typically not caused by inertial loads but rather by failure of supports and debris falling on them. Storage tanks have a mixed seismic performance history because of their varied sizes and shapes (i.e. height-to-diameter ratio). Damage during an earthquake to tanks with the same design as proposed for the project is typically caused by failure of attached piping which is rigid and cannot withstand movement of the tank or by buckling of the tank wall near the bottom. Piping could leak at its junction with a tank leading to the loss of the contents of the tank if it is severe enough.

Foundation and structural designs that can withstand the level of ground shaking that could occur at the project site are in common use today. With foundation and structural design in accordance with the current California Building Code or equivalent, seismic shaking should not result in significant damage of project facilities that would result in offsite property damage or injury to members of the public.

Title 24 is assigned to the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The following mitigations are intended to serve as a guideline for these building standards to specifically address the seismic-related hazards discussed herein.

Mitigation Measure 4.6-1a: Seismic design consistent with current professional engineering and industry standards should be used in construction for resistance to strong ground shaking, especially for lateral forces. The implementation of the seismic design criteria as required by the California Building Code would reduce the potential for structural failure, major structural damage, and loss of life, and reduce the primary effects of ground shaking

on structures and infrastructures to generally acceptable level. At a minimum, the California Building Code requirements or a more stringent building code should be followed during design and construction of all elements of the Valero Improvement Project. Additional requirements recommended by the project California Certified Engineering Geologist or Geotechnical Engineer, based on site-specific studies and specific project requirements, should be followed and become part of the project specifications.

Under the design criteria required under this mitigation measure, connectors will be designed to withstand seismic loading for the maximum credible earthquake at the site and bends will be placed in piping, as appropriate, to absorb seismic shaking. Foundations and anchor bolts will be designed to withstand similar loads. Piping will be protected from strong ground motion by properly designed supports, typically reinforced concrete bents. Several design and operating factors would reduce the potential for buckling, including maintaining the proper fill height for the tank seismic design, anchoring, and installation of annular rings.

Mitigation Measure 4.6-1b: Appropriate grading and design, in accordance with the California Building Code requirements or a more stringent standard, should be used to reduce the secondary effects of ground shaking on structures and infrastructure. Subsurface site conditions should be investigated for all project facilities to identify poor foundation materials that may be susceptible to the effects of liquefaction, lateral spreading, and differential settlement. Poor foundation materials should be removed prior to construction or be subjected to ground improvement techniques. In addition, deep pile foundations should be driven through the poor foundation soils and into more competent materials.

Mitigation Measure 4.6-1c: Structural fill placed during the construction of the Valero Improvement Project should be designed to reduce fill settlement with keyways and subsurface drainage, and adequately compacted (i.e., Minimum 90 percent compaction as defined by American Society for Testing and Materials (ASTM D1557)).

Mitigation Measure 4.6-1d: All structural foundations, above-ground utilities, and underground utilities should be designed to accommodate estimated settlement without failure, especially across transitions between fills and cuts.

Mitigation Measure 4.6-1e: Final design of the proposed improvements should be made in conjunction with a design-level geotechnical investigation submitted to the City of Benicia for review prior to issuing any grading or construction permits.

Impact after Mitigation: Less than Significant

Impact 4.6-2: Proposed foundation construction could be subjected to the geologic hazards related to expansive soils and natural settlement. This impact would be made less than significant by mitigation measures 4.6-1a through 4.6-1e.

Over time, natural settlement typically occurs in unconsolidated deposits, such as artificial fill and Bay Mud, as a result of increased foundation loads from overlying structures. Natural settlement may damage foundations and structures, and should be evaluated prior to construction.

Clayey fill materials underlying the project site have been classified as moderately expansive and compressible (URS 2002). The effects of expansive soils could damage foundations of aboveground structures, paved service roads, and concrete slabs. Surface structures with foundations constructed in expansive soils would experience expansion and contraction depending on the season and the amount of surface water infiltration. The expansion and contraction could exert enough pressure on the structures to result in cracking, settlement, and uplift.

Differential settlement would be a concern as the proposed location of the additional crude oil tank(s) has not previously supported structures, and new structures could place loads heavier than the soils could tolerate. The areas within Lake Lund and Lake Lee are partially underlain by non-engineered artificial fill and pose the potential for the greatest settlement effects. In its current condition, the fill is incapable of supporting proposed structures and would need to be re-compacted as engineered fill. Without such improvements, differential settlement could occur between column or floor slabs due to variability of underlying soil conditions. Provided the site grading is performed as recommended by the geotechnical engineer, settlements of heavily-loaded column footings will be about one-inch and post construction differential settlement between columns and lightly loaded perimeter footings will be approximately one-half inch.

Mitigation Measure 4.6-2: Implementing Mitigation Measures 4.6-1a through 4.6-1e for the design and construction of all Valero Improvement Project components would reduce this impact to a less than significant level.

Impact 4.6-3: Construction of additional treatment units in the crude storage tank area and/or wastewater treatment plant area could potentially adversely effect the stability of slopes along the retention pond perimeter berms. This impact would be made less than significant by Mitigation Measure 4.6-3.

During the construction of the crude storage tank area at the refinery extensive grading was performed to create level areas. In two locations within Lake Lee and Lake Spalding, natural ravines existed. Approximately 60 feet of fill was placed in these ravines creating slope heights at Lake Lee and Lake Spalding of 60 feet and 25 feet, respectively. Fill up to 35 feet is present at the northwest edge of Lake Lund that includes a dike height of less than 10 feet and a 25-foot pad for Tank 1703. After the site was graded level, less than 10 feet of fill was placed in some areas to create perimeter berms. Therefore, typical profiles of Lake Lee and Lake Lund depict deep and shallow fill.

Mitigation Measure 4.6-3: To reduce potential slope instability hazards related to static and dynamic forces in the retention pond areas, a slope stability analysis of the retention

pond perimeter berms should be conducted by a licensed professional engineer. All recommendations should be used in the design and construction of the tanks and submitted to the City of Benicia for review.

4.6.5 CUMULATIVE IMPACTS

There are no cumulative geologic impacts that result from the VIP and the other, cumulative, non-refinery projects.

REFERENCES – Geology, Soils, and Seismicity

Woodward-Clyde Consultants. *Exxon Benicia Refinery Clean Fuels Project*. Prepared for City of Benicia. September 1993.

City of Benicia, *Benicia General Plan,* adopted June 15, 1999.

Graymer, R.W., Brabb, E.E., and Jones, D.L., 1999. *Geology of the Cordelia and Northern Part of Benicia 7.5 Minute Quadrangle, California*: A Digital Map Database, U.S. Geological Survey, Open-File Report 99-162, 8 pp + 1:24,000 map sheets (2).

United States Geological Survey, *7.5 Minute Quadrangle, Benicia* 1959, photo-revised 1968.

URS Corporation, *MTBE PO Draft Environmental Impact Report*, April 2002.

4.7 PUBLIC HEALTH

Public exposure to toxic air contaminant (TAC) emissions from the VIP can result in health risks. However, the incremental health risks from the project are extremely small when compared to typical day-to-day health risks. Since the predicted health risk increments from the VIP are less than the significance thresholds, the impacts are less than significant. No additional mitigation measures would be required.

4.7.1 INTRODUCTION

Public health issues are concerned with evaluating the carcinogenic or adverse non-carcinogenic health effects in the community from exposure to toxic air contaminants (TACs) as a result of the project. TACs are air pollutants that are believed to have health impacts but do not have a corresponding ambient air quality standard. There are hundreds of different types of TACs, with varying degrees of toxicity.

TACs are often part of the criteria pollutants: volatile organic compounds (VOCs) and particulate matter (PM). TAC species that are included as VOCs are substances such as benzene, formaldehyde, and toluene. TAC species that are contained in PM include toxic heavy metals, such as lead, cadmium, and mercury, as well as large organic molecules that can form in the combustion process. These include substances such as polycyclic aromatic hydrocarbons (soot). Sources of TACs include industrial processes such as petroleum refining, petrochemical manufacturing, electric utilities, and chrome plating operations, or in commercial operations such as gasoline stations and dry cleaners, and motor vehicle exhaust.

This section evaluates the health risks from exposure to TACs related to the Valero Project. The incremental risk of contracting cancer and the risk of adverse health effects from exposure to non-carcinogenic substances emitted from the project are reported.

4.7.2 SETTING

4.7.2.1 EXISTING TAC CONCENTRATIONS

Ambient air levels of TACs are measured at several stations in the region by the Bay Area Air Quality Management District (BAAQMD). The two stations nearest to the refinery are in Concord and Vallejo. Tables 4.7-1 and 4.7-2 summarize measured concentrations of TACs at the two monitoring stations, respectively, for the year 2000, which is the most recent year for which certified data are available. These measured levels generally reflect TAC levels in the area, although there may be some higher levels close to ground-level sources of TACs. However, residences and other sensitive receptors are usually not located so close to these sources.

Tables 4.7-1 and 4.7-2 also show the carcinogenic health risks from exposure to these concentrations. The health risks were estimated by applying the cancer unit risk factors to the

TABLE 4.7-1
AVERAGE AMBIENT CONCENTRATIONS OF TOXIC AIR CONTAMINANTS MEASURED IN VALLEJO, TUOLUMNE STREET, IN 2000

Compound	Concentration (ppb)[b]	Concentration (μg/m³)[b]	Unit Risk (μg/m³)$^{-1c}$	Cancer Risk (Chances in one million)
Gaseous TACs[a]				
Acetaldehyde	***0.73***	***1.34***	2.70×10^{-6}	***3.6***
1,3-Butadiene	***0.14***	***0.32***	1.70×10^{-4}	***54.5***
Benzene	0.47	1.53	2.90×10^{-5}	44.3
Carbon Tetrachloride	0.10	0.64	4.20×10^{-5}	26.9
Formaldehyde	***1.90***	***2.37***	6.00×10^{-6}	***14.2***
Perchloroethylene	0.06	0.41	5.90×10^{-6}	2.4
Methylene Chloride	0.56	1.98	1.00×10^{-6}	2.0
MTBE	0.63	2.31	2.60×10^{-7}	0.6
Chloroform[d]	0.15	0.74	5.30×10^{-6}	3.9
Trichloroethylene[d]	0.40	2.19	2.00×10^{-6}	4.4
Particulate TACs[a]	(ng/m³)[b]			
Chromium (Hexavalent)	***0.11***	***1.12×10^{-4}***	0.15	***16.8***
Polycyclic Aromatic Hydrocarbons[e]	***0.54***	***5.44×10^{-4}***	1.10×10^{-3}	***0.6***
Nickel	***3.27***	***3.27×10^{-3}***	2.60×10^{-4}	***0.8***
Lead	***7.04***	***7.04×10^{-3}***	1.20×10^{-5}	***0.1***
Total Risk for All TACs				**175**

[a] All values are from BAAQMD monitoring equipment (BAAQMD 2001), *except those in bold italics*, which come from the average of the five CARB monitoring sites (San Francisco, San Jose, Fremont, San Pablo, and Concord). CARB values are from 2000 except for the Concord and San Pablo sites, where sampling was suspended in 2000. The concentrations used from these two sites are the means of daily samples collected during the period March 1, 1999, through February 29, 2000. In calculating average concentrations, samples less than the limits of detection (LOD) were assumed to be equal to one-half of the LOD. Risks are calculated for the carcinogenic TACs for which routine sampling was performed by the BAAQMD and CARB, except for ethylene dibromide, ethylene dichloride, and vinyl chloride, which were excluded because none of these compounds were detected in any of the air samples taken in the Bay Area.

[b] ppb is part per billion (μg/m³) is microgram per cubic meter or millionth of a gram per cubic meter (ng/m³) is nanogram per cubic meter or billionth of a gram per cubic meter

[c] Unit Risk is the probability of contracting cancer if one is constantly exposed to an average concentration of one microgram per cubic meter of the specific substance.

[d] Concentrations were below the detection limit. One-half the detection limit was used to calculate cancer risks.

[e] The PAH concentration represents the sum of the following species collected as PM-10: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene.

TABLE 4.7-2
AVERAGE AMBIENT CONCENTRATIONS OF TOXIC AIR CONTAMINANTS MEASURED IN CONCORD, ARNOLD INDUSTRIAL WAY, IN 2000

	Concentration			
Compound	(ppb)[b]	($\mu g/m^3$)[b]	**Unit Risk** ($\mu g/m^3$)$^{-1b}$	**Cancer Risk** (Chances in one million)
Gaseous TACs[a]				
Acetaldehyde	***0.73***	***1.34***	2.70 x 10^{-6}	***3.6***
1,3-Butadiene	***0.14***	***0.32***	1.70 x 10^{-4}	***54.5***
Benzene	0.43	1.40	2.90 x 10^{-5}	40.5
Carbon Tetrachloride	0.10	0.64	4.20 x 10^{-5}	26.9
Formaldehyde	***1.90***	***2.37***	6.00 x 10^{-6}	***14.2***
Perchloroethylene	0.05	0.34	5.90 x 10^{-6}	2.0
Methylene Chloride[b]	0.25	0.88	1.00 x 10^{-6}	0.9
MTBE	0.59	2.16	2.60 x 10^{-7}	0.6
Chloroform[c]	0.15	0.74	5.30 x 10^{-6}	3.9
Trichloroethylene[c]	0.40	2.19	2.00 x 10^{-6}	4.4
Particulate TACs[a]	(ng/m^3)[b]			
Chromium (Hexavalent)	***0.11***	***1.12 x 10^{-4}***	0.150	***16.8***
Polycyclic Aromatic Hydrocarbons[d]	***0.54***	***5.44 x 10^{-4}***	1.10 x 10^{-3}	***0.6***
Nickel	***3.27***	***3.27 x 10^{-3}***	2.60 x 10^{-4}	***0.8***
Lead	***7.04***	***7.04 x 10^{-3}***	1.20 x 10^{-5}	***0.1***
Total Risk for All TACs				**170**

a All values are from BAAQMD monitoring equipment (BAAQMD 2001), *except those in italics,* which come from the average of the five CARB monitoring sites (San Francisco, San Jose, Fremont, San Pablo, and Concord). CARB values are from 2000 except for the Concord and San Pablo sites, where sampling was suspended in 2000. The concentrations used from these two sites are the means of daily samples collected during the period March 1, 1999, through February 29, 2000. In calculating average concentrations, samples less than the limits of detection (LOD) were assumed to be equal to one-half of the LOD. Risks are calculated for the carcinogenic TACs for which routine sampling was performed by the BAAQMD and CARB, except for ethylene dibromide, ethylene dichloride, and vinyl chloride, which were excluded because none of these compounds were detected in any of the air samples taken in the Bay Area.

b For explanation of units, see footnotes in Table 4.7-1.

c Concentrations were below the detection limit. One-half of the detection limit was used to calculate cancer risks.

d The PAH concentration represents the sum of the following species collected as PM-10: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene.

measured concentration of each pollutant. The Unit Risk Values are established by the California Office of Environmental Health Hazard Assessment (OEHHA). The total risks at the Concord and Vallejo monitors are estimated to be 170 and 175 in a million, respectively. Over half of the cancer risk is due to benzene and 1,3 butadiene which are emitted principally from motor vehicles. These risks compare with the Bay Area average of 167 in a million (BAAQMD 2001).

The BAAQMD reports that the decline in risk in the region is due mainly to the decline in ambient benzene level with the advent of Phase 2 reformulated gasoline. Phase 2 gasolines have considerably lower concentrations of benzene and other related aromatic compounds. As a result, the calculated cancer risk of 167 in one million is about 45 percent less than the risk that was estimated five years earlier.

However, the risks do not include the entire risk from TACs, mainly because not all of the species contained in diesel particulate matter (diesel PM) are represented. Diesel PM is a mixture of over 30 different toxic chemicals, and only a portion, mainly polycyclic aromatic hydrocarbons (PAHs), may be reflected in the measurements reported in Tables 4.7-1 and 4.7-2. The BAAQMD has estimated that the carcinogenic health risks from exposure to diesel PM in 2000 in the Bay Area region was about 450 in a million (BAAQMD 2001). These region-wide risks were estimated by deriving concentrations of diesel PM from ambient measurements of a surrogate compound. Most of the diesel PM risks are from exposure to exhaust from diesel trucks where the emission sources can be relatively close to receptors.

A group of pollutants that have not been routinely monitored in ambient air are polychlorinated dioxins and furans, which are referred to as dioxins. Monitoring of dioxins has recently begun at stations in Crockett, Livermore, Oakland, Richmond, San Jose, and San Francisco, but data are not yet available.

4.7.2.2 REGULATORY SETTING

TACs are regulated under both state and federal laws. Federal laws use the term “Hazardous Air Pollutants” (HAPs) to refer to the same types of compounds that are referred to as TACs under State law. Both terms encompass essentially the same compounds. Under the 1990 Clean Air Act Amendments, approximately 190 substances are regulated as HAPs.

With respect to State law, in 1983 the California legislature adopted Assembly Bill 1807 (AB 1807), which establishes a process for identifying toxic air contaminants and provides the authority for developing retrofit air toxics control measures on a statewide basis. Air toxics in California may also be regulated because of another state law, the Air Toxics “Hot Spots” Information and Assessment Act of 1987, Assembly Bill 2588 (AB 2588). Under AB 2588, TACs from individual facilities are required to be quantified by the facility and reported to the local air pollution control agency. The facilities are prioritized by the local agencies based on the quantity and toxicity of these emissions, and their proximity to areas where the public may be exposed. High priority facilities are required to perform a health risk assessment, and if specific risk thresholds are exceeded, they are required to communicate the results to the public in the form of notices and public meetings. Depending on the health risk levels, emitting facilities can be required to implement varying levels of risk reduction measures.

BAAQMD is responsible for administering Federal and State regulations related to TACs. Under Federal law, BAAQMD adopts regulations to satisfy National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technology (MACT) for affected sources. BAAQMD also administers the state regulations AB1807 and AB 2588 which were discussed above. In addition, the Agency requires that new or modified facilities, which emit TACs, have to perform air toxics screening analyses as part of the permit application.

In addition, the *City of Benicia General Plan* (1999) identifies goals for ensuring that existing and future neighborhoods are safe from risks to public health from exposure to hazardous substances. The goals and policies for achieving these goals include:

Goal 4.7 Ensure that existing and future neighborhoods are safe from risks to public health that could result from exposure to hazardous materials.

Policy 4.7.1 Actively recruit industries and businesses that sustain environmental quality and have sound, responsible environmental policies, such as "best available control technology" (BACT), source reduction, reduced use of hazardous materials in production, and reduced waste.

Policy 4.7.2 Establish a "Community Right to know "program to promote general public understanding of Benicia toxics problems as they affect current and future generations.

Goal 4.8 Protect sensitive receptors from hazards

Policy 4.8.1 Evaluate potential hazards and environmental risks to sensitive receptors before approving development

The VIP is consistent with these elements of the General Plan.

4.7.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

The significance of health risks from the Project is dependent on the chance of contracting cancer from exposure to the TACs or of having adverse health effects from exposure to noncarcinogenic TACs.

4.7.3.1 CANCER RISK

Cancer risk is defined as the lifetime probability of developing cancer from exposure to carcinogenic substances. Cancer risks are expressed as increased chances in one million of contracting cancer, and it often incorporates more than one exposure pathway (i.e., inhalation, dermal contact, ingestion of contaminated soil, and infant ingestion of breast milk due to the mother's cumulative exposure). Incremental cancer risks are determined by summing the individual risk for each pathway and for each TAC.

The accepted significance threshold for the maximum lifetime cancer risk has been established by several regulations and agencies to be 10 in one million. This includes the regulation under AB2588, as well as Proposition 65, both of which regulations require public notification if the incremental risk equals or exceeds 10 in one million. BAAQMD CEQA Guidelines also recommend that the cancer risk significance threshold for a project be 10 in a million.

4.7.3.2 NON-CANCER HEALTH RISK

Non-cancer adverse health risks are measured against a hazard index, which is the ratio of the predicted exposure concentration to a threshold level, which could cause adverse health effects, as established by OEHHA. The ratio (Hazard Index, HI) of each non-carcinogenic substance affecting a certain organ system is added to the calculated Hazard Indices of the other non-carcinogens to produce an overall Hazard Index for that organ system. Overall Hazard Indices are calculated for each organ system. If the overall Hazard Index for the highest-impacted organ system exceeds one, then the impact would be significant. The HI significance threshold of one is defined in the BAAQMD CEQA Guidelines and is consistent with the value requiring public notification in the AB2588 regulation and in Proposition 65.

4.7.4 IMPACTS AND MITIGATION MEASURES

Incremental health risks from the Project were determined by conducting multi-pathway exposure modeling of the TAC emissions from the Project, both during construction and operations. The EPA model ISCST3 was used, along with five years of onsite meteorological data to determine the worst-case impacts at offsite receptors.

Impact 4.7-1: Public exposure to toxic air contaminant (TAC) emissions from the VIP would result in an increase in health risks. The increases in health risks are the result of exposure to both carcinogenic and non-carcinogenic substances. However, the increases would be less than significant.

Mitigation: None required.

4.7.4.1 TAC EMISSIONS DURING CONSTRUCTION

TAC emissions during construction would be diesel particulate matter (DPM) from truck engines that are involved in construction activities. The number of trucks associated with deliveries during ongoing construction activities was estimated, as a worst case to assume that several projects would be going on simultaneously (VIP and other cumulative projects). As a worst-case, it was assumed that there would be 210 construction workers onsite for these projects and that there would be 10 construction workers for each truck, leading to 21 truck trips per day. Diesel PM emissions were calculated for these truck trips using the CARB emission model EMFAC 2000. These emissions were input to the model ISCST3 to calculate offsite concentrations. The maximum incremental carcinogenic health risk at offsite receptors was estimated to be 0.3 in a million, and the chronic hazard index was estimated to be 0.00147. Since these levels are well below the significance thresholds, the risks are less than significant.

4.7.4.2 TAC EMISSIONS DURING OPERATIONS

TAC emissions associated with the Project would be released from the main stack and from other combustion sources, also from the new crude oil tanks, from gasoline, jet-fuel, and diesel tanks, from fugitives, and from mobile sources with diesel engines. TAC emissions from these sources are described below.

Main Stack Emissions

TAC emissions from the main stack due to the VIP were derived from emissions measurements that were conducted in 1990 and in 2002. These measured values were increased in proportion to the ratio of the increased volume flow rate from the VIP. Increased flow would occur because of increased flow from the FCCU and the Coker, both of which feed into the main stack. Emissions of 21 TACs from the VIP were estimated for the main stack by scaling up measured baseline emissions. Emissions of hexavalent chromium, cyanide, and phenol were not measured during the baseline monitoring. Emissions of these substances were calculated for both the baseline and for the VIP using the California Air Toxic Emission Factor (CATEF) database (CARB 2001). TAC emissions from the main stack after the VIP, including those from existing operations and from the proposed project, are reported in Table 4.7-3.

Other Combustion Emissions

Other combustion sources that are not ducted to the main stack include steam-boilers and process heaters that will have to increase their heating rates above typical historical rates. These units are referred to as external combustion sources. TAC emissions increases for these units were estimated by using emission factors derived from source tests performed on a hot oil furnace that uses the same fuel, and are reported in Table 4.7-4. Increased TAC emissions from the gas turbine, another source not ducted through the main stack, were calculated by using the CATEF emission factors for turbines. TAC emissions increases from the combustion turbine are given in Table 4.7-5.

Vapor Emissions

TAC vapor emissions occur from storage tanks (crude oil, gasoline, and jet and diesel fuel) and from fugitive leaks at valves, flanges, pumps and connectors throughout the refinery. TAC emissions from the tanks are given in Table 4.7-6. TAC emissions from fugitive sources are also given in Table 4.7-7.

Mobile Source Emissions

TAC emissions from the VIP would include increases in diesel PM emissions from the increased truck, train, and ship traffic related to the VIP. These emissions are given in Table 4.7-8.

TABLE 4.7-3
TOXIC AIR CONTAMINANT EMISSIONS FROM THE MAIN STACK

Pollutant	Baseline Rate (lb/hr)	Post VIP Hourly Emissions[a] (lb/hr)	Post VIP Annual Emissions[a] (lb/yr)	Baseline Source
1,3-Butadiene	6.62×10^{-3}	8.35×10^{-3}	73.2	2002 Source Test
Acetaldehyde	0.115	0.153	1.34×10^{3}	1990 Source Test
Ammonia[b]	77.7	80.3	7.03×10^{5}	1990 Source Test
Arsenic	4.42×10^{-3}	5.89×10^{-3}	51.6	1990 Source Test
Benzene	0.0253	0.0318	279.0	2002 Source Test
Beryllium	1.43×10^{-4}	1.91×10^{-4}	1.67	1990 Source Test
Cadmium	8.58×10^{-3}	0.0114	100.0	1990 Source Test
Hexavalent chromium	7.41×10^{-5}	9.87×10^{-5}	0.865	CATEF
Copper	5.12×10^{-3}	6.82×10^{-3}	59.8	1990 Source Test
Cyanide	0.095	0.127	1.11×10^{3}	CATEF
Ethylbenzene	3.31×10^{-3}	4.17×10^{-3}	36.5	2002 Source Test
Formaldehyde	0.221	0.279	2.44×10^{3}	2002 Source Test
Hydrogen sulfide	12.0	0.160	1.40×10^{5}	1990 Source Test
Lead	0.0121	0.0162	142	1990 Source Test
Manganese	8.77×10^{-5}	1.11×10^{-4}	0.969	2002 Source Test
Mercury	0.0282	0.0375	329.0	1990 Source Test
Naphthalene	2.39×10^{-3}	3.01×10^{-3}	26.4	2002 Source Test
Nickel	7.76×10^{-3}	0.0103	90.6	1990 Source Test
Phenol	6.07×10^{-4}	8.09×10^{-4}	7.09	CATEF
Selenium	4.55×10^{-3}	6.07×10^{-3}	53.1	1990 Source Test
Toluene	0.0168	0.0212	186.0	2002 Source Test
Total PAH	2.22×10^{-5}	2.80×10^{-5}	0.245	2002 Source Test
Xylene (Total)	0.0291	0.0367	0.0322	2002 Source Test
Zinc	0.0162	0.0215	0.0189	1990 Source Test

Emission Increases were calculated from the increases in the Exhaust Stack Flow Rates given below

Source	Air Flow (mscfm)[d] FCCU	Coker	Total	Ratio
Post-VIP[c]	143	65	208	0.0
1990 Source Test	105	51.1	156.1	1.332
2002 Source Test	107	58	165	1.261
CATEF	105	51.1	156.1	1.332

a Emissions are total emissions from the main stack (i.e., baseline plus VIP)
b Post-VIP ammonia emissions based on 100 parts per million.
c Post-VIP air rates from Valero.
d Units are thousand standard cubic feet per minute

CATEF = California Air Toxic Emission Factor database (CARB 2001).

TABLE 4.7-4
INCREMENTAL TOXIC EMISSIONS FOR FURNACES AND BOILERS FROM THE VIP

Pollutant	Emission Factors (lb/MMbtu)[a]	Source No. F-104 (lb/hr)	Source No. F-2901-2904 (lb/hr)	Source No. F-4460 (lb/hr)	Source No. F-301 (lb/hr)	Source No. F-351 (lb/hr)	Source No. SG-1032 (lb/hr)
Ammonia	6.00×10^{-3}	0.06	0.63	0.18	0.33	0.33	0.6
Benzene	2.07×10^{-6}	2.07×10^{-5}	2.18×10^{-4}	6.22×10^{-5}	1.14×10^{-4}	1.14×10^{-4}	2.07×10^{-4}
Toluene	8.57×10^{-6}	8.57×10^{-5}	9.00×10^{-4}	2.57×10^{-4}	4.71×10^{-4}	4.71×10^{-4}	8.57×10^{-4}
Xylene	2.82×10^{-6}	2.82×10^{-5}	2.96×10^{-4}	8.46×10^{-5}	1.55×10^{-4}	1.55×10^{-4}	2.82×10^{-4}
PAHs	3.48×10^{-9}	3.48×10^{-8}	3.65×10^{-7}	1.04×10^{-7}	1.91×10^{-7}	1.91×10^{-7}	3.48×10^{-7}
Hydrogen Sulfide	1.73×10^{-4}	1.73×10^{-3}	0.0181	5.18×10^{-3}	9.51×10^{-3}	9.51×10^{-3}	0.0173
Hexavalent chromium	2.31×10^{-7}	2.31×10^{-6}	2.43×10^{-5}	6.94×10^{-6}	1.27×10^{-5}	1.27×10^{-5}	2.31×10^{-5}
Arsenic	1.87×10^{-7}	1.87×10^{-6}	1.97×10^{-5}	5.62×10^{-6}	1.03×10^{-5}	1.03×10^{-5}	1.87×10^{-5}
Cadmium	1.28×10^{-7}	1.28×10^{-6}	1.35×10^{-5}	3.85×10^{-6}	7.05×10^{-6}	7.05×10^{-6}	1.28×10^{-5}
Copper	9.13×10^{-7}	9.13×10^{-6}	9.58×10^{-5}	2.74×10^{-5}	5.02×10^{-5}	5.02×10^{-5}	9.13×10^{-5}
Lead	2.87×10^{-7}	2.87×10^{-6}	3.02×10^{-5}	8.62×10^{-6}	1.58×10^{-5}	1.58×10^{-5}	2.87×10^{-5}
Manganese	3.74×10^{-7}	3.74×10^{-6}	3.93×10^{-5}	1.12×10^{-5}	2.06×10^{-5}	2.06×10^{-5}	3.74×10^{-5}
Mercury	2.25×10^{-7}	2.25×10^{-6}	2.36×10^{-5}	6.75×10^{-6}	1.24×10^{-5}	1.24×10^{-5}	2.25×10^{-5}
Nickel	1.49×10^{-7}	1.49×10^{-5}	1.56×10^{-4}	4.46×10^{-5}	8.18×10^{-5}	8.18×10^{-5}	1.49×10^{-4}
Zinc	4.21×10^{-6}	4.21×10^{-5}	4.42×10^{-4}	1.26×10^{-4}	2.32×10^{-4}	2.32×10^{-4}	4.21×10^{-4}
Acetaldehyde	3.60×10^{-5}	3.60×10^{-4}	3.78×10^{-3}	1.08×10^{-3}	1.98×10^{-3}	1.98×10^{-3}	3.60×10^{-3}
Formaldehyde	1.54×10^{-5}	1.54×10^{-4}	1.62×10^{-3}	4.63×10^{-4}	8.49×10^{-4}	8.49×10^{-4}	1.54×10^{-3}
Phenol	5.34×10^{-6}	5.34×10^{-5}	5.61×10^{-4}	1.60×10^{-4}	2.94×10^{-4}	2.94×10^{-4}	5.34×10^{-4}

[a] Emission factors based on the Benicia Clean Fuels Hot Oil Furnace Sources Test (Best Environmental, Inc 1996). An average value was used to calculate the emission factors.
If a chemical was not detected, half the detection limit was used. Units are pounds per million BTU.

TABLE 4.7-5
GAS TURBINE EMISSIONS (GT 1031)

Compound	Emission Factors (lb/million scf)[a,b]	Emission Rate lb/hr	Emission Rate ton/yr
Acetaldehyde	0.162	5.63×10^{-3}	0.0247
Arsenic	6.79×10^{-5}	2.36×10^{-6}	1.03×10^{-5}
Benzene	0.181	6.30×10^{-3}	0.0276
Beryllium	2.72×10^{-5}	9.46×10^{-7}	4.14×10^{-6}
Cadmium	4.16×10^{-3}	1.45×10^{-4}	6.34×10^{-4}
Chromium (hex)	2.66×10^{-4}	9.24×10^{-6}	4.05×10^{-5}
Copper	0.0132	4.59×10^{-4}	2.01×10^{-3}
Formaldehyde	0.342	0.0119	0.0521
Hydrogen sulfide	0.172	5.98×10^{-3}	0.0262
Lead	1.90×10^{-3}	6.61×10^{-5}	2.89×10^{-4}
Manganese	0.278	9.67×10^{-3}	0.0424
Mercury	8.27×10^{-3}	2.88×10^{-4}	1.26×10^{-3}
Naphthalene	0.0430	1.50×10^{-3}	6.55×10^{-3}
Nickel	0.0143	4.97×10^{-4}	2.18×10^{-3}
Phenol	0.0159	5.53×10^{-4}	2.42×10^{-3}
Phosphorus	0.0252	8.77×10^{-4}	3.84×10^{-3}
PAHs	4.39×10^{-4}	1.53×10^{-5}	6.69×10^{-5}
Selenium	3.39×10^{-4}	1.18×10^{-5}	5.16×10^{-5}
Toluene	0.187	6.50×10^{-3}	0.0285
Xylene (total)	0.415	0.0144	0.0632
Zinc	0.0193	6.71×10^{-4}	2.94×10^{-3}
Ethylbenzene	2.26×10^{-3}	7.86×10^{-5}	3.44×10^{-4}

[a] Emission factors were obtained from the California Air Toxic Emission Factor database (natural gas/refinery gas) (CARB 2001).
[b] Emission calculations assume an incremental firing increase of 40 million Btu/hour and a heating value of 1150 Btu/scf. Units are pounds per million standard cubic feet.

NOTE: Ammonia emissions were assumed to be zero because there are no sources of ammonia.

4.7.5.3 HEALTH RISKS

The TAC emissions identified in Tables 4.7-3 through 4.7-8 were input to the EPA dispersion model ISCST3 to calculate ambient air concentrations at receptors surrounding the facility. To ensure that the maximum offsite concentrations are determined, receptors were placed at 50 meter intervals around the project boundary. Additional receptors were included at 100 meter (328 feet) increments out to a distance of approximately one kilometer from the boundary. An interval of 260 meters was included out to a distance of approximately 2.5 kilometers, and 500 meter intervals to a distance of approximately of 5 kilometers. The model output concentrations of each TAC were then used in the multi-pathway health risk assessment model ACE2588 to

TABLE 4.7-6
TOXIC AIR CONTAMINANT EMISSIONS FROM TANKS

New Crude Storage Tanks

	New Crude Tank #1 (1707)			New Crude Tank #2 (1708)		
Contaminant	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)
Hexane (-n)	0	34.82	34.82	0	34.82	34.82
Benzene	0	33.93	33.93	0	33.93	33.93
Toluene	0	21.96	21.96	0	21.96	21.96
Ethylbenzene	0	5.09	5.09	0	5.09	5.09
Xylene (-m)	0	16.76	16.76	0	16.76	16.76

Gasoline (CARBOB) Tanks

	Tank 1751			Tank 1752			Tank 1754		
Contaminant	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)
Hexane (-n)	77.96	78.78	0.82	75.70	76.40	0.71	81.76	82.05	0.29
Benzene	88.86	90.33	1.47	85.97	87.24	1.27	91.24	91.75	0.51
Toluene	118.64	124.37	5.73	112.67	117.61	4.94	108.25	110.24	2.00
Ethylbenzene	11.62	12.77	1.15	10.71	11.70	0.99	8.49	8.89	0.40
Xylene (-m)	53.09	58.82	5.73	48.64	53.58	4.94	37.02	39.01	2.00

Gasoline (CARBOB) Tanks

	Tank 1755			Tank 1756			Tank 1771		
Contaminant	**Baseline**	**Post-VIP**	**Difference**	**Baseline**	**Post-VIP**	**Difference**	**Baseline**	**Post-VIP**	**Difference**
Hexane (-n)	75.17	75.42	0.25	73.71	74.01	0.30	76.95	77.62	0.67
Benzene	83.84	84.29	0.45	82.40	82.93	0.54	87.25	88.46	1.21
Toluene	99.12	100.86	1.73	98.76	100.85	2.09	113.31	118.03	4.72
Ethylbenzene	7.72	8.06	0.35	7.92	8.34	0.42	10.60	11.55	0.94
Xylene (-m)	33.57	35.30	1.73	34.73	36.82	2.09	48.03	52.75	4.72

TABLE 4.7-6 (Continued)
TOXIC AIR CONTAMINANT EMISSIONS FROM TANKS

Jet Fuel Tanks

	Tank 1772			Tank 1778			Tank 1779		
Contaminant	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)
Benzene	2343.85	2685.71	341.86	953.11	1184.63	231.52	909.91	1126.62	216.71
Ethylbenzene	1404.05	1608.84	204.79	570.95	709.64	138.69	545.07	674.89	129.82
Naphthalene	3.22	3.69	0.47	1.31	1.63	0.32	1.25	1.55	0.30
Toluene	1749.07	2004.18	255.11	711.25	884.02	172.77	679.01	840.73	161.72
Xylenes (mixed)	331.11	379.40	48.29	134.64	167.35	32.71	128.54	159.15	30.61

Diesel Tanks

	Tank 1773			Tank 1774			Tank 1775		
Contaminant	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)
Benzene	8.42	8.48	0.06	19.45	21.37	1.92	13.80	15.55	1.76
Ethylbenzene	4.11	4.14	0.03	9.49	10.43	0.94	6.73	7.59	0.86
N-Hexane	4.59	4.63	0.03	10.61	11.66	1.05	7.53	8.49	0.96
Naphthalene	0.79	0.79	0.01	1.82	1.99	0.18	1.29	1.45	0.16
Toluene	6.24	6.29	0.04	14.42	15.84	1.42	10.23	11.53	1.30
Xylenes (mixed)	19.32	19.45	0.13	44.61	49.02	4.41	31.65	35.68	4.03

Diesel Tanks

	Tank 1777		
Contaminant	**Baseline** (lb/yr)	**Post-VIP** (lb/yr)	**Difference** (lb/yr)
Benzene	2.03	2.21	0.18
Ethylbenzene	0.99	1.08	0.09
N-Hexane	1.11	1.21	0.10
Naphthalene	0.19	0.21	0.02
Toluene	1.51	1.64	0.14
Xylenes (mixed)	4.66	5.08	0.42

NOTES: MTBE is expected to be phased out prior to completion of the VIP.
Emission decreases were not included in the health risk assessment analysis.

TABLE 4.7-7
FUGITIVE TOXIC AIR CONTAMINANT EMISSIONS

	Weight (%)[a]			Emissions (lb/hr)			
Compound[b]	**Valve**	**Flange/Conn**	**Pump**	**Valve**	**Flange/Conn**	**Pump**	**Total** (lb/hr)
1, 2, 4 – Tmb[c]	0.198	0.149	0.0727	2.95×10^{-4}	6.17×10^{-4}	8.06×10^{-5}	9.93×10^{-4}
1, 3 – Butadiene	0.0962	0.0468	5.82×10^{-3}	1.44×10^{-4}	1.94×10^{-4}	6.45×10^{-6}	3.44×10^{-4}
Benzene	1.79	0.953	2.63	2.67×10^{-3}	3.96×10^{-3}	2.91×10^{-3}	9.53×10^{-3}
Biphenyl[c]	5.66×10^{-6}	1.57×10^{-6}	2.91E x 10^{-6}	8.44×10^{-9}	6.53×10^{-9}	3.22×10^{-9}	1.82×10^{-8}
Cumene[c]	0.0939	0.0471	8.73×10^{-3}	1.40×10^{-4}	1.95×10^{-4}	9.67×10^{-6}	3.45×10^{-4}
Cyclohexane[c]	0.726	0.574	1.42	1.08×10^{-3}	2.38×10^{-3}	1.57×10^{-3}	5.03×10^{-3}
Ethylbenzene	0.241	0.0203	0.303	3.60×10^{-4}	8.41×10^{-4}	3.35×10^{-4}	1.54×10^{-3}
Ethylene[c]	0.722	1.74	0.00	1.08×10^{-3}	7.23×10^{-3}	0.00	8.34×10^{-3}
Naphthalene	5.66×10^{-3}	0.0112	2.91×10^{-4}	8.44×10^{-6}	4.66×10^{-5}	3.22×10^{-7}	5.54×10^{-5}
Propylene	9.15	7.49	1.48	137	0.0311	1.64×10^{-3}	0.0464
Toluene	2.37	1.68	3.27	3.54×10^{-3}	6.98×10^{-3}	3.62×10^{-3}	1.41×10^{-3}
Xylene	1.34	1.03	1.42	2.00×10^{-3}	4.29×10^{-3}	1.57×10^{-3}	7.87×10^{-3}
Total VOC				0.149	0.415	0.111	

Component	**Emission Factor**[d] (lb/comp/day)	**Count**
Valve	0.00179	2000
Flange/Conn	0.00166	6000
Pump	0.133	20

a Weight % is the percentage of the specific compound in the total gas leakage and is based on information contained in the Toxic Release Inventory (TRI).

c Chemical has no OEHHA toxicity factor, therefore it was not included in the health risk assessment calculations.

b MTBE is assumed not to be present in post-MTBE phase-out (pre-VIP).

d Emission factors are expressed as pounds of total gas leakage per component per day and are accepted by BAAQMD in the 2001 Annual Update. The factors are based on CAPCOA correlation equations and actual Benicia Screening Values.

TABLE 4.7-8
OPERATIONAL DIESEL PARTICULATE EMISSIONS FROM MOBILE SOURCES

	Valero Improvement Project		Cumulative Valero Projects	
Mobile Source Description	**Count**[a]	**Diesel Particulates** (lb/hr)[b]	**Count**[a]	**Diesel Particulates** (lb/hr)[b]
Trucks	5840 per year		8419 per year	
Bayshore Rd and I-680[c]		1.05×10^{-4}		1.51×10^{-4}
Onsite[c]		5.23×10^{-5}		7.55×10^{-5}
Locomotives[d]	402 per year	4.49×10^{-4}	405 per year	4.49×10^{-4}
Ships	16 per year		16 per year	
Hoteling[e]		0.028		0.028
Pumping[e]		0.0631		0.0631
Transit		0.0107		0.0107
Tugs[f]		0.036		0.036

[a] Mobile source increases are based on "net" increases due to project operations.
[b] Truck emissions were calculated based on modeling source length.
- Bayshore Road = "2" 400-foot sources; 800-foot round trip (0.1515 mile).
- Onsite = "11" 400-foot sources; 800-foot round trip (0.1515 mile).
- Interstate 680 = "19" 800-foot; 1600-foot round trip (0.30303 mile).
- Emission factor = 0.001 pounds per mile.

[c] Half of the trucks are assumed to travel northbound on I-680 and half are assumed to travel southbound on I-680.
- All trucks travel along Bayshore Road.
- Sources on Bayshore Road and on-site sources are half the size of the I-680 sources.

[d] Locomotive net increase is based on an increase of 1,608 rail cars per year and 4 rail cars per day.
[e] Hoteling and pumping emissions modeled as a single source.
[f] Tugs are modeled as two sources: one located at the dock and another in the Bay.

Source sizes were based on road width. Bayshore Road and on-site roads were assumed to be 40 feet wide and Interstate 680 was assumed to be 80 feet wide. The ISCST3 model does not allow an area source to be longer than 10 times its width. Therefore, the sources were modeled as different sizes.

estimate multi-pathway incremental health risks at key receptors. Table 4.7-9 summarizes the results. They show that the maximum incremental cancer risk at a residential receptor is 1.02 in a million, with diesel particulate matter from mobile sources being a major contributor. The maximum non-residential cancer risk is 1.76 in a million. In either case, the incremental cancer risk is less than the significance threshold of 10 in a million, which is the established significance threshold as explained in Section 4.7.4. Therefore the incremental cancer impacts are less than significant.

With regard to potential adverse health effects from non-carcinogenic TACs, Table 4.7-9 reports the maximum hazard indices at key receptors. The maximum levels are well below the significance threshold of 1.0, as described above in Section 4.7.4. Therefore, the impacts are less than significant, and no additional mitigation measures are required.

TABLE 4.7-9
OPERATIONAL HEALTH RISK ASSESSMENT RESULTS

Receptor Description	Cancer Risk[a]	Chronic Hazard Index
Stationary Sources		
Maximum Residential Location[a]	0.665 in one million	0.0060
Maximum Nonresidential Location	0.671 in one million[b]	0.0099
Mobile Sources		
Maximum Residential Location[a]	0.800 in one million	0.000622
Maximum Nonresidential Location	1.70 in one million[b]	0.00813
Combined Mobile and Stationary Sources		
Maximum Residential Location[a]	1.02 in one million	0.00749
Maximum Nonresidential Location	1.76 in one million[b]	0.00962

[a] Cancer risk based on a 5-year average.
[b] Occupational factor of 0.144 applied to maximum cancer risk location.

There will be an increase in the amount of coke and sulfur that will be generated with the VIP, and there could be an increase in fugitive dust from the handling of these substances. These emissions would contribute to PM-10 emissions from the project and, since these emissions would occur at ground-level, there could be increased PM-10 levels immediately downwind of operations. As long as the material handling is shielded to prevent dust entrainment by the wind, particulate matter emissions would not be transported to offsite receptors farther from the source, and the impacts would be less than significant.

Increased sulfur waste from the sulfur recovery unit may be stored onsite until it is disposed of in a secure landfill or is sold as a raw material for other processes. It is moderately hazardous, being classified as a special waste, since the dust can be harmful if inhaled or if contact with the skin occurs. Also, sulfur can cause water that contacts it to become acidic. The sulfur should be covered to prevent wind erosion and to prevent leaching by water runoff. If these measures are adopted, the health risks would be less than significant.

Analysis of VIP Without Scrubber

If other parts of the project are operating before the flue gas scrubber on the main stack is operational, there would be a change in TAC emissions for the project, as compared to the VIP with the flue gas scrubber. In this case, emissions of criteria pollutants from the main stack would be limited to historically demonstrated levels. This would affect TAC emissions from the project, since TAC emissions form portions of emissions of two criteria air pollutants: PM-10 and VOC. Any change in emissions of these two criteria pollutants would result in corresponding changes in TAC emissions. For example, some TACs, such as benzene and 1,3 butadiene, are contained in VOCs, and any changes in VOC emissions from the VIP would result in a corresponding change in these TACs.

When comparing VOC emissions from the VIP with the scrubber (Table 4.2-12) with VOC emissions without the scrubber (Table 4.2-13), there is a 1% decrease in emissions. There would be a corresponding decrease in TAC emissions that are part of VOC emissions. With regard to TACs associated with PM-10, such as lead and cadmium, Table 4.2-13 shows that there would be a 0.4% decrease in emissions.

The decreases in TAC emissions with the no-scrubber scenario would lead to a slight decrease in incremental health risks from stationary sources. The maximum incremental carcinogenic health risk of 0.67 in a million, as reported in Table 4.7-9 for the VIP with the scrubber would be decreased slightly by about 0.01 in a million.

Because operation of the VIP without the flue gas scrubber would lead to a reduction in product throughput, TAC emissions from mobile sources would be only one half the emissions of the VIP with the scrubber. This would lead to a considerable reduction in the carcinogenic health risk increment from mobile sources. The maximum health risk increment of 1.7 in a million from mobile sources, as shown in Table 4.7-9, would decrease by half to 0.85 in a million.

In conclusion, there would be a decrease in the health risk increment from TAC emissions if the flue gas scrubber is not operational and the crude throughput is reduced. In either case (with or without the scrubber), the incremental health risks from the project would be less than significant.

4.7.5 CUMULATIVE IMPACTS

Impact 4.7-2: The proposed project, along with other ongoing and approved projects would lead to a net reduction in emissions of TACs which are responsible for public health impacts. The reduction in TAC emissions would constitute a net improvement in health risks, and the impact would be less than significant.

Cumulative impacts on Public Health could occur if TAC emissions from the VIP were to combine with TAC emissions from other cumulative projects in the region. Table 4.2-12 in Section 4.2, *Air Quality* shows that, for the cumulative projects at the refinery, emissions of PM-10 and VOC, the pollutants that contain TACs would be less than emissions for the VIP scenario alone. TAC emissions for the Cumulative Scenario would also be less than TAC emissions for the VIP alone scenario.

Table 4.7-9 shows that the maximum cancer risk for the VIP is predicted to be 1.76 in a million, which is a less than significant impact. Under the cumulative scenario, the cancer risks would be less than 1.76 in a million, since TAC emissions for this scenario are less than VIP emissions. Therefore, exposure levels of TACs from cumulative projects would be less than significant.

Mitigation: None required.

REFERENCES – Public Health

Bay Area Air Quality Management District, *Toxic Air Contaminant Control Program: Annual Report 2000*, December 2001.

Best Environmental, Inc., *Source Tests for Hot Oil Furnace at Benicia Refinery*, 1996.

California Air Resources Board, *California Air Toxic Emission Factor II Database (CATEF)*, 2001.

City of Benicia, *Benicia General Plan*, adopted by Benicia City Council, June 15, 1999.

Exxon Research and Engineering Co., *Application for a Use Permit, Benicia Refinery Clean Fuels Project, Vol. II, Health Risk Assessment*, revised 1993.

4.8 PUBLIC SAFETY

The risks to public safety from potential accidents from the VIP are low, and the impacts from plausible accidental releases would be less than significant. No additional mitigation measures would be needed.

4.8.1 INTRODUCTION

Refinery operations involve the processing and handling of substances that are classified combustible, flammable and/or acutely toxic, with the potential for fires and explosions or the release of toxic vapors. The risk to the public is measured in terms of the likelihood or probability of an accident and the severity of the consequences of an accident. This section evaluates the potential threats to the public from accidental releases of hazardous substances related to the VIP. In order to minimize the possibility of accidental releases, refinery practices are subjected to strict process safety management programs to prevent and mitigate potential accidents.

4.8.2 SETTING

4.8.2.1 GENERAL REFINERY HAZARDS

Oil refineries handle, store and process large quantities of flammable materials and acutely toxic substances. Accidents related to these substances can result in public exposure to heat radiation from a fire, blast overpressure from an explosion, or airborne exposure to acutely hazardous substances. These hazards can occur from operations at the refinery or from transportation of hazardous materials to and from the refinery.

Fires, which are caused by ignition of flammable materials, can result in exposure to heat radiation. The heat decreases rapidly with distance from the flame. Refinery fires generally pose little risk to the public, mainly because they are typically confined to the vicinity of the equipment from which the flammable release would occur. Since there is a buffer distance between the source of such fires and the public, exposure to heat radiation by the public would generally not occur.

Explosions can occur if flammable vapors and gases are ignited or when a flammable substance is released at high temperatures, and usually under elevated pressure. Impacts of an explosion are expressed in terms of a sudden increase in pressure above ambient pressure, resulting from a blast or shock wave. The types of explosions associated with refineries can include a vapor cloud explosion (VCE) and a boiling liquid vapor cloud explosion (BLEVE). A VCE occurs when a flammable gas is mixed with air and then encounters an ignition source. VCEs are very rare, because they require that sufficient air be combined with the flammable gas before ignition, thus resulting in an explosive mixture. Instead, a more common event would be a flash fire in which ignition occurs before mixing with atmospheric air. Such fires do not result in an explosion which could cause damaging overpressure.

A BLEVE would occur when a confined flammable liquid vessel ruptures from excess pressure because of heating. The result is a rapid expansion of the material as it is exposed to ambient pressure and subsequent ignition of the released liquid aerosol and vapors. Such an event can occur if there is an external fire that engulfs a vessel containing a flammable liquid. BLEVEs are also very rare.

Airborne exposure can occur with a release of a substance from the refinery that is acutely hazardous, such as ammonia, hydrogen sulfide or sulfur dioxide. A release can be a threat if a harmful concentration of the gas occurs at offsite receptors.

4.8.2.2 EXISTING CONDITIONS

The refinery is located on the portion of the property in which there is a buffer between refinery operations and offsite locations. The buffer can help minimize impacts from an accidental release. The closest residences are about 3,000 feet northwest of the process area. Because of the prevailing wind direction, a release from the refinery would usually be downwind of the residential areas. Public roads are a few hundred feet from the area containing stored flammable liquids and are about the same distances from loading areas.

4.8.2.3 ACUTELY HAZARDOUS SUBSTANCES HANDLED AT THE REFINERY

The refinery presently handles a variety of acutely hazardous materials, including flammable substances, such as hydrogen with a flash point as low as –100 degrees Fahrenheit (F) and gaseous hydrocarbons up to butane. Materials with low flash points must be handled carefully to prevent fires or explosions.

Other materials that are acutely hazardous because of their toxicity include:

- Hydrogen Sulfide (H_2S) – an odorous, colorless, corrosive, irritating, and toxic gas. The odor of H_2S is perceived at levels well below the toxicity threshold.
- Ammonia – an odorous, colorless, corrosive, toxic gas with a sharp irritating odor.
- Sulfur dioxide – a colorless, corrosive, toxic gas with an irritating pungent odor.

The risks of upsets or accidents at the existing refinery were evaluated in a Risk Management Plan (RMP) that was prepared in June 1999 (EXXON 1999). The RMP complies with the California Accidental Release Program (CalARP) and with the Federal Regulations under Section 112(r) of the 1990 Clean Air Act Amendments, and it covers the following items related to accidental releases of acutely hazardous substances:

- Identification and quantification of acutely hazardous substances at the refinery,
- A five-year accident history of the plant,

- Identification of potential accidental releases that might occur in the future at the existing plant if a failure in operations were to occur,
- Reporting of expected offsite consequences if such accidents were to occur,
- An emergency response program to mitigate the consequences of an accidental release, and
- A prevention program that can further reduce the potential for accidents.

The existing RMP identified potential accidental releases that might occur by systematically evaluating the potential for failure of critical devices and processes, and plausible accidental releases were modeled to assess the offsite consequences. The RMP then identified a number of prevention and training programs that were instituted to reduce the potential for occurrence of accidental releases.

The prevention measure for the existing refinery is following the design and construction standard to ensure integrity of the equipment. The existing refinery is designed to many industrial design codes, including standards issued by the American Petroleum Institute (API), the American Society of Mechanical Engineers (ASME), and the American National Standards Institute (ANSI).

Process control systems at the existing refinery are designed with protective features, such as failsafe valves that default to safe positions in the event of electronic or pneumatic failure, pressure relief valves for overpressure, alarms and automatic shutdown devices.

The RMP and other related documents contain written operating and maintenance procedures that ensure safe operations. These documents cover subjects in: Employee training and safety participation, process hazards analysis, operating manuals, maintenance procedures, work permit procedures, preventive maintenance procedures, and incident investigation procedures.

4.8.2.4 ACCIDENT HISTORY

The 1999 RMP reported that there were no accidents related to flammable substances or releases of acutely hazardous substances at the refinery in the previous six years (1993 to 1999). From 1999 information has indicated that there were no accidents at the refinery from flammable or from acutely toxic materials that would cause an offsite impact.

In addition, OSHA records on worker accident safety show that the rate of reportable injuries in the past five years at the refinery has been decreasing, which is consistent with the general findings for major oil refineries (Lees 1996). Also, OSHA records show that the worker injury and illness rate at the refinery is about one half the average rate for refineries in the U.S (OSHA 2002).

4.8.2.5 APPLICABLE REGULATIONS

There are a number of federal and state regulations that focus on reducing the risks from chemical hazards, some of which include:

- the California Accidental Release Prevention (CalARP) Program,
- the U.S. Occupational Safety and Health Administration (OSHA) Process Safety Management (PSM) Rule,
- U.S. EPA Accidental Release Prevention/Risk Management Plan (RMP) Rule, and
- the California OSHA Injury and Illness Prevention Program.

These regulations require that facilities assess the potential for accidental releases of acutely hazardous substances and that programs are established to minimize the frequency and extent of accidental releases. The regulations are geared to protect both workers and the general public, and they cover the issues that were described above for RMPs.

After the VIP components are installed at the refinery, a revised RMP will be required to satisfy the CalARP regulation. The RMP will include a detailed hazards and operability study of the changed components, as well as a revised offsite consequence analysis of plausible accidents, and a revised accident prevention and training program. This report covers accidents that might happen, based on the detailed risk analyses that were carried out for the existing equipment which will be modified and on the accident history of similar equipment at other refineries.

In addition, the *City of Benicia General Plan* (1999) with the goal of minimizing public exposure to hazards related to industrial sources. The General Plan has a section that addresses community hazards, policies, and programs, and it follows the guidelines established in the Emergency Planning and Community Right-to-Know Act (EPCRA). The General Plan contains goals and policies that apply to both Public Health and Public Safety, and they include:

Goal 4.7 Ensure that existing and future neighborhoods are safe from risks to public health that could result from hazardous materials.

The main policies for this goal are:

Policy 4.7.1 Actively recruit industries and businesses that sustain environmental quality and have sound, responsible environmental policies, such as “best available control technology” (BACT), source reduction, reduced use of hazardous materials in production, and reduced waste.

Policy 4.7.2 Establish a “Community Right-to-know” program to promote general public understanding of Benicia’s toxics problems as they affect current and future generations.

Policy 4.7.3 Protect existing and future development from contaminated sites, hazardous landfill waste and debris, chemical spills, and other hazards, including unexploded ordnance and explosive waste.

The project is a modification of the existing facility which has a history of safe operations and has been consistent with the policies of the General Plan. Therefore, the VIP modifications would be consistent with the General Plan.

4.8.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

The significance of any potential upset or accident is judged both by the severity of the impact and its likelihood of occurrence. The likelihood of occurrence of an accident can be categorized according to the probability that an accident can occur in a year of operation, where a probability of 0.01 means that there is a one percent chance that an accident would occur within the year of operation, or a ten percent chance that an accident would occur over 10 years of operation. Probability ratings were given on two different studies for the Benicia refinery (Exxon 1993a and URS 2002b). The qualitative ratings for the three categories of accidental releases (low, medium, high probability) are given in Table 4.8-1 for the two studies. To ensure safe operations for the VIP, the more conservative probabilities (likelihood), as given in the URS study were used to determine significance.

TABLE 4.8-1
EVALUATION CRITERIA FOR DETERMINING THE LIKELIHOOD OF AN ACCIDENTAL RELEASE

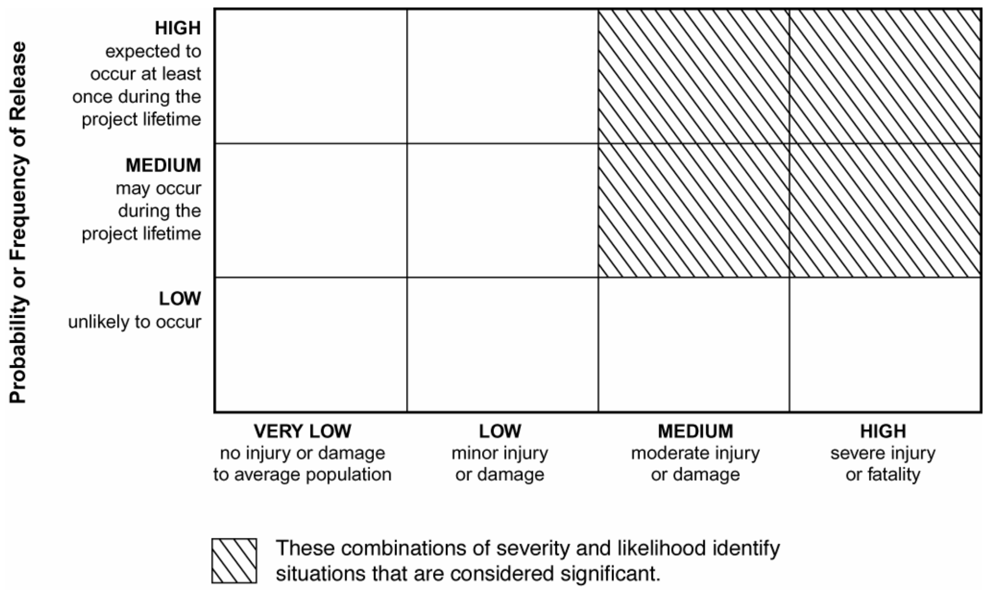
Qualitative Description	Annual Probability[a] (source: Exxon 1993a)	Annual Probability[a] (source: URS 1993b)	Description
Low	$\leq 2 \times 10^{-3}$	$\leq 3 \times 10^{-4}$	Unlikely
Medium	$(>2 \times 10^{-3}) - (2 \times 10^{-2})$	$(>3 \times 10^{-4}) - (3 \times 10^{-3})$	May occur within 30-year period
High	$\geq 2 \times 10^{-2}$	$\geq 3 \times 10^{-3}$	Expected to occur within 30-year period

[a] Annual Probability is the chance that an accident would occur in a year of operation. To ensure safety for the VIP, the probabilities from the URS study are used to determine significance.

The significance of an accidental release is determined by following methods used by regulatory agencies to evaluate risks, including the California Accidental Release Program. The likelihood (probability) of an accidental release is combined with the severity of the offsite consequence to determine if the event would be significant. Figure 4.8-1 shows a matrix that combines likelihood with offsite consequence. An accidental release is judged to be significant if both the likelihood of the event and the offsite consequence are in the medium or high category.

4.8.3.1 SEVERITY OF AN ACCIDENT

Severity criteria must be defined separately for each type of consequence due to the physical differences in the effect of each. The types of accidents considered in this evaluation include toxic releases, fires, and explosions. These hypothetical accidents could result in potential toxic gas exposure, heat impacts, and blast consequences. In qualitative terms, the severity of these consequences can be described as very low, low, medium, and high. A very low severity includes consequences that can be detected but are not expected to result in even minor injury to the surrounding community. A low severity level corresponds to minor irritation or injury. A



Valero Improvement Project EIR / 202115 ■

Figure 4.8-1
Risk Matrix for Ranking Risk Scenarios

medium level of severity corresponds to moderate property damage or injury. A high level of severity corresponds to major damage, serious (i.e., irreversible) injury, or fatality.

Specific criteria have been established to categorize impact severity for the types of consequences that could occur with this project. These criteria are defined for toxic gas exposure; for exposure to thermal radiation, and explosion effects. The severity criteria are applied to consequences determined for persons at or beyond the refinery fence-line.

4.8.3.2 TOXIC EXPOSURE EVALUATION CRITERIA

Toxic exposures are of concern when there is a release from a process containing an acutely hazardous material, or when an upset causes the formation and subsequent release of a toxic material. Among the different standards on toxic gas exposure and effects, the Emergency Response Planning Guidelines (ERPG) (American Industrial Hygiene Association, AIHA, 2002) are generally the most applicable. ERPGs are intended to provide estimates of threshold concentration of acutely hazardous substances where a range of adverse effects might occur depending on the severity of the effect (ERPG 1 through 3). The ERPGs were developed in 1988, and they were updated when new health effects data were available. Severity criteria for toxic gases according to ERPG levels 2 and 3 are given in Table 4.8-2. For the acutely hazardous substances of concern, the suggested Guideline level by the State and Federal regulations is ERPG-2.

TABLE 4.8-2
TOXIC EXPOSURE EVALUATION CRITERIA

Qualitative Level	Concentration Level	Description
Low	below ERPG-2	Concentration range in which irritation or mild transient health effects could occur in the general population after 1-hr exposure.
Medium	between ERPG-2 and ERPG-3	Concentration range in which irreversible or other serious health effects could be experienced in the general population after 1-hr exposure.
High	greater than ERPG-3	Concentration above which life threatening health effects could occur in the general population.

The ERPG (Emergency Response Planning Guidelines) have been established by the American Industrial Hygiene Association.

A project impact would be termed significant if the offsite consequence from a plausible toxic gas release would result in an exceedance of the ERPG-2 level during the life of the project. The ERPG-2 levels of the toxic gases of concern are given in Table 4.8-3.

TABLE 4.8-3
TOXIC GAS THRESHOLD CRITERIA

Toxic gas	End Point Criterion (ppm)[a]	Basis
Ammonia	200	EPRG-2, US EPA RMP Toxic End Point
Hydrogen Sulfide	30	EPRG-2, US EPA RMP Toxic End Point
Sulfur Dioxide	3	EPRG-2 (sulfur dioxide is not a listed substance in the RMP program)

[a] Units are parts per million by volume

4.8.3.3 RADIANT HEAT CRITERIA

Radiant heat is a potential hazard that can be associated with either fires or explosion. Radiant heat exposures are measured in units of kilowatts per square meter (kW/m^2). Table 4.8-4 lists the criteria selected to evaluate radiant heat exposures for this study. Radiant heat levels of less than 4 kW/m^2 are considered to have low impacts.

TABLE 4.8-4
RADIANT HEAT EVALUATION CRITERIA

Qualitative Level	Quantitative Level (kW/m^2)	Description
Low	Below 4 kW/m^2	Level causing pain but allowing escape with no more than second-degree burns.
Medium	4.0 to 12.5	Level causing second-degree burns within 20 seconds, but allowing escape.
High	Above 12.5	Level with the potential for third-degree burns; fatality possible at higher levels.

4.8.3.4 EXPLOSION IMPACT CRITERIA

Blast impacts are of concern wherever flammable materials and ignition sources are present, or where processes operate under high temperatures and pressures. Criteria for blast impacts are described in terms of overpressure (i.e., shock waves) or the instantaneous increase in air pressure as a result of an explosion, as shown on Table 4.8-5. These data are based on criteria presented in the American Institute for Chemical Engineering's "Guidelines for Chemical Hazardous Evaluation Procedures" (AIChE 1989) and Clancey (1972). Overpressure of 0.7 pounds per

TABLE 4.8-5
EXPLOSION EVALUATION CRITERIA

Qualitative Level	Quantitative Level[a]	Description
Low	Below 0.7 psig[a]	Level above which glass breakage could result in minor injury.
Medium	0.7 to 2.3 psig[a]	Level above which moderate structural damage is likely and could result in serious injury.
High	Above 2.3 psig[a]	Lower limit of serious structural damage which could in turn pose life threatening injury; direct injury, e.g., eardrum rupture, occurs at higher overpressures.

[a] Blast impacts are described in terms of incident overpressure or shock waves and are measured in pounds per square inch gauge (psig).

square inch gauge (psig) or less are defined as having a low impact. However, between 0.3 and 0.7 psig, there is the potential for glass breakage and other minor property damage. Overpressures between 0.7 and 2.3 psig are defined as having a medium impact. An overpressure of 2.3 psig is described as the lower limit of serious structural damage. Although other references do not indicate serious injury until 5 psig and fatality at 15 psig or above, structural damage could lead to serious injury or fatalities to occupants of the structure. Therefore, overpressures greater than 2.3 are defined as having a high-level impact.

4.8.3.5 LIKELIHOOD OF AN ACCIDENT

The likelihood of an occurrence can be expressed as “low”, “medium” or “high”. In qualitative terms, a low likelihood event is considered unlikely to occur during the 30 year life of the project. Medium likelihood represents an event that may occur in the 30 year lifetime of the project, and high likelihood is associated with an event expected to occur at least once in the lifetime of the project.

4.8.4 IMPACTS AND MITIGATION MEASURES

4.8.4.1 CONSTRUCTION IMPACTS

Risk of accidents during the construction phase can be minor accidents confined to actual construction events, or can be accidents that would affect ongoing operations. Minor construction accidents are not within the scope of the Public Safety analysis. Construction accidents that would affect ongoing operations would be considered under Section 4.8.5 - Operations Impacts.

4.8.4.2 OPERATIONS IMPACTS

Impact 4.8-1: Possible accidental releases of acutely hazardous substances that might result from the VIP were evaluated, and none were found to cause an unhealthful offsite impact or would not occur within the expected 30 year life of the plant. The impacts would therefore be less than significant.

The Risks to Public Safety from accidents addresses the processes that are being added or modified as a result of the VIP, and the steps include:

- Define VIP Process modifications,
- Identify potential hazards,
- Select representative accident scenarios,
- Conduct an offsite consequence analysis, and
- Compare impacts to significance criteria.

The VIP involves a number of modifications to existing refinery processes, along with the addition of some new processes. Specific process hazards were identified by combining the knowledge of the equipment proposed with an analysis of the potential hazards that could occur with these changed processes. The process hazards analysis has considered that all equipment coming into contact with sour crude oil or sour gas, which are corrosive substances, will have corrosive resistant components to eliminate breakdown and failure during the life of the project.

This report is based on the hazards analysis that was prepared by the Applicant and its consultants. The hazards analysis was based on previous hazards studies that were conducted for the refinery (Exxon 1993a and 1993b). The hazards studies were independently reviewed by a consultant to the City of Benicia (ENSR 1993). ENSR determined that the scenarios identified in the hazards studies provide a conservative estimate of potential accidental releases. Valero and its consultants updated the earlier analysis for purposes of the VIP. Both analyses were critically reviewed as part of the preparation of this EIR. The VIP was examined from the perspective of determining if the project will introduce any fundamentally new hazards into the refinery and/or to what extent the project will alter existing risks. The Valero refinery uses a formal method for conducting the Process Hazards Analyses which include Hazard and Operability (HAZOP) studies and Fault Tree Analyses to determine if events can be propagated throughout the system. These analyses are done on a regular basis, and when the new equipment related to the VIP is installed, an updated detailed Process Hazards Analysis will be carried out.

Mitigation: None required.

POTENTIAL PROCESS FAILURES

The processes affected by the VIP have already been subjected to detailed HAZOPS and are scheduled for additional analyses as equipment modifications are installed.

Operational failures can cause conditions that would lead to failures in cooling systems, heating systems, power supplies and instrument air pressure. These failures can lead to a variety of process upsets. The processes that will be affected by the VIP are identified in Table 4.8-6, along with the types of failure modes that might occur. The characteristics of individual processes related to the VIP and that pertain to potential accidental releases are described below.

Crude Oil Processing

The lower grade crude oils expected in the project will be fractionated at the Pipestill where a vacuum tower aids in the separations. Accidents can occur at this unit with air intrusion in case of equipment leaks. An internal ignition in the Pipestill can damage the equipment, but it will be localized. The VIP is not expected to influence the hazards for this operation.

Fluid Catalytic Cracking Unit (FCCU)

The FCCU requires the use of catalyst to convert heavier hydrocarbons into lighter more volatile products in a reactor. Air is then introduced into a separate regeneration vessel to burn carbon residue from the catalyst. The VIP will result in an increase in the oxygen content of the regenerator combustion air stream to handle the greater amount of catalyst regeneration. A process upset can occur from an imbalance in the pressure between the reactor and the regeneration vessel, and could lead to a fire or explosion in the reactor vessel.

In the current unit, slide valves normally open and close only to shut down catalyst circulation in an emergency situation. In the VIP, they will be replaced with flow control slide valves that will add flexibility in controlling catalyst circulation, temperature, and differential pressure between

TABLE 4.8-6
VIP CHANGES RELATED TO ACCIDENTAL RELEASE POTENTIAL

Process	Defining Operating Characteristic	VIP Change	Unique Process Failure Mode	Unique VIP Effect
Crude Oil Processing	Fractionation. Full range of product properties.	Heavier crude feedstocks Heat exchanger modifications	More LPG	None identified
Fluid Catalytic Cracking Unit (FCCU)	Mix hydrocarbons with fluidized catalyst in reactor vessel. Spent catalyst recirculated to separate regeneration vessel or vessels where combustion air or oxygen enriched air mixture introduced to burn carbon from catalyst.	Heavier feedstock Mechanical changes Oxygen additions to feed Burner modifications	Reactor explosion	Slight increase overheating potential
Coker	Mix hydrocarbons with fluidized coke in reactor vessel. Overall equipment similar to FCCU.	Heavier feedstock Mechanical change Oxygen additions to feed	Reactor explosion	Slight increase overheating potential
Sulfur Recovery Unit	Treat flammables mixed with H_2S	Increase in sulfur loading Auxiliary equipment change	H_2S toxic gas release SO_2 toxic gas release O_2 release	Increase in H_2S and potential SO_2 concentrations. Introduces strong oxidant inventory into flammables area.
Hydrofiners	Operates with mix of hydrogen and flammable liquid.	Feedstock changes Auxiliary equipment change	Hydrogen release	None identified
Hydrogen	Operates with mix of hydrogen and other flammable vapors.	New separations unit for refinery hydrogen production	Hydrogen release	Slight increase in in-process hydrogen inventory
Hydrocracking	Operates with mix of hydrogen and other flammable vapors.	Feedstock changes Auxiliary equipment change New pumps and piping	Hydrogen release	Slight increase in in-process hydrogen inventory
Alkylation		Feedstock changes Auxiliary equipment change New pumps and piping	None identified	None identified
Dimersol		Feedstock changes Auxiliary equipment change New pumps and piping	Ammonia release	None identified
Reformers (powerformer)	Catalytic reaction of hydrocarbon vapors.	Feedstock changes Auxiliary equipment change New pumps and piping	None identified	None identified
Storage Area				
Crude oil storage	Large volume inventory	Addition of two new tanks	Tank or pool fire	Slight increase in likelihood due to additional tanks
Coke silos	Solids storage	Increase in amounts produced, stored and shipped.		

TABLE 4.8-6 (Continued)
VIP CHANGES RELATED TO ACCIDENTAL RELEASE POTENTIAL

Process	Defining Operating Characteristic	VIP Change	Unique Process Failure Mode	Unique VIP Effect
Transportation				
Truck loading	Flammable liquid products transfer	Increase in propane truck traffic	Propane release	Modest increase in truck shipments and probability of release
Railcar loading	Flammable liquid products transfer	Slight increase in railcar traffic for coke, a non-hazardous material. No net change for flammable liquids.	Potential railcar accident.	Slight increase in railcar traffic and probability of release for coke, a non-hazardous material. No net change in flammable liquids.
Pipeline	Liquid products transportation offsite	Slight increase in flow rate and pressure	Flammable liquid release	Slight increase in potential spill volume

the reactor and the regenerator. This change will improve the control capabilities of the unit and will actually reduce the chance for a process upset. It is not clear at this stage of the design whether there will be only replacement or additional pumps in the system. However, because of technological improvements in pumps, the failure rate should not increase over existing conditions.

Coker Unit

The existing coker unit will be modified to increase throughput as a result of the VIP. This includes modifications to the air blower and gas compressor to increase capacity. Oxygen will be added to the compressor air feed with a new and improved design of the oxygen control system. Although the addition of oxygen presents a new hazard, the new design will improve the reliability of the system, thus decreasing the probability of failure over existing conditions.

Oxygen Enhancement at the FCCU and the Coker Unit

Oxygen enrichment will be required at the FCCU and the Coker units to provide sufficient combustion capabilities for these units. Upsets can occur when insufficient oxygen is supplied to these units. In order to minimize the risk of upsets, the instruments that control the oxygen concentration will be subject to a careful process hazards analysis after installation. The analysis will ensure that reliability of oxygen control is maximized and the risks of upsets are minimized. The primary upset condition would be a flow reversal, in which air from the regenerator could be transferred to the reactor and hydrocarbons from the reactor could be transferred to the regenerator, thus leading to an explosive mixture in either the reactor or regenerator. Such events rarely occur and would significantly damage the process internally, but are judged not likely be significant enough to cause offsite impacts on public safety.

Another possible event might be the release of oxygen from the storage tank and mixing with hydrocarbons to cause an explosive mixture. However, the oxygen storage tank is well separated from the vessels storing hydrocarbons, and it would require a major physical release to occur at both sources in order to cause such a mixture. The probability of such an event is judged to be low, since the events are unrelated.

Sulfur Recovery Unit (SRU)

Since the sulfur recovery unit will handle large quantities of hydrogen sulfide, there is the potential for an accidental release of hydrogen sulfide or hydrogen sulfide mixed with flammables, leading to a toxic gas release or fire or explosion.

Hydrogen Production

Because of feedstock changes with the VIP, there will be increased hydrogen production needed for the various processes. A pressure swing absorption (PSA) process will be added to increase hydrogen production. The primary hazards would involve the release of flammable vapors and gases, including hydrogen.

Transportation Hazards

Flammable and toxic materials are transported to and from the refinery by pipeline, railcar, ship, and truck. Transport of these materials can result in a fire or explosion, depending on the conditions of the release. For substances transported by truck, the most severe accident would be the release of an entire truck inventory. Truck deliveries of the hazardous materials, molten sulfur and propane are expected to increase with the VIP. Propane shipments by truck will increase by about 22 percent. The incremental change in risk for a propane truck release will therefore increase. Aqueous ammonia is also transported to the refinery by truck. However, the frequency of ammonia shipments is not expected to change with the VIP. If low-NOx burners are substituted at some combustion sources that presently use thermal de-NOx system with ammonia, the ammonia shipments may actually decrease.

Transportation accidents related to railcar shipments of volatile hydrocarbon liquids can result in fires or explosions. However, the VIP will not increase the rail shipment of these materials. Only coke shipments will increase. Fugitive emissions of coke dust can occur during handling operations. Depending on the particle size of the dust, emissions can be considered as criteria air pollutant (PM-10) or a fine criteria air pollutant (PM-2.5). Health effects from exposure to coke dust would be covered under regulations for the criteria pollutants PM-10 and PM-2.5.

Marine transport of coke and of crude oil will increase as a result of the VIP. There will be one additional ship per month for coke. Also, there will be about three additional ships per month for crude oil transport and a reduction of two barges and ships for gas oil transport. This would result in an increase of about 24 ship visits per year, as compared with 229 ship visits for baseline conditions.

The incremental increase in risk from marine transport was estimated from data provided for ship collisions (FEMA 1989). For harbor and mooring accidents, the probability of an accident is reported in the FEMA document to be 0.001 accidents per transit, and about 0.15 of the accidents would result in a spill. Assuming 48 transits for the 24 additional port calls, the estimated probability of an accidental release resulting in a spill would be 0.0072 releases per year. This probability exceeds the “high” threshold shown in Figure 4.8-1. However, because of the type of collision that could occur in the harbor, the spill volume would be small, and the consequence of such an event on public health and safety would be very low. Such an impact would be less than significant.

For a collision in open waters when a spill volume would be much larger with greater consequences, the probability of such an accident is estimated in the FEMA Handbook to be about 1×10^{-5}/trip. The probability of such an event would therefore be in the low category, and such an impact would be less than significant.

Although not part of the VIP, the transport of MTBE by ship to the refinery will be eliminated, which is two ships per month. The MTBE elimination, which would reduce the potential for ship collisions, would be part of the cumulative analysis.

The refinery generates a variety of solid wastes, some of which are classified as hazardous. Most of the waste consists of spent catalyst and various hydrocarbon contaminated wastes. These wastes are removed from the process equipment, tested, and classified in accordance with U.S. Dept. of Transportation (DOT) requirements, as non-hazardous or hazardous waste material. The existing process, which will continue with the VIP, is to ship spent catalyst in sealed drums off-site by truck either to the manufacturer for recycling or to a regulated landfill.

Accidental Release Scenarios and Impacts

The risk of impacts from existing conditions, which were determined from the previous studies identified above, and the estimated changes in risks from the VIP are given in Table 4.8-7 and in Figure 4.8-2. Table 4.8-7 shows that the likelihood of an accident would not change over baseline conditions for scenarios 1, 2, 6, 7, 8 and 9, with the implementation of the VIP. For all of these scenarios, the likelihood of an accident would remain low. For scenarios 3 and 4, there would be an increase in the likelihood of an accidental release, but the frequency would remain in the low category (unlikely to occur during the life of the project).

Table 4.8-7 shows that, with regard to expected consequence of an accidental release, no changes are expected for scenarios 1, 2, 3, 4, and 5. In all cases, the offsite consequence of such a release would remain low or very low. For scenarios 6, 7, 8, and 9, there would be increases in consequences at offsite receptors. These increases of hydrogen sulfide or sulfur dioxide at offsite receptors are due to the increased sulfur levels in the new feed stock to the refinery with the implementation of the VIP. However, the consequences of these accidental releases would remain in the low or very low category.

For all of the scenarios evaluated, the incremental risks would be less than significant, because the frequency of any expected release would be in the low category. The estimated frequencies of accidents for the VIP are based on expected changes to units that have already been subjected to detailed Hazard and Operability Studies (HAZOPS). Upon completion of detailed design changes for the VIP, new HAZOPS should be carried out to ensure that the probabilities for accidental releases are equal to or less than those reported in this analysis.

The increase in propane truck traffic from the VIP suggests that this is one of the primary changes over baseline operations at the Benicia refinery. Propane truck traffic is projected to increase by approximately 5 trucks per day, from 23 trucks per day to 28 trucks per day.

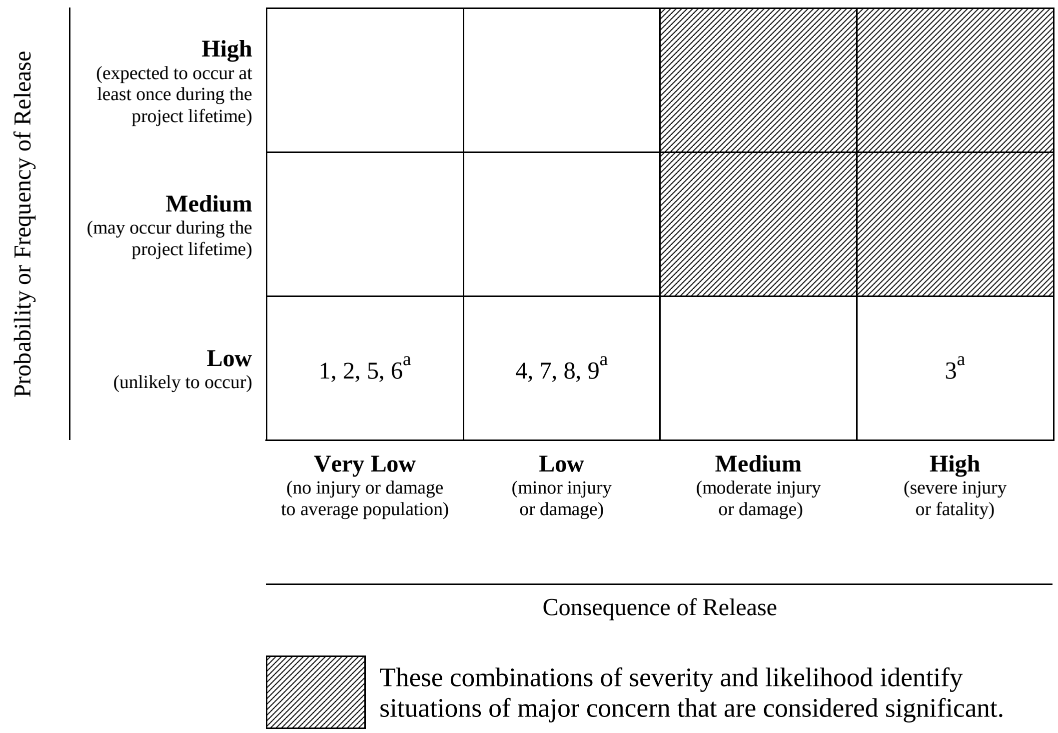
A worst case accident would be the failure of a loading arm or truck filling hose, with the release of rapidly boiling liquid propane. If an ignition source is present, a fire or vapor cloud explosion could occur, resulting in a large overpressure. However, these types of events are rare, since a chain of unrelated events would have to occur, which would include an event that would result in a release, failure to intercept the release, and ignition of the release. The probability of such a sequence of events was estimated by recalculating the probability that was calculated previously in the RMP for the lower number of trucks. As Table 4.8-7 shows, the increased probability for this scenario (scenario 3) is low and is not expected to occur within the 30 year life of the plant.

TABLE 4.8-7
SUMMARY OF BASELINE IMPACT ESTIMATES FOR MAJOR ACCIDENTAL RELEASE SCENARIOS WITH VIP IMPACTS WHERE APPROPRIATE

		Baseline Impacts				VIP Impacts			
No.	Accident Scenario	Worst-case Frequency	Frequency Qualitative Ranking	Consequence at Benicia Fenceline	Consequence Qualitative Ranking	Worst-case Frequency	Frequency Qualitative Ranking	Consequence at Benicia Fenceline	Consequence Qualitative Ranking
1	Vapor cloud explosion resulting from 3/4" release in process area	3.0 x 10^{-4}/yr –	low	0.07 psi	very low	3.0 x 10^{-4}/yr no change	low	0.07 psi[a] no change	very low
2	Vapor cloud explosion resulting from 2" release in process area	3.0 x 10^{-5}/yr –	low	0.23 psi	very low	3.0 x 10^{-5}/yr no change	low	0.23 psi[a] no change	very low
3	Vapor cloud explosion resulting from truck release in storage-loading area	8.4 x 10-7/yr	low	~4 psi	high	1.6 x 10^{-7}/yr (VIP incr.) 9.2 x 10-^{6}/yr, total risk	low	~4 psi[a] no change	high
4	Fire from truck release in storage-loading area	7.6 x $^{10-}$6/yr	low	<5 kW/m^2	low	16 x 10^{-6}/yr (VIP increment)– 9.2 x 10^{-6}/yr total risk	low	(<5 kW/m^2)[b] no change	low
5	Pool fire in process area	1.0 x 10^{-4}/yr	low	<1.6 kW/m^2	very low	1.0 x 10^{-4}/yr no change	low	(<1.6 kW/m^2)[b] no change	very low
6	Hydrogen sulfide dispersion from 3/4" release in process area	3.0 x 10^{-4}/yr	low	0.09 ppm	very low	3.0 x 10^{-4}/yr no change	low	0.18 ppm[c] increase	very low
7	Hydrogen sulfide dispersion from 2" release in process area	3.0 x 10^{-5}/yr	low	4.0 ppm	low	3.0 x 10^{-5}/yr no change	low	8.0 ppm[c] increase	low
8	Sulfur dioxide dispersion from 3/4" release in process area	3.0 x 10^{-4}/yr	low	0.18 ppm	very low	3.0 x 10^{-4}/yr no change	low	0.36 ppm[c] increase	very low
9	Sulfur dioxide dispersion from 2" release in process area	3.0 x 10^{-5}/yr	low	0.36 ppm	low	3.0 x 10^{-5}/yr no change	low	0.64 ppm[c] increase	low

a Overpressure expressed in pounds per square inch
b Radiant heat expressed in Kilowatts per square meter
c Concentration in parts per million

SOURCE: Based on previous estimates from Exxon (1993) and Woodward-Clyde (1993), and new analysis for Scenarios No. 3, 4, 6, 7, 8, and 9.



[a] The numbers of the release scenarios correspond to those identified in Table 4.8-7.

Valero Improvement Project EIR / 202115 ■

Figure 4.8-2
Ranking of VIP Risk Scenarios

VIP Without the Scrubber

If the project is operated prior to installation of the Main Stack Flue Gas Scrubber, impacts to Public Safety would be reduced and would be similar to baseline conditions. The process crude throughput would be a more modest rate of 150 MB/D for this scenario, instead of the proposed rate of 165 MB/D. This would result in fewer marine visits and fewer tanker truck visits to the refinery. Although the consequences of a worst case tanker truck accident would be similar to the full VIP, the likelihood of an accident would be lower, and would be similar to the existing project.

As described in the Air Quality Analysis Section, sulfur dioxide emissions under normal operations would increase over baseline conditions with the no-scrubber scenario. However, under upset conditions (accident scenarios 8 and 9 in Table 4.8-7), there would be lower emissions of sulfur dioxide than is reported for the VIP with the scrubber. This would occur, because the throughput would be reduced, and the amount of sour gas that would have to be incinerated would be less than for the full VIP.

4.8.5 CUMULATIVE IMPACTS

Impact 4.8-2: Other industrial projects in the region are located too far away from the refinery to cause potential cumulative public safety impacts. In most cases, impacts from fires, explosions, or toxic gas releases are limited to the property fenceline or near the fenceline. Also, the probability of an accidental release occurring from a cumulative project at the same time that an accident would occur at the VIP would be extremely low. Therefore, cumulative impacts would be less than significant.

Mitigation: None required.

Impact 4.8-3: As stated in the transportation impacts section above, the MTBE phase-out project will result in the elimination of two marine visits per month, thus resulting in a reduction of marine vessel trips to the refinery. Therefore cumulative public safety impacts related to marine transportation will be less than significant.

Mitigation: None required.

REFERENCES – Public Safety

American Industrial Hygiene Association and the Organization Resources Counselors, Inc., *Emergency Response Guidelines*, 1988-1990.

American Institute of Chemical Engineers, Center for Chemical Process Safety (AIChE), *Guidelines for Chemical Process Quantitative Risk Analysis*, 1989.

Bay Area Air Quality Management District, *Toxic Air Contaminant Control Program: Annual Report 2000*, December 2001.

California Air Resources Board, *California Air Toxic Emission Factor II Database (CATEF)*, 2001.

Clancey, V.J., *Diagnostic Features of Explosion Damage*, Sixth International Meeting on Forensic Sciences, 1972.

City of Benicia, *Benicia General Plan*, adopted by Benicia City Council, June 15, 1999.

ENSR Consulting and Engineering, *Negative Declaration for Exxon MTBE Project*, 1993.

Exxon Research and Engineering Co., *Application for a Use Permit, Benicia Refinery Clean Fuels Project, Vol. II, Health Risk Assessment*, revised 1993a.

Exxon Research & Engineering Co., *Risk Management Plan*, 1999.

Federal Emergency Management Administration, U.S. Dept. of Transportation, U.S. Environmental Protection Agency. *Handbook of Chemical Hazardous Analysis Procedures*, 1989.

Lees, F.P. (ed.), *Loss Prevention in the Process Industries*, Butterworths, New York, N.Y., 1996.

Occupational Safety and Health Administration, *Workplace Injury, Illness and Fatality Statistics*, 2002.

URS, Personal Communication, Valero Refinery Staff to URS Corporation Staff, June 2002a.

URS, MTBE Phase-Out Project, Valero Refining Company-California, Benicia, California, Draft Environmental Impact Report, April, 2002b.

Woodward-Clyde, *Exxon Benicia Refinery Clean Fuels Project: Environmental Impact Report*, 1993.

4.9 HYDROLOGY AND WATER QUALITY

All hydrology and water quality effects related to the implementation of the Valero Improvement Project would be less than significant   No mitigation is required.

- ***The wastewater retention area would be reduced due to the proposed addition of crude oil tanks. Process wastewater and storm water flows would increase. The facilities would be required to meet capacity requirements established by the Regional Water Quality Control Board;***
- ***Solids and pollutants would increase in wastewater effluent discharge and storm water runoff to the Suisun Bay and Suisun Marsh due to increases in process wastewater and construction activities. Discharges would be required to meet discharge requirements established by the Regional Water Quality Control Board;***
- ***Construction activities associated with the Valero Improvement Project would not adversely effect surface water quality;***
- ***The addition of impervious surfaces associated with the Valero Improvement Project would not adversely effect groundwater resources; and,***
- ***The cumulative effect of increased metal and chemical loading in effluent discharge to surface water bodies would not constitute a significant increase to total local and regional discharges.***
- ***The hydrological effect on flooding of the VIP and other refinery projects are not cumulatively considerable because the storm water runoff into the Lower Sulphur Springs Creek drainage area would essentially be the same whether or not the proposed VIP is implemented.***

4.9.1 INTRODUCTION

This section addresses changes in surface water, wastewater management, and groundwater conditions that would result from construction and operation of the Valero Improvement Project (VIP). This section describes the existing hydrologic setting, the framework that regulates the surface water, flooding and water quality, and presents potential project impacts and when necessary provides appropriate mitigation. This section primarily focuses on surface water drainage, storm water management, discharge water quality, and the existing wastewater treatment system at the refinery.

4.9.2 SETTING

4.9.2.1 REGIONAL SETTING

The Valero Benicia Refinery is situated within rolling, low elevation hills (ranging up to 200 feet above mean sea level) along the northern shores of the Carquinez Strait and Suisun Bay, just to the west of the Sacramento-San Joaquin River Delta. Several small drainage catchments are located in the area referred to as Lake Herman/Sulphur Springs Creek watershed. Lake Herman Reservoir which impounds Sulphur Springs Creek is located north of the refinery. Below the reservoir, Sulphur Springs Creek traverses a narrow band of marshland and discharges to Suisun Bay. Along the eastern border of the refinery, this creek flows through an engineered channel through the Benicia Industrial Park. Other small ephemeral tributaries to Sulphur Springs Creek flow from west to east near the refinery property. These include Beaver Creek drainage located along the southern boundary of the refinery. Tidal marshlands lying near or below sea level characterize the Suisun Bay margin and represent the endpoints of the Napa Valley and Sonoma Valley alluvial plains, both located to the north and west of the refinery. These marshlands are incised with numerous winding tidal channels containing brackish water (URS 2002).

The refinery is within the San Francisco Bay Area Hydrologic Basin and is bounded to the east by the Suisun-Fairfield Valley Groundwater Basin and to the west by the Napa-Sonoma Valley Groundwater Basin (CDWR 1975, 2002). The refinery is not located in a water supply groundwater basin. The water bearing units within the Suisun-Fairfield Valley groundwater basin consists of Sonoma Volcanic rocks, Pleistocene alluvium, and recently deposited alluvium. Natural recharge is principally from infiltration of precipitation that falls on the valley floor and the surrounding hills within the drainage basin. Some limited infiltration occurs from streams in areas where the water table is lower than the stream channels. The usable groundwater in this area is of the bicarbonate type and is slightly alkaline, with pH values commonly ranging from 7.1 to 7.6 (Woodward-Clyde 1993).

The primary regional groundwater water-bearing formations include the Recent and Pleistocene (up to two million years old) alluvial deposits and the Pleistocene Huichica formation. Salinity within the unconfined alluvium appears to increase with depth to at least 300 feet (CWDR 2002). Water of the Huichica formation tends to be soft and relatively high in bicarbonate and although it is generally usable for most domestic and irrigation needs, it may be locally unsatisfactory (CWDR 2002).

Groundwater in the region is used for agriculture and to a smaller degree for domestic use. Agricultural use of groundwater is heavy in the Suisun Valley north of the refinery because of the extensive thickness of the older alluvium there, but is very limited in the low lying hills northwest of the refinery because of the limited occurrence of water-bearing formations. Potential future development of groundwater resources is limited by the scarcity of alluvium in the region around and to the northwest of the refinery.

Although some local valleys may have sufficient thickness of saturated material that could potentially yield up to 10 gallons per minute (gpm), much of the Benicia area, including the refinery and the down-gradient vicinity, are underlain by low permeable, fractured bedrock, which has very limited storage capacity and well yield. Because of its limited overall potential for groundwater development, the Benicia area has not been extensively studied as a groundwater basin (Woodward-Clyde 1993).

4.9.2.2 PROJECT SETTING

Storm Water Drainage System

The majority of the surfaces within the refinery, including most locations affected by the project, are covered with impervious asphalt and concrete and as a result, storm water runoff is generally rapid and surface infiltration rates are very low. The storm drainage system at the refinery is divided into three major drainage parcels. Parcel 1 is the main refinery area, administration building, and product tank farm, Parcel 2 contains the crude oil tank farm and Parcel 3 drains the area surrounding the wastewater treatment plant (see Figure 4.9-1, Drainage Parcel and Storm Water Outfall Locations). Within each of the drainage parcels, storm water may be handled three different ways. First, some specific areas are diked or otherwise contained such that storm water flows are collected and may be detained before they are released to the wastewater treatment plant. This controlled system allows the refinery to regulate the volume of storm water flow that enters the wastewater treatment plant at any given time. Second, there are areas where storm-water runoff is not collected or detained, and drains directly into a collection system that transports the flows to the wastewater treatment plant. Finally, there are areas (primarily undeveloped) where storm water drains to a system of outfalls that are permitted under the National Pollutant Discharge Elimination System (NPDES), these outfalls eventually drain to Suisun Bay. The refinery’s storm-water system for each of the major drainage parcels is described below.

Drainage Parcel 1 (Main Refinery Area)

Parcel 1 represents the main refinery area and covers approximately 198 acres (see Figure 4.9-1). Except for a 1-acre undeveloped area between the administration building and main process block, runoff from the main refinery area flows to the wastewater treatment plant through the storm water drainage system. Dikes enclose approximately 61 acres of this drainage area. Drainage from the diked areas is controlled (detained) by manually operated valves so storm water that flows into the areas can be stored and drained to the treatment plant after the storm ends. Runoff from the remaining 137 acres is not controlled and flows directly to the treatment plant.

Storm water runoff is transported to the treatment plant through a 72-inch diameter pipe. This water is treated at the plant and discharged to San Francisco Bay via an NPDES-permitted outfall 001. Storm water in the one-acre undeveloped area between the administration building and main processing block is discharged directly to receiving waters via NPDES discharge points 005 and 002.

SOURCE: Environmental Science Associates

Figure 4.9-1
Drainage Parcel and Stormwater Outfall Locations

Drainage Parcel 2 (Crude Tank Farm)

Parcel 2 consists of approximately 123 acres that is located south of and is geographically separated from the main refinery. This area encompasses the crude tank farm (see Figure 4.9-1). Approximately 37 acres are diked to contain the crude oil tanks. However, three diked areas (Lake Spalding, Lake Lund, and Lake Lee) do not contain crude oil tanks. Lake Spalding reuses treated effluent from the wastewater treatment plant for onsite landscape irrigation and for supply to the refinery firewater system. Lake Lund and Lake Lee stores wastewater that is incompletely treated by the wastewater treatment plant (see Figure 4.9-1). Runoff from these areas can be stored and released to the treatment plant via the storm drain system after the storm ends. Runoff from the remaining 86 acres outside of the diked areas would not come into contact with crude oil; therefore, it is collected and discharged to Sulphur Springs Creek (and ultimately to Suisun Bay) through NPDES-permitted discharge point 006. Since 70 percent of the runoff in this parcel drains directly to the Bay, and the remaining amount can be released to the treatment plant in a controlled manner, runoff from this parcel does not contribute to peak flows or impact the treatment plant during a storm event (Woodward-Clyde 1993).

Drainage Parcel 3(Wastewater Treatment Plant)

Parcel 3 is the area surrounding the wastewater treatment plant (see Figure 4.9-1). This drainage area covers approximately 20 acres, all of which are diked. Approximately half of this drainage area is covered by three surface water impoundments that include an equalization pond, a retention pond, and a final pond. The equalization and retention ponds had historically been used for wastewater storage prior to processing through the biological oxidation unit.

These ponds have been modified so that currently only storm water runoff in excess of the treatment plant-processing rate (2,500 gallons per minute [gpm]) is diverted into them. The final pond is downstream of the treatment plant and receives treated effluent prior to discharge to the Suisun Bay. Storm water that falls on the 10 acres of Parcel 3 that is outside of the three ponds is collected and pumped to the retention pond for later processing at the treatment plant.

Wastewater Treatment

The refinery wastewater and most of the storm water runoff is collected and managed in the existing wastewater treatment system that is regulated by San Francisco Regional Water Quality Control Board (RWQCB). The refinery treats and discharges an average of 2.34 million gallons per day (MGD) of process wastewater including stripped sour water, cooling tower and boiler blowdown, and raw water treatment backwash, ballast water, storm water runoff from process areas, extracted groundwater from onsite remediation activities, and monitoring well purge water from offsite service stations. Preliminary design criteria for the VIP indicate an increase of 0.22 MGD of processed effluent wastewater.

Oily wastewater streams are first treated through corrugated plate separators, which provide gravity separation of the oil and suspended solids from the wastewater. An organic polymer (ferric chloride) is added, which co-precipitates selenite and enhances flocculation, to the wastewater before it enters the induced static flotation units. The coagulated solids float to the surface of the ISF units and are skimmed before returning to the treatment cycle. The skimming of these solids results in the production of waste sludge that is disposed of at the Kettleman Hills Class I landfill in Kettleman City, California. Kettleman Hills Landfill is a Class I facility that accepts most types of hazardous waste for treatment, storage, and/or disposal and provides stabilization, solidification, macro and micro encapsulation and landfill of hazardous sludge. Currently, the refinery ships waste sludge from its wastewater treatment area to Kettleman Hills Landfill roughly once every three days.

Next, the oily stream is combined with the stripped sour water, which comes from a chemical sewer pretreatment unit, in the activated sludge-processing unit. The activated sludge unit has three aeration cells and three clarifiers operating parallel to each other. Microorganisms are introduced to digest the suspended and dissolved organic material in the wastewater before the microorganisms settle to the bottom of the clarifier and get reintroduced to the aeration cells. Finally, the treated water from the top of the final clarifier flows to a holding pond before being pumped from a sump to the Suisun Bay at Outfall 001.

Currently, the hydraulic capacity of the plant is limited by the capacity of the activated sludge clarifiers to a maximum of 2,500 gpm. Process wastewater, oil-free utilities wastewater (i.e. filter backwash, boiler and cooling system blowdown), and stripped sour water discharge to the treatment plant at a current average rate of 1367 gpm (Hammonds 2002). The average process and utility waste water flow of 1,367 gpm, uses approximately 55 percent of the hydraulic capacity of the treatment plant. The remaining 45 percent of capacity (or 825 gpm of flow) is available for treating storm water runoff.

Wastewater and Storm Water Discharges

Treated wastewater is discharged into Suisun Bay through Outfall 001 via a 12-inch pipe with three diffusion ports. Outfall 001 is located at a depth of 18 feet about 1,100 feet offshore and west of the Suisun Reserve Fleet Anchorage. The diffuser at the end of the pipe provides a minimum dilution ratio of 10:1. In addition to discharging the wastewater through Outfall 001, the refinery also reuses treated effluent for onsite landscape irrigation, and in the refinery firewater system as a water conservation measure. The reuse of the treated water is achieved by diverting the water to Lake Spalding located on Parcel 2 (see Figure 4.9-1).

Discharge points for the refinery's non-industrial storm water are Outfalls 002 through 017. Most of the runoff from these locations is contained within the wastewater collection and treatment system. However, several areas are not controlled by the system and overflow offsite into either Sulphur Springs Creek, which ultimately flows to the Suisun Bay, or the Carquinez Strait. In the crude field retention pond area, storm water is either held using existing berms or is collected in low-lying areas, then allowed to evaporate.

In 1993, Dames and Moore performed storm water runoff computations for the 5, 10, and 20-year, 24-hour storm events from the refinery (Woodward-Clyde 1993). These storm events would result in runoff volumes from the overall refinery of approximately 26 (Parcel 1), 34 (Parcel 2), and 39 (Parcel 3) acre-feet, respectively. The runoff computations indicated that the existing drainage system had, at that time, the capacity to convey runoff from the refinery's undiked areas during a 20-year storm event. The analyses also indicated that the existing drainage system, wastewater treatment capabilities, and impoundment volumes, including the storm water retention pond, were capable of handling the 5-, 10-, and 20-year, 24-hour storm events provided that the impoundment basins were dry prior to the storm event, and the treatment plant was operating at the design capacity of 2,500 gpm (Woodward-Clyde 1993). If several storms occur over a period of several days, the storm water retention ponds may become partially or entirely filled from a series of successive storms, thereby reducing available capacity for storm water detention in the event of additional successive storms. The refinery uses the crude field retention pond area, also known as Lake Lund and Lake Lee, to store excess storm water and process effluent bypass of a mixture of storm water and process water (see Figure 4.9-1). In the event that this does occur, subsequent testing is required to return effluent from Lake Lund and Lake Lee to the wastewater treatment pond for treatment (Hammonds 2002).

In summary, the individual tank farm ponds, Lake Spalding, Lake Lund, and Lake Lee are used to store water for the firewater system, onsite irrigation, and storage of diverted storm water and effluent bypass. The VIP has proposed two crude oil storage tanks in the area of Lake Lund and Lake Lee which will decrease the retention area for the diverted effluent bypass.

The refinery is regulated by the RWQCB for effluent discharges from their wastewater treatment plant and discharges of all storm water associated with industrial activity from the refinery to Suisun Bay and Carquinez Straits (waters of the United States). As part of the regular cycle of RWQCB review of Valero Refining Company's NPDES Permit No. CA0005550, the RWQCB adopted and reissued RWQCB Order No. 2002-0112 (RWQCB NPDES Order) in October 2002. The current discharge limitations for untreated storm water and Valero's wastewater treatment plant effluent are outlined in the RWQCB NPDES Order.[1] Its purpose is to describe storm water and effluent discharges generated from the refinery and, based on the discharge types and concentrations, provides effluent and receiving water limitations and special discharge provisions in accordance with the Clean Water Act.[2] The RWQCB NPDES Order, by describing the effluent discharge to receiving surface water and providing discharge limitations and provisions, represents a current and comprehensive assessment of Valero's discharge to receiving waters.

Storm water runoff for the proposed equipment fabrication and storage areas will continue to be discharged into the onsite storm drainage system, and ultimately to the wastewater treatment area, or be held in by existing berms and allowed to evaporate. During construction, storm water runoff will be controlled by measures required by City of Benicia grading ordinance and required erosion control measures set forth by the Storm Water Pollution Prevention Plan.

1 A copy of the RWQCB NPDES Order for the Valero Refinery NPDES discharge permit can be found on the RWQCB's website at www.swrcb.ca.gov./~rwqcb2.

2 In addition to the RWQCB NPDES Order, the RWQCB concurrently prepares Fact Sheet that describes the factual, legal and methodological basis for the RWQCB NPDES Order and provides supporting documentation to explain the rationale and assumptions used in deriving the limits. The Fact Sheet for the Valero Refinery discharge application is dated July 31, 2002 and can be found online at www.swrcb.ca.gov./~rwqcb2.

Receiving Waters and Beneficial Uses

Discharges from the refinery ultimately drain into Suisun Bay and the Carquinez Strait, the channel between Suisun Bay and San Pablo Bay of the San Francisco Delta system. Suisun Bay is the first water body that receives flows from the Sacramento and San Joaquin Rivers and their tributaries. The drainage areas that contribute flows to the rivers comprise about 37 percent of the land area of the state. Much of the land area is primarily devoted to agricultural and forestry land uses, with some major urban centers that contribute discharges into the rivers. Pollutants produced by these activities reach the San Francisco Bay through discharge from wastewater treatment plants, storm water runoff, agricultural drain water, disposal of dredged material, as well as acid mine drainage from abandoned mines. Salinity in Suisun Bay is generally lower than in downstream waters, such as San Pablo Bay, because of river inputs of fresh water. However, nutrient and trace element levels in Suisun Bay are generally not markedly different from those in San Pablo Bay.

The environmental quality of the San Francisco Delta System is directly affected by construction and water discharge that occur within Suisun Marsh that lies located along the edges of Suisun Bay. The San Francisco Bay Conservation and Development Commission's Suisun Marsh Protection Plan has policies that regulate new construction within a marsh protection zone and requires that all water discharge points in the marsh protection zone follow RWQCB requirements (Suisun Marsh Protection Plan 1976). While the elements of the proposed VIP are located outside the Marsh Protection Area identified in the Suisun Marsh Local Protection Program[3], discharge from the refinery's Outfall 001 occurs within the Marsh Protection Area. However, no structural changes to Outfall 001 are proposed as part of the VIP. For additional discussion regarding the Suisun Marsh Protection Plan, refer to the Section 4.10, *Land Use* for information on the proposed project's relationship to the Suisun Marsh and Section 4.3, *Biological Resources* for the associated biological issues.

The receiving waters for the refinery discharge, which include the Suisun Marsh, are tidally influenced water bodies, with significant fresh water inflows during the wet weather season that allow frequent flushing and dilution. Furthermore, based on Regional Monitoring Program data, Carquinez Strait and Suisun Bay meet the definition of estuarine under the definitions included in the California Toxics Rule (CTR) and the Water Quality Control Plan for the San Francisco Bay Basin (RWQCB 2002a). In the San Francisco Bay Basin Plan, the RWQCB identifies a number of beneficial uses of Suisun Bay and the Carquinez Strait that must be protected. The beneficial uses include industrial service supply, water contact recreation, non-contact water recreation, navigation, ocean commercial and sport fishing, wildlife habitat, estuarine habitat, preservation of rare and endangered species, and fish spawning and migration (RWQCB 2002a).

The State Water Resources Control Board's Water Quality Assessment has indicated that Carquinez Strait and Suisun Bay have elevated levels of selenium, mercury, and PCBs in aquatic organisms, sediment, and the water column (RWQCB 2002a). On May 12, 1999, the USEPA added dioxins and furan compounds, chlordane, dieldrin, and 4,4'-DDT to the Board's list

[3] The Suisun March Local Protection Program is the local implementation of the Suisun March Protection Plan.

(RWQCB 2002a). Between 1993 and 2001, RWQCB evaluated the assimilative capacity of the receiving water for the listed pollutants for which the refinery has reasonable potential in its discharge to the Carquinez Strait and Suisun Bay (RWQCB 2002b). It was determined that the assimilative capacity is highly variable due to the complex hydrology of the receiving water. Therefore, there is uncertainty associated with the representative nature of the appropriate ambient background data to conclusively quantify the assimilative capacity of the receiving water (RWQCB 2002a).

NPDES Discharge Limitations

Discharges from the refinery are currently governed by Waste Discharge Requirements specified in the RWQCB NPDES Order and regulated by the San Francisco RWQCB. This RWQCB NPDES Order covers the discharge of process wastewater from the wastewater treatment plant and storm water discharges. Routine water quality monitoring is conducted on outflows from one outfall (Outfall 001) into Suisun Bay, eleven outfalls (Outfall 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, and 017) into Sulphur Springs Creek, and five outfalls (Outfall 012, 013, 014, 015, and 016) into Carquinez Strait.

Effluent limitations are derived from marine criteria and have been included in the RWQCB NPDES Order for the refinery. The State Board's Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy, or SIP) allows background ambient monitoring data to be determined on a discharge-by-discharge or water body-by-water body basis. The RWQCB has chosen to use a water body-by-water body basis because of the uncertainties inherent in accurately characterizing ambient background in the complex San Francisco Bay estuarine system. The Yerba Buena Island and Richardson Bay Stations fit the guidance for ambient background in the SIP compared to other stations in the Regional Monitoring Program. The RWQCB believes that data from these stations are representative of water that will mix with the discharge from Outfall 001 (RWQCB 2002a).

The discharge limitations for Outfall 001 are summarized for effluent mass loading, which is the total effluent discharge of each pollutant included in Section 303(d) of the federal Clean Water Act (see Section 4.9.2.3), and for concentration limits in the RWQCB NPDES Order (RWQCB 2002a).[4] Interim effluent limitations were derived for those constituents that the refinery has demonstrated that compliance is infeasible. Specifically, the RWQCB NPDES Order has established a five-year compliance schedule for copper, selenium, lead, mercury, and nickel. A ten-year compliance schedule has been established for dioxin toxic equivalency (dioxin TEQ). In addition, a data collection period has been set (present – May 18, 2003) to gain a sufficient amount of data for cyanide; whereas, the RWQCB intends to include, in a subsequent permit revision, a final limit on the study results (RWQCB 2002a).

Toxicity bioassays are required for Outfall 001 discharges. These bioassays consist of placing three-spine stickleback and Fathead minnow (or rainbow trout) in undiluted treatment plant effluent and evaluating their survival over a 96-hour period. The permit limitation on the toxicity

---

4 A copy of the RWQCB NPDES Order can be found on the RWQCB's website at www.swrcb.ca.gov/~rwqcb2.

tests requires a survival rate of not less than 50 percent. Discharge from Outfall 001 is also subject to the following receiving water limitations:

- No floating, suspended, or deposited macroscopic particulate matter or foam;
- No bottom deposits or aquatic growth;
- No alteration of turbidity or apparent color beyond present natural background levels;
- No visible, floating, suspended, or deposited oil or other products of petroleum origin; and
- No toxic or other deleterious substances to be present in concentrations or quantities which will cause deleterious effects on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentrations.

Monitoring of the discharge from the treatment plant to the Bay is required under the self-monitoring program to confirm compliance with the RWQCB NPDES Order, and is reported monthly to the RWQCB.

Groundwater

Generally, water table elevations follow the topography at the site (URS 2001). The depth to water is a function of water table depth and the proximity to the edge of a particular terrace. Depth to water at the refinery ranges from 2 to 50 feet below ground surface (bgs) (URS 2001). The prevailing direction of groundwater flow ranges from east to southeast (URS 2001). The groundwater on the east side of Sulphur Springs Creek (i.e. across the creek from the refinery) appears to flow west into the creek. The gradient of groundwater flow in the area ranges from 0.0007 to 0.013 feet/foot (URS 2001).

Near the refinery, the principal source of groundwater recharge is the Benicia Hills and the southern extension of Sulphur Springs Mountain. Previous studies indicate that a shallow water-bearing zone is located in fractured mudstone and exhibits unconfined hydrogeologic conditions. The geologic conditions of the site consist of bedrock overlain by alluvium with artificial fill in ancient drainages that have since been filled (URS 2001). This stratigraphy across the site does not fit a stratigraphic model characterized by aquifers separated by aquitards. Instead, the water table interval intersects both the alluvium and bedrock since the bedrock is closely bedded and fractured. Groundwater in the alluvium/fill and bedrock are in direct communication. The lack of perched water tables and the continuity of the water table between these two units demonstrate the direct communication between these two hydrostratigraphic units. In hydrogeologic terms, the primary difference between these two hydrostratigraphic units is the higher hydraulic conductivity of the alluvium/fill relative to the bedrock (URS 2001). Hydraulic conductivity in bedrock is low, and groundwater flow occurs primarily along fractures and bedding planes (URS 2001).

Groundwater Quality

Two water supply wells are located within one half mile of the refinery.

- Herman Lutz, P.O. Box 727, Benicia, Benicia Industrial Park, installed May 31, 1978.
- St. Dominic Catholic Church, 475 East I Street, Benicia, Hillcrest Street and 5th Street, installed May 7, 1963 (Woodward-Clyde 1993)

The Lutz well is approximately 1,000 feet down-gradient of the refinery. This well was installed as an industrial supply well approximately 20 to 25 feet deep. However, the well was never used due to brackish groundwater conditions. The brackish conditions were evidenced by the presence of high total dissolved solids (TDS) concentrations in groundwater samples. The St. Dominic well is approximately 800 feet up-gradient and is reportedly completed to 280 feet below ground surface (bgs). The water in this well is fresh water and contains high concentrations of iron (Woodward-Clyde 1993). Based on the location of this well it is likely that it used primarily for irrigation water at St. Dominic Catholic Cemetery.

Previous Groundwater Investigations

Soil and groundwater investigations have been conducted at the refinery since 1988. As required by RWQCB Order No. 91-094, a refinery-wide site assessment began in November 1991 for the purpose of characterizing soil and groundwater contamination and developing a remediation plan (URS 2001). Several investigations have been conducted since the initial investigations and have included other areas besides those at the main refinery area. A follow-up RWQCB Order No. 97-077 rescinded RWQCB Order No. 91-094 and required additional investigation and the development of a Remedial Action Plan (RAP) (URS 2001). URS Corporation (URS) prepared and revised a RAP for the refinery in July 2001. The RAP addresses free-phase product plumes and associated dissolved-phase groundwater constituents at the refinery and prepared specific remedial recommendations. These recommendations were determined by evaluating proposed water quality goals and water quality protection standards set forth in *Proposed Water Quality Goals and Protection Standards for the Main Refinery Site and the Terminus of the Old Dock Pipeline* (Radian, 1999) and *Addendum to Proposed Water Quality Goals and Protection Standards for the Main Refinery Site and the Terminus of the Old Dock Pipeline, Valero Benicia Refinery* (URS 2000).

Because engineered fill was placed in the area of the crude storage tank farm area, groundwater occurs at depths greater than 40 feet in the proposed tank 1707 and 1708 area (Lake Lund). A previous investigation by Harding Lawson in 1993 detected no concentrations of hydrocarbon constituents in groundwater samples from the retention pond area (Woodward-Clyde, 1993).

Water Supply

The wastewater treatment process cycle is affected by the hydraulic rate and amount of refinery water use. The refinery's main use of water is to supply refining processes with steam and with cooling water. Specifically, water is used in the cooling towers. The raw water supply used by the refinery is obtained from the city of Benicia, on average of approximately 5 million gallons per day. The VIP will require an additional 432,000 gallons per day or 0.432 million gallons per day (or 484 acre feet per year). The refinery has proposed to use treated water from the City of Benicia's wastewater treatment facility for use in the cooling towers. For a detailed analysis of water supply, please refer to Section 4.14, *Utilities and Service Systems*.

4.9.2.3 REGULATORY SETTING

The regulatory requirements for the proposed project include:

- The federal floodplain management requirements of the Federal Emergency Management Agency (FEMA);
- The federal Clean Water Act, as enforced by the Environmental Protection Agency (EPA);
- The California Porter-Cologne Water Quality Control Act and related California Administrative Code sections administered by the California State Water Resources Control Board and the San Francisco Bay Regional Water Quality Control Board; and,
- Permitting and licensing requirements, which occur during development, and are reviewed by City of Benicia.

The applicable plans, policies, and regulations are discussed below.

Flood Control

Under Executive Order 11988, the Federal Emergency Management Agency (FEMA) is responsible for management of floodplain areas defined as the lowland and relatively flat areas adjoining inland and coastal waters subject to a one percent or greater chance of flooding in any given year (also termed the 100-year floodplain). FEMA requires that local governments covered by federal flood insurance pass and enforce a floodplain management ordinance that specifies minimum requirements for any construction within the 100-year floodplain.

Based on the results of a revised hydrologic study commissioned by the City of Benicia in 1987, FEMA prepared a Flood Insurance Rate Map (FIRM) that delineated flood hazard zones for Benicia and adjacent portions of Solano County. The zones detailed low-lying areas that would be subject to flooding during a 100-year storm. Specifically, the lower reaches of the Sulphur Springs Creek Watershed downstream of Lake Herman were included in the flood hazard zones. A Storm Water Master Plan that includes flood control improvements has been adopted by the refinery and has addressed these flood hazard conditions.

Surface Water Quality

Federal Requirements

Federal Clean Water Act. The purpose of the Clean Water Act is to protect and maintain the quality and integrity of the nation's waters by requiring states to develop and implement state water plans and policies. Section 303 of the Clean Water Act requires states to establish water quality standards consisting of designated beneficial uses of water bodies and water quality standards to protect those uses for all waters of the United States. Under Section 303(d) of the Clean Water Act, states, territories and authorized tribes are required to develop lists of impaired waters. Impaired waters are those that do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water on the lists and develop action plans to improve water quality. This process includes development of Total Maximum Daily Loads (TMDL) that set discharge limits for non-point source pollutants. The recently passed Ducheny Bill (AB 1740) requires the State Water Resources Control Board and its nine Regional Water Quality Control Boards to post this list and to provide an estimated completion date for each TMDL.

Carquinez Strait and Suisun Bay are included on the 1998 California 303(d) List as impaired water bodies resulting from the presence of chlordane, copper, DDT, diazinon, dieldrin, dioxin compounds, exotic species, dioxins and furan compounds, mercury, nickel, PCBs, and selenium. Each pollutant has a discrete source ranging from unknown point sources (for PCBs) to urban runoff (for copper and nickel).

These updates in application of the Clean Water Act have been and will continue to be administered through California’s permitting process, which is administered by the San Francisco Bay Regional Water Quality Control Board.

Environmental Protection Agency. EPA is responsible for implementing federal laws designed to protect air, water, and land. While numerous federal environmental laws guide EPA’s activities, its primary mandate with respect to water quality is the Clean Water Act. EPA has developed national water quality standards in accordance with the Clean Water Act and these standards are used to determine the amount and the conditions under which pollutants can be discharged

On May 18, 2000, the USEPA published in the Federal Register the California Toxics Rule (CTR) establishing water quality standards for toxic pollutants for California waters (FR 31681). The CTR was effective on the date of publication. On April 28, 2000 the Office of Administrative Law approved the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Plan). The State Water Resources Control Board adopted the policy in March 2000. The State Implementation Plan (SIP) became fully effective on May 18, 2000 because it was conditioned on circulation of the CTR. The SIP establishes the implementation policy for all toxic pollutants including dioxins and furans. The SIP also requires a limit for dioxin if a limit is necessary, and requires monitoring for a minimum of 3 years by all major NPDES dischargers for the other sixteen dioxins and furans compounds.

National Pollutant Discharge Elimination System. Part of the Clean Water Act provides for the National Pollutant Discharge Elimination System (NPDES), in which discharges into navigable waters are prohibited except in compliance with specified requirements and authorizations. Under this system, municipal and industrial facilities are required to obtain a NPDES permit that specifies allowable limits, based on available wastewater treatment technologies, for pollutant levels in their effluent. In California, EPA has delegated the implementation of this program to the State Board and to the Regional Boards.

Storm water discharges are regulated somewhat differently. Storm water runoff from construction areas of five acres or more require either an individual permit or coverage under the statewide General Construction Storm water Permit. In addition, specific industries, including wastewater treatment plants that have direct storm water discharges to navigable waters are required to obtain either an individual permit issued by the Regional Board, or obtain coverage under the statewide General Industrial Storm water Permit for storm water discharges.

Oil Pollution Act. Enacted in 1990, this Act (Public Law No. 101-380) amends the Clean Water Act to create a comprehensive oil spill and prevention response scheme. Spill Prevention Control and Countermeasure Plans must be prepared by owners or operators of facilities that have or could reasonably be expected to discharge a certain amount of oil. These plans should contain preventative (failsafe) and contingency (cleanup) plans for controlling accidental discharges, and for minimizing the effect of such events.

State, Regional and Local Requirements

Porter-Cologne Act. The State Board and the Regional Boards share the responsibility under the Porter-Cologne Act to formulate and adopt water policies and plans, and to adopt and implement measures to fulfill Clean Water Act requirements. Specific to the proposed project area, the regional Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) and the California Enclosed Bays and Estuaries Plan serve to protect the water quality of the State consistent with identified beneficial uses.

Prior to authorizations of waste discharge by the Regional Board, the Porter-Cologne Act requires reports of waste discharges to be filed. The Regional Board then prescribes Waste Discharge Requirements, which serve as NPDES permits under a provision of the Porter-Cologne Act. The Basin Plan, the Enclosed Bays and Estuaries Plan, and the NPDES permit, regulate discharges from the refinery wastewater treatment plant into Suisun Bay and Carquinez Strait.

State Water Resources Control Board. The State Board administers water rights, water pollution control, and water quality functions statewide. The State Board provides policy guidance and budgetary authority to nine Regional Boards, which conduct planning, permitting, and enforcement activities. The State Board shares the authority for implementation of the Clean Water Act and the State Porter-Cologne Act with the Regional Boards.

Applicable statewide to all enclosed bays and estuaries, the Enclosed Bays and Estuaries Plan is one of the water quality policies that the State Board has developed for California. As defined by the State Board, enclosed bays are indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. San Francisco Bay and its constituent parts, including Carquinez Strait and Suisun Bay, fall under this category.

Regional Water Quality Control Board, San Francisco Bay Region. The water quality in the area in which the refinery is located is under the jurisdiction of the San Francisco Bay Regional

Water Quality Control Board (RWQCB – Region 9). The RWQCB is responsible for developing and implementing the Basin Plan that documents approaches to implementing State and federal policies in the context of actual water quality conditions. On June 21, 1995, the Board adopted a revised Water Quality Control Plan for the San Francisco Region (Basin Plan) which was subsequently approved by the SWRCB and the Office of Administrative Law on July 20, and November 13, respectively, of 1995. The Basin Plan identifies beneficial uses of receiving waters, water quality objectives imposed to protect the designated beneficial uses, and strategies and schedules for achieving water quality objectives. Section 303 (c) (2) (B) of the Clean Water Act requires Basin Plans to include water quality objectives governing approximately 68 of EPA's list of 126 pollutants. The Regional Board's other activities include permitting of waste discharges, and implementing monitoring programs of pollutant effects.

The State Implementation Plan (SIP) establishes the policy for determining effluent limitations for toxic pollutants. In summary, the steps involve:

- Identifying applicable criteria and objectives,
- Determining whether there is a reasonable potential for the pollutant to cause or contribute to impairment of a water quality criterion or objective; and
- Calculating a value for the effluent limit taking into consideration the applicable criteria or objective, and discharge variability; or
- If a TMDL is in effect, assigning a portion of the loading capacity to the discharge.

San Francisco Bay Basin Plan. The principal elements of the Basin Plan are:

- Statement of beneficial water uses which the Regional Board will protect;
- Water Quality objectives needed to protect the designated beneficial water uses; and,
- Strategies and time schedules for achieving the water quality objectives.

State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the State. Therefore, all water resources must be protected from pollution and nuisance that may occur as a result of waste discharges. Beneficial uses of surface waters, ground waters, marshes, and mud flats serve as a basis for establishing water quality standards and discharge prohibitions to attain this goal.

Water Quality objectives are achieved primarily through the establishment and enforcement of Waste Discharge Requirements for each wastewater discharger. The Basin Plan was amended in 1992 to include stricter water quality criteria that had been previously adopted in 1991 Enclosed Bays and Estuaries Plan.

Waste Discharge Requirements (Point Source). As previously introduced, point source discharges are subject to federal regulations that are implemented at the state level by the Regional Board. Prior to any point source discharge that could affect the quality of the water of the State, the discharger must file a report of waste discharge with the Regional Board. After any necessary public hearings, the Regional Board prescribes Waste Discharge Requirements, which implement the water quality control plans. Under the Porter-Cologne Act, Waste Discharge Requirements serve as NPDES permits.

Waste Discharge Requirements (Non-Point Source). A non-point source is a diffuse source, such as land runoff, precipitation, deposit from the atmosphere, or percolation. Major non-point sources of water pollution are agriculture, mining, oil and gas extraction, pastureland and feedlots, land disposal, and urban runoff. For non-point sources, the Basin Plan outlines the approach that the Regional Board has taken to control non-point source pollution in its Urban Runoff Management scheme. Part of the strategy involves the permitting of storm water discharges from all facilities associated with industrial activities and from all construction activities that result in the disturbance of land totaling five acres or more.

Another non-point source control strategy of the State is the requirement to use site-specific Best Management Practices. These individual or combined measures are those that are the most practical and effective which, when applied, prevent or minimize the potential release of toxic or hazardous pollutants in significant amounts to surface waters. A Best Management Practices Program is required to include information of potential releases and management of solid and hazardous waste.

City of Benicia General Plan and Grading Ordinance. City of Benicia policies to which the project would likely be required to conform include those of the City of Benicia General Plan (City of Benicia, 1999) and City of Benicia Grading Ordinance (City of Benicia, 1996).

City of Benicia General Plan. The City of Benicia General Plan addresses water resources goals and policies for local water bodies including the Carquinez Strait, Lake Herman, and Suisun Marsh. Specifically, the following policy and programs may apply to the components of the project:

Policy 3.22.1: Avoid development that will degrade existing lakes and streams.

- *Program 3.22.1A*: Require that all development in watershed flowing into lakes and unchannelized streams include features to preserve run-off water quality.
- *Program 3.22.1B*: Require a minimum setback of 25 feet from the top of bank of streams and ravines. Development within the setback is not allowed.

Policy 4.12.1: Regulate runoff from new development so that post-development site peak flow rates are not greater than pre-development levels.

Policy 4.12.2: Upgrade existing drainage facilities as necessary to correct localized drainage problems.

Policy 4.14.1: Implement non-point source pollution strategies.

- *Program 4.14.C*: Provide information to the public on provisions of the City's Stormwater Pollution Prevention Plan (SWPPP) program and preparation of SWPPPs for all construction projects of five acres or more. Implement Best Management Practices (BMPs) for stormwater runoff and erosion controls for all developments.

City of Benicia Grading Ordinance

Chapter 15.28: Grading and Erosion Control

- *Section 15.28.070 Application Contents*: Applications for excavating, grading and filling permits shall be accompanied by two sets of plans and specifications 24 inches by 36 inches in size prepared at a scale of 1 inch = 40 feet or greater. Unless waived by the City Engineer, the plans shall be prepared by an engineer licensed by the State of California.

- *Section 15.28.070 Application Contents*: A Storm Water Pollution Prevention Plan for sites over five acres and a copy of the Notice of Intent (NOI) form required for the State Water Resources Control Board's General Construction Activity Storm Water Permit.

- *Section 15.28.130 Excavating, Grading, and Filling – Regulations*: All graded surfaces and materials, whether filled, excavated, transported or stockpiled, shall be wetted, protected, covered or contained in such a manner as to prevent any nuisance from dust, sediment site runoff, or spillage upon adjoining property or streets. Best Management Practices incorporating erosion controls and other controls (i.e. dust palliative) shall be applied to the site when directed by the City Engineer. Equipment and materials on the site and on hauling routes should be used in such a manner as to avoid excessive dust, site runoff, or spillage upon streets or storm drain inlets. This may include limiting work during windy periods.

- Sediment controls and other Best Management Practices shall be constructed on all developments, as determined by the City Engineer, to manage runoff into biologically sensitive areas or onto adjacent property and to control sediment during construction until permanent erosion controls have been established. The sediment and silt collected on site shall then be removed and the resulting material hauled from the site or used as topsoil.

Suisun Marsh Protection Plan. Suisun Marsh Protection Plan, adopted in 1976 contains policies which regulate the marsh's primary management area of 89,000 acres of tidal marsh, managed wetlands, adjacent grasslands, and waterways, as well as a secondary management area of approximately 22,500 acres of significant buffer lands. The Suisun Marsh Local Protection Program was also subsequently adopted by Solano County in the 1980s to implement the Suisun Marsh Protection Plan (see Section 4.10, *Land Use* for further explanation of the Suisun Marsh Local Protection Program).

Groundwater Quality

There is a strong correlation between industrial facilities, such as the refinery, and areas with contaminated soil and groundwater. The following hazardous waste laws and regulations place restrictions on certain facilities that generate wastes considered to be hazardous, which includes soil contaminated with chemicals, fuels, oils, and other substances. These regulations also protect groundwater quality from hazardous materials that could leach through contaminated soils and contact groundwater.

Federal Requirements

Environmental Protection Agency. To implement the following laws, the EPA has developed regulations that provide the general framework of the national hazardous waste management system. Hazardous waste sites, including those with contaminated soil and groundwater, are subject to one or more of the following regulations:

Resource Conservation and Recovery Act (RCRA). RCRA was enacted in 1974 as the first step in regulating the potential health and environmental issues associated with solid hazardous and non-hazardous waste disposal. Under RCRA, EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. Under RCRA, individual states may implement their own hazardous waste management programs, as long as they are consistent with and at least as stringent as RCRA. EPA must approve state programs intended to implement RCRA requirements.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Also known as Superfund, CERCLA was enacted in 1980 to ensure that a source of funds was available to clean up abandoned hazardous waste dumps, compensate victims, address releases of hazardous materials, and establish liability standards for responsible parties.

Superfund Amendments and Reauthorization Act (SARA). SARA amended CERCLA in 1986 to increase Superfund funding, modify contaminated site cleanup criteria, and revise settlement procedures. It also provides a regulatory program for leaking underground storage tank cleanups, and a broad, emergency planning and community right-to-know program.

State, Regional and Local Requirements

Regional Water Quality Control Board. The Regional Board shares enforcement responsibility with the Department of Toxic Substances Control. In the area of groundwater quality in the San Francisco Bay Basin, the Regional Board, San Francisco Bay Region, has identified over 5,400 sites with confirmed releases of constituents of concern which have polluted or threaten to pollute groundwater. For each individual polluted site, the Regional Board approves all proposed groundwater and soil cleanup levels. Cleanup activities are required by the Regional Board to be performed in a manner that promotes attainment of background water quality, or the highest water quality, which is reasonable, if background levels of water quality cannot be restored.

City of Benicia General Plan. The City of Benicia General Plan identifies the refinery as a hazardous waste site. When handling any hazardous substances involved with the groundwater extraction at the site or during construction of the components of the project, the site must be in compliance with permitting and other regulatory requirements.

4.9.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

Construction and operation of the proposed project could potentially affect the quality of Carquinez Strait or Suisun Bay and Suisun Marsh because of changes in either the quantity of additional surface runoff or treated effluent discharges, or in the quality of these wastewaters. In addition, the quantity and quality of groundwater in the vicinity of the VIP components could be affected during construction. One issue examined is the ability of the refinery's wastewater treatment plant to continue meeting compliance requirements during normal operations. Hydrology impacts have been considered significant if any of the following were to occur:

- A change in the rate or amount of surface runoff that could cause an exceedance of the refinery's wastewater treatment plant capacity.
- A substantial change in the runoff or drainage pattern that would result in substantial flooding, erosion, or siltation.
- A substantial depletion in the groundwater storage capacity through groundwater extraction processes.
- A substantial interference in groundwater movement or groundwater recharge.

Water quality impacts have been characterized for the proposed components of the VIP and will be considered significant if any of the following were to occur:

- A change to existing conditions that affects the refinery's capability to meet the discharge limits disclosed in Valero Refining Company's National Pollutant Discharge Elimination System (NPDES) Permit.
- A change in conditions that could disturb, expose or otherwise alter the present state of the existing soil contamination leading to significant adverse changes to the surface water quality.
- Conditions that introduce new contaminants, or increase the amount of previously identified contaminants, to the processed wastewater treatment cycle.
- Potential impairment to the downstream system from groundwater recharge area or storm water runoff.

This analysis considered that all facilities would be located within the existing Main Refinery, Wastewater Treatment Plant or Crude Tank Farm areas (see Figure 4.9-1). The analysis did not consider locations outside of those areas.

4.9.4 IMPACTS AND MITIGATION MEASURES

Impact 4.9-1: In combination, additional processed wastewater and storm water runoff resulting from components of the project could potentially exceed the maximum hydraulic capacity of the system and exceed the capacity of the wastewater treatment retention area. This impact would be less than significant.

Currently, an average of 2.34 million gallons per day (MGD) or 1,625 gallons per minute (gpm) of wastewater is treated onsite. Operation of the proposed project components would produce an additional 0.22 MGD (153 gpm) of process wastewater.

The hydraulic capacity of the wastewater treatment plant is 2,500 gallons per minute (gpm) or approximately 3.6 MGD. This amount is limited by the operational capacity of the sludge clarifiers and constitutes approximately 60 percent of the overall capacity of the system. The proposed project could add approximately 0.22 MGD or 153 gpm of process water to the system. When combined with current wastewater treatment volumes, the proposed project would result in a total volume of 2.56 MGD or 1,770 gpm. The proposed project would generate approximately 8 percent increase in wastewater through the treatment plant and this increase remains within the hydraulic capacity of the system. As discussed Section 4.9.2.2 - *Project Setting*, process wastewater constitutes approximately 55 percent of the treatment plant hydraulic capacity while the remaining 45 percent of hydraulic capacity is available for treatment of storm water. The additional process wastewater resulting from the project (approximately 8 percent) will reduce the available hydraulic capacity for storm water treatment to about 37 percent. However, the amount of storm water that requires management (conveyance, treatment, detention) resulting from the proposed project is not expected to increase substantially because the proposed improvements are located in developed areas that currently generate storm water runoff. The proposed project improvements do not amount to a considerable addition to impervious areas or a substantial change in surface water flow patterns. The majority of the refinery site is developed and therefore, the amount of impervious surfaces that allow water infiltration is relatively limited.

On occasion, Valero has diverted storm water runoff and processed wastewater to the Crude Tank Farm area. This area currently contains a back-up fire water pond, Lake Spalding, and refinery effluent wastewater retention ponds, Lake Lee and Lake Lund (see Figure 4.9-1). As part of the proposed project, one or two additional floating roof crude oil tanks would be installed in the Crude Tank Farm area in the location of the existing wastewater retention ponds. The installation of the tanks would not compromise the capacity or use of the back-up fire ponds but a portion of the Lake Lee and Lake Lund retention area would be eliminated. The average annual effluent diversion volume has been recorded by Valero to be 14.9 million gallons over the past five years. Valero has determined there will be 15 million gallons of storage available in the event that two new tanks are constructed in the Lake Lund and Lake Lee retention area (Hammonds 2002). As required by the RWQCB's *Standard Provisions and Reporting Requirements for NPDES Surface Water Discharge Permits*, the Crude Tank Farm area should be adequately protected against overflow or washout as the result of a 100-year frequency flood (RWQCB 2002a).

In summary, the proposed project would result in an increase of process wastewater and reduce the amount of wastewater retention capacity in Lake Lee and Lake Lund. Additional wastewater generated by the proposed project is not anticipated to exceed the capacity of the wastewater treatment plant but this increase could reduce the available capacity to store and/or manage storm water. Overall, the potential adverse effect of the proposed project could be to reduce Valero's ability to effectively manage wastewater and storm water volumes, in all cases and circumstances, especially during periods of major storm event (i.e. consecutive 100-year event). This potential reduction in Valero's flexibility to manage wastewater and storm water could ultimately result in untreated discharges to surface water.

NPDES sets forth discharge performance requirements that the refinery is required to meet. A mechanism that is used by the RWQCB to assure this performance is through the preparation and submittal of an Anti-degradation Report, which is based on an engineering evaluation of the actual treatment system and its ability to meet performance standards. The RWQCB NPDES Order requires the refinery to submit an Anti-degradation Report before the increase of processed wastewater generated from the proposed project can occur. This order is to ensure the refinery is in compliance with RWQCB Resolution No. 68-16 (*Statement of Policy with Respect to Maintaining High Quality of Waters in California).* Per the RWQCB NPDES Order, the Anti-degradation Report will evaluate treatment capacity of the existing treatment units and propose new units as necessary to enable adequate treatment (RWQCB 2002a). The purpose of the Anti-degradation assessment and report is to ensure that before any throughput increases are implemented under the NPDES permitting process, there is sufficient data indicating that discharge limits can be achieved.

Valero Benicia Refinery has proposed, as part of the VIP, to construct additional treatment units if needed. These units could be among any of the facilities that are described in Section 3.4.3.13, *Wastewater Treatment*. If required by the RWQCB, additional treatment units will be required to be constructed 3 months before throughput increases occur. The lead time will ensure sufficient time to resolve treatment unit start up problems to ensure sufficient capacity.

Valero will be required to comply with the limitations and provisions of the RWQCB NPDES Order and therefore be required, before project implementation, to have adequate treatment and storage capacity. Considering the requirements of the RWQCB under the NPDES process, this impact is considered less than significant.

Mitigation: None required.

Impact 4.9-2: The proposed additional crude throughput and the additional wastewater associated with new and modified process units would increase the mass loading in the wastewater stream. The Wastewater Treatment Plant is required to adequately treat the increase in the mass loading so as not to exceed the limits required in the NPDES permit for the refinery's discharge. This impact would be less than significant.

The USEPA Effluent Guidelines and Standards of Petroleum Refining Point Sources based on Best Available Technology Economically Achievable (BAT), Best Practicable Control Technology (BPT), and/or Best Conventional Pollutant Control Technology (BCT), whichever are more stringent are applicable to the discharge. The RWQCB has calculated the effluent limitations in the RWQCB NPDES Order from the maximum facility production rate at the refinery. The proposed increase to production rate capacity represents a maximum increase of 22.2%, which corresponds to about an 11% increase in wastewater flows (RWQCB 2002a). According to the Code of Federal Regulations (40 CFR 122.29), this increase does not meet the definition as a new source. However, to ensure the increase in flow is consistent with Resolution No. 68-16 (*Statement of Policy with Respect to Maintaining High Quality of Waters in*

California), the RWQCB NPDES Order requires the refinery to submit an Anti-degradation Report, which will address mass increases of pollutants discharged and propose new units if necessary to enable adequate treatment (RWQCB 2002a). The purpose of the Anti-degradation assessment and report is to ensure that before any throughput increases are implemented under the NPDES permitting process, there is sufficient data indicating that discharge limits can be achieved.

The waters of the Carquinez Strait and Suisun Bay have been determined to be impaired by the presence of specific pollutants listed in Section 303(d) of the federal Clean Water Act. The presence of these pollutants would be specifically addressed in the Anti-degradation Report. These pollutants are those for which water quality standards are not expected to be met after implementation of technology-based effluent controls on point sources. The refinery has demonstrated that it is infeasible to meet water quality based effluent limits for copper, nickel, dioxin toxic equivalency (dioxin TEQ), and selenium. Each of these pollutants is a part of the Section 303(d) list. The RWQCB has adopted a revised Water Quality Control Plan for the San Francisco Bay Basin that identifies water quality objectives for Carquinez Strait and Suisun Bay. The effluent limitations that Valero must meet for these pollutants and others are set forth in the RWQCB NPDES Order.

Valero has proposed, as part of the VIP, to construct additional treatment units if needed. These units could be among any of the facilities that are described in Section 3.4.3.13, *Wastewater Treatment*. If determined by the RWQCB to be necessary, specific modifications would be made to the Wastewater Treatment Plant 3 months before throughput increases occur in order. This will ensure sufficient time to resolve treatment unit start up problems.

Valero is required to comply with the limitations and provisions of the RWQCB NPDES Order and therefore be required to have adequate monitoring of their effluent discharge. This includes providing the RWQCB a self-monitoring report (SMR) for each calendar month and an updated storm water pollution prevention plan (SWPPP) and annual report by October 1st of each year, as well as other reports (RWQCB 2002a). Considering the requirements of the RWQCB under the NPDES, this impact is considered less than significant.

Mitigation: None required.

Impact 4.9-3: The increase of crude throughput and the potential processing of a lower grade of crude would result in increased solids loading to the wastewater system. A portion of these solids are treated onsite within the Coker Unit and a portion is accumulated as a processed sludge that is disposed offsite. This impact is less than significant.

Cooling tower blow-down and sour water contains small amounts of sediment and an increase of throughput will potentially cause an increase in sediments in the process wastewater. The oil-water separator would initially remove most of the settleable particles by gravity. The settled solids are continuously removed and sent to the Coker Unit, then processed into the coke product as inert material (Hammonds 2002). Although coke production may increase, this product is sold and is not disposed.

Further, Valero's wastewater treatment process includes the introduction of ferric chloride which results in the production of a waste sludge that is disposed of at the Kettleman Hills Class I Landfill. Historically, the refinery has disposed 1,883 tons of this sludge in 1999; 2,219 tons in 2000; and 1,481 tons in 2001 (Hammonds 2002). Currently and under project operating conditions, the refinery expects to continue shipping a 15-ton truck load of Class I sludge to Kettlemen Hills Landfill every three days. This would yield approximately 1,800 tons of sludge per year. Kettleman Hills Landfill currently has capacity for approximately 6 million tons of additional waste and could continue to accept Class I hazardous wastes until 2009 (Yarbrough 2002). Given that this amount would not substantially differ from historical waste shipments to Kettleman Hills Landfill, and that the landfill would have capacity to receive such shipments and not require the expansion of any disposal facilities, adverse effects related to Class I hazardous waste generation and disposal would be less than significant.

Mitigation: None required.

Impact 4.9-4: Depletion of groundwater supplies due to the increased impervious surface area could potentially decrease groundwater resources. This impact is less than significant.

The proposed project would slightly increase impervious surface area within the refinery, particularly in the tank farm where approximately half of the existing Crude Field Retention Ponds would be removed to construct Tanks 1707 and 1708. The volume and extent of groundwater underlying the refinery is minimized by a lack of thick alluvial deposits, and potential use of this groundwater is restricted due to existing groundwater contamination. For these reasons, potential impacts to groundwater resources associated with the proposed project are therefore considered to be less than significant.

Mitigation: None required.

Impact 4.9-5: Depending on the particular component of the proposed project, varying amounts of wastewater would be generated by construction activities. This wastewater could contain entrained sediment, petroleum constituents, or other contaminants generated during the construction operations. Provided the applicant adheres to the grading and construction plan and city policies and programs this impact is less than significant.

Construction activities such as grading, excavation, and construction could result in generation of contaminants that if not properly managed could accumulate and be discharged to a surface water body. Contaminants can include sediment, petroleum hydrocarbons, oils and grease, and other chemicals associated with construction activities. Grading operations generate silt and clay that are fine-grained enough to become entrained in storm water runoff. Dewatering activities associated with excavation or pier drilling can generate sediment-laden water that if not properly handled can result in degradation of surface water resources. However, grading will be fairly limited since construction areas are already flat. Grading will not occur all at once but will happen over seven years as various project components are implemented.

Valero has a grading and construction plan that requires all phases of the VIP implement best management practices (BMPs) to reduce and eliminate storm water runoff. Per the grading and construction plan, the contractor is required to implement these BMPs and perform routine inspection and maintenance of the BMPs through all phases of construction. Additionally, Valero is required to conduct periodic inspection and maintenance, as necessary, of cut and fill slopes and sedimentation control facilities during the winter rainy season (See Section 4.9.2.3, *Regulatory Setting*).

The placement of engineered fills during site construction would act to reduce the potential for exposing storm water to soil and groundwater contamination. In addition, grading and excavation may generate an unspecified amount of soil. If contaminated, the soils would be segregated, immediately loaded into appropriate containers, and removed from the site to an appropriate off-site facility. Storm water runoff would not come into contact with contaminated soil.

The refinery currently has a Site Safety Plan in place that delineates safety procedures for the refinery. The construction contractor would be required to implement these procedures to protect all construction workers working with contaminated soil and groundwater.

Mitigation: None required.

Impact 4.9-6: Wastewater treatment facilities are located in the 100-year floodplain and new facilities would be subject to flooding. This impact is less than significant.

The refinery's wastewater treatment plant is located within a 100-year flood zone. Components of the project include support facilities that may be needed. These facilities are dependent on the water reuse design and NPDES permitting requirements and may include any of the facilities that are described in Section 3.4.3.13, *Wastewater Treatment*. If additions to the facilities at the Wastewater Treatment Plant are determined to be necessary, flood hazard mitigation measures in accordance with the City of Benicia Floodplain Management Policy are required to be included in the design criteria. This will comply with construction standards established by the California Building Code.

Mitigation: None required.

4.9.5 CUMULATIVE IMPACTS

Impact 4.9-7: The accumulative wastewater and storm water flows from the project and other refinery and non-refinery projects would increase pollutant discharges to the Bay. This would be a less than significant impact.

The proposed VIP will increase Valero's wastewater discharge to receiving waters. In addition to the contribution from the VIP, the refinery will route the 0.04 million gallons per day wastewater flow from the Huntway Asphalt Plant through its wastewater treatment plant. This waste stream will be treated by the wastewater treatment plant prior to discharge and will comply with NPDES discharge limitations. As discussed in Impact 4.9-1, the amount of storm water that requires management (conveyance, treatment, detention) resulting from the proposed project is not expected to increase substantially because the proposed improvements are located in developed areas that currently generate storm water runoff.

The proposed VIP and the other proposed projects at the Benicia refinery, in combination with neighboring refineries and other projects requiring effluent discharges, contribute controlled amounts of effluent waste water to the Suisun Bay and San Pablo Bay. Cumulatively, these discharges represent a significant portion of the contaminants that are assimilated into these surface water resources. Discharges to the waters of the United States are regulated under the RWQCB's implementation of the NPDES that establishes waste discharge requirements and provisions to dischargers to manage effluent concentrations of contaminants. The bases for discharge limits and requirements include the Federal Water Pollution Act, Federal Code of Regulations: Title 40, San Francisco Water Quality Control Plan, California Toxics Rule, National Toxics Rule, State Implementation Policy, USEPA Quality Criteria for Water and the Ambient Water Quality Criteria for Bacteria. Discharges to the Suisun Bay and Carquinez Straits are regulated under waste discharge requirements that are determined based on the ability of the surface water to accommodate additional chemical and metal loading. Under the current environment, the NPDES Waste Discharge Requirements and the process to determine these limits and requirements is the most stringent regulatory mechanism to manage waste discharges to receiving water bodies.

The refinery's discharge to the Suisun Bay and Carquinez Straits constitutes an increase of an existing discharge that is regulated under the NPDES process. Although the refinery's discharge represents an increase, albeit minor, to the cumulative chemical loading to the receiving waters, its contribution is considered less than significant to the overall hydrologic system. The increase to the refinery's discharge, if eliminated from the regional cumulative discharges, would not constitute a significant reduction in the overall metal and chemical loading by local and regional discharges.

Mitigation: None required.

Impact 4.9-8: Cumulatively, the storm water generated from the VIP, together with other refinery projects and the storm water generated from other non-refinery projects may potentially have a downstream flooding effect. This would be less than significant.

The addition of two crude oil tanks in the crude oil tank farm (Drainage Parcel 2) and changes within the main refinery area (Drainage Parcel 1) and wastewater treatment area (Drainage Parcel 3) are within a controlled runoff area (i.e., a diked or containment area capable of temporarily detaining storm water flows). Other refinery projects would have no hydrological effect. Therefore, changes in the peak storm water flows to the Lower Sulphur Springs Creek drainage area as a result of the VIP and other refinery projects are considered *de minimis*.

The Benicia Business Park and Southampton Tourtelot Development projects located northeast and northwest of the refinery, respectively, could considerably change runoff conditions and cause downstream flooding effects to the Lower Sulphur Springs Creek drainage area. However, the incremental impacts of the VIP are not cumulatively considerable because the storm water runoff into the Lower Sulphur Springs Creek drainage area would essentially be the same whether or not the proposed VIP is implemented.

Mitigation: None required.

REFERENCES – Hydrology and Water Quality

Woodward-Clyde Consultants. *Exxon Benicia Refinery Clean Fuels Project*. Prepared for City of Benicia. September 1993.

CWDR, 1975. *California's Ground Water.* California Department of Water Resources. Bulletin 118.

CWDR, 2002. *Draft Ground Water Basins in California.* California Department of Water Resources. Bulletin 118.

City of Benicia, *Benicia General Plan*, adopted June 15, 1999.

City of Benicia, *Benicia Municipal Ordinance*, January 1996.

Hammonds, Samuel 2002. Personal communication, Valero Refinery - Principal Environmental Engineer, Benicia, California September 25 and 26.

Regional Water Quality Control Board, *Valero Benicia Refinery - NPDES Permit No. CA0005550 Order No.2002-0112*, October 2002.

Regional Water Quality Control Board 2002b. Personal Communication with Robert Schlipf, - Oakland, California. September 26, 2002.*The Suisun Marsh Protection Plan*, BCDC, December 1976.

URS Corporation, *MTBE PO Draft Environmental Impact Report*, April 2002.

URS Corporation, *Remedial Action Plan – Valero Benicia Refinery*, July 2001.

URS Corporation, *Addendum to Proposed Water Quality Goals and Protection Standards for the Main Refinery Site and the Terminus of the Old Dock Pipeline – Valero Benicia Refinery,* July 2000.

Radian Corporation, *Proposed Water Quality Goals and Protection Standards for the Main Refinery Site and the Terminus of the Old Dock Pipeline*, 1999.

Yarbrough, Terri 2002. Personal communication, Kettleman Hills Personnel, Kettleman City, California. October 1, 2002.

4.10 LAND USE, PLANS AND POLICIES

All land use effects of the Valero Improvement Project (VIP) either would be less than significant or would result in no impact. No mitigation is required.

- ***Project construction may result in temporary secondary impacts to adjacent industrial uses and nearby residences.***
- ***The project would not conflict with established plans, policies and ordinances.***
- ***The project would not potentially divide an established community.***
- ***The project would not affect a habitat conservation plan or natural community plan.***

4.10.1 INTRODUCTION

This section discusses land use planning issues, including the VIP's consistency with local land use and zoning and applicable local plans, policies, and regulations. The applicable plans and their relevant policies discussed in this section include *City of Benicia General Plan* (General Plan), *Benicia Zoning Ordinance* (Zoning Ordinance), Bay Conservation and Development's *San Francisco Bay Plan* (Bay Plan) and the Suisun Marsh Local Protection Program.

4.10.2 SETTING

4.10.2.1 REGIONAL SETTING

The City of Benicia is located in the southernmost section of Solano County, overlooking the Carquinez Strait, which connects San Pablo Bay to the west and Suisun Bay and the Sacramento Delta to the east. Benicia is located adjacent to the Interstate 680 corridor and to Interstate 80 (I-80) via Interstate 780 (I-780). The City is also home to the Port of Benicia, a deep water privately operated port. Benicia is forty miles from Oakland International and fifty miles from San Francisco International Airports. Union Pacific Railroad operates two major rail lines and related trackage serving Benicia businesses. The City of Benicia encompasses 14 square miles of land area, and is located 35 miles northeast of San Francisco and 57 miles southwest of Sacramento.

4.10.2.2 PROJECT SITE LOCATION

The VIP is located entirely within the refinery, which is located at 3400 East Second Street in Benicia. The refinery is approximately 1.5 miles northeast of the Benicia business district and is within the Benicia Industrial Park (see Figure 3-1, *Regional Location*). Valero owns approximately 800 acres of land in the area of the refinery. Valero's property is located about half a mile north of Interstate 780 (I-780) and immediately west of Interstate 680 (I-680). The

Valero property is bisected in a north-south direction by East Second Street, and is bounded on the north by residential development and open space, on the east by the Benicia Industrial Park and I-680, on the south by industrial development and on the west by residential development. Refinery facilities occupy approximately 330 acres of this property. North and west of East Second Street, the remainder of the Valero property is undeveloped.

On-Site Land Uses

The refinery consists of four primary areas: a process block area, where crude oil is converted into gasoline and other chemicals; a crude tank farm, flanking both sides of the process block area, where processed petroleum products are stored; an administrative area, including the refinery's main public entry and parking lot along East Second Street; and the refinery's wastewater treatment plant, separated from the main refinery area by I-680 (see Figure 3-2, *Valero Benicia Refinery*). Coke shipments occur at Berth 3 at the Port of Benicia, located off of Bayshore Road, just west of the Benicia Martinez Bridge. Additionally, the refinery's wastewater effluent outfall discharges approximately 1,100 feet offshore into Suisun Bay.

The refinery occupies approximately 330 acres of the 800 acres owned by Valero. The remaining portions of the property are undeveloped.

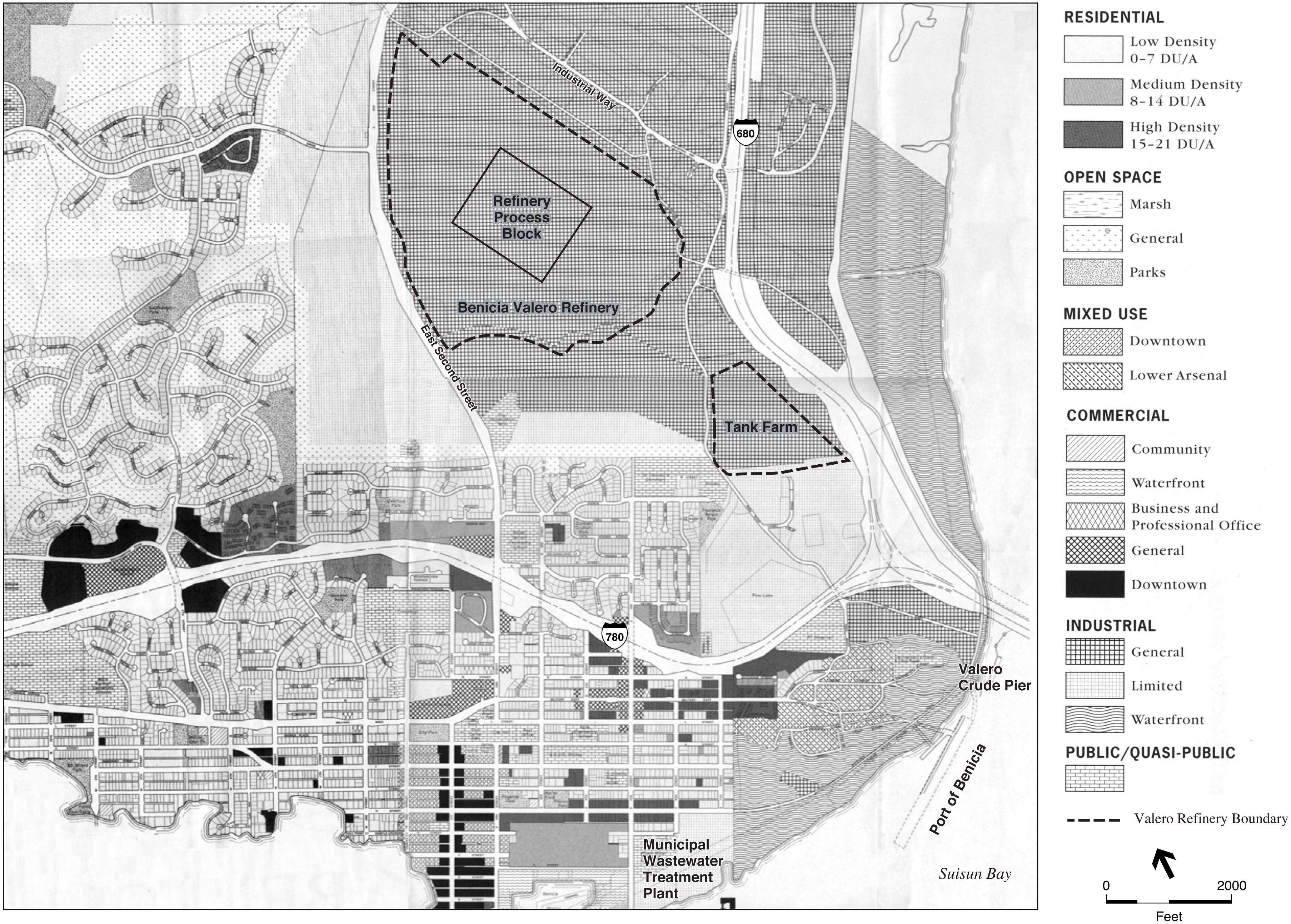
Surrounding Land Uses

Land uses in the vicinity of the refinery are depicted on Figure 4.10-1, *Land Use Diagram*. These uses are characterized by general industrial and low-density residential development, with small areas of medium to high-density residential, public/quasi public, limited industrial and parkland.

In general, the refinery complex is immediately bordered by 470 acres of mostly undeveloped Valero property to the south and west, and general industrial uses to the north and east. The refinery is adjacent to medium and heavy industrial uses that comprise the Benicia Industrial Park, which is well removed from central Benicia. The industrial park is generally enclosed within the area bordered by East Second Street, I-680, and I-780.

Residential uses are located to the south (Hillcrest neighborhood) and west (Southampton neighborhood) of the Valero buffer land boundaries, with the closest residences located approximately 3,000 feet away from the project site. Numerous bunkers are located throughout the refinery property, which are associated with the historic Benicia Arsenal. These bunkers are currently used for storage.

Outside the refinery property, other industrial uses located within the eastern section of the Benicia Industrial Park include refinery service businesses, warehousing, manufacturing, a self-storage unit operation, and the CalTrans Carquinez Bridge Maintenance Facility. Other uses to the east of the property boundary include Interstate 680, the Union Pacific Railroad, and the refinery's wastewater treatment plant.



SOURCE: City of Benicia

Figure 4.10-1
Land Use Diagram

4.10.2.3 CITY OF BENICIA GENERAL PLAN

To meet the requirements of state law, all cities and counties in California are required to prepare and adopt a general plan. Pursuant to state law, the general plan is a comprehensive, long-term plan for the physical development for the City, and any land outside its boundaries, which bears relation to its planning. The *City of Benicia General Plan*, adopted in 1999, includes specific policies to preserve and enhance existing development and to provide for orderly and appropriate new development of the City of Benicia until approximately the year 2020. Actions and approvals required by the City of Benicia Community Development Department must be consistent with the General Plan. The General Plan contains the Community Development and Sustainability chapter (Chapter 2), which includes a discussion of the various types of land uses in Benicia. It also has goals and policies addressing growth management, economic development, circulation (i.e., transportation and traffic), community/public services and public facilities. The General Plan's Community Identity chapter (Chapter 3) covers historic and cultural resources, visual character, and open space and conservation of resources. The Community Health and Safety chapter (Chapter 4) addresses options for developing a more healthy community, hazards to the community, emergency response plans and community safety measures, and community noise sources and related effects. Each General Plan chapter contains goals, policies, and implementation measures that may be pertinent to the VIP.

The project site exists within the geographic area named in the General Plan as the Benicia Industrial Park, which is the major industrial area in the City. The site is more specifically located in the refinery within the Industrial Park, with limited refinery functions occurring outside the footprint of the refinery (such as the wastewater treatment plant, coke shipments and effluent outfall). Benicia's industrial land is divided into three General Plan Land Use categories: 1) General Industrial; 2) Limited Industrial; and 3) Water-related Industrial. The land use designation for the project site is General Industrial, which is the least restrictive of the three categories, and is intended to allow flexibility for industrial development. Over half of the Benicia Industrial Park is designated General Industrial. This includes nearly all of the area north of I-780 and east of East Second Street.

General Plan goals and policies applicable to the VIP from the land use perspective are included below. Policies pertaining to other environmental topic areas, such as traffic and circulation, response to hazards and public safety, hydrology and water quality, and visual quality are included in their respective sections of this EIR.

Growth Management

Goal 2.1:	Preserve Benicia as a small-sized city.
Policy 2.1.1:	Ensure that new development is compatible with adjacent existing development and does not detract from Benicia's small town qualities and historic heritage, (and to the extent possible, contributes to the applicable quality of life factors noted above).

Policy 2.1.4:	Strive to preserve significant areas of vegetation and open space when approving development projects.

Economic Development

Goal 2.5:	Facilitate and encourage new uses and development which provide substantial and sustainable fiscal and economic benefits to the City and the community while maintaining health, safety, and quality of life.
Policy 2.6.1	Preserve industrial land for industrial purposes and certain compatible “service commercial” and ancillary on-site retail uses.
Policy 2.6.4:	Link any expansion of industrial use to the provision of infrastructure and public services that are to be developed and in place prior to the expansion.
Policy 2.6.5:	Establish and maintain a land buffer between industrial/commercial uses and existing and future residential uses for reasons of health, safety and quality of life.

Open Space and Conservation of Resources

Goal 3.15	Provide buffers throughout the community.
Policy 3.15.4	Use open space as a buffer against natural and man-made hazards.
Policy Program 3.15.F:	Require open space buffers around known hazardous areas such as the Exxon (Valero) Refinery and the Interpretive Trail Site.

4.10.2.4 CITY OF BENICIA ZONING ORDINANCE

The City of Benicia Zoning Ordinance (zoning ordinance) is the primary tool for achieving the objectives of the General Plan. The zoning ordinance provides detailed specifications for allowable development within areas designated by the General Plan. The refinery process area, tank farm and wastewater treatment plant are designated General Industrial (IG) by the Benicia Zoning Ordinance. General Industrial uses are permitted by right under Benicia’s Zoning Ordinance, except that a use permit is required for all oil and gas refining. Valero’s undeveloped land, which serves as a buffer between the refinery’s industrial uses and other land uses, is zoned Limited Industrial (IL). The VIP would not affect the IL zone. The dock area is zoned Waterfront Industrial (IL).

4.10.2.5 BAY CONSERVATION AND DEVELOPMENT COMMISSION

The San Francisco Bay Conservation and Development Commission (BCDC) is a state agency with permit authority over the Bay and its shoreline. Created by the McAteer-Petris Act in 1965, BCDC regulates filling, dredging, and changes in use in San Francisco Bay. BCDC also regulates new development within the 100 feet of the shoreline to ensure that maximum feasible public access to and along the Bay is provided. The Commission is also charged with ensuring that the limited amount of shoreline property suitable for regional high priority water-oriented uses (ports, water-related industry, water-oriented recreation, airports and wildlife areas) is reserved for these purposes. Land-side uses and structural changes are governed by policies regarding public access.

BCDC planning documents applicable to the VIP include: the *San Francisco Bay Plan* (Bay Plan), adopted in 1969 and since amended, which specifies goals, objectives and policies for existing and proposed waterfront land use and other BCDC jurisdictional areas; the *Bay Area Seaport Plan*, prepared in conjunction with the Metropolitan Transportation Commission, which is BCDC's overall policy for long-term growth and development of the Bay Area's six seaports, including the Port of Benicia; the *Benicia Waterfront Special Area Plan*, adopted by the Commission (April, 1977) and the City of Benicia to provide detailed planning and regulatory guidelines for the Benicia shoreline between West Second Street and the Benicia-Martinez Bridge; and, the *Suisun Marsh Protection Plan*, adopted in 1976 contains policies which regulate the marsh's primary management area of 89,000 acres of tidal marsh, managed wetlands, adjacent grasslands, and waterways, as well as a secondary management area of approximately 22,500 acres of significant buffer lands. The *Suisun Marsh Local Protection Plan* was subsequently adopted by Solano County (including the Cities of Fairfield and Suisun City) in 1980s.

4.10.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

VIP land use was evaluated in terms of its compatibility with other land uses in the vicinity. In addition, the project was evaluated for its compatibility with the applicable plans and policies of the City of Benicia, including land use and zoning designations for the area around the refinery.

According to Appendix G of the *CEQA Guidelines*, a project may be deemed to have a significant impact on the environment if it will:

- conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project adopted for the purpose of avoiding or mitigating an environmental effect.
- physically divide an established community; or
- conflict with any habitat conservation plan or natural community plan.

A project would also be considered to have a significant impact on the environment if it would cause physical changes in the environment that would be substantially incompatible with existing land uses.

4.10.4 IMPACTS AND MITIGATION MEASURES

4.10.4.1 CONSTRUCTION

Impact 4.10-1: Construction of new refinery components and on-site improvements may result in intermittent impacts to adjacent industrial uses and nearby residences due to traffic congestion, air emissions, noise increases, view disruptions and public safety. This impact is less than significant.

Project construction-related activities which would affect adjacent land uses are discussed in Section 4.1, *Aesthetics, Visual Quality, Light and Glare*; 4.11, *Noise*; and, 4.13, *Transportation/Traffic*.

As discussed in Section 3.5, *Construction of the Proposed Project,* construction activities would begin in 2003, with completion in about 2009 (see Section 3.5.1, *Schedule* for construction phasing information). Construction of the proposed Valero Improvement Project (VIP) would not require the demolition of any existing refinery facilities. However, grading, transport of materials, and building and installation of new equipment would be required.

Construction impacts would be short-term in nature and are not expected to continue after completion of the project. For additional analysis of construction impacts, please refer to the above-identified sections. Mitigation measures identified in these sections would mitigate all potential construction-associated land use impacts to a less than significant level.

Mitigation: None required.

4.10.4.2 LAND USE COMPATIBILITY

Impact 4.10-2: The project would not conflict with established plans, policies and ordinances in Benicia. No impact would occur.

The refinery process area, tank farm and wastewater treatment plant are designated General Industrial by *City of Benicia General Plan* and General Industrial (IG) by the Benicia Zoning Ordinance. General Industrial uses are permitted by right under the Zoning Ordinance, except that a use permit is required for all oil and gas refining. Dock facilities are designated Waterfront Industrial in the General Plan and zoned Water Related Industrial (IW). The project would conform to uses designated by the San Francisco Bay Plan and the Benicia Port Plan. The VIP would, thus, not conflict with any applicable land use plans and policies. There would be no impact.

Mitigation: None required.

4.10.4.3 DIVIDE AN ESTABLISHED COMMUNITY

Impact 4.10-3: The project would not potentially divide an established community. No impact would occur.

The VIP would not result in any adverse or significant impacts with respect to land use. As discussed above, the project does not conflict with any of the plans, policies, or ordinances set forth in the City of Benicia, Solano County, or the Bay Plan, Benicia Port Plan and Suisun Marsh Local Protection Program.

The VIP would be constructed within the existing footprint of already-developed portions of the project site, in physically discrete areas occupied by existing refinery and tank storage operations. The nearest residential uses are located in the Hillcrest neighborhood approximately 3,000 feet (approximately 0.6 miles) due south of the perimeter of the refinery process area, and roughly 1,800 feet from the existing tank farm. Development on the project site would be contained within the footprint of the existing refinery and tank farm, would not develop portions of the existing open space buffer, and as such would not physically divide an existing community.

The VIP would not convert prime farmland to nonagricultural use, or impair agricultural productivity of prime agricultural land. Finally, the VIP would not result in a substantial alteration of present or planned land uses in the area.

Mitigation: None required.

4.10.4.4 HABITAT CONSERVATION OR NATURAL COMMUNITY PLANS

Impact 4.10-4: The project would not affect a habitat conservation plan or natural community plan. No impact would occur.

The proposed VIP is located outside the Marsh Protection Area identified in the Suisun Marsh Local Protection Program; therefore, in terms of land use, the program is not directly applicable to the project. The Suisun Marsh Plan does, however, contain policies which focus on the construction of new utilities within the marsh protection zone. As mentioned in the setting, one of Valero's effluent outfalls discharges approximately 1,100 feet into Suisun Bay, within the protected zone. The quantity and quality of the runoff and treated wastewater emitted from the WWTP's outfall could change as part of the project. While the Suisun Marsh Plan regulates the construction of new utilities in protected zones by permitting utility construction, the effluent outfall in this case already exists, and no new effluent or utility construction within the marsh is proposed. The Suisun Marsh Plan requires that the disposal of wastewater from the existing outfall follow the requirements of the Solano County Health Department and Regional Water Quality Control Board. A discussion of the project's effect on hydrology and water quality is included in Section 4.9, *Hydrology and Water Quality*. A discussion of special status species in the Suisun Marsh area can be found in Section 4.3, *Biological Resources*.

Mitigation: None required.

REFERENCES – Land Use, Plans and Policies

City of Benicia, *City of Benicia General Plan*, adopted June 15, 1999.

City of Benicia, *Benicia Zoning Ordinance (Title 17)*, January 9, 2002

San Francisco Bay Area Seaport Plan, BCDC and Metropolitan Transportation Commission, as amended through September 1997.

San Francisco Bay Plan, BCDC, as amended through August 2001.

The Suisun Marsh Protection Plan, BCDC, December 1976.

4.11 NOISE

The project would impact the ambient noise environment during both the construction and operational phases of the project.

Since the VIP would be located on refinery property, project-related noise impacts would primarily be to offsite residential receptors located to the west and south of the refinery. Existing daytime ambient noise levels at these residential receptors are in the order of 41 – 70 dBA, L_{eq}. Using the noise level of 60 dBA for speech interference for construction activities and noise level performance standards in the Benicia General Plan as the basis for significance thresholds for operational activities, the proposed project would lead to the following potentially significant impact

Noise during construction of the proposed project would temporarily increase the ambient noise levels at the residential receptors to levels above those specified in the Benicia General Plan. This impact would be mitigated to a less than significant level with the incorporation of the proposed mitigation measures.

This section addresses noise impacts associated with the proposed Valero Improvement Project (VIP). It analyzes both potential noise impacts caused by construction and operation of the VIP on the ambient noise environment. Background information on environmental acoustics, including definitions of terms commonly used in noise analysis is provided below.

4.11.1 INTRODUCTION

Sound is mechanical energy transmitted by pressure waves through a medium such as air. Noise is defined as unwanted sound. Sound is characterized by various parameters that include the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level or energy content (amplitude). In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. Sound pressure level is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing, and 120 to 140 dB corresponding to the threshold of pain. Because sound pressure can vary by over one trillion times within the range of human hearing, a logarithmic loudness scale is used to keep sound intensity numbers at a convenient and manageable level.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). When all the audible frequencies of a sound are measured, a sound spectrum is plotted consisting of a range of frequency spanning 20 to 20,000 Hz. The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the sound frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ears decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA).[1] Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements.

4.11.1.1 NOISE EXPOSURE AND COMMUNITY NOISE

An individual's noise exposure is a measure of the noise experienced by the individual over a period of time. A noise level is a measure of noise at a given instant in time. However, noise levels rarely persist consistently over a long period of time. Rather, community noise varies continuously with time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

These successive additions of sound to the community noise environment vary the community noise level from instant to instant requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

L_{eq}: The equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The L_{eq} is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

L_{max}: The instantaneous maximum noise level measured during the measurement period of interest.

L_{min}: The instantaneous minimum noise level measured during the measurement period of interest.

L_x: The sound level that is equaled or exceeded x percent of a specified time period. The L_{50} represents the median sound level. L_{90} represents the background noise level.

1 All noise levels reported herein reflect A-weighted decibels unless otherwise stated.

DNL: The energy average of the A-weighted sound levels occurring during a 24-hour period, and which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

CNEL: Similar to the DNL the Community Noise Equivalent Level (CNEL) adds a 5-dBA "penalty" for the evening hours between 7:00 p.m. and 10:00 p.m. in addition to a 10-dBA penalty between the hours of 10:00 p.m. and 7:00 a.m.

4.11.1.2 EFFECTS OF NOISE ON PEOPLE

The effects of noise on people can be placed into three categories:

- Interference with activities such as speech, sleep, and learning – The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors, the thresholds are about 15 dBA higher. Steady noise of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 DNL. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses.

- Subjective effects of annoyance, nuisance, and dissatisfaction – Based on attitude surveys used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas, the main causes for annoyance are interference with speech, radio and television, house vibrations, and interference with sleep and rest. The DNL as a measure has been found to provide a valid correlation of noise level and the percentage of people annoyed.

- Physiological effects such as hearing loss or sudden startling – While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants generally experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise, or the corresponding reactions of annoyance and dissatisfaction. A wide variation exists in the individual thresholds of annoyance, and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so called "ambient noise" level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:

- except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived;
- outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- a change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and
- a 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause adverse response

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion, hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA.

4.11.1.3 NOISE ATTENUATION

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate of 6 to 7.5 dBA per doubling of distance from the source, depending on the topography of the area and environmental conditions (i.e., atmospheric conditions and noise barriers, vegetative or manufactured, etc.). Widely distributed noise, such as a large industrial facility spread over many acres or a street with moving vehicles, would typically attenuate at a lower rate, approximately 4 to 6 dBA.

4.11.2 SETTING

4.11.2.1 EXISTING SETTING

Sensitive Receptors

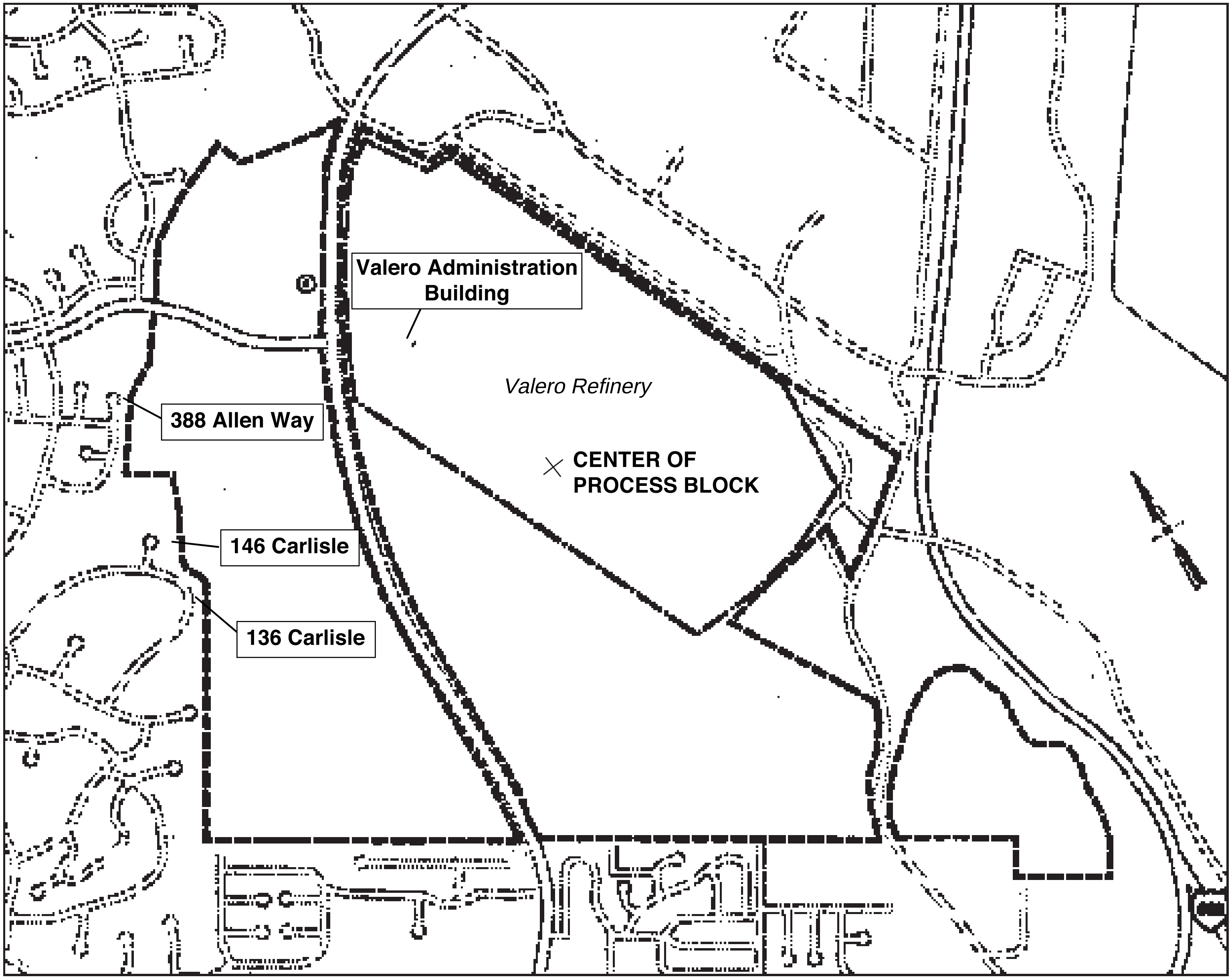
The proposed project is located within the Valero Benicia Refinery in an area designated for General Industrial uses in the *City of Benicia General Plan*. Noise-sensitive uses do not immediately adjoin the developed part of the refinery. In general, the refinery complex is immediately bordered by 470 acres of mostly undeveloped Valero property to the south and west, and general industrial uses to the north and east. Residential uses are located to the south (Hillcrest neighborhood) and west (Southampton neighborhood) of the Valero buffer land boundaries, with the closest residences located approximately 3,000 feet away from the process block of the refinery where the VIP would be constructed. The buffer lands separating the neighborhoods from the refinery are designated for non-noise sensitive uses designated as General Industrial, Limited Industrial, and General Open Space in the General Plan (City of Benicia 1999). Areas to the northeast and southeast of the refinery are also non-noise sensitive land uses, consisting of Interstate 680 and the Benicia Industrial Park.

Noise sources and ambient noise levels

Transportation sources, such as automobiles, trucks, trains, and aircraft, are the principal sources of noise in the urban environment. Along major transportation corridors, noise levels can reach 80 DNL, while along arterial streets, noise levels typically range from 65 to 70 DNL. Industrial and commercial equipment and operations also contribute to the ambient noise environment in their vicinities. The ambient noise environment at the project site is dominated by existing operations at the refinery, and vehicular traffic on Interstate 680 and Interstate 780.

A noise assessment was conducted for Valero by Illingworth & Rodkin, Inc. to evaluate noise level increases at noise sensitive uses in the vicinity of the Valero Benicia Refinery due to the implementation of the VIP. This assessment was reviewed by ESA prior and found to technically accurate and adequate prior to incorporation into this section. To provide the basis for evaluating potential impacts of the project on the nearest noise-sensitive uses, noise measurements conducted as part of the Valero Cogeneration Project and a Valero Community Noise Monitoring Survey were used. For these studies, long term noise measurements were conducted at four residences within the neighboring Southampton and Hillcrest communities, located approximately 3,300 to 3,750 feet from the center of the process block in which the VIP would be located. These residences have varying views of the block and the overall refinery due to the surrounding topography. Noise measurements were made using Larson-Davis Laboratories Type 812 and 820 Sound Level Meters. These meters meet the American National Standards Institute requirements for a Type 1 precision sound level meter. The meters were calibrated before and after the surveys with a Larson-Davis Laboratories acoustical calibrator. In the Community Noise Monitoring Survey, a reference long-term noise measurement was also made at the parking lot of the Valero Administration Building located approximately 1,500 feet from the center of the process block in which the VIP would be implemented. These noise-monitoring locations are shown in Figure 4.11-1. Table 4.11-1 below, lists the four noise monitoring locations, their distance from the center of the process block in which the VIP would be located and summarizes the range of average daytime and nighttime ambient noise levels measured at each of these locations. The Allen Way and Carlisle Way residences are located within the Southampton neighborhood located to the west of the refinery. The La Cruz residence is located in the Hillcrest neighborhood south of the refinery approximately the same distance from the center of the process block as the nearest Southampton residences. Based on noise monitoring conducted for the Benicia Clean Fuels project and as shown in Table 4.11-1, the ambient noise levels in Hillcrest are slightly higher than those observed in the Southampton area. This is because La Cruz location has an unobstructed view of the entire refinery.

The noise monitoring and analysis have been conducted in accordance with the requirements for acoustical analysis included as Appendix I of the General Plan.



SOURCE: Illingworth & Rodkin, Inc.

Figure 4.11-1
Noise Measurement Locations

TABLE 4.11-1
AMBIENT NOISE LEVELS AT MONITORED LOCATIONS, dBA

	Monitoring Location	Distance to VIP Process Block (ft)	Daytime Noise Level Range (Hourly Leq)	Nighttime Noise Level Range (Hourly Leq)
1	388 Allen Way	3,750	46 – 70	43 – 65
2	136 Carlisle Way	3,300	42 – 55	36 – 49
3	146 Carlisle Way	3,450	41 – 57	35 – 49
4	Valero Administration Building	1,200	64 – 66	64 – 66
5	37 La Cruz	3,300	48 - 62	53 - 58

SOURCE: Illingworth & Rodkin, Inc., May 2002.

4.11.2.2 REGULATORY SETTING

Noise issues applicable to the proposed project are addressed in local General Plan policies, and local noise ordinance standards.

The Community Health and Safety Element of the City of Benicia General Plan contains policies and programs to reduce or eliminate the effects of excessive noise in the community. Policies applicable to the proposed project include:

Policy 4.23.2: Use noise dampening building standards, site design landscaping, and setbacks instead of sound walls, wherever possible.

Policy 4.23.3: Use available techniques such as building insulation, berms, building design and orientation, buffer yards, and staggered operating hours to minimize noise at the source.

Policy 4.23.6: Attempt to reduce noise in areas already highly impacted by excessive noise.

The Community Health and Safety Element contains noise performance standards, which are directly applicable to this project. These performance standards are used for determining the compatibility of proposed noise sensitive land uses with stationary noise sources. The standards also apply to new projects that include stationary noise sources, which may affect an existing noise sensitive development. The intent of these performance standards is both to prevent new noise sources from encroaching on existing noise sensitive developments and to prevent new noise sensitive development from encroaching on existing uses. The noise limits set by these performance standards are shown in Table 4.11-2. Noise sources evaluated relative to the performance standards in Table 4.11-2 should be considered with respect to their standard daily or weekly operating conditions. Noise sources may produce unusual noise levels due to

TABLE 4.11-2
NOISE LEVEL PERFORMANCE STANDARDS, dBA

Land Use	Exterior Hourly Leq Daytime 7 am to 10 pm	Exterior Hourly Leq Nighttime 10 pm to 7 am	Interior Hourly Leq Daytime 7 am to 10 pm	Interior Hourly Leq Nighttime 10 pm to 7 am
Residential	55	50	40	35
Transient Lodging	55	50	40	35
Hospitals	--	--	40	35
Nursing Homes	55	50	40	35
Theaters, Auditoriums	--	--	35	35
Churches	55	50	40	40
Schools	55	50	45	45
Libraries	55	50	45	45

a Stationary noise sources include industrial operations, outdoor recreation facilities, HVAC units, loading docks, etc.
b The above standards may be adjusted upwards to allow for an increase in the existing ambient hourly Leq caused by a proposed project. An increase of less than 3 dB is permitted, even if the standards in Table 4.11-2 are exceeded; an increase of 3 dB or greater constitutes a significant environmental impact, unless the increase does not cause the standards in Table 4.11-2 to be exceeded.
c The noise level standards contained above shall be applied to a typical hour of operation. When a peak hour of operation is expected to occur consistently during daily or weekly operations, the standards shall also be applied to those operations.
d Each of the noise standards specified above shall be lowered by five dB for tonal noises (humming, high pitched tones, speech music, or recurring impulsive noises). This lowering of the standard does not apply to residential units established in conjunction with industrial or commercial caretaker dwellings.
e The City may choose to apply the noise level performance standards at designated outdoor activity areas, in lieu of the property line.
f The above standards do not apply to safety signals or warning devices.
g For noise sources that occur on an infrequent basis and are considered to be safety equipment (such as flaring or pressure relief valves), a maximum noise level of 75 dB is acceptable, as measured from the receiver's property line. Noise levels that are projected to exceed this maximum are considered a significant environmental impact.
h Where outdoor activity areas do not exist and/or are not expected to be affected, the City may choose to only apply the interior noise level criteria.

SOURCE: City of Benicia General Plan, Community Health and Safety Element – Table 4-4. June 1999.

temporary equipment malfunction, or unusual atmospheric conditions. Noise levels associated with these infrequent conditions are exempt from the performance standards contained in Table 4.11-2. In addition, the performance standards are not applicable to safety signals or warning devices. Noise sources such as flaring and pressure relief valves are allowed to generate a maximum noise level of 75 dBA, as measured at the receiver's property line.

Title 8, Chapter 8.2 of the Benicia Municipal Code contains noise regulations that apply to the proposed VIP. Section 8.20.140 addresses noise from the operation of machinery, equipment, fans and air conditioning units. This section limits noise increase from such mechanical devices to a maximum of five dBA over ambient base noise levels at the property line of any property generating the noise. Section 8.20.150 prohibits construction activities within any residential zone, or within a radius of 500 feet from a residential zone between the nighttime hours of 10 p.m. of any one day and 7 a.m. of the following day in such a manner that a reasonable person of normal sensitiveness residing in the area is caused discomfort or annoyance unless a permit has been obtained from the city manager or his designee. This section would not apply to the VIP as construction activities associated with the project would take place more than 3,000 feet from the nearest residential zones.

4.11.3 SIGNIFICANCE CRITERIA

Based on Appendix G of the *CEQA Guidelines,* a project may be deemed to have a significant effect on the environment with respect to noise if it would result in:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

A change in noise levels of less than three dBA is not discernible to the general population; an increase in average noise levels of three dBA is considered barely perceptible, while an increase of five dBA is considered readily perceptible to most people (Caltrans 1998).

Therefore, for the purposes of this EIR, the following would constitute a significant project impact:

- Operational noise generated by the project causes the ambient noise level to exceed the City's noise performance standards summarized in Table 4.11-2;
- Operational noise generated by the project causes the ambient noise level to increase by 3 dBA or more, if the existing ambient noise levels already exceed the prescribed noise limits.
- Operational noise generated by the project results in a 5 dBA or greater increase in noise level at the property line and the resulting noise level remains below the performance standards summarized in Table 4.11-2. This would also be consistent with the requirements of Section 8.20.140 of Title 8, Chapter 8.2 - Noise Regulations of the Benicia Municipal Code.
- Construction noise generated by the project exceeds a speech interference level of 60 dBA, Leq during the daytime and 55 dBA, Leq during the nighttime.

4.11.4 IMPACTS AND MITIGATION MEASURES

4.11.4.1 CONSTRUCTION NOISE

Impact 4.11-1: Construction activities would intermittently and temporarily generate noise levels above existing ambient levels in the project vicinity over the duration of the construction period. This potentially significant impact would be reduced to a less than significant level with the implementation of Mitigation Measure 4.11-1.

Construction of the VIP would primarily take place during the major and minor turnarounds for the refinery. Construction noise levels at and near locations on the project site would fluctuate depending on the particular type, number, and duration of use of various types of construction equipment. The effect of construction noise would depend upon how much noise would be generated by construction, the distance between construction activities and the nearest noise-sensitive uses, and the existing noise levels at those uses. Construction-related material haul trips would raise ambient noise levels along haul routes, depending on the number of haul trips made and types of vehicles used. In addition, certain types of construction equipment generate impulsive noises (such as pile driving), which can be particularly annoying. Table 4.11-3 shows typical noise levels during different construction stages. Table 4.11-4 shows typical noise levels produced by various types of construction equipment. Noise levels during the noisiest phases of construction (pile driving) could reach 90 – 105 dBA.

Noise from construction activity generally attenuates (decreases) at a rate of 6 to 7.5 dBA per doubling of distance. Conservatively assuming an attenuation of 6 dBA per doubling of distance, pile driving could lead to noise levels of 54 to 69 L_{eq} at the nearest sensitive receptors located approximately 3,000 feet from the VIP site. These predicted noise levels would exceed the significance criteria previously established based on speech interference during daytime and nighttime conditions. Therefore, this would be considered a potentially significant impact.

Noise levels at sensitive receptors during other construction phases would be less than the daytime and nighttime significance thresholds of 60 and 55 dBA, Leq, respectively. During nighttime, construction-related noise could be more noticeable (since background noise is lower) given the more sensitive nature of the nighttime period. Section 8.20.150 of the City of Benicia Noise Ordinance prohibits construction activities at night (10 p.m. to 7 a.m.) when construction is occurring within 500 feet of a residential property. No residential property is located within 500 feet of the project site where the VIP would be located, so this section of the ordinance does not apply to the proposed project.

If after a more detailed evaluation, pile driving is determined to be a necessary part of the construction process, Valero would require the contractor to implement the following mitigation measure throughout the duration of construction activity to reduce noise impacts of pile driving operations on sensitive receptors:

TABLE 4.11-3
TYPICAL COMMERCIAL CONSTRUCTION NOISE LEVELS

Construction Phase	Noise Level[a] (dBA, L_{eq} at 50 feet)
Ground Clearing	84
Excavation	89
Foundations	78
Erection	85
Exterior Finishing	89
Pile Driving	90 - 105

a Estimates correspond to a distance of 50 feet from the noisiest piece of equipment associated with a given phase and 200 feet from the other equipment associated with that phase.

SOURCE: U.S. Environmental Protection Agency, *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*, December 1971.

TABLE 4.11-4
TYPICAL NOISE LEVELS FROM CONSTRUCTION EQUIPMENT

Construction Equipment	Noise Level (dBA, L_{eq} at 50 feet)
Dump Truck	88
Portable Air Compressor	81
Concrete Mixer (Truck)	85
Scraper	88
Jack Hammer	88
Dozer	87
Paver	89
Generator	76
Pile Driver	101
Backhoe	85

SOURCE: Cunniff, *Environmental Noise Pollution*, 1977.

Mitigation Measure 4.11-1: Over the duration of pile driving activities, Valero should require the construction contractor to implement the following mitigation measures:

- **To reduce the potential for noise impacts from pile driving, alternate methods of driving should be used, if feasible. Alternate measures may include pre-drilling of piles, the use of more than one pile driver to lessen the total time required for driving piles, and other measures.**

- **Pile driving activities should limited to daytime hours between 7 a.m. and 7 p.m., on weekdays. Pile driving shall be prohibited during weekends, state and federal holidays.**

- **Valero would also designate a construction complaint manager for the project for the duration of the construction activities.**

Significance after Mitigation: Given the temporary nature of this impact, implementation of Mitigation Measure 4.11-1 would reduce impacts related to construction to less than significant.

4.11.4.2 OPERATIONAL NOISE

Impact 4.11-2: Operational noise associated with the VIP could increase at nearby noise receptors. This impact would be less than significant.

Operational activities associated with the project that would generate noise primarily include the installation of additional noise-generating equipment that would be installed to modernize and optimize the operation of the Valero Benicia Refinery. The project would lead to an increase in truck trips to the refinery to deliver materials to serve the needs of new or modified equipment, feedstock changes, and production changes during the time frame of the VIP. Increase in truck traffic to the refinery would be minimal and would amount to less than 20 trips per day. An increase in roadway volumes of 100 percent would result in a 3-dBA increase in noise (a doubling of sound energy), which would constitute a significant impact based on the significance criteria previously established for this project. An increase in traffic volume of less than 20 trips per day would therefore lead to a less than significant impact.

The types and number of equipment that would be installed at the refinery as part of the project is shown in Table 4.11-5 below. Based on noise measurements conducted by Illingworth & Rodkin for the Valero MTBE Phase-Out project, noise levels generated by this equipment are also shown in Table 4.11-5.

Based on monitored and projected noise levels at the parking lot of the Valero Administration Building (reference location), noise from the simultaneous operation of all the VIP equipment would be almost 12 dBA less than the noise monitored from equipment currently operating at the refinery. Noise from the operation of the VIP equipment would be 52 dBA at the reference location, while noise from the existing refinery sources was monitored to be 64 – 66 dBA, Leq. The reference location was chosen far enough from the adjacent streets and close enough to the refinery noise sources so that the refinery forms the primary noise source in defining the ambient noise environment at the location. When the projected VIP noise levels are logarithmically added to existing noise levels at the reference location, the total noise remains unchanged from the existing monitored levels. Therefore, even with the addition of the VIP equipment, the noise generated from the refinery, as a whole would remain unchanged because existing noise levels at

TABLE 4.11-5
NOISE LEVELS FROM NEW EQUIPMENT, dBA

Equipment	Number	Noise Level at 50 feet (dBA) with all equipment operating	Comments
Air Fin Exchanger Fans	50	78	Noise level based on the operation of a bank of approximately 50 belt-driven, air fin fans of 20 horsepower operating simultaneously on an elevated structure.
Pumps > 100 hp	25	72	Noise level based on Siemens pumps of 75 and 100-hp capacity at 1775 rpm.
Compressors / Blowers	2	68	Noise level based on the operation of two 300 horsepower compressors.
Furnaces	3	76	Noise level includes some contribution from other refinery equipment.

SOURCE: Illingworth & Rodkin, Inc., May 2002.

the refinery are loud enough that they mask the relatively low noise generated from the VIP equipment. Consequently, future noise levels with the implementation of the VIP would remain the same as existing monitored levels at the nearest sensitive receptors and therefore. Operation of the VIP would constitute a less than significant impact.

In addition to the noise generated by the operation of new equipment, the proposed project may result in a slight increase in the frequency and magnitude of flaring events. The refinery has two flares that serve as safety devices designed to burn off any combustible gas release in an environmentally safe manner. When there is a large release of gas to the flares (release rate greater than 10 Million Standard Cubic Feet per Day [MSCFD]), a noticeable noise level of up to 75 dBA is possible in the community. These large releases cannot be anticipated and they occur only few times a year, if at all, with a duration of a few hours or less. In 1999, there were 11 flare events reported that lasted at least 2 hours. Sine 1999, only 2 of the 23 flare complaints received at the refinery were related to flaring noise. The noise during a flaring event is partly attributable to the steam that is injected into the flare to ensure smokeless combustion. Combustible gas releases to the flare system result from the following kinds of occurrences:

- Compressor trips
- Process unit shut downs and upsets
- Unanticipated high ambient temperatures
- Turnarounds

The proposed VIP will not install any compressors that could result in an increase in the frequency of flaring. The two compressors/blowers proposed to be installed as part of the VIP would operate at a very low-pressure level and would be incapable of flaring. Though the VIP would not install or modify equipment that is particularly prone to causing upsets, any additions or changes to the process units have the potential for changing their operation and there may be some unexpected operational difficulties that will need to be resolved following startup. This could result in a potential for increase in the number of flaring events. Similarly, the VIP would involve use of some additional air coolers, but they will not increase the potential for hot weather flaring frequency or magnitude above the current level. Finally, the VIP does not include any new process units that will require separate shut downs and turnarounds. Thus, turnaround flaring would not change with the implementation of the VIP. In summary, since the project would not install or modify equipment that could lead to an increase in the frequency of flaring events, the impact of flaring would be considered less than significant.

Mitigation: None required.

4.11.5 CUMULATIVE IMPACTS

Impact 4.11-3: The proposed project together with proposed and planned future development at the refinery could result in cumulative increase in noise levels. This impact is less than significant.

Noise from cumulative development at the refinery would primarily occur from construction activities and the addition of refinery equipment. The cumulative projects included in this analysis are:

1. **Cogeneration Project** – Based on the noise analysis conducted for the cogeneration project as part of the California Energy Commission approval process, the predicted steady state noise from the cogeneration facility would be 39 to 42 dBA, L_{eq} at the nearest representative residential receptors. Therefore, the cogeneration plant would cause an increase of up to 1 to 3 dBA to the existing ambient L_{eq} and would cause no change to the overall CNEL.

2. **MTBE Phase-Out Project** – This project would include shutting down the MTBE unit that would result in shutdown of several process unit pumps and fans. Overall the project would result in a net reduction in power demand by the type of equipment that produces noise. Because the new noise generating equipment would replace existing equipment approximately in the same locations, and since Valero requires noise from newly installed equipment to be limited to 85 dBA at the point of worker exposure, the project would result in an overall reduction in the noise created by the operating equipment (URS, 2002). Therefore this project would decrease, rather than add to the cumulative noise levels in the vicinity of the refinery.

3. **Alkylation Unit Modifications, Selective Hydrogenation Facilities** – Noise producing equipment associated with these projects could include up to 5 pumps and five air fin exchanger fans. Steady noise from these pieces of equipment would be less than 30 dBA at

the nearest residential receptors, and would add imperceptibly to the ambient noise levels there.

4. **Major Refinery Maintenance Turnaround (1Q04) and Minor Refinery Maintenance Turnaround (1Q06)** – Since turnarounds involve only maintenance activities, the actual operational noise levels will be less than that experienced during normal operation. However, maintenance operations can involve construction-type activities and similar noise levels. Therefore, the turnarounds will not contribute to any significant cumulative effects on noise.

5. **Light Ends Rail Rack Arm Drains** – No major noise producing equipment such as pumps, compressors/blowers, air fin exchangers, or furnaces will be used for this project. The project would involve only additional piping at the rail track. The project will not contribute to any significant cumulative effects on noise.

6. **BAAQMD Reg. 9 Rule 10 NOx Alternate Compliance Plan** – This project would not lead to any physical changes in the refinery. Therefore, it would not contribute to the cumulative construction or operational noise levels.

The cumulative impact of all these projects operating simultaneously at the refinery would at most cause a 3 dBA increase in background L_{eq} at the nearest residential receptor. No measurable change is predicted in DNL at the residential receptors. Since the VIP would not affect ambient noise levels at these receptors, the total increase in ambient noise level due to the cumulative projects in conjunction with the noise generated by the VIP, at the nearest residential receptors would be up to 3 dBA, L_{eq}. This increase would be less than significance thresholds identified for this project and would constitute an imperceptible increase over existing levels. Therefore, the project, along with the other cumulative projects at the refinery would lead to a less than significant cumulative noise impact.

In addition to projects at the refinery the Benicia Business Park project, the Benicia – Martinez Bridge, Southampton Tourtelot Development and the City of Benicia Wastewater Reuse project would add to the cumulative noise levels in the area. Based on information in the EIR/EIS for the Benicia-Martinez Bridge project and the EIR for the Benicia Business Park project, noise levels generated by these projects in combination with the VIP, would not result in a cumulative significant impact. Information on noise levels generated by the Southampton Tourtelot Development and City of Benicia Wastewater Reuse project was unavailable and hence not considered in this cumulative impact evaluation.

Mitigation: None required.

REFERENCES – Noise

Caltrans, Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects, October 1998.

Governor's Office of Planning and Research, *CEQA: California Environmental Quality Act Statutes and Guidelines*, 1994.

Harns, Cyril, Handbook of Noise Control, 1979.

City of Benicia, *General Plan* - *Community Health and Safety Element*, June 1999.

City of Benicia, Benicia Municipal Code: Title 8, Chapter 8.2 – *Noise Regulations.*

Illingworth & Rodkin, Inc., *Valero Improvement Project Noise Assessment*, May 2002.

URS Corporation, *MTBE Phase-Out Draft EIR*, 2002.

4.12 PUBLIC SERVICES

The review confirms the conclusions of the Initial Study that all effects related to the implementation of the VIP would be less than significant. No mitigation would be required.

- ***The VIP would not adversely affect the ability of the Benicia Fire Department to provide fire suppression and emergency response services to the refinery or other parts of the City.***
- ***The VIP would not adversely affect the Benicia Police Department's ability to provide police protection services to the project site and City as a whole.***
- ***Implementation of the proposed project would not adversely affect the ability of the Benicia Unified School District to adequately provide educational services to residents of Benicia.***
- ***The proposed project would not substantially degrade the quality of existing park and recreation facilities or require the provision of new or expanded facilities.***
- ***The proposed VIP would not adversely affect other public services such as libraries or hospitals.***

4.12.1 INTRODUCTION

This section, included in this EIR for informational purposes, discusses public service issues, including the proposed project's relationship to existing police, fire, park, school and other public services provided in the City of Benicia.

4.12.2 SETTING

4.12.2.1 FIRE PROTECTION

An on-site fire brigade at the Valero Benicia Refinery provides first-response fire, medical, hazardous materials and rescue services for the refinery. The Valero Fire Department is a full-service industrial fire department licensed by the State Fire Marshall.

Additionally, the Benicia Fire Department provides fire protection services to the proposed project site. The City of Benicia maintains a "multi-hazard" Emergency Operations Plan (EOP) adopted by the City Council in 2002 that identifies procedures for various types of emergencies. The EOP is periodically updated and drills evaluating the effectiveness of the plan are conducted from time to time.

The Benicia Fire Department currently employs 30 firefighters, of whom 15 are also paramedics, three chief officers, one Administrative Fire Captain, one Assistant Fire Marshal, and one full-time and one part-time clerical staff. The Department maintains at least eight fire fighting personnel on duty at all times. Average response time within the Benicia city limits is approximately five minutes. About 70% of calls received pertain to emergency medical services

Services are provided to the incorporated areas of Benicia out of two fire stations. The larger facility is Station 1, which is located about 1.5 miles southwest of the Valero Refinery on Military West Road; Station 2 is a smaller facility located about 2 miles west of the refinery on Hastings Drive. Five fire fighters are stationed at Station 1, which receives approximately 1,500 calls per year. Equipment includes one engine, a reserve engine, a ladder truck, water tender, two brush fire trucks, a command vehicle, and a paramedic/rescue squad.

Station 2 consists of three fire fighters on duty, two engines, two brush fire trucks, one utility vehicle, and one reserve rescue unit. Station 2 responds to about 500 calls per year. These two fire stations provide Benicia with fire suppression, fire prevention, paramedic and disaster preparedness services. In addition, the Benicia Fire Department's capabilities are augmented by mutual aid agreements with Solano County and the State Office of Emergency Services, and by about 20 active volunteer fire fighters which have been trained and equipped by the Benicia Fire Department.

The City of Benicia operates a Community Alert Network System (CANS) that consists of five alert sirens positioned throughout the city. These sirens broadcast an auditory alert to the citizens of Benicia during emergencies or other potentially hazardous situations. The City has determined that the existing CANS system coverage could benefit from the addition of at least two sirens in the City of Benicia, one in the Benicia Industrial Park and the other in the lower eastside of the city, near downtown. Additionally, the City of Benicia is in the process of implementing a Community Awareness and Emergency Response (CAER) system in southern Solono County. The CAER system is based on the same type of civil alert system used by the National Weather Service to provide warnings of potentially dangerous weather events such as tornadoes. The CAER system allows authorized City departments to transmit real-time emergency information through low-frequency radio service (e.g., AM radio). It should be noted that the Valero Benicia Refinery is currently in negotiations with the City to enhance the CANS and CAER systems, and this is included for informational purposes only and is not considered part of the proposed improvement project analyzed in this EIR (personal communication, Bill Tanner, Valero Refinery, October 2002).

4.12.2.2 POLICE PROTECTION

Police protection for the project areas is provided by the Benicia Police Department. The Benicia Police Department shares the responsibility for policing the Benicia Industrial Park, where the project site is located, with private security officers employed by the individual industries in the park. The Benicia Police Department, located at 200 East L Street, has 37 sworn officers. For routine calls, response times to the Valero Benicia Refinery are approximately 3.5 minutes (M. Chavis, personal communication 2002).

Security at the refinery is provided 24 hours a day by a private security contractor Security guards are stationed at eight posts throughout the facility. In the event of a major security problem, or if law enforcement services are needed, Valero's shift manager is responsible for seeing that the City of Benicia Police Department is notified by Valero or Allied Security staff.

4.12.2.3 SCHOOLS

The Benicia Unified School District (BUSD) serves the project area. There are five elementary schools (Joe Henderson Elementary; Mills Elementary; Mathew Turner Elementary; Semple Elementary; and Mary Farmar Elementary), one middle school (Benicia Middle School); and two high schools (Liberty High School and Benicia High School). According to the BUSD, all of these schools are currently at capacity.

The Leroy F. Greene School Facilities Act of 1998, or Senate Bill 50 (SB 50), restricts the ability of local agencies, such as the City of Benicia, to deny land use approvals on the basis that public school facilities are inadequate. SB 50 establishes the base amount of allowable developer fees at $0.33 per square foot for commercial construction. Public school districts can, however, impose higher fees provided they meet the conditions outlined in the act.

4.12.2.4 PARKS

The *Benicia General Plan* describes three park types in Benicia, including *Regional Parks* (Usually serving one or more community with a variety of activities designed to enhance the use and experience of the natural environment. Uses may include trails, nature centers, picnic areas, etc.); *Community Parks* (generally serving several neighborhoods and accommodating a wide variety of activities to meet the needs of diverse users); and, *Neighborhood Parks* (designed to serve residential populations in close proximity to the park). There are six neighborhood parks within approximately one-half mile from the refinery, including Francesca Terrace Park (.2 mile); Duncan Graham Park (.4 mile); Overlook Park (.4 mile); and, Southampton Park (.6 mile). The Benicia Community Park is located 0.9 miles to the northwest of the refinery, not far from Lake Herman.

4.12.2.5 OTHER PUBLIC SERVICES AND FACILITIES

Other public facilities in the community include medical facilities and libraries. There are no hospitals located in Benicia. However, there are two hospitals in nearby Vallejo, the Sutter Solano Medical Center and Kaiser Permanente. Other nearby hospitals in Contra Costa County includes Kaiser-Martinez, Mt. Diablo Hospital, and Contra Costa County Regional Medical Center. The City of Benicia Public Library (located at 150 East L Street) serves the project area.

4.12.2.6 REGULATORY SETTING

The *Benicia General Plan* contains goals and policies in the Community Development and Community Health and Safety Elements, which pertain to the proposed VIP in terms of the project's relationship to public services. These goals and policies are summarized as follows:

Goal 2.4:	Ensure that development pays its own way.
Policy 2.4.1:	Ensure any new development to be fiscally and financially sound and pay its own way with respect to City and School District capital improvements.
Policy 4.6.1:	Encourage building designs that help to reduce crime.
Policy 4.6.3:	Maintain an adequate officer-to-population ratio in all areas, as approved by the City Council.
Goal 4.22:	Update and maintain the City's Emergency Response Plan.
Goal 4.22.1:	Provide an early community alert and notification system and safe evacuation plan for emergency incidents.
Program 4.22.A:	Provide the public with information and training on what to do until help arrives in emergency situations.
Program 4.22.B:	Develop a siren system to alert and notify the community in an emergency.
Program 4.22.C:	Request voluntary donations from identified sources of hazards to implement the Emergency Response Plan.
Program 4.22.D:	Consider a City radio station to inform residents in the event of an emergency.

4.12.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

According to Appendix G of the *CEQA Guidelines*, a project may be deemed to have a significant impact on the environment if it will:

- Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services: fire, police, schools, parks, other?

4.12.4 IMPACTS AND MITIGATION MEASURES

Physical impacts to public services and facilities are usually associated with population immigration and growth in an area, which increase the demand for a particular service leading to the need for expanded new facilities. An increase in any given area may result in the need to develop new, or alter existing, government facilities in order to accommodate existing demand. The project would add fewer than 20 permanent, full-time employees to the project site, an amount considered to be an insubstantial population increase. The project would also result in additional employment of construction workers.

The Initial Study determined that the temporary addition of a construction work force would not be considered a significant impact. Further, the VIP would not directly conflict with the goals and policies of the General Plan, which deal with public services.

4.12.4.1 FIRE PROTECTION

Impact 4.12-1: Implementation of the proposed project would not affect the Benicia Fire Department's ability to provide adequate fire suppression and emergency medical services to the project site and City as a whole. No impact.

Given the current, adequate existing fire protection personnel, equipment and response times, the VIP would not increase demand for fire protection services. The refinery would continue to be served first by its on-site fire brigade under future operating conditions. Therefore, it is not expected that the VIP would increase the use of existing fire protection facilities such that a substantial physical deterioration, alteration, or expansion of these facilities would occur. No significant impacts would occur.

Mitigation: None required.

4.12.4.2 POLICE PROTECTION

Impact 4.12-2: Implementation of the proposed project would not affect the ability of the Benicia Police Department to provide police protection services to the project site and City as a whole. No impact.

Given that the project would provide internal security services and have adequate protection personnel, equipment and response times, the VIP would not increase the demand for police protection services. Therefore, it is not expected that the VIP would increase the use of existing police facilities such that substantial physical deterioration, alteration, or expansion of these facilities would occur.

Mitigation: None required.

4.12.4.3 SCHOOLS

Impact 4.12-3: Implementation of the proposed project would not affect the ability of the BUSD to adequately provide educational services to residents of Benicia. No impact.

As noted in Section 4.12.2.3, there is currently a shortage of schools in the BUSD. As evidenced by capacity conditions, the current district-wide demand for schools has not been met. Although the project would not induce substantial population growth, the applicant would contribute

School Impact Fees as required by SB 50. These fees are intended to help school districts address their capacity problems by requiring developments to provide a fair share of the cost to develop new school facilities. Given the proposed project's contribution of School Impact Fees and the fact that there would be no substantial population in-migration into the area, there would be no need for new school facilities resulting from the VIP. No impacts to schools would occur.

Mitigation: None required.

4.12.4.4 PARKS

Impact 4.12-4: The proposed project would not degrade the quality of existing park and recreation facilities or require the provision of new or expanded facilities. No impact.

The VIP would constitute an increase in on-site construction workforce, who would likely already live either in Benicia or other surrounding communities in the Bay Area, and would likely use recreational facilities nearest to their places of residency. Therefore, the project's construction workforce is not likely to use existing Benicia neighborhood, community and regional parks or other recreational facilities, and it is not likely that their use would cause substantial physical deterioration of these parks. The VIP would not include or require construction of new or expansion of existing recreation facilities.

Mitigation: None required.

4.12.4.5 OTHER PUBLIC SERVICES OR FACILITIES

Impact 4.12-5: The project would not affect other public facilities. No impact would occur.

The VIP would not directly or indirectly induce substantial population growth in the area. Any short-term increase in population due to construction activities is considered to be minimal, with adequate numbers of construction workers currently residing within commuting distance. Therefore, no further constraints would be placed on any current public services providers such as hospitals or libraries as a result of the VIP. No adverse physical impacts associated with the provision of public facilities (new or altered) would occur.

Mitigation: None required.

REFERENCES – Public Services

California Education Data Partnership, http://www.ed-data.k12.ca.us

City of Benicia, *City of Benicia General Plan*, adopted June 15, 1999.

Personal Communication, Marge Chavis, Benicia Police Department, August 8, 2002.

Personal Communication, Chief Ken Hanley, Benicia Fire Department, August 8, 2002.

4.13 TRANSPORTATION

As determined by ESA, the construction phase of the VIP during the major turnaround (which includes both the turnaround and the VIP construction traffic) at the Valero Refinery would generate 3,696 average daily trips including 455 a.m. peak hour trips and 455 p.m. peak hour trips.

- ***The proposed construction phase of the VIP would result in a potentially significant impact to the a.m. peak hour operations of I-680 northbound off-ramp/Bayshore Road during initial project construction in 2004.***
- ***The impact at I-680 northbound off-ramps/Bayshore Road can be mitigated by implementation of Mitigation Measure 4.13.1 which includes the provision of traffic control personnel at the impacted intersection during the a.m. peak hour. If the traffic control officer were to be used, the level of service at the intersection would be LOS B (11.0 seconds of delay). The forecast queue length would almost be reduced in half from 625 feet to 340 feet (or 14 vehicles).***
- ***The construction of the VIP would contribute traffic volumes to one of the I-680 ramp junctions (Industrial Way) that are already forecast to operate at LOS F in 2004 without the project. However, the VIP's contribution would be less than significant.***

Operation of the VIP would add approximately 20 new employees, generating approximately 20 new a.m. peak hour trips, and 20 p.m. peak hour trips. This amount is insignificant when compared to the 2025 baseline traffic volumes at the study area intersections and ramp junctions.

4.13.1 INTRODUCTION

The following section summarizes the results of the project traffic analysis prepared by ESA in July – August 2002. This section provides a discussion of the methodologies and findings of the traffic analysis, while the raw calculation worksheets and other pertinent raw data are provided in a separate Traffic Analysis and Data Report (ESA 2002). The policies and objectives of the *City of Benicia General Plan* Circulation Element and the Congestion Management Program (CMP) of the Solano Transportation Authority (STA) were reviewed for this traffic analysis.

Data used in the traffic analysis include existing 2002 peak hour traffic counts, traffic volume projections from the Solano Transportation Authority's 2025 Countywide Travel Demand Model, and existing freeway and ramp volumes provided from Caltrans. Additional traffic data was provided from the *Benicia Business Park EIR Traffic Analysis* prepared by Fehr & Peers Associates in September 1999.

The study analyzes the existing conditions, a short-term future development horizon (year 2004, when peak construction activity associated with the VIP construction and the refinery's scheduled major turnaround[1]), and a 20+ year cumulative condition of the project study area (cumulative year 2025) in relation to the regular operational phase of the project.

For purposes of the traffic analysis, the VIP construction activities during the major turnaround represents the greatest amount of traffic added to the project area during the short-term horizon (years 2003 to 2009). This high volume of construction activity and traffic would only occur for a four to six week period. VIP construction workers would make up approximately 10% of the total workforce (an average of 200 VIP construction workers of the total 2000 workers), and result in a proportional amount of traffic generation. The VIP construction traffic alone would result in insignificant impacts to the project study area due to lower volumes of construction traffic (when compared to the major turnaround traffic). However, in considering the overall effects, the VIP traffic is added to the combined base of the existing traffic and the major turnaround traffic to assess the overall impact. Thus, the incremental impact of the VIP construction traffic is not underreported. Furthermore, because the VIP construction phase would generate much more traffic, although temporary in nature, than would the continuing operations of the VIP, the worst-case effect of the project is considered in this analysis.

In the long-term scenario (i.e., project buildout), the typical project operations would result in the addition of approximately 20 new full time employees. Net truck traffic associated with the refinery operations is expected to increase by 16 trucks per day.

Where identified, mitigation measures are recommended to mitigate any potential construction impacts. Detailed traffic analysis data for the study area roadways and intersections are provided in a separate Traffic Analysis and Data Report (ESA 2002).

4.13.2 SETTING

4.13.2.1 CURRENT CONDITIONS

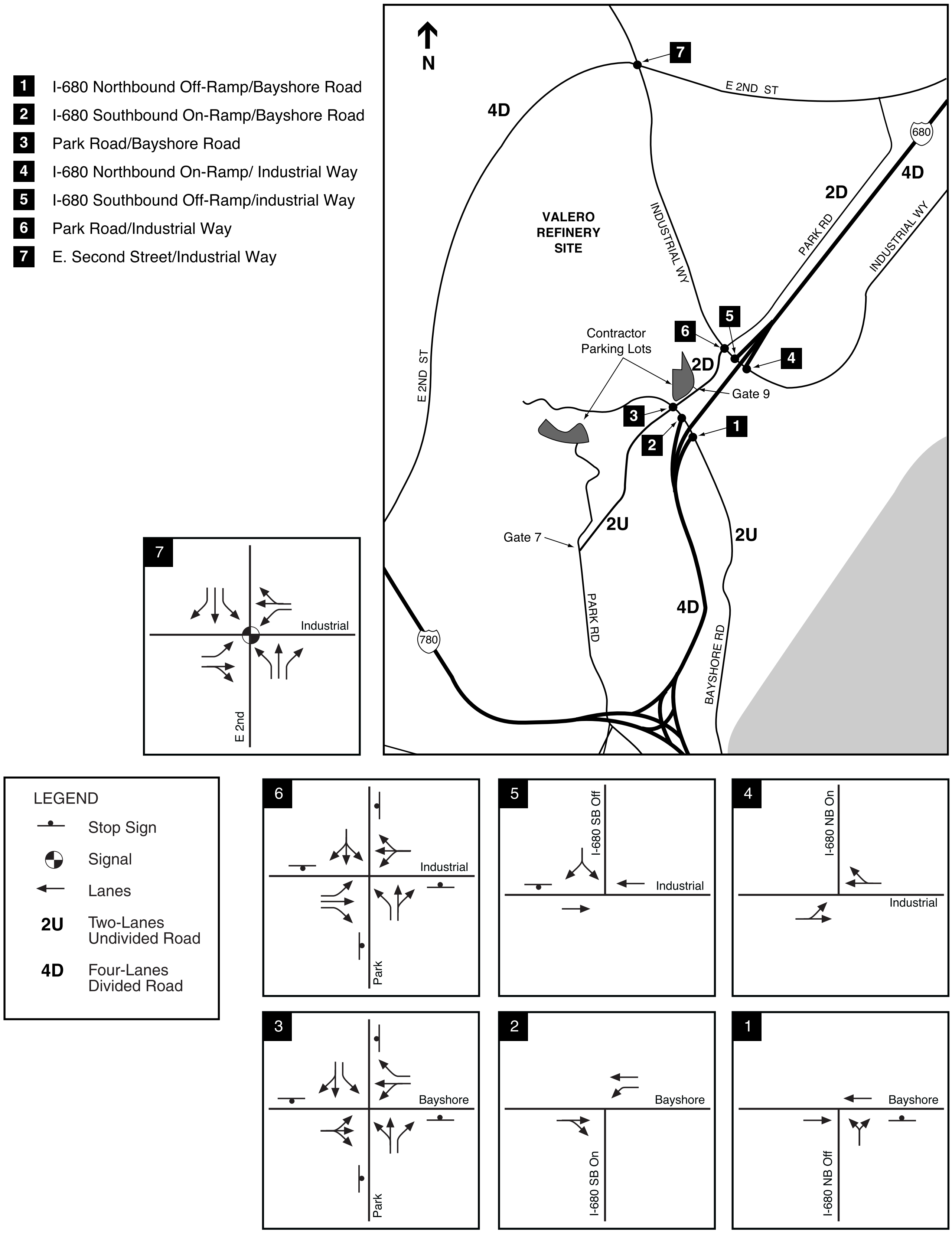
Existing Roadway Network

Figure 4.13-1 illustrates the location of the Valero Refinery in relation to the regional and local circulation network, relative access locations (Gates 7 and 9) for construction traffic destined to the VIP, and the study area intersections. Two major freeways as well as several local streets provide vehicular circulation in the vicinity of the refinery. This transportation network is described below.

Interstate 680

Interstate 680 (I-680) is a four-lane, north-south freeway in the project vicinity. From the Benicia-Martinez Bridge, I-680 extends north to Interstate 80 (I-80) in Cordelia. Limited access interchanges are located at Bayshore Road (northbound off-ramps and southbound on-ramps

[1] The major turnaround is a relevant cumulative activity, as described in Section 3.6.11, Maintenance Activities.



SOURCE: Environmental Science Associates

Figure 4.13-1
Transportation Network and Study Area
Roadway and Intersection Geometrics

only) and Industrial Way (northbound on-ramps and southbound off-ramps only). Construction related traffic for the VIP would utilize these interchanges. A full-access interchange exists at Lake Herman Road.

At this time, Caltrans is initiating the construction of a second freeway bridge adjacent and east of the existing Benicia-Martinez Bridge. The new bridge span will consist of five northbound traffic lanes (four mixed-flow lanes and one slow vehicle lane). The existing bridge will be restriped to accommodate four lanes for southbound traffic and a 12-foot wide bicycle/pedestrian path on the western edge of the existing bridge. This project also includes the construction of a new toll plaza facility, the reconstruction of the I-680/I-780 interchange and portions of the I-680/Marina Vista interchange in Contra Costa County, provision of bicycle and pedestrian facilities, accommodation of right-of-way for a future rail transit facility, and the necessary connections to the existing approaches.

Interstate 780

Interstate 780 (I-780) is a four lane, east-west freeway extending from the Benicia-Martinez Bridge westerly to I-80 in Vallejo. A full access interchange is located at East Second Street, which provides access to the administrative building of the refinery.

Bayshore Road

Bayshore Road in the vicinity of the refinery is a two-lane roadway with a posted speed limit of 35 miles per hour (mph). Bayshore Road extends from H Street in Benicia north to its terminus just west of Park Road at Gate 4 of the refinery. At its interchange with I-680, a southbound on-ramp and northbound off-ramp are provided. No parking is allowed along Bayshore Road.

Park Road

Park Road is a two-lane, north-south arterial roadway that parallels I-680 on its west side, veering northwest before terminating at East Second Street. Park Road serves as the connection between the split interchange ramps at Industrial Way (southbound off-ramp and northbound on-ramp) and Bayshore Road (southbound on-ramp and northbound off-ramp). South of Industrial Way, Park Road has a posted speed limit of 35 mph and has a center two-way left-turn lane. North of Industrial Way, Park Road has a posted speed limit of 40 mph, and parking is prohibited between the hours of 7:00 p.m. and 6:00 a.m.

Industrial Way

Industrial Way is a two-lane roadway that connects traffic from I-680 to East Second Street, continuing a short distance north of East Second Street to its terminus. The posted speed limit on Industrial Way is 40 mph. Near its southern end, between Oregon Street and Noyes Way, Industrial Way is a three-lane street, with two lanes in the southbound direction and one lane in the northbound direction. Industrial Way provides access to warehousing/shipping areas and is traversed by railroad tracks at various locations. The roadway width is not sufficient to accommodate on-street parking.

East Second Street

East Second Street is an arterial roadway that extends north and east from downtown Benicia to the I-680/Lake Herman Road interchange. It forms the western boundary of the refinery. From Industrial Way to Lake Herman Road, E. Second Street has two travel lanes and a two-way center left-turn lane, with a posted speed limit of 45 mph. South of Industrial Way to I-780, E. Second Street has four travel lanes with center median and striped left-turn pockets. No parking is allowed on either side of the roadway. As it approaches downtown Benicia to the south, East Second has a speed limit of 35 mph.

Study Intersections

Seven existing intersections were selected for analysis since they would be most likely be significantly affected by VIP construction traffic. The location, geometrics and traffic controls of these intersections are shown in Figure 4.13-1. The seven study area intersections are:

1. I-680 northbound off-ramp/Bayshore Road;
2. I-680 southbound on-ramp/Bayshore Road;
3. Park Road/Bayshore Road;
4. I-680 northbound on-ramp/Industrial Way;
5. I-680 sorthbound off-ramp/Industrial Way;
6. Park Road/Industrial Way; and
7. East Second Street/Industrial Way.

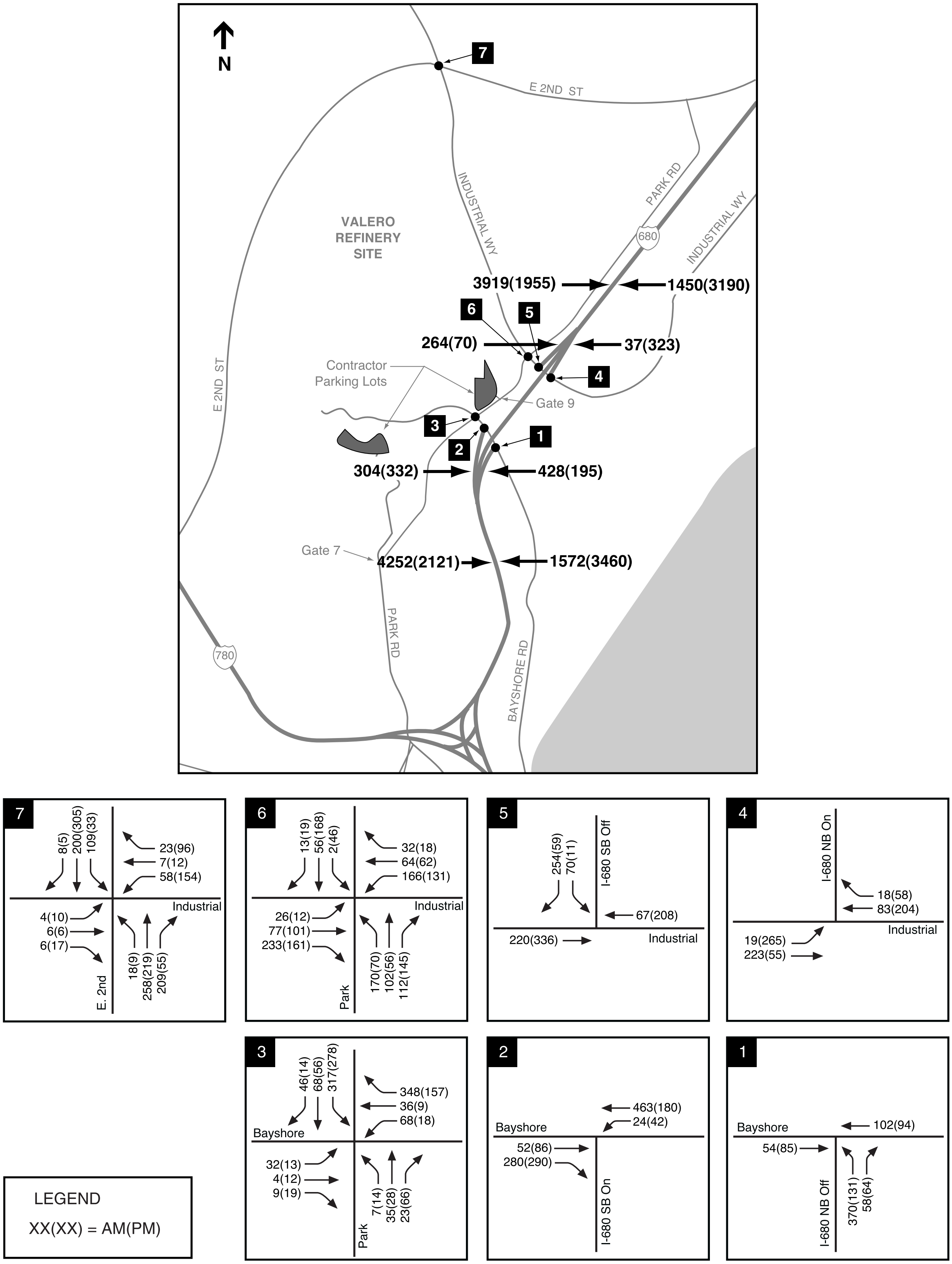
Existing Traffic Volumes

In July 2002, BayMetrics Traffic Resources, an independent traffic data collection firm, conducted a.m. and p.m. peak period turning movement counts at five of the seven study intersections. The 2002 volumes at the two other intersections were based on 1999 traffic counts provided by the City, and factored to reflect 2002 conditions (i.e., traffic growth from 1999 and 2002 was determined at the Park Road/Bayshore Road intersection and was applied to the appropriate movements of the I-680/Bayshore Road interchange intersections. Figure 4.13-2 illustrates the a.m. and p.m. peak hour traffic volumes at the study area intersections.

Figure 4.13-2 also shows the existing a.m. and p.m. peak hour traffic volumes on segments and ramps of I-680 that would be affected by project construction traffic. These counts were taken from the Caltrans website (www.dot.ca.gov), and the *2001 Traffic Volumes on California State Highways* publication.

Methodology

The assessment of intersection conditions addresses level of service (LOS), in terms of vehicle control delay (in seconds per vehicle) for signalized and unsignalized intersections. The level of service grades (LOS A-F), as reported in Highway Capacity Manual (HCM2000), are dependent



SOURCE: Environmental Science Associates

Figure 4.13-2
Existing (AM/PM) Peak Hour
Freeway, Ramp and Intersection Volumes

on the v/c ratios and vehicle control delay (in seconds) at the signalized and unsignalized intersection, respectively. Both signalized and unsignalized study area intersections have been analyzed using the HCM2000 method. The degree of congestion at an intersection is described by the level of service, which ranges from A to F, with A representing free-flow conditions with little delay and F representing over-saturated traffic flow throughout the peak hour. A complete description of the meaning of level of service can be found in the Highway Research Board Special Report 209, *Highway Capacity Manual* (HCM2000). Brief descriptions of the six levels of service, as abstracted from the Manual, are shown in Tables 4.13-1 and 4.13-2.

TABLE 4.13-1
LEVEL OF SERVICE DEFINITIONS

Level of Service	Unsignalized Intersection Delay per Vehicle (sec)	Signalized Intersection Delay per Vehicle (sec)
A	≤10.0	≤10.0
B	>10.0 and ≤15.0	>10.0 and ≤20.0
C	>15.0 and ≤25.0	>20.0 and ≤35.0
D	>25.0 and ≤35.0	>35.0 and ≤55.0
E	>35.0 and ≤50.0	>55.0 and ≤80.0
F	>50.0	>80.0

SOURCE: Highway Capacity Manual, Transportation Research Board, Special Report No. 209. , Washington, D.C., 2000.

According to the *City of Benicia General Plan*, level of service standards for local streets and roads has been established at Level of Service D (LOS D).

Existing Level of Service Analysis

The study area intersections were analyzed using the Traffix (for unsignalized intersections) and Synchro (for signalized intersections) software packages. Both Traffix and Synchro are based on the methodologies outlined in HCM2000. The resultant existing a.m. and p.m. peak hour intersection levels of service for the seven study area intersections are shown in Table 4.13-3.

As indicated in the table, all study area intersections currently operate with satisfactory levels of service (LOS B or better) in both peak hours.

Congestion Management Program Level of Service Analysis

The Solano Transportation Authority (STA) is the designated Congestion Management Agency (CMA) for Solano County. This agency develops the countywide Congestion Management Program (CMP) and updates it every 2 years. The CMP identifies a system of state highways and regionally significant principal arterials (known as the CMP system) and specifies level of service

TABLE 4.13-2
LEVEL OF SERVICE DESCRIPTIONS

LOS	Description
A	No approach phase is fully utilized by traffic, and no vehicle waits longer than one red indication. Typically, the approach appears quite open, turns are made easily, and nearly all drivers find freedom of operation.
B	This service level represents stable operation, where an occasional approach phase is fully utilized and a substantial number are nearing full use. Many drivers begin to feel restricted within platoons of vehicles.
C	This level still represents stable operating conditions. Occasionally drivers may have to wait through more than one red signal indication, and backups may develop behind turning vehicles. Most drivers feel somewhat restricted, but not objectionably so.
D	This level encompasses a zone of increasing restriction approaching instability at the intersection. Delays to approaching vehicles may be substantial during short peaks within the peak period; however, enough cycles with lower demand occur to permit periodic clearance of developing queues, thus preventing excessive backups.
E	Capacity occurs at the upper end of this service level. It represents the most vehicles that any particular intersection approach can accommodate. Full utilization of every signal cycle is seldom attained no matter how great the demand.
F	This level describes forced flow operations at low speeds, where volumes exceed capacity. These conditions usually result from queues of vehicles backing up from a restriction downstream. Speeds are reduced substantially, and stoppages may occur for short or long periods of time due to the congestion. In the extreme case, both speed and volume can drop to zero.

SOURCE: Highway Capacity Manual, Transportation Research Board, Special Report No. 209. , Washington, D.C., 2000.

TABLE 4.13-3
EXISTING INTERSECTION LEVEL OF SERVICE SUMMARY

Intersection	Control	A.M. Peak Hour		P.M. Peak Hour	
		Delay	LOS	Delay	LOS
1. I-680 NB off-ramp/Bayshore Road	1-way stop	13.3 sec.	B	10.4 sec.	B
2. I-680 SB on-ramp/Bayshore Road	no control	8.0 sec.	A	8.1 sec.	A
3. Park Road/Bayshore Road	all-way stop	13.5 sec.	B	10.6 sec.	B
4. I-680 NB on-ramp/Industrial Way	no control	7.4 sec.	A	8.4 sec.	A
5. I-680 SB off-ramp/Industrial Way	1-way stop	10.5 sec.	B	10.2 sec.	B
6. Park Road/Industrial Way	all-way stop	12.1 sec.	B	11.8 sec.	B
7. E. Second Street/Industrial Way	Signal	10.3 sec.	B	12.4 sec.	B

standards for those roadways. This system is monitored regularly by the local jurisdictions where the facilities are located, and results are included in the biennial report produced by STA. The minimum standard for the Solano County CMP network is LOS E, except at those locations were the initial LOS measurement at the inception of the program was LOS F.

The CMP facilities in the project study area selected for analysis include segments of I-680 between Lake Herman Road and the Benicia-Martinez Bridge, as well as the affected on- and off-ramps at Bayshore Road and Industrial Way. The basis for evaluating the freeway ramp junctions is methodology provided in the *2000 Highway Capacity Manual*. Freeway capacity analysis and levels of service assessments are usually conducted for each "checkpoint" of an interchange system (i.e., merge and diverge checkpoints). The ramp junctions' levels of service are based on "passenger cars per mile per lane" (pc/mi/ln) which establishes the density of vehicles on the freeway mainline in which vehicles coming from, or entering, each checkpoint would need to maneuver from, or maneuver in to. Levels of service for the study area ramp junctions are shown in Table 4.13-4.

TABLE 4.13-4
EXISTING RAMP JUNCTIONS LEVEL OF SERVICE SUMMARY

Ramp Location	Checkpoint	A.M. Peak Hour		P.M. Peak Hour	
		Density	**LOS**	**Density**	**LOS**
1. I-680 NB off-ramp/Bayshore Road	Diverge	8.7 pc/mi/ln	A	26.3 pc/mi/ln	C
2. I-680 SB on-ramp/Bayshore Road	Merge	**37.7 pc/mi/ln**	**F**	19.8 pc/mi/ln	B
3. I-680 NB on-ramp/Industrial Way	Merge	10.9 pc/mi/ln	B	27.9 pc/mi/ln	C
4. I-680 SB off-ramp/Industrial Way	Diverge	33.1 pc/mi/ln	D	14.8 pc/mi/ln	B

As indicated in the table, most of the study area ramp junctions currently operate with satisfactory levels of service (LOS D or better) in both peak hours except for the southbound on-ramp at Bayshore Road. This ramp junction currently operates at LOS F in the a.m. peak hour. The service level calculation sheets for all study ramp junctions are provided in a separate Traffic Analysis and Data Report (ESA 2002).

Parking

Approximately 850 parking spaces are available for construction workers at the Valero Refinery. These spaces are split between two contractor parking areas within the refinery. The parking lot at Gate 9 (north of the Park Road/Bayshore Road intersection) currently accommodates 350 vehicles, while the parking lot at Gate 7 (along Park Road across from the Crude Tank Farm) can accommodate 500 vehicles.

No on-street parking is permitted along Lake Herman Road and East Second Street in the vicinity of the refinery. On-street parking typically does not occur on Industrial Way, Bayshore Road, and the other local roadways, because sufficient off-street parking is provided for the land uses in the area, and because shoulder widths on these roadways are generally too narrow to accommodate parked vehicles.

Bicycle and Pedestrian Facilities

In the study area, there is a designated Class II bikeway (striped lanes and posted bikeway signs) on East Second Street south of Rose Drive. Between Rose Drive and Industrial Way, a shoulder is striped but no bikeway signs are provided. North of Industrial Way, the shoulder width is variable and continuous bike lanes are not provided. There are no other bike lanes along roadways in the vicinity of the refinery. No pedestrian facilities, such as sidewalks or off-street paths, are provided in the vicinity.

Public Transportation

Local public transit in Benicia is provided by the City, which operates two bus routes. The Pleasant Hill BART/Vallejo route runs between those endpoints through Benicia, serving the downtown area. The Southampton/North Hills Express route was discontinued in August 2002, but will be replaced by a new Industrial Park route in late 2002. This route used to connect the North Hills area to other Benicia destinations and Pleasant Hill BART. None of these routes currently serve the project vicinity.

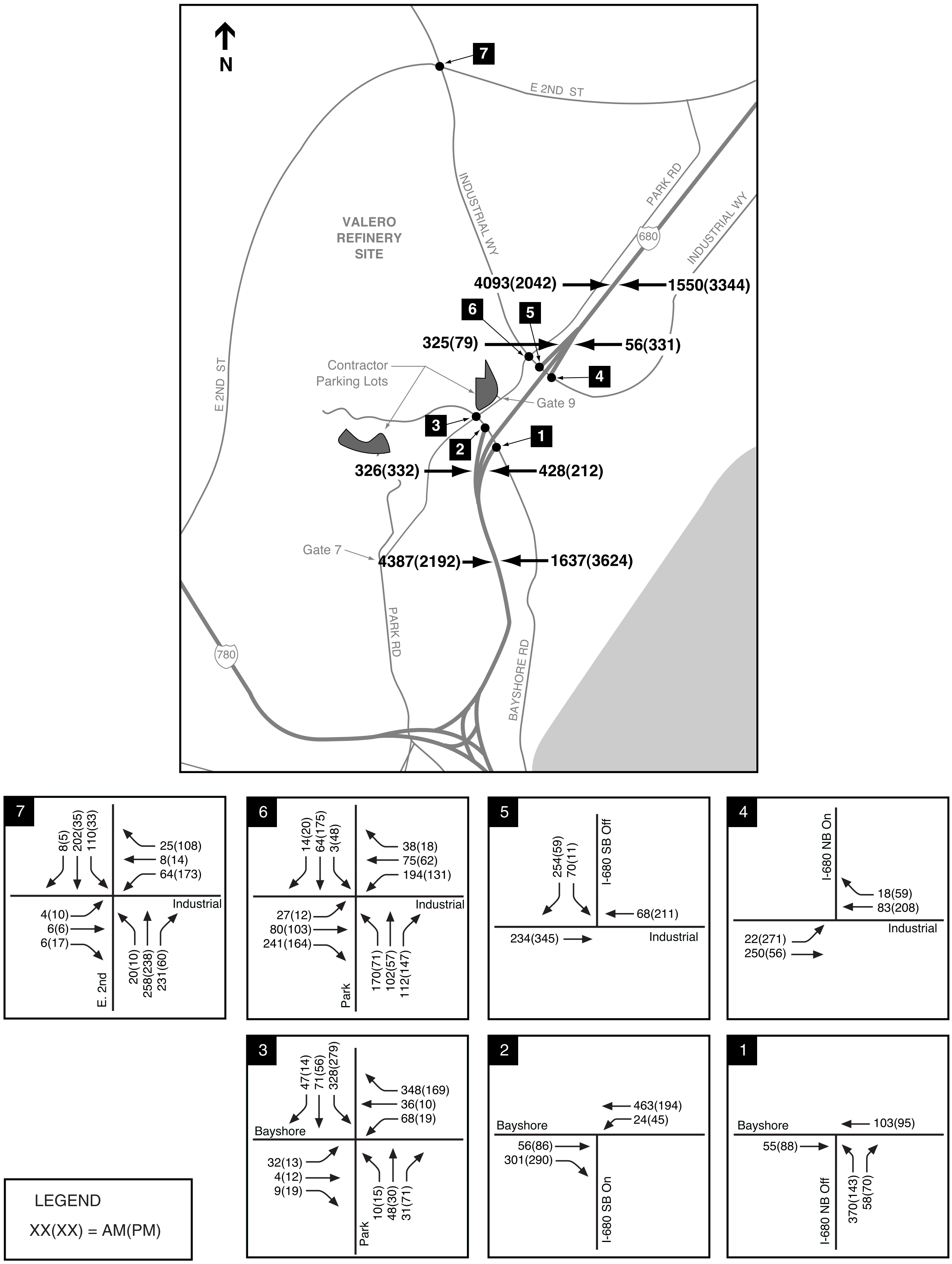
14.13.2.2 2004 CONDITIONS

The 2004 scenario examines the impacts of traffic generated in a short-term horizon that includes the peak construction activity (i.e., the greatest amount of project traffic) associated with the 2004 major turnaround planned on the refinery site.

2004 Baseline Traffic Volumes

Year 2004 a.m. and p.m. peak hour traffic volumes were extrapolated based on a “straight line” growth rate of traffic volumes from the existing 2002 counts and the modeled 2025 CMP forecast volumes (i.e., an extrapolation of two years of interim growth from a total of 23 years of cumulative growth). Each annual growth rate was applied to respective 2002 study intersection turn movement volumes to obtain 2004 background conditions. In instances where the 2025 model projected a net decrease in traffic volumes, the 2002 traffic volumes were assumed for the background conditions.

No additional roadway or intersection improvements within the study area would occur in the year 2004 scenario. Therefore, the existing intersection geometrics were utilized in the level of service analysis for the 2004 condition. The 2004 baseline (without project) a.m. and p.m. peak hour traffic volumes are shown in Figure 4.13-3.



SOURCE: Environmental Science Associates

Figure 4.13-3
2004 No Project (AM/PM) Peak Hour
Freeway, Ramp and IntersectionVolumes

2004 Levels of Service

The results of the year 2004 baseline condition a.m. and p.m. peak hour level of service analysis for the intersections under investigation are shown in Table 4.13-5. Detailed level of service calculation sheets are provided in a separate Traffic Analysis and Data Report (ESA 2002).

TABLE 4.13-5
2004 BASELINE INTERSECTION LEVEL OF SERVICE SUMMARY

Intersection	Control	A.M. Peak Hour Delay	A.M. Peak Hour LOS	P.M. Peak Hour Delay	P.M. Peak Hour LOS
1. I-680 NB off-ramp/Bayshore Road	1-way stop	13.3 sec.	B	10.6 sec.	B
2. I-680 SB on-ramp/Bayshore Road	no control	8.0 sec.	A	8.1 sec.	A
3. Park Road/Bayshore Road	all-way stop	14.0 sec.	B	10.7 sec.	B
4. I-680 NB on-ramp/Industrial Way	no control	7.4 sec.	A	8.5 sec.	A
5. I-680 SB off-ramp/Industrial Way	1-way stop	11.1 sec.	B	10.3 sec.	B
6. Park Road/Industrial Way	all-way stop	13.2 sec.	B	12.1 sec.	B
7. E. Second Street/Industrial Way	Signal	10.3 sec.	B	12.6 sec.	B

As indicated in the table, all study area intersections would continue to operate with satisfactory levels of service (LOS B or better) in both peak hours in the 2004 baseline condition.

Congestion Management Program Level of Service Analysis

Similar to the intersection analysis, 2004 a.m. and p.m. peak hour traffic volumes on segments and ramp junctions of I-680 were extrapolated based on a "straight line" growth rate of traffic volumes from the existing 2002 counts and the modeled 2025 CMP forecast volumes. Figure 4.13-3 illustrates the 2004 baseline a.m. and p.m. peak hour volumes at the I-680 freeway segments and ramp junctions. Baseline 2004 levels of service (calculated for passenger cars per mile per lane – pc/mi/ln) for the study area ramp junctions are shown in Table 4.13-6.

As indicated in the table, most of the study area ramp junctions would continue to operate with satisfactory levels of service (LOS D or better) in both peak hours except for the southbound on- and off-ramps at Bayshore Road and Industrial Way, respectively. These ramps are forecast to operate at LOS F in the a.m. peak hour.

Benicia-Martinez Bridge Construction

As discussed in the Setting section, by first quarter of 2004, Caltrans would have already begun the construction of a second freeway bridge adjacent and east of the existing Benicia-Martinez

TABLE 4.13-6
BASELINE 2004 RAMP JUNCTIONS LEVEL OF SERVICE SUMMARY

Ramp Location	Checkpoint	A.M. Peak Hour Density	A.M. Peak Hour LOS	P.M. Peak Hour Density	P.M. Peak Hour LOS
1. I-680 NB off-ramp/Bayshore Road	Diverge	9.3 pc/mi/ln	A	27.8 pc/mi/ln	C
2. I-680 SB on-ramp/Bayshore Road	Merge	**39.0 pc/mi/ln**	**F**	20.4 pc/mi/ln	C
3. I-680 NB on-ramp/Industrial Way	Merge	11.9 pc/mi/ln	B	29.2 pc/mi/ln	D
4. I-680 SB off-ramp/Industrial Way	Diverge	**34.8 pc/mi/ln**	**F**	15.6 pc/mi/ln	B

Bridge. This new bridge span would consist of five northbound traffic lanes (four mixed-flow lanes and one slow vehicle lane). This project also includes the construction of a new toll plaza facility, the reconstruction of the I-680/I-780 interchange and portions of the I-680/Marina Vista interchange in Contra Costa County. Based on discussions with Caltrans District 4 staff,[2] any freeway closures or detouring associated with the bridge construction would occur during the off-peak nighttime hours, and would not affect the peak operations of I-680 and I-780 in the vicinity. In addition, Caltrans has indicated that affected local jurisdictions (i.e., City of Benicia) would be notified in advance of the proposed construction schedule, and Caltrans would effectively work with these jurisdictions in the timing of the bridge construction.

4.13.2.3 REGULATORY SETTING

Solano County

As previously noted, the Solano Transportation Authority (STA) operates as the Congestion Management Agency (CMA) for Solano Country. One of the CMA's responsibilities is to analyze the impacts of local land use decisions on the regional transportation system (the CMP system). The Solano County CMA has the purview to comment on any environmental impact report prepared for proposed land use development projects, and to require that analysis of CMP system facilities be performed with the STA travel demand model. If a proposed project is projected to cause a segment of the CMP system to deteriorate below the adopted LOS standard, a deficiency plan must be prepared to provide mitigation for that impact. The CMA's adopted LOS standard is LOS E for roadways and freeways in the CMP system.

City of Benicia

The *City of Benicia General Plan* contains goals, policies and programs intended to facilitate the movement of people and goods throughout the city. The following list includes policies from the General Plan that are relevant to the proposed project.

[2] Telephone conversation with Mo Pazooki, Caltrans District 4, August 2002.

Policy 2.14.1: Give priority to pedestrian safety, access and transit over automobile speed and volume.

Policy 2.14.2: Discourage street widening and the removal of on-street parking to ease traffic flow.

Policy 2.15.2: Encourage the development of pedestrian paths in hill areas as a way to link neighborhoods to schools, parks, employment centers and convenience commercial destinations.

Policy 2.20.1: Maintain at least LOS D on all city roads, street segments and intersections.

Policy 2.20.2: Seek alternatives to road widening.

Policy 2.23.1: Provide adequate on-street and off-street parking.

The proposed project is generally consistent with these policies. The traffic standards established in these policies have been incorporated into the following thresholds of significance. The project's consistency with these thresholds would ensure consistency with the General Plan policies related to traffic.

4.13.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

4.13.3.1 THRESHOLDS OF SIGNIFICANCE

For the purposes of this EIR, the proposed project would result in significant transportation impacts if it would:

- Create direct transportation or circulation impacts associated with inconsistencies with General Plan policies.
- Cause a signalized intersection to fall below LOS D, cause the need for a signal at an unsignalized intersection, or cause queuing, which exceeds the lane capacity at any intersection.
- Contribute to future cumulative demand that exceeds on-site project roadway capacity.
- Contribute one percent or more of the total future volume to an external roadway or freeway with inadequate capacity to meet future cumulative demand.
- Result in projected parking demand that would exceed the proposed parking supply on a regular and frequent basis.
- Result in potential conflicts for pedestrians or bicyclists, or fail to provide adequate bicycle and pedestrian access.
- Increase transit demand above the levels provided by local transit operators or agencies.

4.13.3.2 APPROACH TO TRAFFIC IMPACT ANALYSIS

Project impacts to traffic are evaluated for the peak construction period of the Valero Improvement Program facilities. This work would be accomplished as part of a major turnaround scheduled for early 2004. The major turnaround projects generate the highest amount of construction traffic on the local and regional circulation system. As many as 2,000 construction workers per day would be at the refinery, of which an average 200 workers (or ten percent of the workforce) would be associated with the VIP. The impact of the project was estimated by evaluating how intersection and roadway levels of service would change with and without the addition of construction-related traffic to the 2004 baseline conditions. Other than the construction traffic from the major turnaround, other additional construction projects at the refinery during the 2003 to 2009 period were determined to have no significant impact on the circulation system.

For the cumulative (2025) scenario, the VIP would be in its operational phase (i.e., construction of its components would have already been completed). The cumulative baseline traffic volumes are based on the Solano Transportation Authority's Countywide Travel Demand Model, and include volume forecasts for all cumulative developments planned in the County and surrounding cities (based on maximum General Plan land uses and applicable development applications). The operational phase of the VIP would add approximately 20 new employees, generating 20 new a.m. peak hour trips, and 20 new p.m. peak hour trips. This amount would be insignificant when compared to the 2025 baseline traffic volumes in the study area.

Trip Generation

The proposed construction phase of the major turnaround component would generate the greatest amount of trips in the project study area, while the project operation phase (buildout) would generate nominal peak hour traffic volumes. The construction phase trips are temporary in nature, with the major turnaround project construction phase anticipated to last for approximately 45 days. The following trip generation estimates were provided by the Valero refinery staff. Table 4.13-7 provides the trip generation estimates of construction related traffic for the major turnaround component.

TABLE 4.13-7
PROJECT CONSTRUCTION PHASE TRIP GENERATION

			A.M. Peak Hour			P.M. Peak Hour		
	Size/Units	**ADT**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
MAJOR TURNAROUND WITH VIP CONSTRUCTION PHASE TRAFFIC								
Construction Workers	2,000 emps.	3,636	455	0	455	0	455	455
Construction Trucks	30 trucks	60	0	0	0	0	0	0
Total Proposed Construction Traffic		**3,696**	**455**	**0**	**455**	**0**	**455**	**455**

The combined construction workforce for the VIP and major turnaround is expected to reach a peak of 2,000 employees during the major turnaround in first quarter of 2004. Of the 2,000 employees, an average of 200 would be associated with the VIP. Construction worker trip generation rates were based on the peak number of workers and their expected arrival and departure times within the two-hour peak periods. An average vehicle occupancy (AVO) of 1.1 (consistent with previously approved studies for this refinery) was assumed. The AVO of 1.1 would represent a minimum (conservative) amount of ridesharing and transit usage.

According to Valero staff, the construction workforce would be divided equally into two shifts, a daytime shift and a nighttime shift, each shift with 1,000 workers or 1,818 total vehicle trips (1,000 workers / 1.1 AVO = 909 vehicles; 909 vehicles X 2 trips for inbound and outbound = 1,818 trips per shift).

Discussions with Valero staff indicate that the workforce would arrive for the daytime shift equally between 7:00 a.m. and 9:00 a.m., and leave the refinery equally between 4:00 p.m. and 6:00 p.m. As calculated, two arrival and departure groups would occur during the two-hour peak period, thus generating 455 a.m. peak hour vehicle trips (inbound) during each hour in the two-hour a.m. peak period, and 455 p.m. peak hour vehicle trips (outbound) during each hour in the two-hour p.m. peak period. Likewise, the nighttime shift workforce would arrive between 7:00 p.m. and 9:00 p.m. and depart between 4:00 a.m. and 6:00 a.m. with similar arrival and departure patterns as the daytime shift. The following impact analysis and supporting thresholds of significance are based on the analysis of a peak one-hour period during the morning and evening peak commute hours.

Construction truck trips has been estimated at 30 trucks (i.e., 60 total truck trips, inbound and outbound) per day, however delivery truck traffic would occur during the day between the a.m. and p.m. peak hour commute periods.

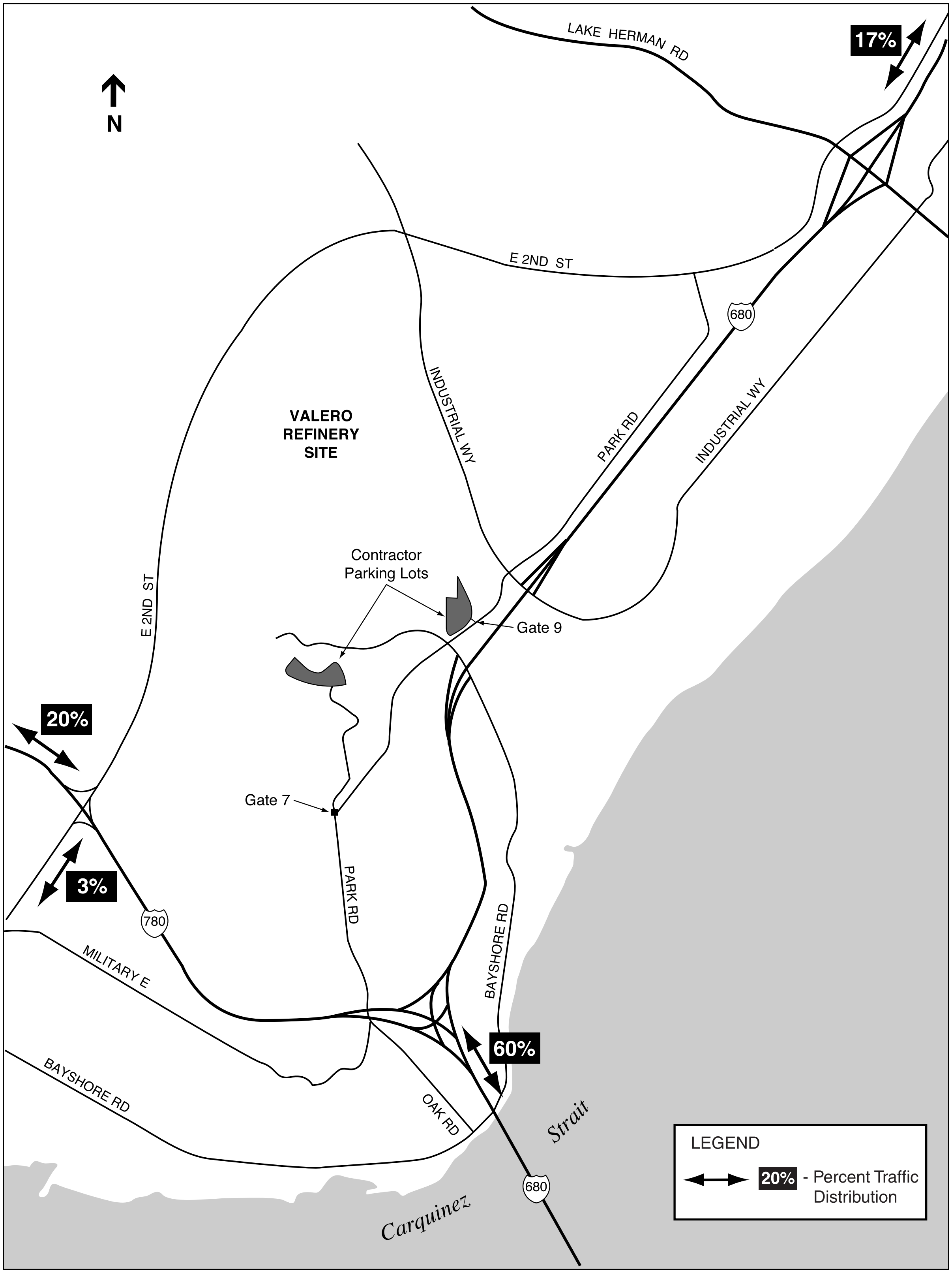
In summary, the total daily trips generated during the construction phase would be 3,696 ADT. The total a.m. peak hour trips generated would be 455 a.m. peak hour trips, while the total p.m. peak hour trips would also be 455 peak hour trips.

Trip Distribution

Constriction employee traffic distribution has been estimated based on previously approved traffic analyses conducted for projects at this site (Woodward-Clyde Consultants, 1993) and conversations with Valero staff. It is likely that the proposed VIP would draw on the same contractor work forces as those proposed for other similar projects in the vicinity. The proposed project's vehicle distribution is estimated as:

- 60 percent to/from the south on I-680
- 17 percent to/from the north on I-680
- 20 percent to/from the west on I-780
- 3 percent internal to the City of Benicia

Figure 4.13-4 illustrates the construction worker trip distribution.



NOTE: Percent distribution is a portion of all project-related external trips.

SOURCE: Environmental Science Associates

Figure 4.13-4
Construction Phase Trip Distribution

Trip Assignment

The a.m. and p.m. peak hour construction phase trip generation estimates were applied to the distribution paths discussed above and shown in Figure 4.13-4 and the construction phase trip assignment was determined. The project trip assignment was added to the year 2004 baseline a.m. and p.m. peak hour volumes to derive the 2004 plus project traffic volumes which will determine project-specific impacts to the study area circulation network. Figure 4.13-5 illustrates the 2004 plus project trip assignment at the study area intersections.

4.13.4 IMPACTS AND MITIGATION MEASURES

4.13.4.1 YEAR 2004 PLUS PROJECT LEVELS OF SERVICE

An analysis of the 2004 plus project peak hour volumes was conducted using the HCM2000 methodology for the study area intersections. Table 4.13-8 presents the results of the 2004 plus project level of service summary. As indicated in the table, all study area intersections would continue to operate with satisfactory levels of service (LOS C or better) in both peak hours in the 2004 plus project condition except for the intersection of I-680 northbound off-ramp/Bayshore Road in the a.m. peak hour.

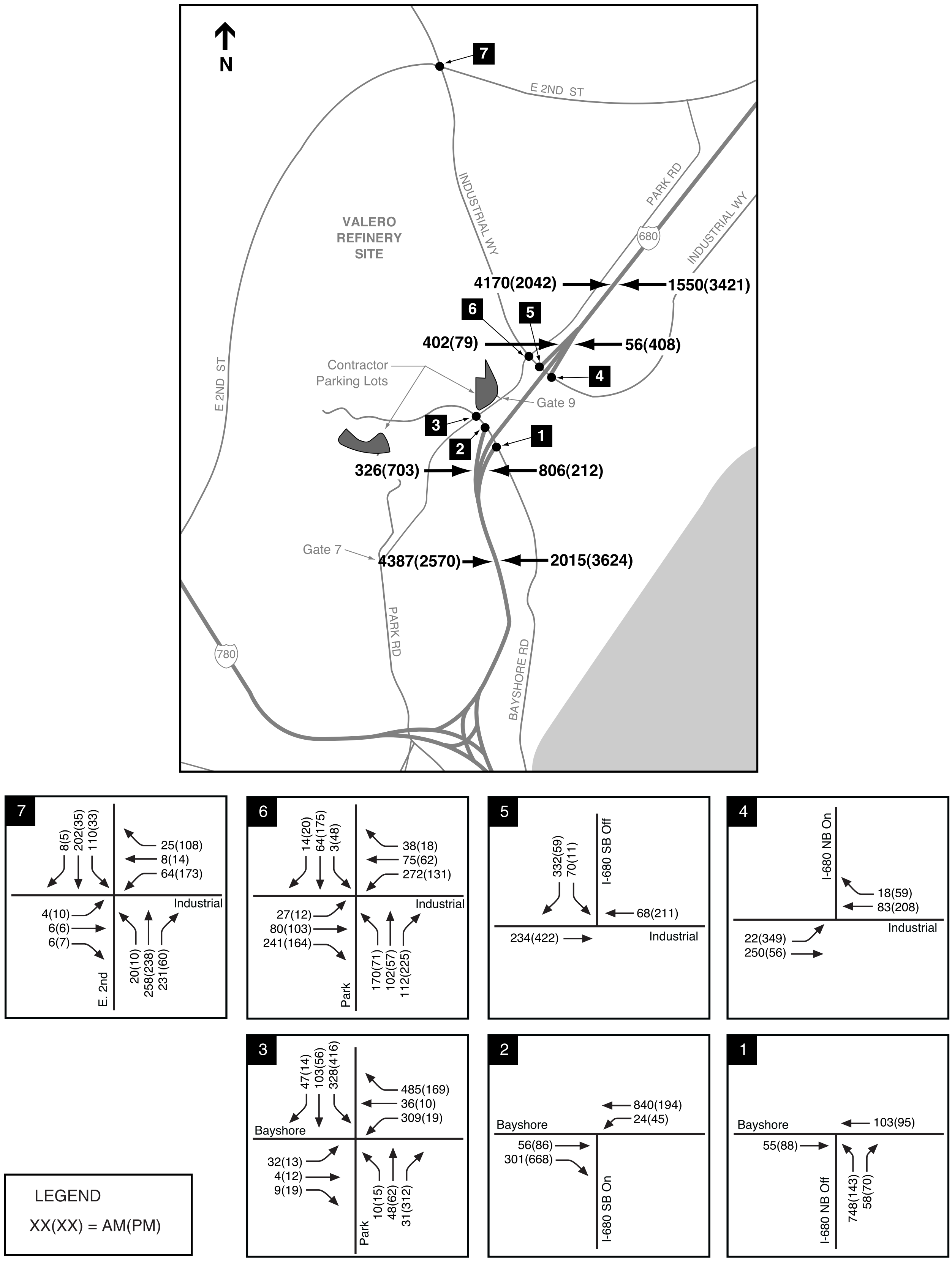
Impact 4.13-1: The proposed construction phase of the VIP would result in a potentially significant impact to the a.m. peak hour operations of I-680 northbound off-ramp/Bayshore Road in the 2004 plus project scenario. This impact can be mitigated to a less than significant level by implementation of Mitigation Measure 4.13-1.

Construction traffic would significantly change the a.m. peak hour level of service at this intersection. As shown in Table 4.13-8, the intersection of I-680 northbound off-ramp/Bayshore Road would change from LOS B (13.3 seconds of delay) to LOS F (60.4 seconds of delay) during the a.m. peak hour. With the addition of project construction traffic, the maximum design queue length (i.e., 95th percentile queue) at the northbound off-ramp would be approximately 25 vehicles, or 625 feet (assuming 25 feet per vehicle). Although the length of the off-ramp is over 1,000 feet, there is a slight potential for vehicles to queue into the northbound I-680 travel lanes at peak conditions**.**

Mitigation Measure 4.13-1: Since this significant impact would be temporary and only occur for a period of approximately 45 days, there are several measures that can be applied to improve intersection levels of service without the installation or construction of additional transportation facilities (e.g., lane widening, traffic signal installation, etc.). Implementation of these measures would effectively reduce the a.m. and p.m. peak hour construction traffic volumes at the project site.

These measures include, at a minimum:

- Provision of traffic control personnel at impacted intersections during the peak hours. For this intersection, the refinery and the City of Benicia would be required to apply for a Caltrans Encroachment Permit, since “manual” traffic control would occur within the



SOURCE: Environmental Science Associates

Figure 4.13-5
2004 Plus Project (AM/PM) Peak Hour
Freeway, Ramp and Intersection Volumes

TABLE 4.13-8
2004 PLUS PROJECT INTERSECTION LEVEL OF SERVICE SUMMARY

Intersection	Control	A.M. Peak Hour Delay	A.M. Peak Hour LOS	P.M. Peak Hour Delay	P.M. Peak Hour LOS
1. I-680 NB off-ramp/Bayshore Road	1-way stop	**60.4 sec.**	**F**	10.6 sec.	B
2. I-680 SB on-ramp/Bayshore Road	no control	8.0 sec.	A	9.4 sec.	A
3. Park Road/Bayshore Road	all-way stop	21.5 sec.	C	17.5 sec.	C
4. I-680 NB on-ramp/Industrial Way	no control	7.4 sec.	A	8.8 sec.	A
5. I-680 SB off-ramp/Industrial Way	1-way stop	11.8 sec.	B	10.4 sec.	B
6. Park Road/Industrial Way	all-way stop	15.9 sec.	B	12.9 sec.	B
7. E. Second Street/Industrial Way	signal	10.3 sec.	B	12.6 sec.	B

State right-of-way. An evaluation of manual traffic control was conducted assuming the intersection as a "fixed time" signalized intersection. The signal would simulate a traffic control officer controlling vehicle flow at the intersection during the a.m. peak hour. If the traffic control officer were to allow the off-ramp traffic to enter the intersection unimpeded for 60 seconds, the level of service at the intersection would be LOS B (11.0 seconds of delay). The forecast queue length would almost be reduced in half from 625 feet to 340 feet (or 14 vehicles).

Although not required, the following additional measures would provide for further improvements to the study area intersection delays:

- Stagger work hours and shifts of construction personnel during the a.m. and p.m. peak commute periods.
- Use alternative and additional gate access locations to disperse traffic from the I-680 northbound off-ramp/Bayshore Road intersection.
- Attendance at monthly traffic meetings between Valero staff and City staff (police, traffic engineer, and public works department) to review and implement the traffic controls listed above.

With the implementation of Mitigation Measure 4.13.1, the significant project impacts at the I-680 northbound ramps/Bayshore Road intersection would be mitigated to a level of insignificance. Morning peak hour intersection levels of service would improve to LOS B (11.0 seconds of delay).

As previously noted, the major turnaround project represents the greatest amount of traffic added to the project area during the short-term horizon (years 2003 to 2009). This high volume of construction activity and traffic would only occur for a four to six week period. Construction-related components of the VIP would also occur during the major turnaround period, comprising approximately ten percent of the total workforce (an average of 200 VIP construction workers of the total 2000 workers), and resulting traffic generation. Analysis of the VIP alone would result in insignificant impacts to the project study area due to lower volumes of construction traffic (when compared to the major turnaround). This relatively low increase would not significantly affect the baseline (without project) levels of service.

Congestion Management Program Level of Service Analysis

Similar to the 2004 plus project intersection analysis, 2004 plus project a.m. and p.m. peak hour traffic volumes on segments and ramp junctions of I-680 were analyzed for levels of service at ramp junctions to be used by project construction traffic. Figure 4.13-5 illustrates the 2004 plus project a.m. and p.m. peak hour volumes at the I-680 freeway segments and ramp junctions. Year 2004 plus project levels of service (calculated for passenger cars per mile per lane – pc/mi/ln) for the study area ramp junctions are shown in Table 4.13-9.

TABLE 4.13-9
2004 PLUS PROJECT
RAMP JUNCTIONS LEVEL OF SERVICE SUMMARY

		A.M. Peak Hour		P.M. Peak Hour	
Ramp Location	**Checkpoint**	**Density**	**LOS**	**Density**	**LOS**
1. I-680 NB off-ramp/Bayshore Road	Diverge	12.8 pc/mi/ln	B	27.8 pc/mi/ln	C
2. I-680 SB on-ramp/Bayshore Road	Merge	**39.0 pc/mi/ln**	**F**	26.5 pc/mi/ln	C
3. I-680 NB on-ramp/Industrial Way	Merge	11.9 pc/mi/ln	B	30.5 pc/mi/ln	D
4. I-680 SB off-ramp/Industrial Way	Diverge	**35.5 pc/mi/ln**	**F**	15.6 pc/mi/ln	B

As indicated in the table, most of the study area ramp junctions would continue to operate with satisfactory levels of service (LOS D or better) in both peak hours except for the southbound on- and off-ramps at Bayshore Road and Industrial Way, respectively. These ramps would continue to operate at LOS F in the a.m. peak hour with the addition of project traffic.

Impact 4.13-2: The proposed construction phase of the VIP would result in a contribution of construction traffic volumes to one of the I-680 ramp junctions which are already forecast to operate at LOS F in the baseline (i.e., without project) condition. However, when the 2004 baseline and 2004 plus project ramp volumes are compared at the impacted ramps, the project's contribution would be nominal. Although not required for Impact 4.13-2, implementation of Mitigation Measure 4.13-1 would further alleviate any project impacts.

In comparison of the “passenger cars per mile per lane” (pc/mi/ln) at the affected I-680 southbound ramps (Industrial Way and Bayshore Road) during the a.m. peak hour, the project’s contribution would be considered minimal. At the I-680 southbound on-ramp at Bayshore Road, the project would not contribute any volumes to the on-ramp in the a.m. peak hour, as the pc/mi/ln does not change. However, at the I-680 southbound ramps at Industrial Way the project would contribute approximately 77 vehicles in the a.m. peak hour. This corresponds to an increase in pc/mi/ln of 0.70. This increase would be considered insignificant and would not significantly affect the baseline (without project) levels of service.

Mitigation: None required.

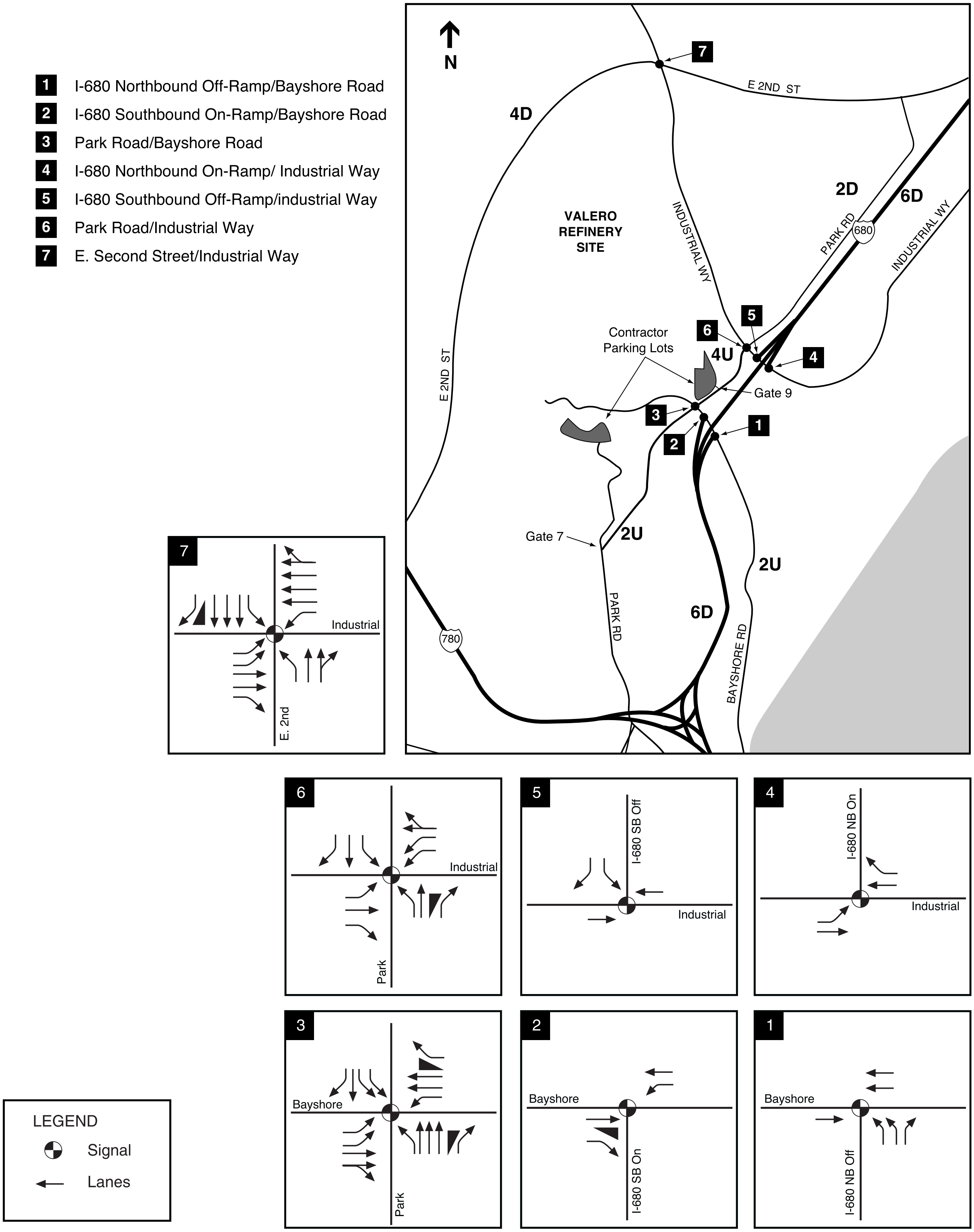
4.13.5 CUMULATIVE IMPACTS

The cumulative 2025 scenario, which is defined by the cumulative horizon year of the Solano Transportation Authority’s (STA) Countywide Congestion Management Program (CMP) travel demand model, was analyzed to determine long-term traffic impacts associated with the buildout of the Solano County and City of Benicia General Plans. The locations and sizes of the major development projects envisioned in the County and Cities’ General Plans have been programmed into the Countywide *Year 2025 Travel Demand Model* which was developed by STA. The modeled forecast traffic volumes were then manually adjusted for consistency with local and regional travel patterns (i.e., “post-processed”) utilizing the approved “incremental” method. A separate Traffic Analysis and Data Report (ESA 2002), contains the raw model data and post-processing worksheets.

Based on review of the Countywide Travel Demand Model network, additional roadway and/or intersection improvements planned for the study area intersections were based on the City of Benicia General Plan Circulation Element, as well as completion and full operation of the Preferred Alternative bridge span analyzed in the Benicia-Martinez Bridge PR/PSR. Figure 4.13-6 contains the future General Plan intersection geometrics for the study area intersections.

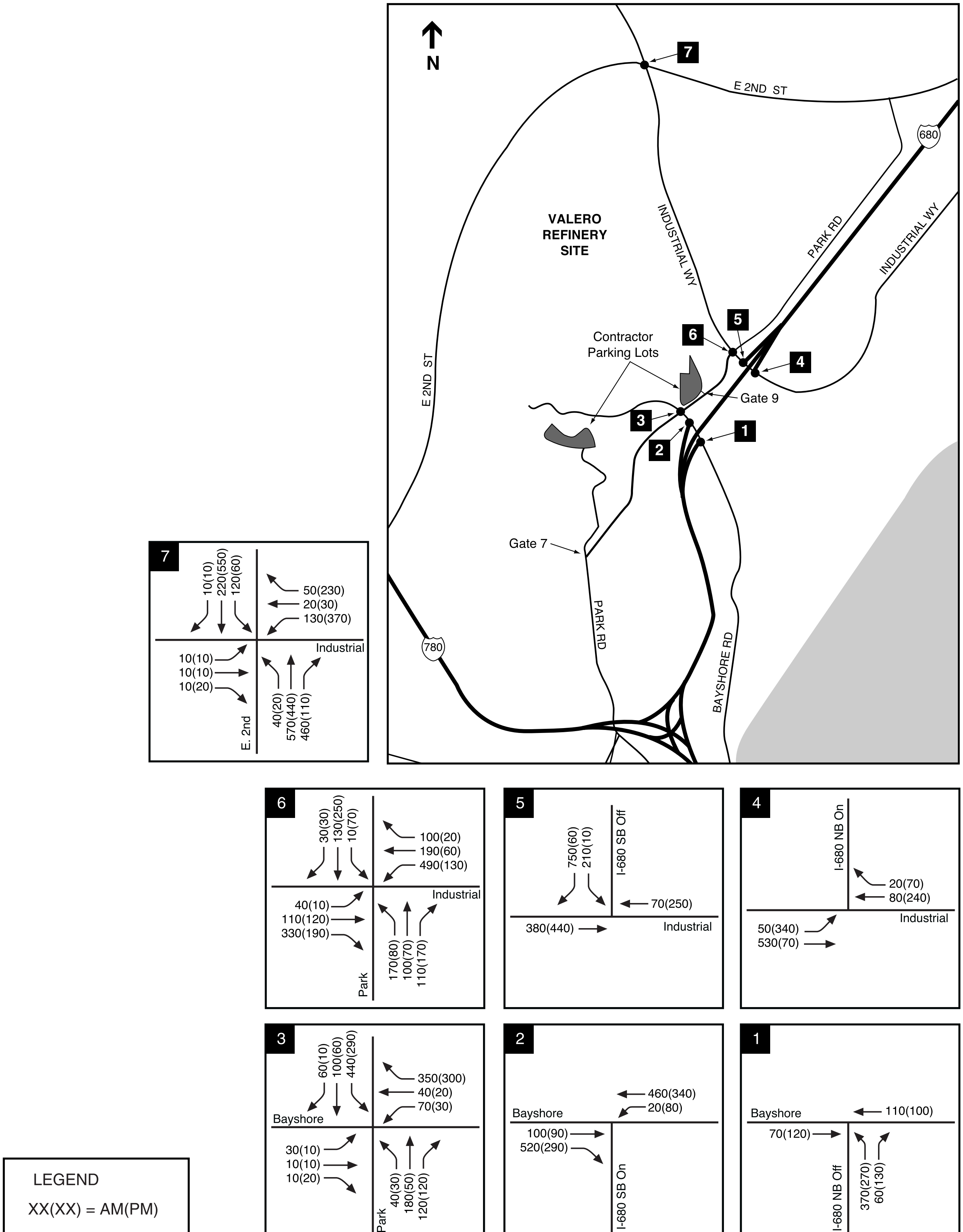
Impact 4.13-3: According to the Project Description, the minimal build out operational phase of the Valero Refinery is anticipated to generate 40 new daily trips, 20 new a.m. peak hour trips, and 20 new p.m. peak hour trips.

The cumulative 2025 baseline a.m. and p.m. peak hour traffic volumes are shown in Figure 4.13-7. Intersection levels of service were calculated for the cumulative a.m. and p.m. peak hour traffic volumes at key study area intersections. The calculated levels of service at the study area intersections and ramp junctions are presented below in Tables 4.13-10 and 4.13-11, respectively.



SOURCE: Environmental Science Associates

Figure 4.13-6
General Plan Roadway
and Intersection Geometrics



SOURCE: Environmental Science Associates

Figure 4.13-7
Cumulative 2025 (AM/PM)
Intersection Peak Hour Volumes -
Baseline

TABLE 4.13-10
CUMULATIVE 2025 INTERSECTION LEVEL OF SERVICE SUMMARY

Intersection	Control	A.M. Peak Hour Delay	A.M. Peak Hour LOS	P.M. Peak Hour Delay	P.M. Peak Hour LOS
1. I-680 NB off-ramp/Bayshore Road	signa1	7.6 sec.	A	4.9 sec.	A
2. I-680 SB on-ramp/Bayshore Road	signa1	28.9 sec.	C	12.5 sec.	B
3. Park Road/Bayshore Road	signa1	28.9 sec.	C	27.6 sec.	C
4. I-680 NB on-ramp/Industrial Way	signa1	0.1 sec.	A	0.0 sec.	A
5. I-680 SB off-ramp/Industrial Way	signa1	20.3 sec.	C	21.9 sec.	C
6. Park Road/Industrial Way	signa1	3.9 sec.	A	3.7 sec.	A
7. E. Second Street/Industrial Way	signal	23.9 sec.	C	8.4 sec.	A

TABLE 4.13-11
CUMULATIVE 2025 RAMP JUNCTIONS LEVEL OF SERVICE SUMMARY

Ramp Location	Checkpoint	A.M. Peak Hour Density	A.M. Peak Hour LOS	P.M. Peak Hour Density	P.M. Peak Hour LOS
1. I-680 NB off-ramp/Bayshore Road	Diverge	0.0 pc/mi/ln	A	0.6 pc/mi/ln	A
2. I-680 SB on-ramp/Bayshore Road	Merge	20.4 pc/mi/ln	C	4.5 pc/mi/ln	A
3. I-680 NB on-ramp/Industrial Way	Merge	0.1 pc/mi/ln	A	12.4 pc/mi/ln	B
4. I-680 SB off-ramp/Industrial Way	Diverge	13.6 pc/mi/ln	B	0.0 pc/mi/ln	A

As indicated in the table, all study area intersections would continue to operate with satisfactory levels of service (LOS C or better) in both peak hours in the cumulative 2025 condition.

As indicated in the table, all of the study area ramp junctions would operate with satisfactory levels of service (LOS C or better) in both peak hours in the cumulative 2025 condition.

The addition of the VIP's operational traffic alone would be considered nominal and insignificant when compared to the 2025 baseline volumes at the study area intersections and ramp junctions. Therefore, the additional traffic from the operational phase of the VIP would be a less than significant impact in the cumulative 2025 condition.

Mitigation: None required.

REFERENCES – Transportation

California Department of Transportation (Caltrans), Traffic Manual, January 15, 1999.

City of Benicia, *City of Benicia General Plan.*

Traffic Analysis and Data Report, Environmental Science Associates, October 2002.

Solano Transportation Authority (STA), 2015 Countywide Travel Demand Model, August 2002 run.

Draft Environmental Impact Report for the Benicia Business Park, LSA Associates, Inc., 1999.

Traffic Impact Analysis for the Benicia Business Park EIR, Fehr & Peers Associates, Inc., 1999.

Transportation Research Board (TRB), Highway Capacity Manual, 2000.

4.14 UTILITIES AND SERVICE SYSTEMS

The implementation of the Valero Improvement Project would increase refinery raw water demand. A detailed Water Study has been prepared that documented the City's current and future water demands and the current and future water supply sources. The Water Study concluded that the current and future demands, including the VIP project, could be met with existing supplies in normal years, but that the water supplies would not be sufficient to meet future demands, with or without the VIP, in dry years. The Water Study concluded that planned future water supplies could meet all planned future demands, including the VIP, and identified the sources of supply currently being developed, including the costs, time frames for implementation, and permits, entitlements, and other approvals. Should the City not obtain or not be able to develop the additional water supplies, the future increased refinery demand for raw water would result in a significant impact to the City water supply during dry years. Some planned water supply projects would alleviate dry-year water shortages and some would provide mitigations that would reduce both the VIP and cumulative water impacts to less than significant. Implementation of the City's water conservation ordinance, if needed, would help to alleviate water shortages.

The VIP would have less than significant effects on the other utilities and services systems:

- ***The Valero Improvement Project would not cause wastewater effluent discharges to exceed wastewater quality limitations of the Regional Water Quality Control Board.***
- ***Implementation of the proposed project would not substantially increase the amount of wastewater treated at the City of Benicia's wastewater treatment plant.***
- ***The proposed project would slightly increase the routine disposal of spent catalyst and sludge from the refinery wastewater treatment plant.***

No mitigation would be required for effects on other utilities and services systems.

4.14.1 INTRODUCTION

This section presents a discussion and analysis of utility and service systems such as water supply, wastewater treatment and stormwater drainage, and solid waste generation and disposal. With the exception of rawwater use, the Valero Improvement Project has minor utility requirements that would be met through existing refinery facilities. In all cases, these requirements are insignificant in comparison to the requirements of base refinery operations. The areas affected during operation are discussed below.

4.14.2 SETTING

14.14.2.1 WATER SUPPLY

As a part of this environmental review, the City of Benicia prepared a *Water Study* that evaluated the proposed water usage of the VIP with respect to the City's present and future water supplies and water uses (ESA2002). The *Water Study* analysis was prepared following the methodology required for a "Water Supply Assessment", as described in state law, although, as discussed later in this section, a Water Supply Assessment is not required for the VIP. The City policies, water demands, and the available water supply sources to the City of Benicia and to the VIP are summarized here. The purpose is to provide adequate information to establish the baseline water supply conditions, thresholds of significance and provide the basis for analysis of VIP water supply impacts.

City of Benicia General Plan

The *City of Benicia General Plan* contains goals and policies, which relate to fulfilling the water needs of existing and future land uses. The water supply goals, policies and programs are summarized below:

Goal 2.36:	Ensure an adequate water supply for current and future residents and businesses.
Policy 2.36.1:	Approve development plans only when a dependable and adequate water supply to serve the development is assured.
Policy 2.36.2:	Continue to pursue and secure adequate water sources of the highest quality available.
Program 2.36.A:	Pursue use of reclaimed wastewater—especially for major industrial users—where feasible.
Policy 2.36.3:	Implement measures to reduce water consumption.
Program 2.36.B:	Initiate water conservation programs and conduct drought contingency planning.
Program 2.36.C:	Continue to implement City-adopted water conservation Best Management Practices.
Policy 2.36.4:	Encourage public and private uses to minimize water use and to recycle processed water whenever and wherever feasible.

The City has prepared plans for developing new water supplies to increase the reliability and certainty for current and future users and for meeting *General Plan* Goal 2.36. The City also has prepared a *1996 Water System Master Plan* (MW, 1996) and a current *2001 Urban Water Management Plan* (Buck and Assoc., 2001). These plans are summarized in the *Water Study*.

The City is working with the refinery to further pursue the development and use of reclaimed wastewater, (General Plan Program 2.36.A). The refinery has completed a preliminary study to evaluate the feasible alternatives (URS, 2002) and the City has developed and begun to implement a reclamation and reuse action plan to move the program forward (See Section 3.6.2.3, *City of Benicia Wastewater Reuse Project*). Valero has committed to implementing reclamation and reuse of municipal wastewater, consistent with General Plan Program 2.36.A.

City of Benicia Water Supply Sources

As described previously in Section 3.4, the VIP, in combination with other activities at the refinery, would increase water use above historic refinery demands. The City is the purveyor of raw, untreated water to the refinery. Current supplies and entitlements to the City are documented in the *UWMP* and the *1996 Water System Master Plan*. The future planned water supply projects and sources are also documented in the *Water Study*.

State Water Project (SWP)

The City's primary source of water supply is from the State Water Project (SWP) through agreements with the Solano County Water Agency (SCWA), a SWP contractor. Water is diverted from the Sacramento River from Barker Slough in the North Delta, and conveyed down the North Bay Aqueduct to the North Cordelia Forebay. A 30-inch diameter pipe then transports the water to a point where it joins the Cordelia line coming from the Cordelia Pump Station and the Putah South Canal Terminal Reservoir. From this point a 36-inch diameter line leads to a diversion structure that allows water to go to the City's water treatment plant or to Lake Herman. Water from the Putah South Canal is used only when North Bay Aqueduct water is unavailable or water quality at the North Bay Aqueduct intake is unacceptable. Lake Herman, with a capacity of 1,800 acre-feet (AF) is used as terminal storage for water from the SWP. In lieu of use of North Bay Aqueduct water, water from Lake Herman may be used as a backup supply or a raw water supply to the Valero refinery.

The current contract entitlement for the City from SCWA is 16,390 AF. SWP contracts are structured to increase to the ultimate planned water demand. The SCWA contract with Benicia anticipates full build up of SWP demand by 2004, to an annual contract amount of 17,200 AF. However, in 1985 Benicia, Fairfield and Vallejo agreed to reduce their amount to provide SWP water to the cities of Rio Vista and Dixon. This will result in Benicia's long-term yearly supply from the SWP via the SCWA to drop to 16,075 AF.

The reliability of the SWP is influenced by environmental regulations intended to protect biological resources, and by hydrologic conditions (DWR 2002). Intake of SWP water into the North Bay Aqueduct is also hydraulically limited to a maximum flow of 175 cubic-feet per second (cfs)[1]. Seasonal curtailments of SWP water supply limiting North Bay Aqueduct flows to 65 cfs can occur during late spring (i.e. during most of May and June in 2001) for purposes of protecting Delta Smelt. The duration of this curtailment appears to become more extensive with the severity of the dry year.

[1] 1 cfs is equal to 1.98 acre-feet per day or 724 acre-feet per year.

City of Vallejo Agreement

In addition to the contract with the SCWA, Benicia has two contracts with the City of Vallejo that allow Benicia to purchase water.

A 1962 agreement (amended in 1989) allows the City to purchase up to 1,100 AF per year and has provisions for passing on shortages experienced by Vallejo to the City. The contract expires in 2025. The water provided by Vallejo may come from either the SWP or the Solano Project, a project developed and operated by the U.S. Bureau of Reclamation.

An additional agreement was executed in 1992 for providing up to 4,400 AF of water per year to be delivered from Vallejo to Benicia. This contract also contains shortage provisions depending on the three sources of water that Vallejo can make available: State License water (water rights from Barker Slough), SWP water via the North Bay Aqueduct, and the Solano Project (UWMP 2001). This agreement expires in 2010.

Mojave Water Agency Agreement

City of Benicia has also developed a water banking arrangement with the Mojave Water Agency. Through its membership in the SCWA, the City has participated in a banking and water exchange program with the Mojave Water Agency, another SWP contractor. In dry years the City takes available water within its allocation from the SWP, but may also call upon water previously banked in the Mojave groundwater basin. During normal or wet years, Benicia may make available to Mojave Water Agency a portion of Benicia's SWP allocation for groundwater recharge. During dry years, City of Benicia may draw up to 50% of the water it has banked, or up to 10,000 acre-feet per year from Mojave Water Agency's SWP allocation after it has accumulated and banked 20,000 acre-feet in previous years. When Benicia chooses to draw on its banked water, Mojave Water Agency is capable of making-up reductions in the SWP supply through groundwater withdrawal.

Short-Term and Dry Year Water Purchases

The City has purchased supplemental water in dry years from other water rights holders. These are short-term transfers of water, but no long-term permanent transfers or agreements exist other than those noted with the City of Vallejo and Mojave Water Agency.

City Future Supply Plans and Sources

To increase available supply in dry years and to meet projected growth in water demands, the City is also pursuing a number of new water supply alternatives. The two primary alternative supplies under consideration are the reuse of reclaimed wastewater and the procurement of additional water rights to Sacramento River Water from the State of California. In addition, the City could seek to procure additional supplies through the extension of the Vallejo Agreements, and by the purchase of dry year supplies from willing sellers.

Wastewater Reclamation and Reuse

The City currently has a limited program for reclamation and reuse of wastewater, but the *General Plan* clearly expresses the City's intention of making use of this supplemental supply. As presented in the project description, Section 3.4.3.13, *Water Source*, and documented in Appendix B, the refinery has proposed to use treated water from the City of Benicia's wastewater treatment facility for use in refinery cooling towers, when such reuse water becomes available. That potential reuse of water would result in a net reduction of the refinery's overall water consumption. A preliminary analysis prepared by URS Corporation (April 2002) identified several potentially feasible alternatives to use at the refinery up to three million gallons per day of the City's wastewater treatment effluent (after additional treatment).

The City's preliminary municipal wastewater reuse action plan, which outlines the City's planned steps and current timetable to study and implement wastewater reuse, is in Section 3.6.2.3. To date, the City has completed Task 1 of the action plan, confirming the feasibility of using a reverse osmosis system to treat City wastewater to the standards required for refinery use. The City has also completed the first phase of Task 2, estimating the effects of the reuse project on the quantity and quality of City effluent. Analysis is currently underway to determine the effects at the refinery wastewater treatment plant.

Additional Water Rights and SWP Supplies

The Cities of Fairfield, Vacaville and Benicia (Cities) have filed applications with the California State Water Resources Control Board (SWRCB) to divert and use surface water within their respective service areas. The proposed project would acquire the right to divert and use up to a total of 31,620 acre-feet of water a year from existing, available surface waters. Of this total, the City of Benicia has applied for a water rights permit to obtain 10,500 acre-feet per year (Application 30681) from the Sacramento River.

Approval by the SWRCB would enable the three cities to obtain appropriative water rights for diverting and using currently unappropriated surface waters originating from the Sacramento River, in addition to water now appropriated to the State Water Project (SWP) or the Central Valley Project (CVP). The water rights would enable the cities to divert additional water from Barker Slough, a tributary of the Sacramento/San Joaquin Delta, using available capacities of the existing Barker Slough Pumping Plant and the North Bay Aqueduct. The diversions could occur when waters that are surplus to those amounts needed to maintain Delta water quality standards and satisfy senior water rights obligations are available.

The purpose of the water rights project is to acquire additional water supplies to meet existing and future water demands of the cities, and to increase the reliability of their water supplies. Without additional supplies, it is likely that the City of Benicia would be unable to meet water demands with average water yields from all of its other sources, and could be severely impaired in dry years. The final Environmental Impact Report (CH2M Hill 2002) for the water rights project has been certified, and negotiations are under way to resolve outstanding issues related to the water rights applications. The SWRCB will make the ultimate determination on issuance of the water rights allocation to the City of Benicia.

Extension of Vallejo Agreements and Purchase of Supplemental Supplies

The City could seek to extend the Vallejo Agreements for purchase of water available to the City of Vallejo. In the past, the City has purchased supplemental water in dry years from other water rights holders that are willing to transfer water. These are short-term transfers of water, but no long-term permanent transfers or agreements have been made other than those previously noted with the City of Vallejo and Mojave Water Agency.

Other Agreements, Policies, and Regulatory Provisions

Untreated Raw Water Delivery Agreement

An Untreated Raw Water Delivery Agreement was entered into in 1967 between the City of Benicia and the prior owners of the refinery. Under the Water Delivery Agreement, Benicia provides raw water to the refinery that is obtained by the City under its water supply entitlements for SWP water through the North Bay Aqueduct. The water supply agreement ends in 2009 and is to be renegotiated. The agreement is for delivery of up to 12,316 acre-feet per year, although the average demand for raw water by the refinery has been 5,600 acre-feet per year for the period 1995-2000, and the historical use has ranged from about 4,600 to 6,200 acre-feet per year (UWMP 2001).

Good Neighbor Agreement between the City of Benicia and Valero Benicia Refinery

The City and Valero entered into a "Good Neighbor" agreement that is intended to document assurances to the City of Benicia by Valero. The agreement was entered into as a part of the purchase of the refinery by Valero. The Good Neighbor agreement acknowledges that the existing Untreated Raw Water Delivery Agreement requires revision. The areas requiring review include, but were not limited to the quantity of water provided, response to water shortages, sources and source water quality, wastewater reclamation and reuse, capital improvements and notification requirements. The Good Neighbor agreement stipulates that the demand quantity for the refinery will not exceed 6,720 acre-feet per year, and that any increase above this amount would require specific pricing negotiations. It also defines notification requirements. The notification lead time for short term increases in water demand is 12 months, and is 24 months for long term changes in water demand. The agreement further recognizes that the full entitlement implied by the City/Valero water delivery contract is constrained by drought, changes in environmental conditions and regulation, and other externally imposed restrictions on the City entitlement that are beyond the City's control.

Water Planning

City of Benicia Urban Water Management Plan

In 2001, the City of Benicia updated its *Urban Water Management Plan*. The *UWMP* was prepared to comply with requirements of the California Water Code (Water Code, Div 6, Part 2.6). The *UWMP* documents historical and future water demands, identifies available sources of supply to the City, and describes management practices to conserve water. The City depends on surface water imports, not groundwater.

The *UWMP* documents raw water deliveries to the refinery from 1995 to 2000, as shown in **Table 4.14-1**. The average demand for raw water by the refinery over this period was 5,600 acre-feet per year. At the time the *UWMP* was prepared, the City was unaware of any plans that would significantly alter the refinery demand pattern.

TABLE 4.14-1
HISTORICAL RAW WATER DELIVERIES TO VALERO (ACRE-FEET PER YEAR)

Year	1995	1996	1997	1998	1999	2000
Valero Raw Water Delivery	5,112	6,008	6,255	5,788	4,979*	5,460
Treated Water Delivery	4,494	4,717	5,037	4,595	5,011	4,989
Total	9,606	10,725	11,292	10,383	9,980	10,449
Refinery Percent of Total Use	53.2%	56.0%	55.4%	55.7%	49.9%	52.3%

* In 1999, the refinery conducted a major turnaround, affecting its water use for that year. (See also Section 3.6.1.1).
SOURCE: *Urban Water Management Plan*, City of Benicia, 2001.

The *UWMP* forecasted future demand from the refinery based on methods defined in the *1996 Water System Master Plan*. The forecasted water demands are shown for the planning horizon from 2000 to 2020 in **Table 4.14-2**. Demands were developed in the *1996 Water System Master Plan* for treated water production and the Valero refinery's raw water demand. High, baseline, and low forecasts were made. The baseline refinery consumption was an extrapolation of historical use rather than of contractual entitlements. The high forecast was based upon an assumed doubling of the industrial treated water use from the baseline forecast and a 10% increase in the baseline demands of the refinery. The *1996 Water System Master Plan* included a maximum buildout demand estimate of 6,226 acre-feet per year at the refinery. The *UWMP*, however, forecast a lower level of demand for the refinery.

TABLE 4.14-2
BASELINE WATER DEMAND FORECAST (ACRE-FEET PER YEAR)

Year	2000	2005	2010	2015	2020
Valero Raw Water Demands	5,370	5,450	5,525	5,600	5,660
Treated Water Demands	6,537	6,777	7,057	8,088	8,956
Total	11,907	12,227	12,582	13,688	14,616
Refinery Percent of Total System Use	45.1%	44.6%	43.9%	40.9%	38.7%

SOURCE: *Urban Water Management Plan*, City of Benicia, 2001.

Senate Bill 610

Senate Bill 610 amended the Public Resources Code (relating to CEQA), and the Water Code (relating to Urban Water Management Plans and to preparation of water supply assessments). The purpose and legislative intent of SB 610 was to further integrate land use and water supply planning, and to ensure that long-term water supplies are available to support new land uses.

The City is the CEQA lead agency for the Valero Improvement Project. The City also operates the "public water system" that serves the VIP. The SB 610 amendments to the Public Resources Code and the Water Code would place stringent requirements on the City in the review of the VIP if the Valero Improvement Project were to meet the specific definition of a "Project" [2] in the California Water Code. The VIP water use falls short of the SB 610 definition, so SB 610 does not apply to the VIP.

However, to evaluate the potential impact of VIP water use, the City's *Water Study* was prepared using the same methodology that would be required of a Water Supply Assessment under SB 610, namely, to inventory the City's total projected supplies and address whether those supplies will be available during normal, single-dry, and multiple-dry years during a 20-year projection, and also to evaluate whether that projected available water would satisfy the demand of the proposed project, given present and planned future uses.

City of Benicia Emergency Water Conservation Ordinance

The City has adopted an emergency water conservation ordinance (Title 13, Chapter 13.35: *Emergency Water Conservation Ordinance*) that incorporates a 5-stage plan for usage reduction by all water users. The City Manager determines when to move to more restrictive stages. Each stage mandates a percentage reduction in water use of the base year as established in 1989. Water use beyond the maximum allowed for at each stage will be subject to a drought penalty or charge based on the amount of the water use. Enforcement provisions include installation of flow restriction devices, or for disconnection of water service for continued violation. The ordinance includes provisions for exceptions and variances. Valero is not subject to the requirements in the ordinance, although during past water shortages, the refinery has reduced water use and funded temporary water purchases.

A refinery has water needs that are similar to other chemical manufacturing processes in that the water use at each process unit is related to the unit's production. Such demand can be referred to as "hardened", because water use efficiency is a part of the system design. Beyond very small potential reductions, it usually is not possible to reduce water use without also reducing the production of any given process unit. Since refinery processes are related, reducing production of one process unit also affects the production of other process units. The overall effect is to reduce operations and production at the refinery.

2 A "Project" is any project that would demand an amount of water equal to , or greater than, the water required by a 500 dwelling unit project. For water supply planning, 0.5 acre-feet per year is most frequently used as the water use for a single dwelling unit, so the 500 dwelling unit criterion would equal a total of 250 acre-feet per year.

Gasoline and diesel fuel manufacturing is important to the State's economy and curtailment of petroleum fuel production would have adverse economic impacts to the State. For this economic reason and for reasons of public safety, water use allocations in times of severe water shortages typically would include less than 10% reductions to all such key industries and to necessary institutional and commercial uses, emergency services and fire protection.

4.14.2.2 WASTEWATER TREATMENT AND STORMWATER DRAINAGE

The *City of Benicia General Plan* contains goals, policies and programs that pertain to Benicia's wastewater treatment capacity. These are summarized below:

Goal 2.40: Ensure adequate wastewater treatment capacity to serve all development shown in the General Plan.

Policy 2.40.2: Promote the use of reclaimed water where feasible.

Valero Benicia Refinery

The refinery has a wastewater treatment facility that treats wastewater from refinery operations and storm water runoff from process areas. The plant receives wastewater from a number of on-site sources, including processing units, boiler blowdown, cooling water blowdown, ballast water, and boiler condensate. The water is treated and discharged under the refinery's National Pollutant Discharge Elimination System (NPDES) permit to Suisun Bay. Storm water from non-process areas at the refinery is collected and discharged without treatment through 16 outfalls, which are monitored for water quality. These outfalls are also permitted under the refinery's NPDES permit. A more detailed discussion of the refinery's wastewater treatment plant, its capacity and operations, and discharge limitations is provided in Section 4.8.2.2, Hydrology and Water Quality.

Municipal Wastewater Treatment Plant

Wastewater generated from domestic uses at the refinery is discharged to the Benicia Wastewater Treatment Plant. The refinery currently generates approximately 7,500 gallons per day (0.0075 million gallons per day) of domestic wastewater, which represents a small fraction of the wastewater received at the City's treatment plant. Further, the City's treatment plant also treats the 0.03 million gallons per day of wastewater generated by the Huntway Asphalt Refinery, recently purchased by Valero. Dry weather flows at the Benicia Wastewater Treatment Plant are approximately 2.86 million gallons per day and wet weather flows are about 3.91 million gallons per day. The total capacity of the City's wastewater treatment plant is 4.5 million gallons per day. During dry weather, the plant operates at approximately 64% capacity.

4.14.2.3 SOLID WASTE

The following Benicia General Plan goals and policies pertaining to recycling and solid waste apply to the proposed Valero Improvement Project:

Goal 2.42: Enhance the recycling of solid waste.

Policy 2.42.1: Strive to accomplish the mandated objectives of the California Integrated Waste Management Act.

The Keller Canyon Landfill is a Class II facility that accepts municipal solid waste, non-liquid industrial waste, contaminated soils, ash, grit, sludge and serves the refinery, as well as the City of Benicia. That landfill is located in Pittsburg and covers 2,600 acres of land; 244 acres are permitted for disposal. The site currently handles 2,500 tons of waste per day, although the permit allows up to 3,500 tons of waste per day to be managed at the facility. The landfill has approximately 35 million cubic yards of remaining capacity and a life of about 37 years.

Other available landfills that serve the rest of Solano County have almost 30 million cubic yards of capacity remaining. Recycling and source reduction efforts are currently being implemented by Solano County and the incorporated cities within Solano County under the Integrated Waste Management Act of 1989 (Assembly Bill 939). These efforts are designed to extend the life expectancy of the landfills serving the County.

Hazardous waste is transported to the Kettleman Hills Landfill. The landfill is located about three miles southwest of Kettleman City, California, one half mile northwest of State Highway 41 and 2.5 miles southwest of Interstate Highway 5. Kettleman Hills Landfill is a Class I facility that accepts most types of hazardous waste for treatment, storage, and/or disposal and provides stabilization, solidification, macro and micro encapsulation and landfill of hazardous sludge. PCB solids, small capacitors, light ballasts and associated debris may also be landfilled onsite in the landfill. Waste disposal occurs on 499 acres of the 1600-acre Kettleman Hills facility. Valero currently ships waste sludge from its Wastewater Treatment Plant to the Kettleman Hills Landfill roughly once every three days.

According to Valero’s use permit application, much of the solid waste generated at the refinery is spent catalyst that can no longer be recycled. The amount of spent catalyst disposed of historically (1999-2002) at the Valero site was 609 tons per year.

4.14.3 SIGNIFICANCE CRITERIA AND METHODOLOGY

4.14.3.1 SIGNIFICANCE CRITERIA

Appendix G of the *CEQA Guidelines* was used as the basis for defining the thresholds of significance. For the water supply impacts, the methodology included specific thresholds to ensure compliance with recent changes to the state law, and because the City’s existing water supplies may be insufficient to serve current and planned future demands. The VIP may be deemed to have a significant impact on the environment if it would:

- Result in City water use in excess of water supplies available in normal, dry, and multiple dry years with water from all existing entitlements and sources, or if the project would require new or expanded water entitlements or resources.
- Result in refinery or City wastewater discharges that exceed the limitations of the Regional Water Quality Control Board.
- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.
- Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.
- Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs.
- Not comply with federal, state, and local statutes and regulations related to solid waste.

4.14.3.2 METHODOLOGY

The detailed basis for the evaluation of the water supply impacts is contained in the *Water Study*, which was based on the information in the Benicia *UWMP*, the *1996 Water System Master Plan*, the Department of Water Resources *State Water Project Delivery Reliability Report* (*Draft)* (DWR, 2002) and the Cities of Fairfield, Vacaville and Benicia *Water Rights Project Final EIR* (CH2M Hill, 2002). The *Water Study* used the methodology prescribed for the preparation of a Water Supply Assessment under SB 610, which went into effect on January 1, 2002.

For purposes of the impact analysis, the refinery's current (baseline) water use was established as the average of the historical refinery water use from 1995 to 2000. The average water use for this period was 5,600 acre-feet per year. This represents an actual, measured raw water use total without the VIP in place.

A specific quantitative threshold of significance for water supplies was established to evaluate whether there will be a significant impact from the VIP on the City's current or planned future water supply. Impacts would result to the City's available water supply if the refinery's total water demand were to exceed the amount established under the baseline water demand scenario for raw water delivery as anticipated in the *UWMP*, consistent with the *1996 Water System Master Plan*. The build-out water demand for the refinery was anticipated[3] in the *UWMP* as increasing to 5,660 acre-feet per year in the year 2020. As such, the VIP would result in significant impacts if the total of the current refinery demand and new VIP water demand would exceed the maximum amount forecast in the *UWMP* or would result in shortages during critical dry years, or would reduce the water available to current and planned future uses of water that are identified in the *General Plan*.

[3] Table 2-15, page 2-17, *1996 Water Systems Master Plan* and Table 2-3, pg 2-4 of the *UWMP*.

4.14.4 IMPACTS AND MITIGATION MEASURES

4.14.4.1 WATER SUPPLY

Impact 4.14-1: The Valero Improvement Project would increase demand for raw, untreated water from the City of Benicia in excess of the baseline refinery demand anticipated in the *UWMP*. In the future, the City's overall water demand may exceed available supplies from current sources in dry years. This impact would be significant.

This impact could be altered to be less than significant if the City were to obtain additional water supplies or if the City were able to implement planned future water supply programs and projects. Some of these measures are beyond City control and some are within the control of the City and Valero. Because one or more of these planned water supply programs is considered likely to result in sufficient water to meet planned demand, including the VIP demand, the impact of the VIP increase would be less than significant.

The proposed Valero Improvement Project would add the following facilities that would each increase the amount of fresh water used at the refinery: scrubber (172,800 gallons per day); coker modifications (7,200 gallons per day); sulfur recovery cooling water (14,400 gallons per day); hydrogen production (21,600 gallons per day). The net increase of fresh water consumption at the refinery would be 216,000 gallons per day (242 acre-feet per year).

The VIP demand, added to current refinery demand, would exceed the forecasted raw water demand contained in the *UWMP* for the refinery. With the VIP, projected water use would be the baseline water use of 5,600 acre-feet per year, plus the increased water use of 242 acre-feet per year, for a total of 5,842 acre-feet per year. This exceeds the expected 2020 demand of 5,660 acre-feet per year by 182 acre-feet per year. The proposed project would constitute an approximate 4% increase in water use compared to existing conditions.

The *Water Study* concluded that existing water supplies were sufficient in normal years for meeting VIP demands, in addition to all existing and planned future demands. However, the *Water Study* also concluded the current supplies would not be sufficient to meet existing and planned future City demand, with or without the VIP, during dry years. The effect of the VIP related to water supply would be less than significant during normal water years.

The effects of the VIP would be significant during dry years, or multiple-dry years, unless the City can obtain additional water to serve existing and planned demand, including the VIP. The City water supply is subject to cutbacks during dry years. Those dry-year cutbacks could result in shortages to current residential, commercial, and industrial users. During water shortages, the increment of water provided for the VIP would be considered to be a significant adverse impact of the project, both individually and through its contribution to cumulative water demands.

Table 4.14-3 presents the supply and demand for normal and dry years. The table shows the surplus or shortage that would occur in the future, both with and without the supplemental water rights currently being sought by the City. In normal years, the VIP impacts to water supply would be less than significant over the 2005 to 2020 planning horizon because enough water would be available, with or without new supplies and approval of the water rights permit.

Without the approval of the water rights application and appropriation from the Sacramento River, the sufficiency of the water supply for the City of Benicia, and hence the VIP, is questionable during dry years. The assessment shows potential shortages in dry years beginning in 2010 based on demand and supply forecasts in the *UWMP*. The dry year reliability presented in Table 4.14-3 reflects Department of Water Resources planning assumptions about reliability of the SWP water supply[4] in dry years. The situation would be made worse in multiple dry years.

Mitigation measures would be needed to increase water supplies available to the refinery or to the City so the supply would be reliable and sufficient for the VIP without affecting other uses.

Mitigation Measure 4.14-1a. The City would continue to move forward with obtaining the future water supplies as identified in the *Water Study*, the *UWMP*, and the *1996 Water System Master Plan*.

In order to obtain sufficient water for planned water demand from all City users during dry years, the City would pursue the project and programs identified in the *Water Study*, the *UWMP* and the *1996 Water System Master Plan*. These projects and programs are intended to implement the goals, policies and programs of the City *General Plan*. The specific programs would increase the overall water supply to the City in normal and in dry years, and increase the reliability and certainty for current and planned future uses.

The City's options for obtaining additional water supply, as identified in the *Water Study*, the *UWMP* and the *1996 Water System Master Plan*, are as follows:

> **Acquisition of Additional Water Rights.** The City would continue to seek to secure a water rights permit from the SWRCB for application 30681 and for appropriation of 10,500 acre-feet per year. As stated in the Water Rights EIR, acquisition of additional water rights would not require construction of new facilities, and therefore no disturbance impacts normally associated with construction would occur. That EIR also determined that acquisition of the water rights would not result in direct or indirect impacts to physical or biological environmental resources.

Short-Term Transfers. The City could attempt to purchase short-term water supplies from other SWP contractors to meet future demand. Since water would be conveyed to the City through the existing SWP facilities, no new facilities would be required. Therefore, no construction-related disturbance impacts would occur. It is not known which SWP contractors would be willing sellers when the City purchases the water, so it cannot be determined which areas would be affected by the purchase of the water.

[4] *State Water Project Draft Reliability Report*, Draft, DWR, 2002

TABLE 4.14-3
TWENTY-YEAR SUPPLY AND DEMAND ASSESSMENT FOR NORMAL AND DRY YEARS (ACRE-FEET)

Water Source		2005	2010	2015	2020
Lake Herman					
	Normal Year	500	500	500	500
	Dry Year	0	0	0	0
State Water Project[1]					
	Normal Year	17,200	17,200	16,075	16,075
	Dry Year	5,160	5,160	4,820	4,820
Vallejo Contracts[2]					
	Normal Year	5,500	5,500	1,100	1,100
	Dry Year	2,420	2,420	1,100	1,100
Mojave Water District					
	Normal Year	0	0	0	0
	Dry Year	5,000	5,000	5,000	5,000
Supplemental Water Purchases[3]					
	Normal Year	0	0	0	0
	Dry Year	0	0	0	0
Supplemental Water Rights Application 30681					
	Normal Year	10,500	10,500	10,500	10,500
	Dry Year[4]	9,000	9,000	9,000	9,000
Total Supplies					
	Normal Year	33,700	33,700	28,175	28,175
	Dry Year	21,580	21,580	19,920	19,920
Surplus (Shortage)					
	Normal Year	21,473	21,118	14,487	13,559
	Dry Year	9,353	8,998	6,232	5,304
Total Supplies w/o Supplemental Water Rights					
	Normal Year	23,200	23,200	17,675	17,675
	Dry Year	12,580	12,580	10,920	10,920
Surplus (Shortage) w/o Water Rights					
	Normal Year	10,973	10,618	3,987	3,059
	Dry Year	353	-2	-2,768	-3,696
Raw Water Demands (AF)		5,450	5,525	5,600	5,660
Treated Water Demands		6,777	7,057	8,088	8,956
Total Baseline Water Demand		12,227	12,582	13,688	14,616

1 SWP dry year supply at the 90% exceedence frequency from DWR *State Water Project Reliability Report* (Draft, 2002). Normal year presented as full Table A entitlement.
2 Current agreement with Vallejo for 1,100 AF through 2025 contract and 4,400 AF contract termination in 2010 with 30% supply on 4,400 AF contract in driest years.
3 Future additional water purchases, although possible, are forecast at zero because they are not certain.
4 Source: Table F-1 Buildout Water Supply by Source with Proposed Project, Design Dry Year Condition, and 10 Day May Delta Smelt North Bay Aqueduct Pumping Constraint, *City of Fairfield, Vacaville, and Benicia Water Rights Appropriations DEIR.* City of Fairfield

Solano Project: The City could purchase additional water supplies that could be delivered through the Solano Project, which is operated by the U.S. Bureau of Reclamation. The City currently receives water purchased from the City of Vallejo through the Solano Project. Since water could be conveyed to the City through the existing Solano Project facilities, no new facilities would be required. Therefore, no construction-related disturbance impacts would occur. It is not known which Solano Project contractors would be willing sellers when the City purchases the water, so it cannot be determined which areas would be affected by the purchase of the water.

Vallejo Agreement: The City could attempt to extend its water purchase agreement with the City of Vallejo. Since this would be a continuation of current conditions, no impacts would occur. No new facilities would be required to extend this purchase agreement.

When the water rights appropriation is secured or sufficient other sources are secured, Benicia's firm supply would be sufficient to meet the future demand in dry and multiple dry years.

Mitigation 4.14-1b. The City of Benicia would continue to implement General Plan Program 2.36.A to pursue reuse of reclaimed wastewater where feasible, and the refinery would accept and use reclaimed water from a City reclamation project.

The reclamation and reuse of wastewater opportunities are described in Section 3.4, *Project Description*, and the project proponent has made a commitment to using reclaimed wastewater when it becomes available from the City. In addition, the refinery must implement reclamation and reuse consistent with the mitigation requirements of the California Energy Commission for the Valero Cogeneration Project. The VIP demands would be included in the final costing and planning to implement the reuse program and project. The project is still undergoing review.

Development of the Water Reuse Plan would require construction of tertiary treatment facilities and pipelines. Pipeline construction would involve trenching that could tear up public roadways and temporarily disrupt traffic. Other disturbances caused by pipeline construction, such as dust generation, noise, and visual effects associated with materials stockpiling, would be potentially significant, but temporary, impacts. Depending on the alignment of the pipeline, construction could also disturb biological resources. Construction of tertiary treatment facilities would result in similar disturbance impacts (e.g., noise, dust, visual, construction worker traffic and effects on biological resources). Operation of the tertiary treatment facilities would require the use of hazardous chemicals and would generate brine, which would require proper disposal at an appropriate off-site location. In addition to identifying a proper method for disposing of the brine, an NPDES permit would be required for surface water discharges. Surface water discharges could result in secondary effects on water quality. These potential impacts would be addressed in a separate environmental review of the wastewater reuse facilities. The impacts and mitigations that might be associated with the development of the reuse facility would be reviewed pursuant to CEQA at a future date when the project is defined in sufficient detail.

Significance after Mitigation: Less than Significant

As described above, the *UWMP* and the *1996 Water System Master Plan* forecasted future water demands based on General Plan land use designations. The future demand forecasts included potable water for future industrial demands for lands zoned for industrial use, but that have not yet been developed and that are not expected to be developed within the next several years. As a result, the City expects to have sufficient water available to serve the VIP during its initial stages. This will allow the City time to perfect future water supplies, whether through reuse of wastewater or through the other programs and projects identified in the *UWMP*, and as also described in the *Water Study*.

Within weeks or months of SWRCB approval of the Water Rights application, the City water supply would become sufficient to meet all projected City demands, together with the other forecasted cumulative demands and the VIP demands. Progress on this application has been made and SWRCB approval may be forthcoming relatively soon.

If wastewater reuse were to be implemented by the City, the refinery could begin preparations to use the product in refinery cooling towers. The Action Plan is described in Section 3.6.2.3 and recent progress is described in Section 4.14.2.3 of the setting, above. Several years would be required before wastewater reuse could begin. Reuse water could become a substantial fraction of the water used at the refinery and could substantially reduce overall refinery raw water use, to a point well below the current refinery average use value of 5,600 acre-feet per year.

Another potential source is the City purchase of supplemental water from other water rights holders. Very little lead-time is required to receive purchased water. These short-term transfers of water have been made in the past, and also could be available in the future, although such water could have a high price and may not be available in sufficient quantities. Furthermore, since no long-term permanent transfers or agreements exist, such supplemental water may not be available to the City in every year. Over the next several years, however, such purchases may be able to meet the water demand increment of the VIP, if needed.

Not all of the measures above would be required to mitigate the water demand of the VIP. It would be necessary only to develop sufficient new water supply, either through obtaining additional potable water or industrial reuse water, so that Benicia's firm water supply would satisfy future demand, including the VIP, in dry- and multiple-dry years.

4.14.4.2 WASTEWATER TREATMENT

Impact 4.14-2: The Valero Improvement Project would increase the amount of wastewater and the pollutant loading of the wastewater processed at the refinery's wastewater treatment plant. This would be reduced to a less than significant impact by the wastewater treatment processes that meet the discharge limitations of the NPDES permit.

The VIP would increase the production rate capacity of the refinery to a crude throughput of up to 165,000 barrels per day. This represents a 22.2% increase in production capacity. According to the Regional Water Quality Control Board's Order, this addition of facilities and increased productivity would also increase the quantity of wastewater discharged (including the rerouting of about 0.03 million gallons per day of the Huntway Asphalt Plant wastewater from the City plant to the refinery plant) at the on-site wastewater treatment plant by up to 0.26 million gallons per day by late 2004. To treat the additional wastewater generated by project improvements, Valero may need to install new treatment units, if there were to be insufficient capacity at the existing treatment plant. The capacity determination is still unknown. This would be a potentially significant impact without the mitigation measures incorporated into the VIP in order to meet the NPDES discharge permit requirements imposed by the RWQCB. See also Section 4.9, *Hydrology and Water Quality*.

Mitigation: None required.

Impact 4.14-3: The Valero Improvement Project could increase the amount of wastewater treated at the City of Benicia's wastewater treatment plant. This impact would be less than significant.

The VIP is expected to generate fewer than 20 new permanent employees and a work force of roughly 200 construction employees. The increase in employees on site would constitute only a minor increase in refinery wastewater processing requirements at the City treatment plant. Thus, effects related to municipal wastewater processing would be less than significant.

Mitigation: None required.

4.14.4.3 SOLID AND HAZARDOUS WASTE DISPOSAL

Impact 4.14-4: The Valero Improvement Project would increase routine disposal of spent catalyst and of sludge from the refinery wastewater treatment plant. This impact would be less than significant.

The VIP would increase the productivity of refinery operations and would thus increase the amount of solid waste (spent catalyst) generated. Whenever feasible, spent catalyst would be recycled by catalyst companies for reuse. The amount of spent catalyst disposed of historically (1999-2002) by the refinery has been 609 tons per year. With the project, the amount of spent catalyst could increase up to 15% or about an additional 90 tons per year. Given that Valero recycles much of its spent catalyst, complies with existing solid waste regulations, and that there is sufficient landfill capacity for the proposed project, the project's effects would be less than significant.

Valero's wastewater treatment process includes an iron-copreciptation step that results in the production of waste sludge that is disposed of at the Kettleman Hills Class I landfill. This sludge is a ferric chloride and selenite by-product of the wastewater treatment process. Historically, Valero disposed 1,883 tons of this sludge in 1999, 2,219 tons in 2000 and 1,481 tons in 2001. Currently and under future project operating conditions, Valero expects to continue shipping a 15-ton truckload of sludge to Kettlemen Hills every three days. This would yield approximately 1,800 tons of sludge per year, with the VIP increment being a small part of this total. Kettleman Hills Landfill currently has capacity for approximately 6 million tons of additional waste and could continue to accept Class I wastes until 2009[5]. The refinery's annual disposal amount would be about 0.03% of the current landfill capacity and is an insignificant contribution to the cumulative amounts disposed at the landfill. This would not substantially differ from the refinery's historical waste shipments to Kettleman Hills Landfill, which has capacity to receive such shipments and not require the expansion of any disposal facilities. The effects of VIP Class I hazardous waste generation and disposal would be less than significant.

Mitigation: None required.

4.14.5 CUMULATIVE IMPACTS

4.14.5.1 WATER SUPPLY

Impact 4.14-5a: The Valero Improvement Project, together with the Cogeneration Project and other refinery projects would increase demand for raw, untreated water from the City of Benicia in excess of the baseline refinery demand anticipated in the UWMP. Together with other future, non-refinery projects, the VIP would make a significant contribution to the cumulative shortfall in City water supply in dry years. This impact is potentially significant.

This impact could be altered to be less than significant if the City were to obtain additional water supplies or if the City were able to implement planned future water supply programs and projects. Some of these measures are beyond City control and some are within the control of the City and Valero. Because one or more of these planned water supply programs is considered likely to result in sufficient water to meet planned demand, including the VIP demand, the impact of the VIP increase would be less than significant.

In addition to the VIP as proposed, the Valero Cogeneration Project, already approved by the California Energy Commission (CEC), will also increase the water demand above the baseline conditions. Total annual water use for the Cogeneration Project will average 314 acre-feet per year (102 million gallons per day), with 37% of that water being makeup water for the new Cogeneration Project cooling tower. Average annual water use for the existing refinery operations averages 5,600 acre-feet per year; with the additional water demands of the VIP and the Cogeneration Project, the total refinery cumulative water use would be 6,156 AF/yr. This would exceed the threshold of significance by a total of 556 AF/yr. As previously noted in the project description, the California Energy Commission (CEC) included a mitigation for the Valero

5 Personal communication, Terri Yarbrough, Kettleman Hills Landfill, October 2002.

Cogeneration Project that requires that "within 30 months the project owner would implement a wastewater reuse and/or water use reduction program that would fully offset the amount of water used by the project, using either refinery wastewater or City of Benicia's treated wastewater". The implementation of this mitigation would reduce the cumulative effects of the Cogeneration Project to less than significant. Until the Cogeneration Project complies with the CEC conditions, the Cogeneration Project water use, together with additional water demands of the VIP and other refinery projects, would result in increased water deficits in the dry years and increase the severity of the water supply shortages in multiple-dry years.

The VIP and other refinery projects, in addition to all other planned demands for the City accounted for in the *UWMP* would have a cumulative impact related to water supply since demands would exceed supply in dry years. Mitigation measures 4.14-1a and 4.14-1b above, by mitigating direct impacts of the VIP, also would reduce cumulative impacts of the VIP to less than significant.

Water conservation measures instituted under the City Ordinance would reduce water demand in times of water shortages. To the extent that new development within the City also would be under the use limitations of the ordinance, water demand would be reduced for those new developments as well as for existing users.

Significance after Mitigation: **Less than Significant**

4.14.5.2 WASTEWATER TREATMENT

Impact 4.14-5b: The VIP, together with other refinery projects, would increase the quantity of pollutants and the amount of wastewater processed at the refinery wastewater treatment plant. This would be a less than significant impact due to NPDES discharge limitations.

Mitigation Measures 4.14-1a and 4.14-1b would assure that the impact of the VIP on the quality of the wastewater discharge would be less than significant, and therefore, the contribution of the VIP and other refinery projects to the cumulative impact also would be less than significant.

Impact 4.14-5c: The VIP, together with other refinery and non-refinery projects within Benicia, could increase the amount of wastewater treated at the City wastewater treatment plant. This cumulative impact would be less than significant because the refinery contribution would be less than significant.

The VIP would not result in a cumulative impact associated with municipal wastewater treatment capacity because the cumulative refinery projects would result in a decrease in flow of the approximately 0.03 million gallons of wastewater per day from the Huntway Asphalt Refinery to the City facility. This would be roughly 1% of the permitted capacity of Benicia's Wastewater Treatment Plant and is not considered a significant cumulative impact.

4.14.5.3 SOLID AND HAZARDOUS WASTE DISPOSAL

Impact 4.14-5d: The VIP would increase the refinery's routine disposal of spent catalyst and sludge from the refinery wastewater treatment plant at the Keller Canyon landfill. The VIP contribution to the cumulative waste disposed at the landfill would be less than significant.

Implementation of the proposed project would not result in significant cumulative impacts related to solid or hazardous waste generation and disposal because the proposed project's incremental effect on hazardous waste is considered to be less than significant.

REFERENCES – UTILITIES AND SERVICE SYSTEMS

Association of California Water Agencies, *Water Supply and Development. A User's Guide to California Statutes Including SB 221 (Kuehl) and SB 610 (Costa)*, March 2002.

California Energy Commission, *Staff Assessment: Valero Cogeneration Project*, Application for Certification (01-AFC-05), August 2001.

City of Benicia, *Benicia General Plan*, adopted June 15, 1999.

City of Benicia, *Exxon Benicia Refinery Clean Fuels Project Draft EIR*, State Clearinghouse No. 93C0336A, September 1993.

Keller Canyon Landfill website, http://www.pleasanthillbayshoredisposal.com

Regional Water Quality Control Board, *Valero Benicia Refinery - NPDES Permit No. A0005550*, October 2002.

Valero Benicia Refinery, *Application for City of Benicia Use Permit*, March 2002.

Byron Buck Associates with M. Cubed. *2001 Urban Water Management Plan, City of Benicia, California*. December 2001.

Montgomery Watson. *City of Benicia 1996 Water System Master Plan. Volume I: Final Report.* September 1996.

California Department of Water Resources. *The State Water Project Delivery Reliability Report* (Draft). August 2002

CH2M Hill. Cities of Fairfield, Vacaville and Benicia Water Rights Project Final EIR (SCH #20003203). March 2002.

EOA. *Water Reuse Action Plan*, September 2002.

CHAPTER 5
CEQA STATUTORY SECTIONS

5.1 SIGNIFICANT UNAVOIDABLE ENVIRONMENTAL IMPACTS

There are no significant unavoidable impacts from the VIP.

5.2 CUMULATIVE IMPACTS

5.2.1 INTRODUCTION

The CEQA Guidelines define a cumulative impact as one resulting from the combined effect of the proposed project plus all other reasonably foreseeable projects. CEQA requires that:

- Cumulative impacts be discussed when they may be significant;
- The discussion may be more general than that for the individual project impacts, but that the discussion should reflect the potential extent, severity, and probability of the impact;
- The cumulative impact analysis can be based on a list of reasonably foreseeable projects or projections from a General Plan or a regional planning agency; and,
- Reasonable options for mitigating or avoiding the project's contribution to significant cumulative impacts be proposed, noting that for some cumulative impacts the only feasible mitigation may involve the adoption of ordinances or regulations rather than the imposition of conditions on a project-by-project basis.

This section contains the cumulative impact analysis for the environmental areas addressing project impacts in Sections 4.1 through 4.14 of this Environmental Impact Report. Although included here, the effects of these cumulative impacts also were included in the impact assessments in those sections.

The key characteristics of a cumulative impact analysis are:

- A project impact (significant or not), plus
- Impacts from other projects of the same type as that of the project. This is especially important in this case, where the cumulative projects include other on-going refinery projects, as well as projects with similar impacts, such as traffic.
- The interaction of these impacts to create a cumulative impact affecting the same geographic unit of analysis as that of the proposed project.

5.2.2 CUMULATIVE PROJECTS CONSIDERED

The construction and operation of the VIP would not be the only large activity at or in the vicinity of the refinery during the next five or more years. In the near term, operation of the first unit of the Cogeneration Project and the construction / operation of the MTBE Phase Out Project should be complete prior to the start of VIP construction. In the near future, the refinery would undertake the construction of other, independent, projects. These independent projects include:

Alkylation Unit Modifications
Selective Hydrogenation Facilities
Light Ends Rail Rack Arm Drains
BAAQMD Regulation 9 Rule 10 NO_x Alternative Compliance Plan
Treatment of wastewater from the Huntway Asphalt Refinery

These projects would be part of the cumulative development context for assessing the cumulative environmental impacts of the proposed VIP. Later during the VIP construction interval, Valero will undertake other normal maintenance activities[1], including major and minor refinery turnarounds. All of these projects are part of the cumulative development context for assessing the cumulative environmental impacts of the proposed VIP. Construction worker forecasts include these projects.

Finally, several other large projects by other sponsors also could be underway in the vicinity of the refinery; their construction could overlap that of the proposed VIP. The larger of these other projects would be the construction of the Benicia Bridge, south of the refinery. Another project, which may occur during the VIP, is the development of the Seeno Benicia Business Park, immediately east of the refinery. A third separate project, the City of Benicia's Wastewater Reuse Project, also could be in development. A fourth project, the Southampton Tourtelot Development in Benicia, would be under construction at that time, as well. These projects were considered relevant to this analysis as they fall within the geographic scope of the area affected by the VIP from a cumulative impact perspective.

No other projects that might also contribute to cumulative impacts in some environmental topics, are known to be under way outside the boundaries of the refinery. However, cumulative regional growth is accounted for in the water supply, traffic and air quality analyses.

The known cumulative projects are described in Section 3.6, *Relevant Cumulative Projects*.

While construction of the Benicia-Martinez Bridge is actually underway, and construction of the Southampton Tourtelot project can begin as soon as ordnance cleanup is completed, the Benicia Business Park project has no City approval to proceed. The City's Wastewater Reuse Project is in the planning stage. It is unknown whether the latter two projects will proceed during the construction and operation term of the VIP; however, this analysis assumes that both would be in construction or operation during VIP construction.

1 Normal maintenance activities at the Valero refinery are not considered as CEQA projects.

If any other projects and/or countywide growth outside the boundaries of the refinery might also contribute to particular cumulative impacts, those projects have been noted within the impact discussion for a particular environmental topic or issue. For example, traffic projections include regional growth in traffic volumes on I-680 and I-780 over the next 25 years.

5.2.3 AREAS OF NO CUMULATIVE IMPACT

Based upon the Initial Study prepared for the VIP and comments received during the scoping process, the City determined that the project would not contribute to cumulative impacts for the following resources:

- Population and Housing
- Recreation
- Agricultural Resources
- Mineral Resources

Cumulative impact assessments for the remaining environmental impact areas follow:

5.2.4 AREAS OF POTENTIAL CUMULATIVE IMPACT

5.2.4.1 VISUAL IMPACTS

The construction of all reasonably foreseeable projects at the refinery would expand the industrial appearance of the overall complex. However, none of the changes associated with individual projects are expected to substantially impact visual resources. As such, the VIP and the other refinery projects are expected to produce a less than significant cumulative overall visual quality impact. Section 4.1, *Aesthetics, Visual Quality, Light and Glare* presents a detailed analysis of VIP-related visual impacts.

Section 3.6, *Relevant Cumulative Projects*, describes how other planned projects at the refinery include new construction, expansion to processing units, and routine maintenance activities. These projects would be located within the existing refinery complex, and would not expand industrial operations outside the processing, tanks storage, and wastewater processing areas. New processing facilities would be painted the same color scheme of the existing refinery and would not represent any overall significant changes in the industrial appearance of the complex. Some staging and laydown areas used for construction of these foreseeable projects would be visible, and would incrementally add to the overall extent of disturbed, graded areas surrounding the main processing and tank storage facilities, but this impact is not significant.

As discussed in Impact 4.1-1, the project’s effect on views from Lake Herman Road would be less than significant. The cumulative development closest to Lake Herman Road would be the Benicia Business Park. Although the Business Park would be visible from some of the same point on Lake Herman Road as the refinery, the contribution of the refinery projects to the cumulative impact would be less than significant.

The construction of the other non-refinery cumulative projects, together with all of the reasonably foreseeable projects at the refinery, would expand the industrial appearance of the overall complex and the southeast portion of the city, as well.

Construction and operation of the Caltrans Benicia – Martinez Bridge, the Benicia Business Park and/or other large-scale industrial developments within the City, and the City of Benicia Wastewater Reuse Project each would alter the visual character of their sites, as well as altering the overall visual character of the entire area. While noticeable, these visual changes would be less than significant. During construction, staging and laydown areas would be visible, and would incrementally add to the overall extent of disturbed, graded areas in the vicinity, but this cumulative impact would not be significant.

5.2.4.2 AIR QUALITY

According to the BAAQMD CEQA Guidelines, any proposed project that would individually have a significant air quality impact would also be considered to have a significant cumulative air quality impact. For any project that does not individually have significant operational air quality impacts, the determination of significant cumulative impact is based on an evaluation of the consistency of the project with the local general plan and consistency of the general plan with the regional air quality plan.

The VIP, as mitigated, would have a less than significant impact on regional air quality. Further, the VIP together with anticipated future projects at the refinery would result in a decrease in emissions. Thus, the project would not contribute to a significant cumulative impact. In addition, the project is consistent with the applicable General Plan and Clean Air Plan as discussed below.

The appropriate general plan for the VIP is the City of Benicia General Plan and the regional air quality plan is the 2000 Bay Area Clean Air Plan. The implementation of the VIP would be consistent with the City of Benicia General Plan. The determination of the City General Plan's consistency with the Bay Area Clean Air Plan is based on the analysis in the air quality section of the EIR for the City's General Plan. The EIR determined the General Plan to be consistent with the Clean Air Plan. Therefore, the VIP would not be considered to have a significant cumulative air quality impact under BAAQMD guidelines for determining the significance of cumulative impacts.

In addition to projects at the refinery the Benicia Business Park project, the Benicia – Martinez Bridge, Southampton Tourtelot Development and the City of Benicia Wastewater Reuse project would add to cumulative emissions of air pollutants in the area. Based on information in the EIR/EIS for the Benicia-Martinez Bridge project and the EIR for the Benicia Business Park project, emissions generated by these projects in combination with the VIP, would not result in a cumulative significant impact. Information on air pollutants emissions generated by the Southampton Tourtelot Development and City of Benicia Wastewater Reuse project was unavailable and hence not considered in this cumulative impact evaluation.

5.2.4.3 BIOLOGICAL RESOURCES

Additional wastewater associated with other non-refinery projects, especially industrial development, together with refinery discharges, could increase the mass of pollutants in receiving waters. Those increased levels of pollutants may directly affect sensitive life stages or bioaccumulate and affect higher life forms, such as special status fishes that live near or would feed on organisms living in the vicinity. This impact is considered to be potentially significant.

Although potential increases in pollutants from the cumulative projects could occur, compliance with the discharge requirements of the refinery's NPDES permit could reduce these potential impacts to less than significant. As discussed in Impacts 4.3-3 and 4.3-4, the NPDES permitting process provides discharge standards that, when followed, limit this impact to less than significant.

5.2.4.4 ENERGY

Valero estimates that up to an additional 23 MW will be needed within the refinery for the VIP expansion. Valero also will construct other projects that account for an additional 7 MW in energy demand. The increased electrical energy demand for the combined refinery projects would be 30 MW, an increase of 60% over the existing electrical energy requirement of the refinery.

The California Energy Commission approved a total of 102 MW of on-site cogeneration at the refinery, and one 51 MW cogeneration unit is currently under construction. When that unit goes into service, it will remove the refinery's existing 50 MW load from the grid. With that cogeneration unit operating[2], net electrical energy demand would be approximately 21 MW less than current conditions (a 28% reduction). When that cogeneration unit does not operate, the refinery would require approximately 80 MW to meet the combined energy demand of existing facilities and planned improvements (a 60% increase over existing conditions). Thus, at the refinery substation, the PG&E grid would experience a 21 MW reduction in electrical demand for more than 91% of the time and a net 30 MW increase for less than 9% of the time[3]. This infrequent increase in refinery electrical energy demand would be less than significant.

The cumulative electrical and natural gas demands of the other, non-refinery cumulative projects would be served by PG&E. Those projects represent planned development under the Benicia General Plan and it is PG&E's responsibility to plan for and construct the energy distribution structure and to deliver natural gas and electricity to those developments. Within this context, the net contribution of the refinery's cumulative projects' electricity and gas use to the cumulative energy demand within Benicia would be less than significant.

---

[2] In the California Energy Commission's (CEC) review of Valero's Application for Certification for the Cogeneration facility, Valero expects a 98% reliability factor for the Cogeneration Unit (CEC, 2001). The CEC concluded that this reliability is well above the industry norm for similar cogeneration units, 91.5%. However, it is assumed that the cogeneration unit's availability over a year would lie between 91.5% and 98%.

[3] These demands can be compared to PG&E's current load of approximately 9320 MW on the regional power grid.

5.2.4.5 PUBLIC HEALTH

Cumulative impacts on Public Health could occur if Toxic Air Contaminates (TAC) emissions from the VIP were to combine with TAC emissions from other cumulative projects in the region. Table 4.2-12 in Section 4.2, *Air Quality* shows that, cumulative emissions of PM-10 and VOC, the pollutants that contain TACs would be less than emissions for the VIP scenario alone. Table 4.7-9 in Section 4.7, *Public Health* shows that the maximum cancer risk for the VIP is predicted to be 1.76 in a million, which is a less than significant impact. Under the cumulative scenario, the cancer risks would be less than 1.76 in a million, since TAC emissions for this scenario are less than VIP emissions. Therefore, exposure levels of TACs from cumulative projects would be less than significant.

5.2.4.6 PUBLIC SAFETY

Refinery operations involve the processing and handling of substances that are flammable and/or acutely toxic, with the potential for fires and explosions or the release of toxic vapors. This risk is measured in terms of the likelihood or probability of an accident and the severity of the consequences of an accident. Refinery accidents with off-site consequences are low-probability events and are not expected to interact with accidents related to other cumulative projects outside of the refinery site. While accident risks exist, the cumulative effects would be less than significant.

Other industrial projects in the region are located too far away from the process areas of the refinery to cause potential cumulative public safety impacts. In most cases, impacts from fires, explosions, or toxic gas releases are limited to the property fenceline or near the fenceline. Also, the probability of an accidental release occurring from a cumulative project at the same time that an accident would occur at the VIP would be extremely low. Therefore, cumulative impacts would be less than significant.

As stated in Section 4.8.5.1, *Potential Process Failures*, the MTBE phase-out project will result in the elimination of two marine visits per month, thus resulting in a reduction of marine vessel trips to the refinery. Therefore cumulative public safety impacts related to marine transportation will also be less than significant.

5.2.4.7 HYDROLOGY AND WATER QUALITY

The proposed VIP will increase Valero's wastewater discharge to receiving waters. In addition to the contribution from the VIP, the refinery will route the 0.04 million gallons per day wastewater flow from the Huntway Asphalt Plant through its wastewater treatment plant. This waste stream will be treated by the wastewater treatment plant prior to discharge and will comply with NPDES discharge limitations. As discussed in Impact 4.9-1, the amount of storm water that requires management (conveyance, treatment, detention) resulting from the proposed project is not expected to increase substantially because the proposed improvements are located in developed areas that currently generate storm water runoff.

The proposed VIP and the other proposed projects at the Benicia refinery, in combination with neighboring refineries and other projects requiring effluent discharges, contribute controlled amounts of effluent waste water to the Suisun Bay and San Pablo Bay. Cumulatively, these discharges represent a significant portion of the contaminants that are assimilated into these surface water resources. Discharges to the waters of the United States are regulated under the RWQCB's implementation of the NPDES that establishes waste discharge requirements and provisions to dischargers to manage effluent concentrations of contaminants. The bases for discharge limits and requirements include the Federal Water Pollution Act, Federal Code of Regulations: Title 40, San Francisco Water Quality Control Plan, California Toxics Rule, National Toxics Rule, State Implementation Policy, US EPA Quality Criteria for Water and the Ambient Water Quality Criteria for Bacteria. Discharges to the Suisun Bay and Carquinez Straits are regulated under waste discharge requirements that are determined based on the ability of the surface water to accommodate additional chemical and metal loading. Under the current environment, the NPDES Waste Discharge Requirements and the process to determine these limits and requirements is the most stringent regulatory mechanism to manage waste discharges to receiving water bodies.

The refinery's discharge to the Suisun Bay and Carquinez Straits constitutes an increase of an existing discharge that is regulated under the NPDES process. Although the refinery's discharge represents an increase, albeit minor, to the cumulative chemical loading to the receiving waters, its contribution is considered less than significant to the overall hydrologic system. The increase to the refinery's discharge, if eliminated from the regional cumulative discharges, would not constitute a significant reduction in the overall metal and chemical loading by local and regional discharges.

The addition of two crude oil tanks in the crude oil tank farm (Drainage Parcel 2) and changes within the main refinery area (Drainage Parcel 1) and wastewater treatment area (Drainage Parcel 3) are within a controlled runoff area (i.e., a diked or containment area capable of temporarily detaining storm water flows). Other refinery projects would have no hydrological effect. Therefore, changes in the peak storm water flows to the Lower Sulphur Springs Creek drainage area as a result of the VIP and other refinery projects are considered *de minimis*.

The Benicia Business Park and Southampton Tourtelot Development projects located northeast and northwest of the refinery, respectively, could considerably change runoff conditions and cause downstream flooding effects to the Lower Sulphur Springs Creek drainage area. However, the incremental impacts of the VIP are not cumulatively considerable because the storm water runoff into the Lower Sulphur Springs Creek drainage area would essentially be the same whether or not the proposed VIP is implemented.

5.2.4.8 LAND USE PLANS AND POLICIES

The construction and the operation of the VIP, in addition to other cumulative refinery projects and other non-refinery cumulative development, would not result in any known cumulative impacts to land use plans and policies. The impact of each project, if any, would be specific to its site and land use changes and overall effects were considered in the development of the Benicia General Plan.

5.2.4.9 NOISE

Noise from cumulative development at the refinery would primarily occur from construction activities and the addition of refinery equipment. The cumulative projects included in this analysis are:

1. **Cogeneration Project** – Based on the noise analysis conducted for the cogeneration project as part of the California Energy Commission approval process, the predicted steady state noise from the cogeneration facility would be 39 to 42 dBA, L_{eq} at the nearest representative residential receptors. Therefore, the cogeneration plant would cause an increase of up to 1 to 3 dBA to the existing ambient L_{eq} and would cause no change to the overall CNEL.

2. **MTBE Phase-Out Project** – This project would include shutting down the MTBE unit that would result in shutdown of several process unit pumps and fans. Overall the project would result in a net reduction in power demand by the type of equipment that produces noise. Because the new noise generating equipment would replace existing equipment approximately in the same locations, and since Valero requires noise from newly installed equipment to be limited to 85 dBA at the point of worker exposure, the project would result in an overall reduction in the noise created by the operating equipment (URS, 2002). Therefore this project would not add to the cumulative noise levels in the vicinity of the refinery.

3. **Alkylation Unit Modifications, Selective Hydrogenation Facilities** – Noise producing equipment associated with these projects could include up to 5 pumps and five air fin exchanger fans. Steady noise from these pieces of equipment would be less than 30 dBA at the nearest residential receptors, and would add imperceptibly to the ambient noise levels there.

4. **Major Refinery Maintenance Turnaround (1Q04) and Minor Refinery Maintenance Turnaround (1Q06)** – Since turnarounds involve only maintenance activities, the actual operational noise levels will be less than that experienced during normal operation. However, maintenance operations can involve construction-type activities and similar noise levels. Therefore, the turnarounds will not contribute to any significant cumulative effects on noise.

5. **Light Ends Rail Rack Arm Drains** – No major noise producing equipment such as pumps, compressors/blowers, air fin exchangers, or furnaces will be used for this project. The project would involve only additional piping at the rail track. The project will not contribute to any significant cumulative effects on noise.

6. **BAAQMD Reg. 9 Rule 10 NOx Alternate Compliance Plan** – This project would not lead to any physical changes in the refinery. Therefore, it would not contribute to the cumulative construction or operational noise levels.

The cumulative impact of all these projects operating simultaneously at the refinery would at most cause a 3 dBA increase in background L_{eq} at the nearest residential receptor. No measurable change is predicted in DNL at the residential receptors. Since the VIP would not affect ambient noise levels at these receptors, the total increase in ambient noise level due to the cumulative projects in conjunction with the noise generated by the VIP, at the nearest residential receptors would be up to 3 dBA, L_{eq}. This increase would be less than significance thresholds identified for this project and would constitute an imperceptible increase over existing levels. Therefore, the project, along with the other cumulative projects at the refinery would lead to a less than significant cumulative noise impact.

In addition to projects at the refinery the Benicia Business Park project, the Benicia – Martinez Bridge, Southampton Tourtelot Development and the City of Benicia Wastewater Reuse project would add to the cumulative noise levels in the area. Based on information in the EIR/EIS for the Benicia-Martinez Bridge project and the EIR for the Benicia Business Park project, noise levels generated by these projects in combination with the VIP, would not result in a cumulative significant impact. Information on noise levels generated by the Southampton Tourtelot Development and City of Benicia Wastewater Reuse project was unavailable and hence not considered in this cumulative impact evaluation.

5.2.4.10 PUBLIC SERVICES

The construction and operation of the VIP, or of other cumulative refinery projects would have less than significant adverse impacts on fire protection, police protection, schools, parks or other community facilities or services. However, other non-refinery cumulative development, including the Benicia Business Park or other industrial development within the City, could adversely affect the provision of certain of these City services if these projects increase the number of Benicia residents or increase the demand on City fire and police protection services.

To the extent that these future cumulative developments provide the necessary tax base or other compensation to support the provision of necessary additional services and facilities, the potential impacts would be mitigated to less than significant.

5.2.4.11 TRAFFIC AND TRANSPORTATION

An analysis of the 2004 plus project peak hour volumes was conducted using the HCM2000 methodology for the study area intersections. The detailed analysis presented in Section 4.13, *Transportation*, indicates that for the 2004 plus project level of service, all study area intersections would continue to operate with satisfactory levels of service (LOS C or better) in both peak hours in the 2004 plus project condition except for the intersection of I-680 northbound off-ramp/Bayshore Road in the a.m. peak hour.

Similar to the 2004 plus project intersection analysis, 2004 plus project a.m. and p.m. peak hour traffic volumes on segments and ramp junctions of I-680 were analyzed for levels of service at ramp junctions to be used by project construction traffic. Figure 4.13-5 illustrates the 2004 plus project a.m. and p.m. peak hour volumes at the I-680 freeway segments and ramp junctions. Year 2004 plus project levels of service (calculated for passenger cars per mile per lane – pc/mi/ln) for the study area ramp junctions are shown in Table 4.13-9.

As indicated in the table, most of the study area ramp junctions would continue to operate with satisfactory levels of service (LOS D or better) in both peak hours except for the southbound on- and off-ramps at Bayshore Road and Industrial Way, respectively. These ramps would continue to operate at LOS F in the a.m. peak hour with the addition of project traffic.

The cumulative 2025 scenario, which is defined by the cumulative horizon year of the Solano Transportation Authority's (STA) Countywide Congestion Management Program (CMP) travel demand model, was analyzed to determine long-term traffic impacts associated with the build out of the Solano County and City of Benicia General Plans. The locations and sizes of the major development projects envisioned in the County and Cities' General Plans have been programmed into the Countywide *Year 2025 Travel Demand Model* which was developed by STA. The modeled forecast traffic volumes were then manually adjusted for consistency with local and regional travel patterns (i.e., "post-processed") utilizing the approved "incremental" method.

Based on review of the Countywide Travel Demand Model network, additional roadway and/or intersection improvements planned for the study area intersections were based on the City of Benicia General Plan Circulation Element, as well as completion and full operation of the Preferred Alternative bridge span analyzed in the Benicia-Martinez Bridge PR/PSR. The addition of the VIP's operational traffic alone would be considered nominal and insignificant when compared to the 2025 baseline volumes at the study area intersections and ramp junctions.

5.2.4.12 UTILITIES AND SERVICE SYSTEMS

Water Supply

The Valero Improvement Project, together with the Cogeneration Project and other refinery projects would increase demand for raw, untreated water from the City of Benicia in excess of the baseline refinery demand anticipated in the UWMP. Together with other future, non-refinery projects, the VIP would make a significant contribution to the cumulative shortfall in City water supply in dry years. This impact is potentially significant.

This impact could be altered to be less than significant if the City were to obtain additional water supplies or if the City were able to implement planned future water supply programs and projects. Some of these measures are beyond City control and some are within the control of the City and Valero. Because one or more of these planned water supply programs is considered likely to result in sufficient water to meet planned demand, including the VIP demand, the impact of the VIP increase would be less than significant.

In addition to the VIP, the already approved Valero Cogeneration Project, will also increase the water demand above the baseline conditions. Total annual water use for the Cogeneration Project will average 314 acre-feet per year (102 million gallons per day), with 37% of that water being makeup water for the new Cogeneration Project cooling tower. Average annual water use for the existing refinery operations averages 5,600 acre-feet per year; with the additional water demands of the VIP and the Cogeneration Project, the total refinery cumulative water use would be 6,156 AF/yr. This would exceed the threshold of significance by a total of 556 AF/yr. As previously noted in the Chapter 3, *Project Description*, the California Energy Commission (CEC) included a mitigation for the Valero Cogeneration Project that requires that "within 30 months the project owner would implement a wastewater reuse and/or water use reduction program that would fully offset the amount of water used by the project, using either refinery wastewater or City of Benicia's treated wastewater". The implementation of this mitigation would reduce the cumulative effects of the Cogeneration Project to less than significant.

Until the Cogeneration Project complies with the CEC conditions, the Cogeneration Project water use, together with additional water demands of the VIP and other refinery projects, would result in increased water deficits in the dry years and increase the severity of the water supply shortages in multiple-dry years.

The VIP and other refinery projects, in addition to all other planned demands for the City accounted for in the *UWMP* would have a cumulative impact related to water supply since demands would exceed supply in dry years. Mitigation measures 4.14-1a and 4.14-1b would reduce cumulative impacts of the VIP to less than significant.

Water conservation measures instituted under the City Ordinance would reduce water demand in times of water shortages. To the extent that new development within the City also would be under the use limitations of the ordinance, water demand would be reduced for those new developments as well as for existing users.

Wastewater Treatment

The VIP, together with other refinery projects, would increase the quantity of pollutants and the amount of wastewater processed at the refinery wastewater treatment plant. This would be a less than significant impact due to NPDES discharge limitations.

Mitigation Measures 4.14-1a and 4.14-1b would assure that the impact of the VIP on the quality of the wastewater discharge would be less than significant, and therefore, the contribution of the VIP and other refinery projects to the cumulative impact also would be less than significant.

The VIP, together with other refinery and non-refinery projects within Benicia, could increase the amount of wastewater treated at the City wastewater treatment plant. This cumulative impact would be less than significant because the refinery contribution would be less than significant.

The VIP would not result in a cumulative impact associated with municipal wastewater treatment capacity because the cumulative refinery projects would result in a decrease in flow of the approximately 0.03 million gallons of wastewater per day from the Huntway Asphalt Refinery to the City facility. This would be roughly 1% of the permitted capacity of Benicia's Wastewater Treatment Plant and is not considered a significant cumulative impact.

Solid and Hazardous Waste Disposal

The VIP would increase the refinery's routine disposal of spent catalyst and sludge from the refinery wastewater treatment plant at the Keller Canyon landfill. The VIP contribution to the cumulative waste disposed at the landfill would be less than significant.

Implementation of the proposed project would not result in significant cumulative impacts related to solid or hazardous waste generation and disposal because the proposed project's incremental effect on hazardous waste is considered to be less than significant.

5.3 GROWTH INDUCING IMPACTS

The proposed project would result in the intermittent presence of a construction work force of up to 200 full-time employees during construction of the various VIP components. The temporary addition of a construction work force would not be considered a significant impact, nor would the addition of fewer than 20 full-time permanent employees.

The project would require access to an available construction labor pool. Adequate labor exists in the Bay Area to fill the number of jobs the project would create, and the project would not be required to import labor.

The project would therefore not, directly or indirectly, induce population growth.

California's continuing and rapid population growth has statewide direct and indirect cumulative impacts on population and housing. The effect of the VIP on population growth is indistinguishable from the general mix of factors that lead people to move to California and is not a critical component in such decisions. It has no impact on the rate of growth due to births. Public services (e.g., fire protection, police protection) are at or near their limit in some localities. VIP creates no new demand for those services. As is discussed in Section 5.2, during reduced-water years, operation of the VIP could have a significant adverse impact on public water supply however, with mitigation this impact would be reduced to less than significant.

5.4 EFFECTS FOUND NOT TO BE SIGNIFICANT

The environmental effects of the VIP are identified and discussed in detail in Chapter 4. All identified environmental effects of the project would be less than significant, or less than significant after implementation of the identified mitigation measures. The following topics of analysis in this EIR were found to have no potentially significant effects:

- Agricultural Resources
- Cultural Resources
- Geology, Soils, and Seismicity
- Land Use
- Mineral Resources
- Population and Housing
- Public Services
- Recreation

CHAPTER 6

ALTERNATIVES ANALYSIS

6.1 CEQA AND DEVELOPMENT OF ALTERNATIVES

6.1.1 CEQA REQUIREMENTS

The California Environmental Quality Act (CEQA) requires an Environmental Impact Report (EIR) to describe and evaluate a reasonable range of alternatives to the proposed project.

The purpose of alternatives analysis lies in CEQA's mandate to lessen substantially or to avoid significant environmental damage where feasible. The development of alternatives to the project is one of CEQA's two tools to accomplish this mandate; the other tool is the development of individual mitigation measures for individual impacts of the proposed project. Thus the focus of an alternatives analysis under CEQA is to present feasible project alternatives that could result in fewer significant adverse environmental impacts than would the proposed project.

An EIR must focus on alternatives that either eliminate significant adverse environmental effects or reduce them to a less than significant level. However, these alternatives must be capable of feasibly attaining the project's basic objectives, even if such alternatives would be more costly or would impede the project's objectives to some degree. If the CEQA Lead Agency prefers the project as proposed to one of the suggested alternatives, the agency must explain why it chooses to reject the other alternatives, if they were considered in developing the proposal. If the alternative itself would reduce some impacts but cause other significant impacts, then the EIR also must assess those impacts, but in less detail than for the proposed project.

CEQA guidelines state that the discussion of alternatives need not be exhaustive. The key issue is whether the range of alternatives spans the fundamental ways in which alternatives to the project can be formulated to reduce environmental impacts. With this information, the EIR provides decision-makers and the public with the mitigation measures and the project alternatives available to minimize or avoid those substantial adverse effects that would result from the proposed project. However, an EIR need not consider alternatives for which the effects cannot be reasonably ascertained and for which implementation is remote and speculative.

CEQA also requires an EIR to evaluate a "no project" alternative.

6.1.2 DEVELOPMENT AND SELECTION OF ALTERNATIVES

6.1.2.1 ALTERNATIVES AND PROJECT OBJECTIVES

Alternatives must permit feasible attainment of the proposed project's basic objectives, even if the alternative would be more costly. In this case, Valero's objectives for the VIP, as previously described previously in Section 3.2.1, *Project Objectives*, are as follows:

1. Provide ability to process lower grades of raw materials – crude oils and gas oils.
2. Provide flexibility to substitute raw materials – crude oil instead of gas oil.
3. Optimize operations for efficient production of clean burning fuels.
4. Mitigate any impacts to avoid detrimental impacts on the community.

In addition to alternatives that meet project objectives, the California Environmental Quality Act also requires an EIR to evaluate a "no project" alternative. Although the "no project" alternative might be considered as the existing configuration and operation of the refinery, in fact current projects are underway to complete the conversion of the refinery to manufacture gasoline that uses ethanol, rather than MTBE, as its oxygenate, and to complete the cogeneration facility. Regular major and minor maintenance activities and other minor refinery projects also would be undertaken on an on-going schedule, as well. Thus, the "no project" alternative includes changes and on-going activities needed to keep the refinery in operation. The "no project" alternative is considered and discussed briefly in Section 6.2.1.

CEQA Guidelines require that alternative locations for the project be considered. An alternative site for the project is discussed in Section 6.1.2.2

In alternatives analysis, it is common to consider "reduced project" alternatives, because a reduced project is often reasonably effective in reducing adverse project impacts. This is especially true for those projects for which the significant adverse effects, such as water use or traffic, are proportional to the number of housing units or to the number of square feet in an office or industrial building. Here, by contrast, significant project impacts are tied to specific project components, rather than the scale of the project as a whole. Thus, the alternatives analysis evaluated a range of scenarios under which specific project components and schedules would be altered to eliminate specific impacts that would occur with the VIP.

6.1.2.2 CANDIDATE SCENARIOS

Beginning with the basic concepts discussed above, the following general scenarios were considered: 1) reduced project scenarios, 2) scenarios that limit refinery feedstocks, 3) scenarios that reduce identified significant impacts, and 4) an alternative site scenario. Under these general headings, specific alternative scenarios are presented and discussed below. For each scenario that was eliminated from further consideration, the reasons for doing so are presented here. The scenarios that were carried forward are described and their impacts are discussed in Section 6.2.

Reduced Project Scenarios

Scenario #1: VIP without the Main Stack Scrubber

This scenario considers the implications if the main stack scrubber (the primary air emission abatement device) were not included in the project. Because the main stack scrubber would be the primary control for emissions from the refinery's main stack, other components that send their exhausts to the refinery main stack would be affected. As described in Section 3.5.1, *Schedule*, the Main Stack Components are necessary in order to accomplish fully the first two objectives of the project – that is, they provide the flexibility to utilize lower priced raw materials and to substitute different raw materials as feeds for refinery processes. These Main Stack Components include the Expanded Crude Oil Processing Capacity (Pipestill Modifications), the FCCU Feed Flexibility Modifications, the Coker Expansion, and the Sulfur Removal and Recovery Capacity equipment and, the primary Main Stack Component, the Scrubber, which would be installed to limit the air emissions associated with the other Main Stack Components. The Main Stack Components are described in Sections 3.4.3.1 through 3.4.3.5. The interim VIP operations without the scrubber in place are generally described in Section 3.4.3.5, as well as in other sections of Chapter 3, *Project Description*.

The only way additional crude could be processed at the refinery without a main stack flue gas scrubber would be to compensate by using additional light/sweet raw materials instead of lower grades of raw materials. This would be inconsistent with the first VIP objective. The second and third VIP objectives, to substitute raw materials and to optimize the refinery processes, could be met to some degree without the scrubber.

If additional crude were to be processed without the scrubber in operation, the refinery would still have to meet the Bay Area Air Quality Management District (BAAQMD) condition that historic main stack emission levels would not be exceeded. This would not reduce air emissions or eliminate a significant impact.

Where discernable changes in VIP impacts, such as visual, air quality, noise, and water use, would result from operations without the scrubber, they are described in those sections of Chapter 4, *Setting, Impacts and Mitigations*. These would continue for as long as the main stack flue gas scrubber does not operate.

Sections 3.4.1 and 3.4.3 of the *Project Description* clearly state that some VIP components may not be built. Therefore, it is possible that the scrubber might not be installed. This option is a part of the project definition, and therefore is not considered to be an alternative to the project.

Scenario #2: Project without the VIP Optimizing and Supporting Components

The VIP components other than the Main Stack Components are referred to here as the Optimizing and Supporting Components. Due to the nature of most of these other project components and their relationships to the existing equipment and refinery operations, elimination of many or all these project components would not result in decreases in the refinery's pollutant emissions to the environment. Thus, this variation of a "reduced project" scenario would be of no environmental benefit because, instead of reducing emissions as the VIP would, it would result in no change in emissions. Furthermore, since these are the components that address the VIP's third objective, this scenario could not meet that objective of the VIP and this scenario was rejected as an alternative to the VIP.

Limit Basic Feedstocks Processed at the Refinery

Scenario #3: Limit Basic Raw Materials to be Processed

This alternative could reduce emissions from the refinery during operation. Limiting the sulfur content, as well as the levels of other impurities in the crude feedstocks would offer the refinery the opportunity to process these feeds and make products without concern for exceeding the permitted levels of air emissions.

The essence of this alternative is in the types of operation presented in the project description for interim VIP operations without the scrubber in place. These operations are generally described in Section 3.4.3.5, as well as in other sections of Chapter 3, *Project Description*.

However, this alternative would allow additional crude to be processed at the refinery with fewer emissions only by using additional light/sweet raw materials instead of lower grades of raw materials. This would be the antithesis of the first VIP objective and cannot achieve the goals of the VIP. This appears to be infeasible and is not considered to be an alternative to the project.

Scenarios that Reduce Significant Impacts of the VIP

Significant impacts that were identified for the VIP result from several sources:

- Traffic congestion when VIP construction coincides with any major turnaround.
- Increased use of raw water.
- Potential biological effects due to the construction of new tanks in the crude oil tank farm.

Traffic Impact Reduction Scenarios

To reduce the traffic congestion that could occur when VIP construction coincides with a major turnaround, either of two approaches could be used: 1) construction traffic congestion could be reduced by constructing the VIP at a time other than the 2004 major turnaround (or any major turnaround); and, 2) construction traffic congestion at the affected intersection could be reduced by providing additional Freeway ramp and street access to refinery construction areas. These measures are discussed in more detail below.

Scenario #4A: Construct the VIP at a time other than the 2004 major turnaround.

Construction of the VIP would require that various refinery major process units be shut down to enable critical mechanical equipment to be installed internally and all piping connections to be made. This shutdown of the major process units would itself be a turnaround. As such, this additional turnaround would disrupt the normal orderly sequence of these maintenance activities.

The shift in the time of VIP construction would reduce the traffic impacts of VIP construction at the I-680 off ramps. Although reducing the construction traffic impacts of the VIP, this alternative would not necessarily eliminate the significant construction traffic impacts that would occur during the 2004 major turnaround, even without the VIP. Thus, that significant traffic impact would remain.

With respect to a separate turnaround, the monetary cost of constructing the VIP during a turnaround would be composed of the actual costs incurred plus the cost of providing replacement product for term customers plus the lost income during the shutdown. At this level of detail, it is not possible to precisely predict this total added cost but, historically, Valero notes that the cost of a refinery wide shutdown can be tens of millions of dollars. Because the significant traffic impact during the 2004 turnaround would not be eliminated, and based on the monetary cost of this alternative and the effects on the availability of product in the California market, this scenario would not eliminate the significant traffic impact and also is economically infeasible. It is not considered to be an alternative to the project.

Scenario #4B: Route some construction worker traffic into the refinery via Gate 8.

Although the VIP proposes the most direct route for construction worker traffic, a portion of that traffic could be routed into the refinery via Gate 8, on East 2nd Street, with little impact on refinery activities. This has been done in the past, in cooperation with the City. This alternative is a practical and viable partial alternative, and is discussed in Section 6.2.2, *Some Construction Worker Access Via Gate 8*.

Raw Water Use Reduction Scenarios

To reduce the use of additional water that would result from the addition of the Main Stack Flue Gas Scrubber and other VIP equipment, the following approaches could be taken.

Scenario #5A: Reduce additional water use by eliminating the Main Stack Flue Gas Scrubber

Since the main stack scrubber's water use (150 gallons per minute) would be half of the water that would be consumed by the VIP, were the scrubber not to be built, water use by the rest of the units (assuming that such use would be otherwise unchanged) would be half of that projected for the full VIP. As stated in the Project Description, Sections 3.4.1 and 3.4.3, there is the potential that the scrubber might not be installed; thus, the impacts of the project without the main stack scrubber are described throughout this EIR. However, as explained in Scenario 1, above, elimination of the main stack scrubber would not achieve the project objectives. Therefore, elimination of the Main Stack Flue Gas Scrubber is not considered an alternative to the project.

There are alternative scrubbing processes that could be used in the Main Stack Flue Gas Scrubber. Caustic, lime and sodium phosphate based scrubbing can also be considered for this application. However, they would require as much makeup water, or more, than would be required by the amine process planned for use in the scrubber. The alternative scrubbing processes would not reduce this significant project impact.

As stated in the project description, reuse of municipal wastewater in the refinery cooling towers would be considered when it becomes available, and could offset the water demands of the scrubber and other VIP components. This, however, is not an alternative, because it is considered part of the proposed VIP.

Scenario #5B: Reduce other water use by the VIP by design and/or operational measures

The other uses of water in the VIP are necessary to the operation of the new facilities. The hydrogen production process actually reacts water (in the form of steam) with light hydrocarbons to produce the hydrogen that is used to extract sulfur from the various oil streams — as needed with higher sulfur feedstocks. The Coker modifications would require steam to maintain operation at higher rates. Additional cooling water would be needed in the sulfur recovery process due to the increased amounts of sulfur that would be extracted from the raw materials. This cooling process would utilize reuse water when it becomes available, however, such reuse is not an alternative, because it is considered part of the proposed VIP. Alternatives have not been identified for the other uses of water that also would accomplish the basic project objectives. This scenario is not considered further here.

Scenarios that eliminate potential biological impacts at the crude oil tank farm.

To reduce or eliminate the biological impacts that could occur as a result of the construction of new tanks at the crude oil tank farm, either the new tanks might not be constructed or they might be constructed at alternative locations, such as in the undeveloped areas west of, and on the hills above the process block.

Scenario #6A: The VIP without New Crude Oil Tanks

The potential impacts to biological resources associated with construction in the tank farm area would not occur should the new crude oil tanks not be constructed. The alternative of the VIP without the new crude oil tanks would substantially reduce the refinery’s ability to receive, store and process different crude oils. The resulting inability to segregate and store the various crudes would limit the refinery’s ability to purchase and process these new raw materials. This would prevent Valero from achieving the first VIP objective. It is not considered a viable alternative to the project.

Scenario #6B: Relocate the New Crude Oil Tanks outside of the Crude Oil Tank Farm

The potential biological impacts would not occur if the new tanks were not constructed in the crude oil tank farm, but were constructed in an area that is not potentially sensitive habitat. The alternative of relocating the new crude oil tanks to other locations, such as in the undeveloped areas west of, and on the hills above the process block would eliminate the potential biological impacts identified for the VIP as proposed.

Constructing new tanks in these areas would involve all of the activities of constructing a new tank farm. Since bermed containment areas are required around these tanks, significant grading would be needed to create the necessary level areas, within which the berms and tanks could be built. Also, new interconnecting piping runs would have to be built to connect the new tanks to the process block area. This alternative would involve construction of the tanks in an area that is now considered a buffer area for the refinery. Locating these tanks, piping and containment areas closer to residential areas increases the visible presence of the refinery for some community residents and may increase their safety concerns. This alternative is considered further in Section 6.2.3, *Place New Tanks In New Crude Oil Tank Farm*.

Alternative Project Site Scenarios

Due to the nature of the VIP, as a collection of new components and modifications to existing process units at the refinery, there are several alternate site issues.

Scenario #7A: Alternate Locations for VIP Components

Modifications to the internals of existing components must be made at the locations of those existing components. Auxiliary equipment to serve existing process components must generally be very close by, as well. The refinery's flexibility to locate the individual components at alternate locations that are relatively close to the process units they serve is a necessary part of the VIP, as described in Sections 3.4.1, *Introduction*, and 3.4.3, *The VIP Components*, however this flexibility to move the components is strictly limited by engineering and operating constraints. Although retaining flexibility in the locations of the individual components, the VIP proposes to construct all components entirely within the existing refinery footprint, so the VIP would not result in development of new or previously undisturbed areas of the refinery[1].

Scenario #7B: Alternate Location for the VIP as a Whole

It is clearly infeasible to consider an alternative location for the VIP as a whole, since the VIP, as a collection of components and modifications, is not a stand-alone project. Relocation of the VIP to another site would result in construction of a new refinery at that new site, a greatly larger project than the VIP and entailing a new set of environmental impacts related to that new site. This alternative is infeasible and is not considered further here.

1 An example of a component that might be moved a relatively substantial distance is the new crude oil tanks; that alternative site issue is discussed in Scenario 6B, above.

6.2 ALTERNATIVES TO THE PROJECT

6.2.1 NO PROJECT ALTERNATIVE

The “No Project” alternative would be the result of the changes in the existing Valero Refinery configuration and operation due to projects that currently are underway to complete the conversion to ethanol, rather than MTBE, as the oxygenate in gasoline, to complete and begin operation of one or both 51 MW units of the two-unit cogeneration facility and to complete and begin operation of the other cumulative projects at the refinery. By necessity, the refinery’s regular major and minor maintenance activities also must continue to occur on an on-going schedule, as well. As a result, the “no project” alternative includes those changes, as well as the on-going activities needed to keep the refinery in operation into the immediate future.

The “No Project” alternative will not allow Valero to meet the first two of its four VIP objectives.

The following summarizes potential impacts of the “No Project” alternative and compares them to the impacts of the VIP:

Aesthetics, Visual Quality, Light and Glare

Aside from construction of the remaining on-going and cumulative projects, no new structures would be built. The visible changes would be due to the construction and operation of those on-going and cumulative projects. Otherwise, the impacts of the No Project would be essentially similar to, although of lesser magnitude than, the impacts of the VIP.

Air Quality

No change in air emissions, other than those changes due to emissions from the on-going and cumulative projects. Criteria pollutant emissions levels from the refinery main stack would remain at or below current emission limits, as described in Section 4.2, *Air Quality*, but emissions of SO_2, at current levels, would remain substantially higher than those that would occur with the VIP’s Main Stack Flue Gas Scrubber in operation.

The No Project would eliminate the increases in ship traffic that would be part of the VIP, so those added ship exhaust emissions would not occur. As the importation of MTBE by ship also will cease when the conversion to methanol is complete, those ship emissions also would cease.

Biological Resources

No construction would occur in the Crude Tank Farm. As with the VIP, NPDES permit revision would control runoff and wastewater effluent discharge to Suisun Bay. Wastewater treatment modifications could be required by the conditions of the revised NPDES permit that is now being revised, independent of the VIP. Otherwise, impacts of the No Project would be essentially the same as VIP impacts.

Cultural Resources

The impacts would be essentially the same as VIP impacts.

Energy

No change in operations or in energy use. The cogeneration project would be put into service, with the first unit expected to be in operation by the end of 2002, while there is no projected date for construction of the second unit. Under the No Project alternative, the refinery would use less total energy than it would under the VIP.

Geology, Soils, and Seismicity

Other than the on-going and cumulative projects, no construction would occur under the No Project, as opposed to construction under the VIP. No change in geologic conditions would occur. The impacts would be essentially the same as VIP impacts.

Public Health

The impacts would be essentially the same as VIP impacts.

Public Safety

The impacts would be essentially the same as VIP impacts.

Hydrology and Water Quality

The impacts would be essentially the same as VIP impacts.

Land Use, Plans and Policies

The impacts would be essentially the same as VIP impacts.

Noise

Start up and operation of the Cogeneration facility will increase noise levels over the existing levels. Otherwise, essentially no change would occur. The impacts of the No Project would be less than the impacts of the VIP.

Public Services

The impacts would be essentially the same as VIP impacts.

Transportation

No change. Refinery turnarounds would continue under the No Project, as with the VIP. Traffic impacts of the turnarounds would dominate the traffic effects of VIP construction and the differences in traffic impacts between the No Project alternative and the VIP would be minor.

Utilities and Service Systems

Raw water use at the refinery would not increase under the No Project alternative, except for increases in water use due to the Cogeneration project. The refinery probably would continue to pursue the development of reuse water or it may elect to develop water use reductions to offset that additional water use; one or other of these actions is a condition of the Energy Commission approval of the Cogeneration project.

6.2.2 SOME CONSTRUCTION WORKER ACCESS VIA GATE 8.

A significant traffic impact would occur when the worker traffic from the VIP construction work force combines with the workforce of the 2004 major turnaround. The VIP workers would represent about 10% of the total workforce present during the turnaround, and the significant traffic impact would occur during the turnaround whether the VIP were under construction or not.

Although the VIP proposes the most direct route for construction worker traffic access to the refinery, a portion of that worker traffic could be routed into the refinery by proceeding along I-780, exiting at the East 2nd Street off ramp, or by exiting I-680 at Lake Herman Road to Second Street, and then proceeding to refinery Gate 8 to access the construction sites. This access could occur with little impact on refinery activities, which involve access and egress through Gate 8. This gate has been used by construction workers in the past, in cooperation with the City.

This alternative is practical and viable, and given the limited actual difference between this alternative and the VIP, also could be considered as a supplement or an alternative to mitigation measure 4.13-3, which is included in Section 4.13, *Traffic and Transportation*.

This alternative would allow Valero to meet all of its four VIP objectives.

The potential impacts of the Gate 8 alternative would be the same as the impacts of the VIP in every respect except for the construction worker traffic that would be directed to the East 2nd Street offramps of I –780 and I-680 and then to refinery Gate 8. This diversion of construction traffic may or may not be sufficient by itself to improve the level of service at the I-680/Bayshore offramp to above LOS F. It would have to be determined whether the amount of traffic that would have to be diverted to the East 2nd Street offramps could actually be served by those offramps without causing a significant adverse impact at the 2nd Street intersection with the ramps. The East 2nd Street ramps from I-780 presently are at LOS B and LOS C, with a morning peak hour LOS E at the eastbound onramp. Thus, a review of actual traffic levels and consultation with the City would be required to determine the quantity of construction worker traffic that can be served at these ramps and on East 2nd Street during the turnaround.

6.2.3 PLACE NEW TANKS IN A NEW CRUDE OIL TANK FARM

The potential biological impacts described in Section 4.3, *Biological Resources*, would not occur if the new tanks were not constructed in the crude oil tank farm. The alternative of relocating the new crude oil tanks to other locations, such as in the undeveloped areas west of, and on the hills above the process block would eliminate these potential biological impacts that were identified for the VIP as proposed.

Constructing new tanks in these areas would involve all of the activities of constructing a new tank farm. Since bermed containment areas are required around these tanks, significant grading would be needed to create the necessary level containment area, within which the berms and tanks could be built. Also, new interconnecting piping runs would have to be built to connect the new tanks to the docks and also to the process block area.

This alternative would involve construction of the tanks in an area that is now considered a buffer area for the refinery. Compared to the VIP, this alternative would involve additional construction related activities, which include substantial grading for the tanks' new containment area and berms and the construction of an access road, new pipeways, pipelines and associated equipment to support this new crude oil tank farm, and would result in the operation of a new tank farm in what is now a refinery buffer area. No substantive operating differences between this alternative and the VIP would be anticipated.

This alternative would allow Valero to meet all of its four VIP objectives.

The potential impacts of this alternative are described below:

Aesthetics, Visual Quality, Light and Glare

The construction of new crude oil tanks would result in a second crude oil tank farm located in an area now considered to be a part of the buffer area between the refinery and the residents to the west or south. The new tanks, containment areas, berms, access road and piping runs would be visible from some or all of the key locations discussed in Section 4.1, *Aesthetics, Visual Quality, Light and Glare*, as well as possibly from some other residential areas.

Other light and glare impacts of the New Tank Farm Alternative would be essentially the same as the impacts of the VIP.

Air Quality

There would be no difference between the air quality impacts of this alternative and the VIP.

Biological Resources

No construction would occur in the existing Crude Tank Farm. Construction impacts that might occur in the existing tank farm area with the VIP would be replaced by other, presumably lesser biological impacts that would accompany construction of the new tanks in a new crude oil tank farm.

All other impacts of this alternative would be essentially the same as those of the VIP.

Cultural Resources

The impacts would be essentially the same as VIP impacts.

Energy

More energy would be used to construct the tanks in the new location, because there would be added grading to level the site and construct the containment berms. All other impacts of this alternative would be the same as those of the VIP.

Geology, Soils, and Seismicity

The Geology, Soils, and Seismicity impacts will depend upon the existing conditions of the new tank farm site. Site selection would identify the adverse conditions on candidate sites and choose a site for which those any adverse conditions could be mitigated through geotechnical studies and specific corrective measures. Other impacts would be essentially the same as those of the VIP.

Public Health

Placement of the new crude oil tanks closer to residents would not increase the risk to public health. The crude oil that would be contained in the tanks would present a very small health risk to residents. The impacts of this alternative would be essentially the same as those of the VIP.

Public Safety

Locating the new crude oil tanks closer to residents would not increase the risk to public safety. The crude oil in the tanks presents little safety risk to the public. The impacts of this alternative would be essentially the same as those of the VIP.

Hydrology and Water Quality

Runoff water from the new tank farm area would be controlled according to the requirements of the NPDES permit, so would have no effect on the quality of the water runoff. The quantity of runoff would not increase, although it may occur at a rate different than from the undeveloped site. The impacts of this alternative would be essentially the same as those of the VIP.

Land Use, Plans and Policies

The impacts of this alternative would be essentially the same as those of the VIP.

Noise

The impacts of this alternative would be essentially the same as those of the VIP.

Public Services

The impacts of this alternative would be essentially the same as those of the VIP.

Transportation

The impacts of this alternative would be essentially the same as those of the VIP.

Utilities and Service Systems

The impacts of this alternative would be essentially the same as those of the VIP.

6.2.4 PROJECT AT AN ALTERNATE SITE

The “alternate site” alternative for the VIP as a whole is not considered here. An alternate site could require construction of an entire new refinery, which would be a greatly larger project than the VIP and would result in new environmental impacts related to the specific site. On the other hand, the proposed VIP would result in development only within the existing refinery footprint, and would not result in development in new or previously undisturbed areas within the existing refinery footprint.

CHAPTER 7
REPORT PREPARATION

7.1 REPORT AUTHORS

7.1.1 LEAD AGENCY

City of Benicia Community Development Department

Lamont Thompson, Project Coordinator
Colette Meunier, Community Development Director

7.1.2 CONSULTANTS

Kitty Hammer – Consultant Project Manager

Environmental Science Associates

Dail B. Miller – Project Director
Chuck Bennett – Project Manger, Project Description, Alternatives, Cumulative Impacts
Tim Morgan – Deputy Project Manager, Air Quality, Website
Micah Rapoport – Geology and Soils, Hydrology and Water Quality
Marie Galvin - Water Supply
Peter Hudson, R.G. –Geology and Soils, Hydrology and Water Quality
Jyothi Iyer – Air Quality, Noise
Michael Jacinto – Aesthetics, Land Use, Public Services, Utilities and Service Systems
Gus JaFolla – Administrative, Word Processing, and Report Production
Tom Roberts – Biological Resources
Phil Rieger, Ph.D. – Biological Resources (Fisheries)
Dean Martorana – Cultural Resources
Dennis Pascua –Traffic and Transportation
Jan Mulder – Energy
Ron Teitel – Graphics
Robert Vranka, Ph.D. – Public Health, Public Safety, Risk of Upsets
Matt Zidar – Water Supply

Sampson Engineering, Inc. / ATI

Dave Powell – Senior Engineer, Project Description, Alternatives, Cumulative, Public Safety, Risk of Upsets

Cassidy, Shimko, and Dawson

Anna Shimko, Esq. – CEQA Legal Issues

7.2 AGENCIES AND PERSONS CONTACTED

The Notice of Preparation and Initial Study, published on April 26, 2002, for the Draft Environmental Impact Report was provided to the following agencies/departments for review and comment:

Bay Area Air Quality Management District
Bay Conservation and Development Commission
The Bay Institute
California Air Resources Board
California Department of Conservation
California Department of Fish and Game
California Energy Commission
California Highway Patrol
Caltrans - Transportation Planning
Caltrans, District 4
Communities for a Better Environment
Contra Costa County - Community Development Department
Environmental Defense Fund
City of Fairfield - Planning, Zoning and Development
City of Martinez - Community Development Department
Regional Water Quality Control Board - San Francisco Bay Region
Sierra Club – San Francisco Office
Solano County - Department of Environmental Management
Solano Transportation Authority
Southeast Alliance for Environmental Justice
State Clearinghouse
State Lands Commission
City of Vallejo - Department of Development Services
Water Resources Control Board
WaterKeepers Northern California

The City also mailed copies of the Notice of Preparation without the Initial Study to owners of property within 500 feet of the Valero property boundaries. The process area with its surrounding undeveloped buffer, the Valero wastewater plant and the Valero dock were included for purposes of developing the mailing list. The list included well over 500 property owners.

In addition to the above mailings, the following individuals were consulted a number of times during preparation of the Draft Environmental Impact Report: Robert Schlipf of the San Francisco Regional Water Quality Control Board and Steve Hill and Doug Hall of the Bay Area Air Quality Management District.

Two scoping meetings were held as well. The first was held with a joint meeting of the City of Benicia City Council and the Planning Commission on May 22, 2002. The second was held on May 29, 2002. Comments received during these scoping meetings were considered during preparation of the Draft Environmental Impact Report.

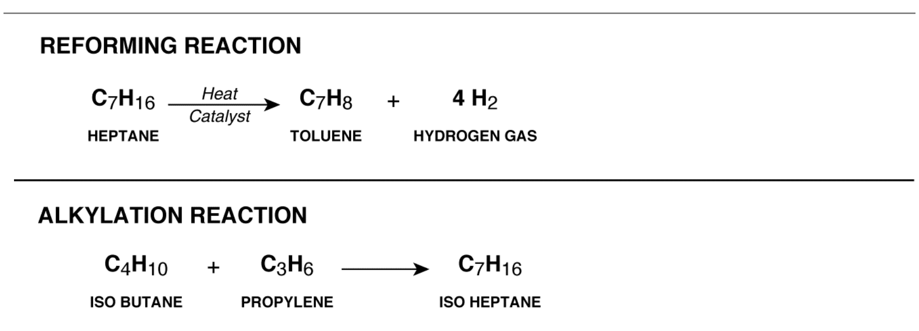
CHAPTER 8

GLOSSARY AND ACRONYMS

8.1 GLOSSARY

A number of technical terms are used in the refining industry and at the Valero Refinery to describe the operations and equipment that are in use there. This glossary includes selected definitions and in some cases expanded descriptions of these terms that allow the reader of this document who is unfamiliar with the refining industry to understand the basic operations within a refinery. In addition, these expanded descriptions also present how these processes specifically take place at the Valero refinery.

Alkylate	A high octane component that is blended with reformate and other gasoline component streams to make finished gasoline.
Alkylation	Alkylation is a reforming or chemical transformation process in which the olefins that are produced in the Fluid Catalytic Cracking Unit (FCCU) are reacted with isobutane in the presence of an acid catalyst to produce alkylate, which is a gasoline component with a high octane rating (see Figure 8-1, *Catalytic Reforming Reactions*). At the refinery, the alkylate manufactured in the Alkylation Unit is used to remove olefins that are produced in the FCCU but are too light for blending in gasoline and to upgrade the octane rating of gasoline produced at the refinery.



Valero Improvement Project EIR / 202115 ■

Figure 8-1

Catalytic Reforming Reactions

Barrel	A volume of 42 gallons.
C5	Hydrocarbons with five carbon atoms. Refers to mixed pentane (C5) streams or fractions.
Catalyst	In classical chemistry terms, a catalyst promotes a chemical reaction without itself being consumed in the reaction. A catalyst accelerates a chemical reaction so it will proceed at a reasonable rate at lower temperatures and pressures than the reaction would without a catalyst. Typically, refinery catalysts are round or cylindrical in shape and are materials called zeolites, or alumina, or are silica or elemental carbon, called coke. These catalysts deteriorate over time and require replacement when their activity drops below a specified level. At the refinery, Valero uses catalysts in hydrofiners, fluidized catalytic crackers, reformers, and processes that transform the molecular structure of some of the petroleum feed to compounds with better economic value.
Catalytic Cracking	Most hydrocarbon molecules are not easy to crack without applying high heat and pressure. In addition to high temperatures, high pressures -- as great as 150 to 200 times atmospheric pressure -- are required to crack many hydrocarbon molecules. Catalytic (cat) cracking uses heat and pressure in the presence of a catalyst to crack larger hydrocarbon molecules. The catalyst allows cracking to occur at only about 2 times atmospheric pressure, making the process easier to control and the reaction vessel less expensive to build. At the refinery, Valero uses the catalytic cracking in several major process units, including the FCCU, Coker and Hydrocracker, to convert heavy feedstocks into lighter output streams.
Catalytic Reformer	Catalytic reforming changes paraffins, which have low octane numbers, into naphthenes, isoparaffins, and aromatics, all of which have much higher octane numbers (the higher the octane number, the more valuable is the compound). Reforming removes hydrogen atoms from the feedstock's hydrocarbon molecules and creates more carbon-to-carbon bonds in the hydrocarbon compounds that result. See Figure 8-1, *Catalytic Reforming Reactions*, for examples of these catalytic reactions. At the refinery, the Catalytic Reformer is used to reduce the paraffin content in feeds from the Naphtha Hydrofiner and from the Hydrocracker and to upgrade the octane rating of gasoline produced at the refinery.
Caustic	The caustic used in most proposed processes is sodium hydroxide (NaOH)
CO	Carbon monoxide, a toxic gas generated by incomplete combustion.
Coker	The largest and heaviest hydrocarbon molecules in crude oil end up in the pipestill's heaviest fraction, the bottom cut, and called pitch. Pitch is the feedstock for a cracking process that takes place in the fluid Coker. In the Coker, these large hydrocarbon molecules are transformed into naphthas and into coke, which is a solid composed primarily of carbon. The coke is separated from the naphthenes inside the Coker vessel as a solid and is sold. At the refinery, Valero uses the Fluid Coker to convert the heaviest feedstock into lighter output streams that are more suitable for use in

gasoline. All of the fluid output streams from the Coker require further processing; the coke, a solid, is sold for use as an industrial fuel.

Cracking Cracking is used to produce more gasoline from each barrel of crude oil. The lower, heavier cuts or fractions from the Pipestill and the gas oils that are purchased as feedstocks consist of large, heavy hydrocarbon molecules, which are too large to have the desired properties. However, when hydrocarbons are heated to about 900°F they begin to break, or crack, into smaller molecules. Cracking converts some of the larger molecules of heavy oils into shorter-chained molecules, such as naphthenes, and ring-shaped molecules, such as aromatics (see Figure 8-2, *Cracking Reactions*). Both naphthenes and aromatics are desirable components of gasoline.

At the refinery, Valero uses the cracking in several major process units, including the Fluidized Catalytic Cracker Unit (FCCU), the Coker and the Hydrocracker, to convert heavy feedstocks into lighter output streams.

CRACKING REACTION

$$\underbrace{H_{15}C_7 - C_{15}H_{30} - C_7H_{15}}_{\text{HEAVY GAS OIL}} \xrightarrow[\text{Catalyst}]{\text{Heat}} \underbrace{C_7H_{16} + C_7H_{14}}_{\text{GASOLINE BLEND}} + \underbrace{C_{15}H_{30}}_{\text{RECYCLE}}$$

HYDROCRACKING REACTION

$$\underbrace{H_{15}C_7 - C_{15}H_{30} - C_7H_{15}}_{\text{HEAVY GAS OIL}} + \underbrace{H_2}_{\text{HYDROGEN GAS}} \xrightarrow{\text{Heat}} \underbrace{C_7H_{16} + C_7H_{16}}_{\text{GASOLINE BLEND}} + \underbrace{C_7H_{30}}_{\text{RECYCLE}}$$

Valero Improvement Project EIR / 202115 ■

Figure 8-2
Cracking Reactions

Criteria Air Pollutant An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set. Examples include: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM-10 and PM-2.5.

Crude oil Crude oil is the term used for the naturally occurring petroleum mixtures that are pumped from wells and then delivered to the refinery by tank ship and pipeline. Crude oil is the basic petroleum feedstock that is processed at the refinery. Crude oil contains many different hydrocarbon molecules representing many potential products such as propane, butane, gasoline, jet fuel, diesel oil, fuel oil, wax, and asphalt. Because crude oil is a natural product, there is a wide variation in its characteristics depending mostly on the wells from which it is obtained. Crude oils usually contain some sulfur; crudes that contain low percentages of sulfur, 0.5% or less, are called “sweet” crudes, while crudes that contain high percentages of sulfur, 2.5% or more, are called “sour” crudes. Crudes with sulfur percentages in between are called “intermediate”. Crude oils also may contain other organic compounds that include nitrogen and metals, along with inorganic salts and water, again, depending on the origin of the crude oil.

Crude oil consists mainly of hydrocarbons, chemical compounds made up of hydrogen and carbon atoms that are combined into molecules of different sizes, shapes, and configurations. The smallest hydrocarbon molecules, with only a few atoms of hydrogen and carbon, such as methane and propane, are gases under normal conditions, while somewhat larger hydrocarbon molecules, such as gasoline and diesel, are liquids and very large hydrocarbon molecules, such as asphalt and tar, are solids. These basic physical properties result mainly from the number of carbon atoms in each compound and give the crude the name “light” or “heavy”, depending on the fractions of lighter and heavier hydrocarbons in the crude oil.

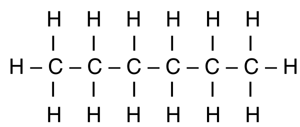
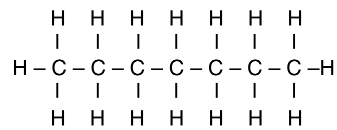
However, in addition to the differences in the numbers of atoms in the hydrocarbons, there also are differences in the chemical structures or arrangements of the carbon and hydrogen atoms in hydrocarbon molecules. These differences in chemical structure result in differing chemical properties among hydrocarbons that contain the same number of carbon atoms. In processing a crude oil into useful products, the refinery must accommodate the physical and chemical properties of those hydrocarbon compounds that occur in the crude oil that will be the primary feedstock. Four classes of hydrocarbons are important indicators of the amounts of useful products that can be made from a specific crude oil. These four classes of hydrocarbons, called paraffins, olefins, naphthenes, and aromatics, have differing chemical structures and properties, some desirable and some undesirable. Examples of the chemical structures of each of these hydrocarbon classes are shown in Figure 8-3, *Chemical Structures of 4 Hydrocarbon Classes.*

Crude oil does not naturally contain a very large volume of high-demand fuel products such as gasoline, diesel, or jet fuel. Typically, a barrel of crude oil may contain 20% or less of the hydrocarbon molecules that make up gasoline. Demand for petroleum products has resulted in the development of methods to chemically rearrange the hydrocarbon molecules in crude oil to produce more fuel, particularly gasoline, from each barrel of crude oil.

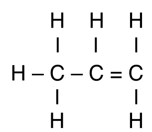
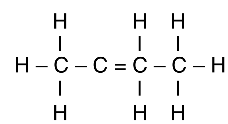
Considering all of this, a refinery must be configured to process, in an optimal way, the composition of the specific crude oil or oils that is in the primary feedstocks. The refinery must be able to process the specific “weight” of crude, given its content of paraffins, olefins, naphthenes, and aromatics, and must be able to process and remove the impurities such as sulfur, nitrogen, metals and inorganic salts.

At the refinery, Valero now uses primarily Alaskan crude oil (a light, sweet crude) and San Joaquin Valley crude oil (a heavier, intermediate sour crude oil). Valero proposes to develop the capability to economically process additional heavy crudes and crudes with more sulfur on average than those processed at the refinery since 1970.

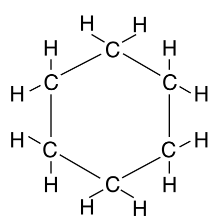
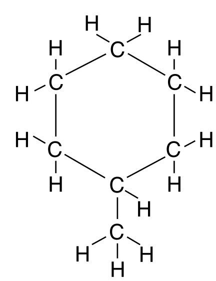
PARAFINS - SATURATED CARBON - CARBON BONDS

NAME	HEXANE	HEPTANE
FORMULA	C_6H_{14}	C_7H_{16}
STRUCTURE		

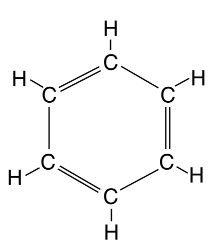
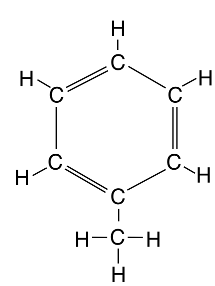
OLEFINS - UNSATURATED CARBON - CARBON BONDS

NAME	PROPYLENE	BUTYLENE
FORMULA	C_3H_6	C_4H_8
STRUCTURE		

NAPHTENES - CYCLICAL CARBON MOLECULES

NAME	CYCLOHEXANE	METHYL CYLOHEXANE
FORMULA	C_6H_{12}	C_7H_{14}
STRUCTURE		

AROMATICS - CYCLIC CARBON MOLECULES WITH RESONATING DOUBLE BONDS

NAME	BENZENE	TOLUENE
FORMULA	C_6H_6	C_7H_8
STRUCTURE		

SOURCE: Austin, Shrevés Chemical Process Industries, McGraw Hill 1984

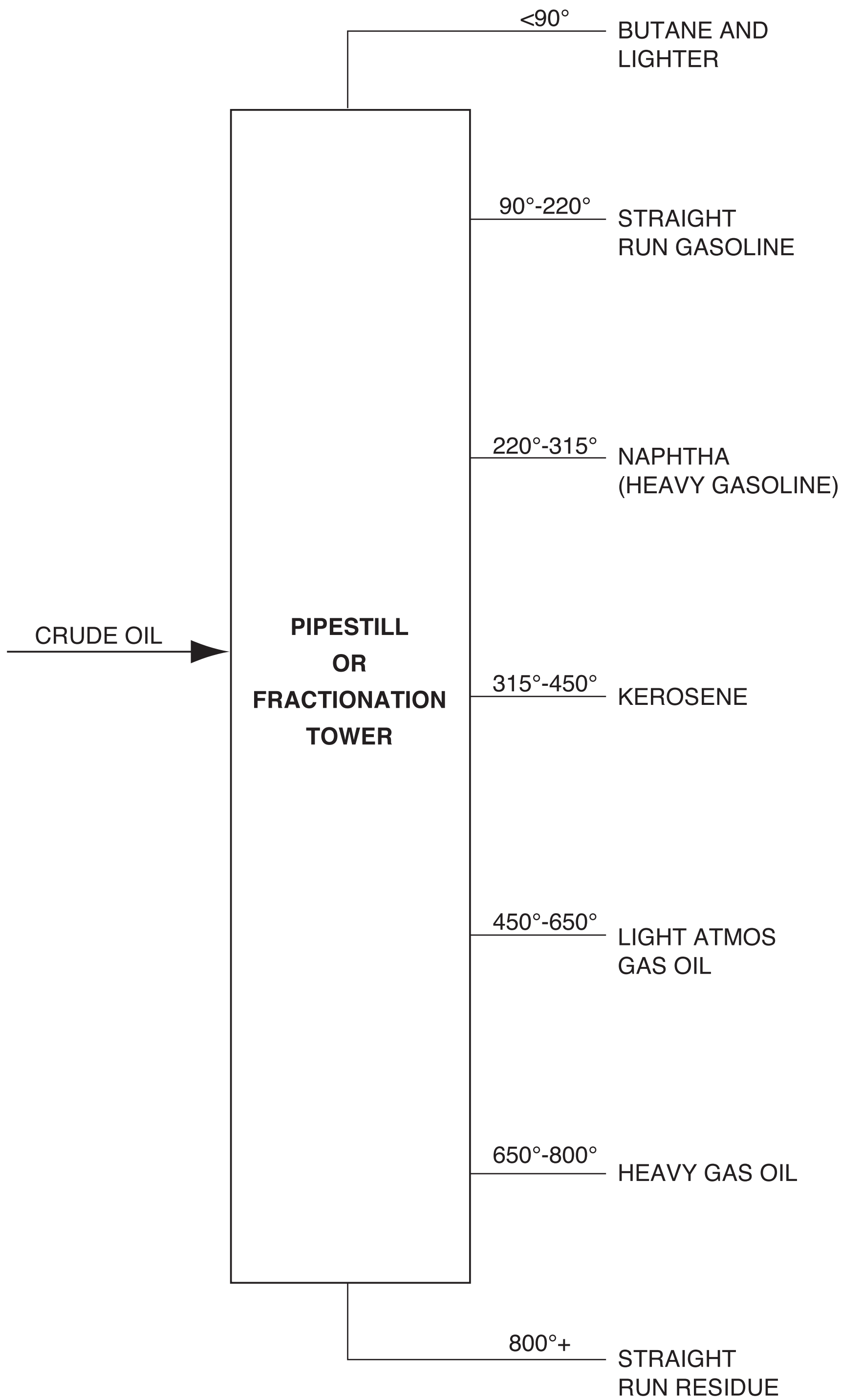
Figure 8-3
Chemical Structure of 4 Hydrocarbon Classes

Dimersol	The Dimersol process is a reforming or chemical transformation process in which olefins are reacted with propylene in the presence of a catalyst to reduce the olefin content of the feedstock and to produce isohexane, which is a high-octane gasoline blending material (see Figure 8-1). At the refinery, the Dimersol Unit is used to convert olefins that are produced in the FCCU but are too light for blending in gasoline, and to upgrade the octane rating of gasoline.
Distillation	The process of separating each of the chemical hydrocarbon compounds (fractions) in the crude oil mixture by heating the mixture.
Feedstock	The term “feedstock” (also called a “feed”) is commonly used to denote the fluid material that is fed into a refinery process unit. For example, crude oil is a feedstock for the Pipestill. In a similar vein, the term “stream” refers to the feedstock and also can refer to the output of the process.
Flare System	Upsets occur in refinery processes. When such upsets occur, they can create excess pressure in a pipe, vessel or process unit. To make the refinery operationally safe, such over pressurization is released into a system of pipes that collect the material and direct it to the refinery flares, tall stacks where these excess gases are burned prior to release into the atmosphere. Flares have been developed so that the light created when hydrocarbons burn is only slightly visible or not visible, however, some larger upsets can result in flaring that is quite visible. At the refinery, Valero has two flare stacks connected to each other by pipework that circles units in the main processing area.
Fraction	The temperature range where a hydrocarbon fraction changes from a liquid to a vapor or from a vapor to a liquid. Examples of crude oil fractions, in order of the increasing number of carbon atoms, are: light ends; butanes; gasoline; naphtha; kerosene; gas oil; and residue.
Fractionation	Fractionation is a special form of distillation where several output streams of similar boiling point ranges are separated from hydrocarbon mixtures. In the fractionation process, the feedstock is introduced into the fractionation column and vaporized by heating. As the hydrocarbon vapors rise, they reach progressively cooler regions of the column and they eventually condense to liquids on horizontal trays inside the column. Each hydrocarbon fraction, or “cut”, is collected from a tray positioned at the height (and temperature) in the column where that particular vapor condenses into a liquid. Each cut condenses within a specific temperature range, and therefore at a specific height in the column. Each of the cuts from the column is then sent to storage tanks or is sent to other units for further processing. At the refinery: Fractionation towers are parts of many of the refinery process units, and are used to separate the output streams for further processing or handling.

Furnaces	Furnaces provide the heat sources needed in the refinery to carry out the distillation or fractionation processes and to provide the energy for cracking large hydrocarbon molecules, driving catalytic reactions to form desirable hydrocarbons, or eliminating undesirable compounds from feed streams. At the refinery, furnaces are integral parts of most refinery processes. Reforming and cracking depend on heat supplied by the furnaces, and fractionation processes rely on furnaces for direct heating of the feedstocks.
Gas Oil	Gas Oil is a material that has been processed in a refinery and is one of the heavier fractions resulting from the initial distillation and separation of crude oil.
Hydrocracker	The hydrocracker is another process unit that cracks large hydrocarbon molecules to gasoline blending stock. Simply put, hydrocracking is catalytic cracking with hydrogen gas added. Heat and a pressure of 100 to 200 atmospheres is required to break the large hydrocarbon molecules in the feed streams into smaller molecules. At the refinery, Valero uses the Hydrocracker to convert heavy feedstocks into light output streams that are more suitable for use in gasoline. The lighter output stream, light hydrocrackate, can be used as a gasoline blending stock, while the other output stream requires further processing.
Hydrofining	Hydrofining, also called hydrotreating, is a process used primarily to control the sulfur content of a feedstock or stream. In hydrofining, hydrogen is added to the petroleum stream with heat in the presence of a desulfurizing catalyst either to create a separable sulfur compound or to capture the sulfur on the surface of the catalyst. Hydrofining also removes some of the nitrogen compounds in the hydrocarbon feeds by converting them to ammonia. At the refinery, each of the hydrofiner units is named for the petroleum stream that is treated in that unit. For example, the Naphtha Hydrofiner removes sulfur from the Naphtha stream and the Jet Fuel Hydrofiner removes sulfur from jet fuel. Other hydrofiners at the refinery are the Diesel Hydrofiner, the Cat (Catalytic Cracker) Feed Hydrofiner, the Light Cat Naphtha Hydrofiner and the Heavy Naphtha Hydrofiner.
Hydrogen Production and Use	Hydrogen gas is generated in several ways in a refinery. Hydrogen is produced primarily in a Catalytic Reformer, where natural gas is reacted with steam to release hydrogen gas. Hydrogen gas also is released from liquid hydrocarbons as a part of the processes that occur in the various process reformers (see Reforming, below). Hydrogen also can be recovered from streams of hydrogen-rich gas that occur in other process units, such as the Hydrofining Units. Large amounts of hydrogen are consumed in the refinery for changing the configuration of the chemical bonds in some molecules or in processes that convert sulfur-containing and nitrogen-containing compounds to gases that can be separated easily from the hydrocarbon molecules. These processes include Hydrocracking and Hydrofining. At the refinery, Valero has two methods of producing Hydrogen gas called Hydrogen trains. Each train includes equipment to distribute the hydrogen for use in various refinery processes. At present, hydrogen present in the

	tail gas of the Hydrofining Unit is not recovered and is burned. Valero plans to increase hydrogen production by adding a Pressure Swing Absorber to separate relatively pure hydrogen gas from the tail gas of the hydrofiners. Also, the existing hydrogen trains will be maximized by replacing the CO_2 fluid with a more efficient fluid.
Hydrotreater	Removes sulfur, as H_2S, and nitrogen from gas oils.
Main Exhaust Stack	Exhausts from several refinery processes are piped to and then released to the atmosphere through a tall exhaust stack. The stack is tall enough to allow the pollutants that are released to be mixed with the air, so that pollutant concentrations in the exhaust and on the ground satisfy all regulatory requirements. At the refinery, Valero has one main exhaust stack, which collects the exhausts from the Pipestill, FCCU and the Coker, as well as certain other equipment. To insure compliance with Bay Area Air Quality Management District (BAAQMD) permits and regulations, Valero maintains continuous emission monitoring instruments to measure the concentrations of sulfur dioxide and nitrogen dioxide in the exhaust that is emitted from the main stack.
Mercaptan	An odorous hydrocarbon compound that contains sulfur.
Naphtha	Naphtha is an intermediate stream of Gasoline and Diesel boiling in the same boiling range as gasoline.
Nitric Oxide (NO)	Precursor of ozone, NO_2, and nitrate; nitric oxide is usually emitted from combustion processes. Nitric oxide is converted to nitrogen dioxide (NO_2) in the atmosphere, and then becomes involved in the photochemical processes and/or particulate formation. (See Nitrogen Oxides.)
Nitrogen Oxides (NOx)	A general term pertaining to compounds of nitric oxide (NO), nitrogen dioxide (NO_2), and other oxides of nitrogen. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition. NO_2 is a criteria air pollutant, and may result in numerous adverse health effects. NOx nitrogen oxides (a general designation including nitrogen dioxide and nitrogen trioxide).
Olefins	A class of unsaturated hydrocarbons having the general formula C_nH_{2n}.
Pipestill	The Pipestill represents the first step in the crude oil refining process. The pipestill distills and separates fractions of the crude oil petroleum mixture. This process of separating components of mixtures is called fractionation or fractional distillation. To make the separations, the pipestill utilizes the physical property that different hydrocarbon compounds boil at different temperatures according roughly to the number of carbon atoms in the molecule. For example, smaller hydrocarbon molecules, such as methane and propane, are gases at ambient temperatures and pressures, and have very low boiling points. Gasoline, a mixture of compounds with 6 to 10 carbon atoms, boils at temperatures between approximately 150°F and 350°F. (°F is degrees Fahrenheit; for reference, water boils at 212°F). At the other extreme, heavy oils with large molecules have to be heated to 600°F or higher to turn them into gases at atmospheric pressure. Under reduced pressure, termed a “vacuum”, all of these molecules vaporize at

	lower temperatures, but the primary advantage of vacuum distillation is in the fractionation of the larger heavier molecules, which can be fractionated at lower temperatures. In the fractionation process, the crude oil is fed into the distillation column and vaporized by the reboiler of the Pipestill. As the hydrocarbon vapors rise, they reach progressively cooler regions of the pipestill and they eventually condense to liquids on horizontal trays inside the column. Each hydrocarbon fraction, or "cut", is collected from a tray positioned at the height in the Pipestill where that particular vapor condenses into a liquid. Each cut condenses within a specific temperature range. Figure 8-4 shows a typical range of hydrocarbon fractions, or cuts, and the boiling points the refining industry typically uses to define these cuts for the pipestill unit, the first fractional distillation unit in which crude oil is processed. Each of the cuts from the pipestill is then sent to storage tanks or is sent to other units for further processing. At the refinery, Valero has an atmosphere and a vacuum pipestill.
Pitch	The residual material from the vacuum distillation column of the pipestill
Reforming	Reforming modifies the chemical structure of the feedstock hydrocarbons into more valuable hydrocarbon compounds. Reformers use a special catalyst to create aromatics and other cyclical hydrocarbon molecules from naphthenes in the streams fed into the reformer. The aromatics and other cyclical hydrocarbons perform better in cars and have higher economic value than the straight-chain molecules from which they are made. As a by-product, reformers also make hydrogen gas. At the refinery, Valero uses reformers to provide a gasoline blending stock and make hydrogen gas. Three different reforming processes are used at the Valero refinery: catalytic reforming, alkylation, and dimersol processing (see definitions, below).
Reformulated Gasoline	Also called RFG or Cleaner Burning Gasoline (CBG). Gasoline with a different composition from conventional gasoline (e.g., lower aromatics content) that results in the production of lower levels of air pollutants.
Scrubber	Scrubbing is a term used for a chemical process where a component of a gas stream is removed from the gas and is transferred into a liquid. Scrubbing hazardous compounds from gases is a primary pollution control technology, as well as being used to separate non-hazardous compounds as well. At the refinery, there is no flue gas scrubber for the main stack at the refinery at this time. Valero is considering installing a new main stack scrubber to reduce the concentration of sulfur oxides created in the burning of refinery gas prior to release to the atmosphere. However, there are numerous process gas scrubbers, such as those used to remove sulfur from fuel gas streams.
Selective Catalytic Reduction	A NOx emission control system.
Selective Hydrogenation	Selective Hydrogenation removes di-olefins and converts light mercaptans into heavier sulfides.



SOURCE: Leffler, 1979

Figure 8-4
Typical Ranges of Hydrocarbon Fraction Boiling Points

Sour Water	Sour water is water in which ammonia and sulfur-bearing compounds are dissolved. At the refinery, Valero treats all sour water by first minimizing the contaminants in a stripping tower prior to treatment in the wastewater treatment system.
Sulfur Recovery Unit	Valero has two independent Sulfur Recovery units; each unit is called a train that uses a chemical process, the Claus process, to recover and produce molten sulfur. The molten sulfur is transported from the refinery by truck. In a Sulfur Recovery Unit (SRU), hydrogen sulfide is absorbed from refinery gases to reduce their sulfur content so that the gas can be burned in heaters used to heat refinery intermediate streams. The hydrogen sulfide is released by steam heating the solution and the hydrogen sulfide is burned to form sulfur oxides which are absorbed and converted to molten sulfur using the Claus process. The Sulfur Recovery Unit and the processes taking place inside its equipment are very common and are found in almost all refineries.
Tail Gas Unit	Valero removes the residual sulfur from the exhaust gas of the sulfur recovery trains with a Tail Gas Unit. The Tail Gas Unit accepts the exhaust gas from the Claus Process of the Sulfur Recovery Unit. Although the Claus Process of the Sulfur Recovery Unit removes most of the sulfur in the input gases, the residual sulfur content is too high to meet current air emission standards. The Tail Gas Unit removes residual sulfur in the exhaust gas from the Sulfur Recovery Unit prior to venting the treated exhaust gas to the atmosphere.
Tanks	In a refinery, large storage tanks are used to store incoming petroleum raw materials such as crude oil, intermediate refinery products such as gas oil, and final products that can be blended for consumer products such as gasoline. All raw materials and products are pumped through pipelines that connect the tanks, refinery process units and refinery shipping terminals. The tanks typically are equipped with a special floating roof to reduce the evaporation of raw hydrocarbons into the air. The major storage tanks are all located together in the tank farm.
Vapor Pressure:	The pressure exerted by a vapor that is in equilibrium with its solid or liquid form. Vapor pressure is often expressed in millimeters of mercury (mmHg) or in pounds per square inch (PSI).
VOC	Volatile Organic Compounds: Carbon-containing compounds that evaporate into the air (with a few exceptions). VOCs contribute to the formation of smog and/or may themselves be toxic. VOCs often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints.
Wastewater Treatment	Equipment in which the water wastes from the refining process are treated and monitored to insure that the refinery discharge meets the regulations of the San Francisco Regional Water Quality Control Board (RWQCB), the responsible state agency. The wastewater treatment plant also treats runoff from process areas.

At the refinery, Valero has installed equipment to remove residues of oil that may be dissolved in the water waste streams in the refinery. The wastewater treatment process is primarily a biological one where cultured microorganisms render oil in wastewater into innocuous compounds. The wastewater treatment process facilities are located on the southeastern-most part of the refinery. The treated discharge from the wastewater treatment equipment is directed through an outfall into Suisun Bay.

8.2 ACRONYMS USED IN THIS EIR

ABAG	Association of Bay Area Governments
AIHA	American Industrial Hygiene Association,
ANSI	American National Standards Institute
APE	Area of Potential Effect
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
BCDC	Bay Conservation and Development Commission
BLEVE	Boiling Liquid Vapor Cloud Explosion
Btu	British Thermal Units
CalARP	California Accidental Release Program
CALFED	The CALFED Bay Delta Program
CARB	California Air Resources Board
CaRFG2	The CARB’s acronym for phase 2 reformulated gasoline.
CaRFG3	The CARB’s designation for phase 3 reformulated gasoline.
CAER	Community Awareness Emergency Response
CEQA	California Environmental Quality Act
CDFG	California Department of Fish and Game
CFR	Code of Federal Regulations
CGS	California Geological Survey
CMP	Countywide Congestion Management Plan
CO	Carbon Monoxide
COE	Army Corps of Engineers
CTR	California Toxics Rule
EIR	Environmental Impact Report

EPA	United States Environmental Protection Agency
ERPG	Emergency Response Planning Guidelines
FCCU	Fluid Catalytic Cracking Unit
H_2S	Hydrogen Sulfide
HAPs	Hazardous Air Pollutants
HAZOP	Hazard and Operability Study
HI	Hazard Index
HRA	Health Risk Assessment
kW	Kilowatt
kW/m^2	Kilowatts per square meter
lb/hr	Pounds per Hour
lb/yr	Pounds per Year
LOD	Limits of Detection
LPG	Liquefied Petroleum Gas - (light hydrocarbons)
MACT	Maximum Achievable Control Technology
MCE	Maximum Credible Earthquake
MDEA	Methyldiethanolamine
$\mu g/m^3$	Micrograms per cubic meter
MGD	Million Gallons per Day
MTBE	Methyl Tertiary Butyl Ether
MTC	Metropolitan Transportation Commission
MW	Megawatt
NAHC	Native American Heritage Commission
NESHAPs	National Emission Standards for Hazardous Air Pollutants
ng/m^3	Nanograms Per Cubic Meter
NO_x	Oxides of Nitrogen or Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
OEHHA	California Office of Environmental Health Hazard Assessment
PAH	Polycyclic Aromatic hydrocarbons
PM-10	Particulate Matter 10 microns or less
PM-2.5	Particulate Matter 2.5 microns or less
ppb	Parts per Billion
ppm	Parts per Million

Psig	Pounds per Square Inch Gauge
POC	Precursor Organic Compounds
PSA	Pressure Swing Absorption
PSM	Process Safety Management program
RMP	Risk Management Plan
RWQCB	San Francisco Regional Water Quality Control Board
scf	Standard Cubic Feet
SHBC	State Historical Building Code
SHPO	State Historic Preservation Officer
SO_2	Sulfur Dioxide
SRU	Sulfur Recovery Unit
STA	Solano (County) Transit Authority
TAC	Toxic Air Contaminants
TBACT	Best Available Control Technology for Toxics
TEQ	Toxic Equivalent
TMDL	Total Maximum Daily Loads
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VCE	Vapor Cloud Explosion
VIP	Valero Improvement Project
VOC	Volatile Organic Compounds