CHAPTER 3

PROJECT DESCRIPTION

3.1 PROJECT OVERVIEW AND LOCATION

3.1.1 INTRODUCTION AND OVERVIEW

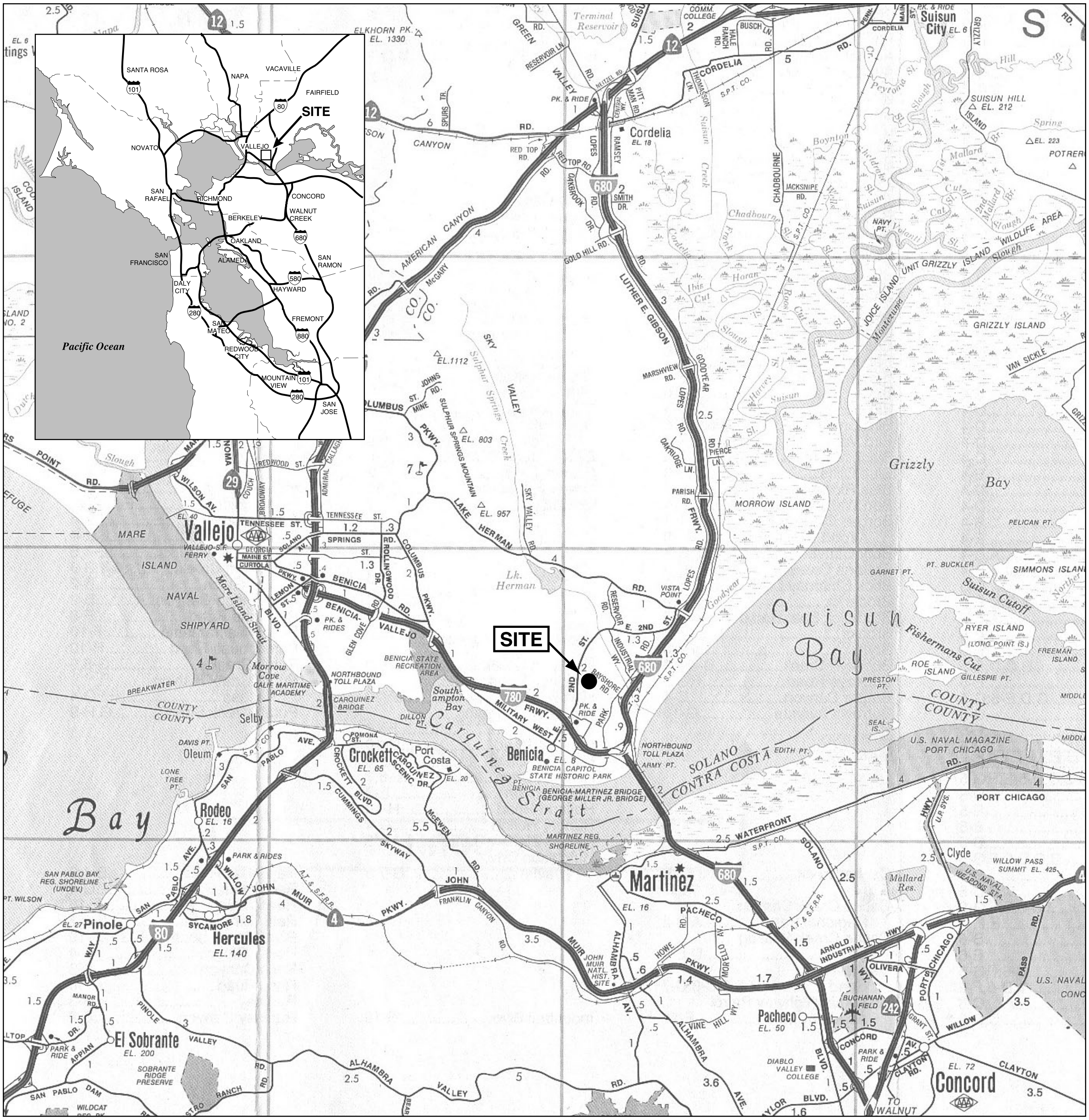
The Valero Benicia Refinery, purchased from Exxon in 2000 by the Valero Energy Corporation, was originally built in 1969. Since originally constructed, the Benicia Refinery has undergone modifications and upgrades. The Valero Benicia Refinery currently processes a limited range of raw materials to produce 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.

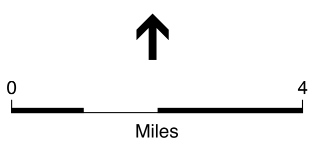
The Valero Improvement Project (VIP) proposes a series of modifications and additions to the Valero Benicia Refinery. The project would modify existing and install new refining equipment. All units would be located within the refinery boundaries, generally placed among similar existing equipment. When 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.

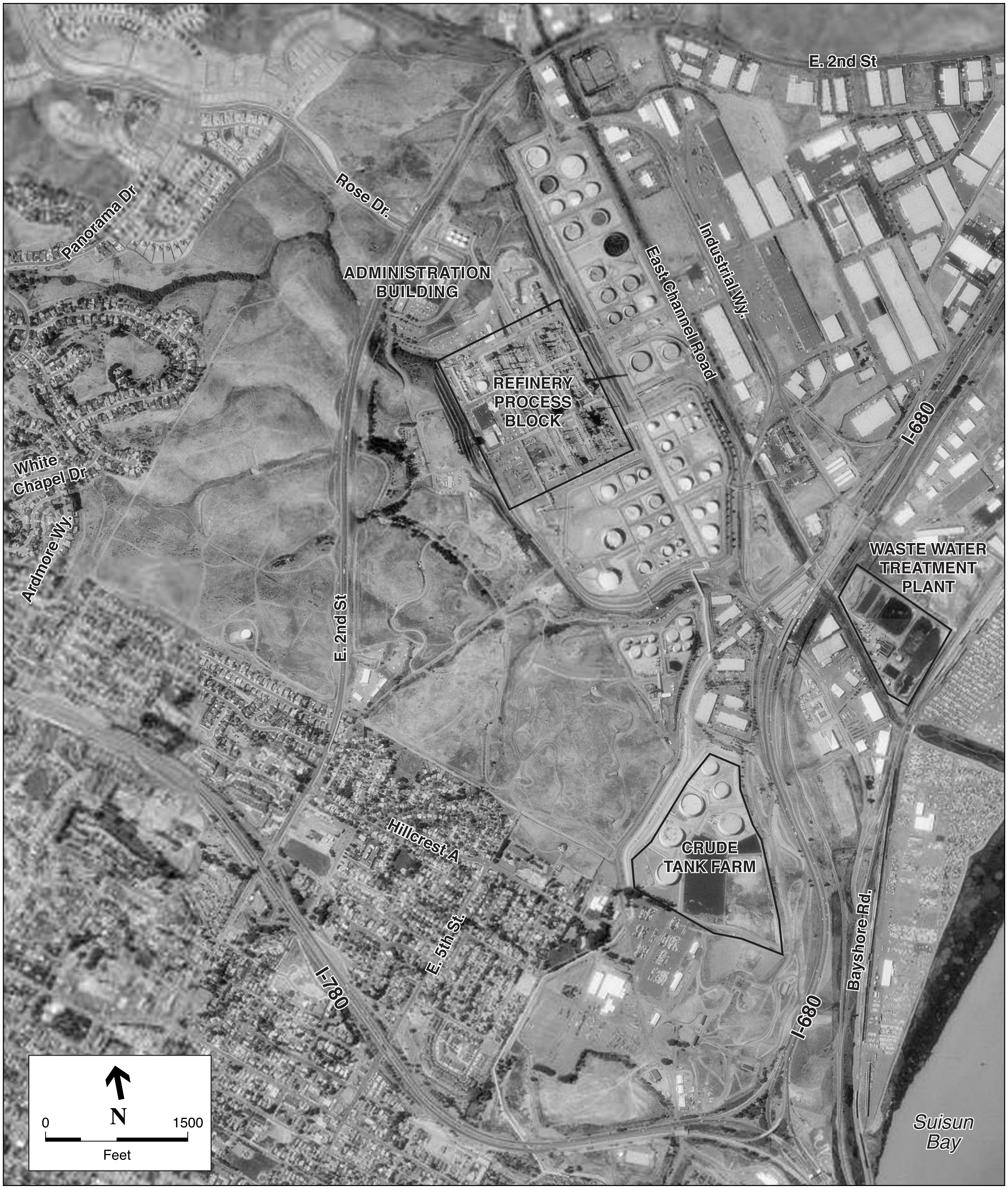
As a result of the project, the refinery would be able to continue to efficiently produce clean burning fuels in the California market and would remain economically competitive into the future. The refinery would be able to process a higher percentage of lower grades of crude oil than it presently can 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

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.

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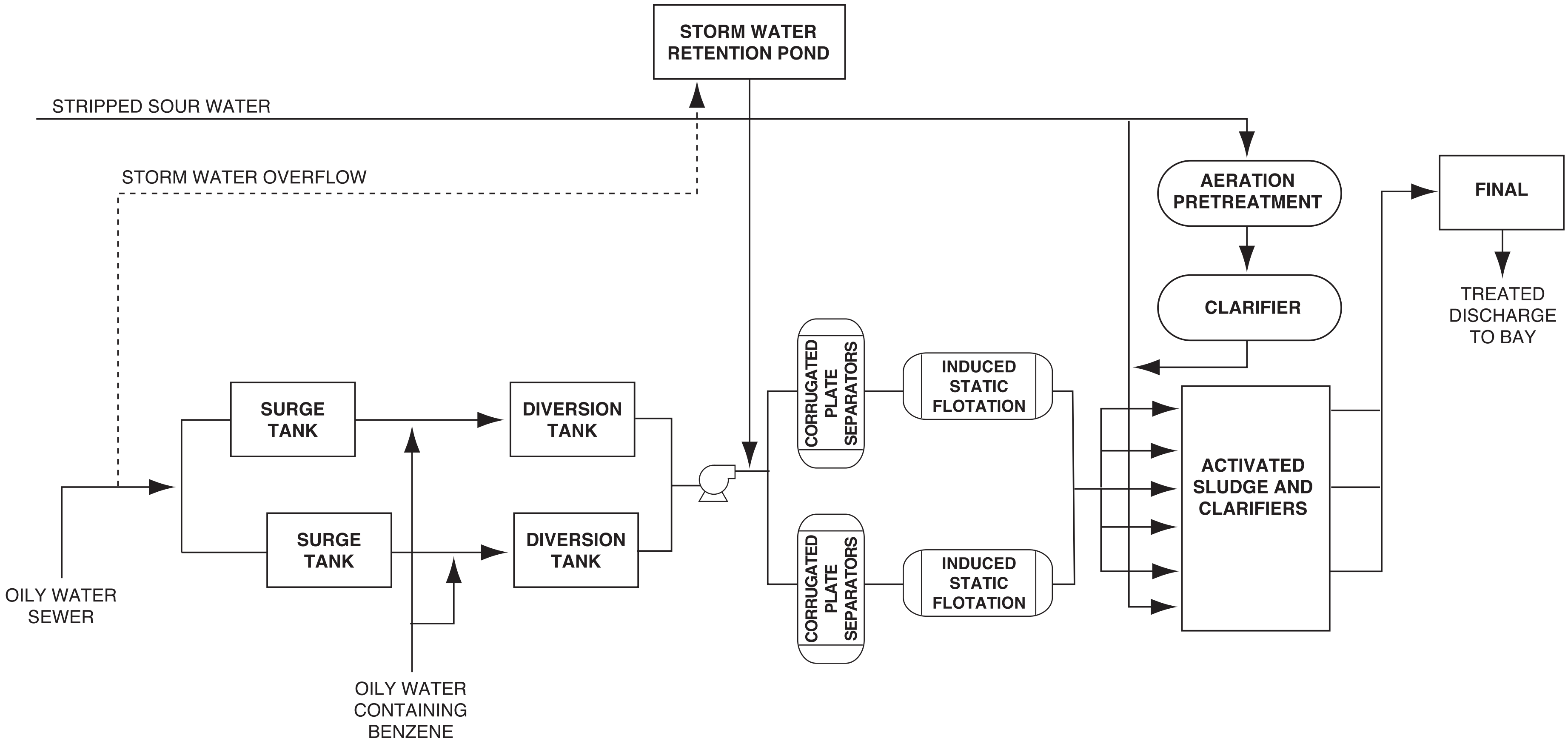
[3] Valero's RWQCB NPDES permit No. CA0005550 includes the proposed diversion and treatment of wastewater from the Huntway Asphalt Refinery. See section 4.9 *Hydrology and Water Quality*. A copy of Valero's RWQCB NPDES discharge permit can be found on the RWQCB's website at www.swrcb.ca.gov./~rwqcb2.

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

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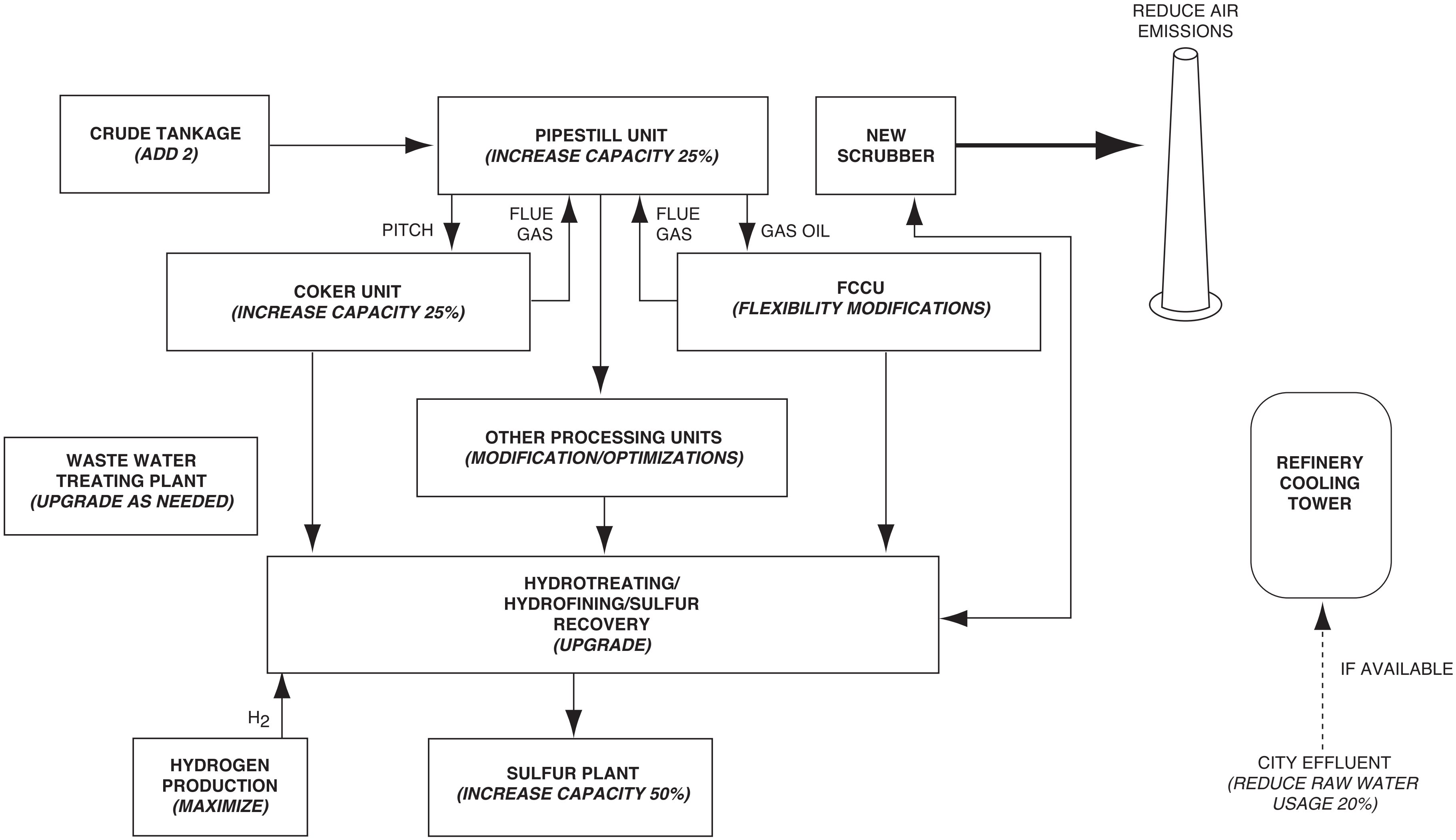
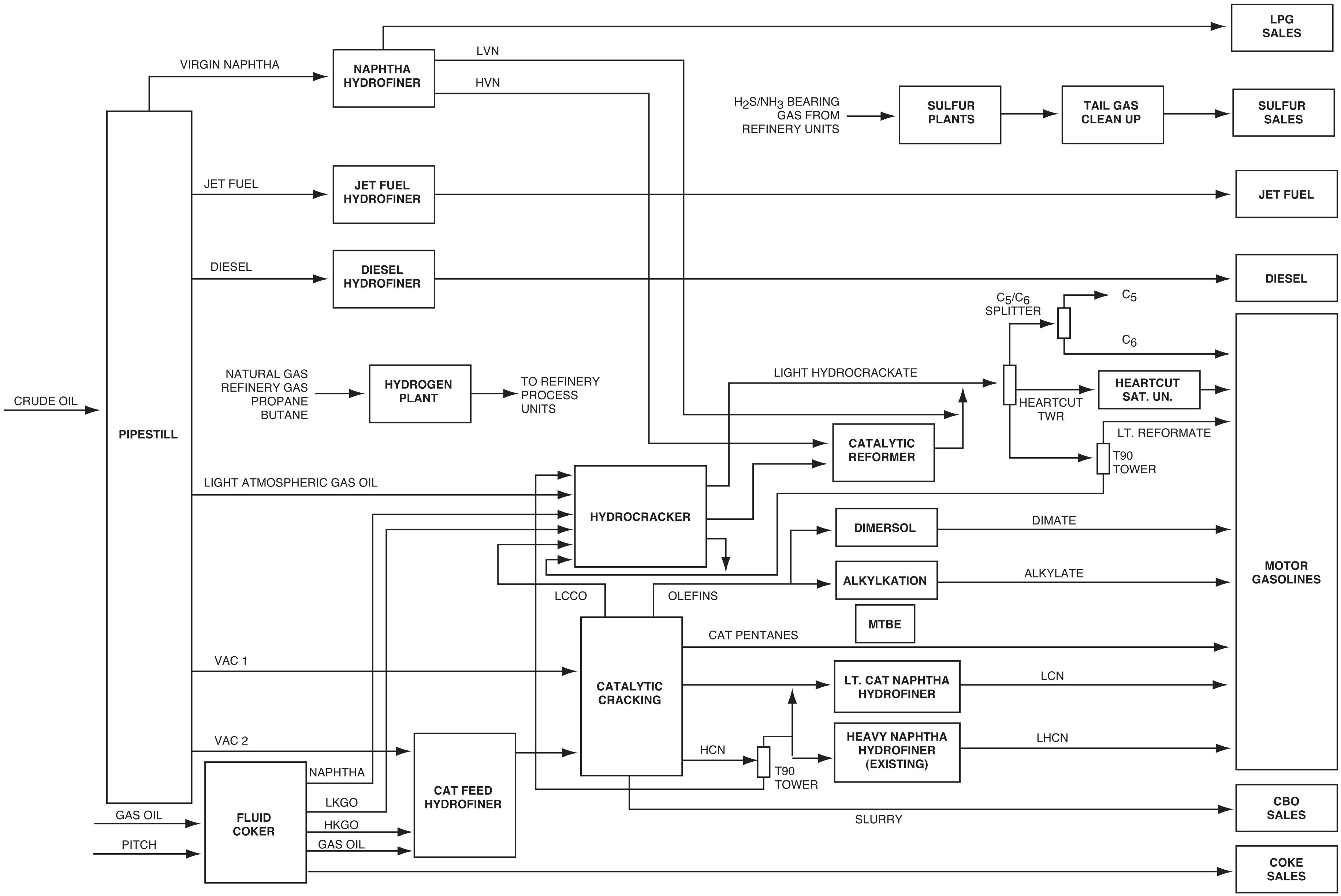
SOURCE: Environmental Vision

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

Main Stack Components

VIP Section Ref.	3.4.3.1		3.4.3.2	3.4.3.3	3.4.3.4	3.4.3.5
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**
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.
Equipment Location	Near Pipestill Unit.	N/A	Within FCCU boundary.	At present location.	Throughout Process Block Area.	In Pipestill Unit area, near main stack.
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.
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.
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.
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.					
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.					
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)

Other Optimizing and Supporting Components

VIP Section Ref.	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	**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	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	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)	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.	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	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 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										
Interim Control Without Main Stack Scrubber	No interim controls needed. Operations do not depend on the Main Stack Scrubber for emission control.									
Primary Long Term Control	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

Introduction *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.*

Current Operation

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.

Proposed Changes

Operational Changes. 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.

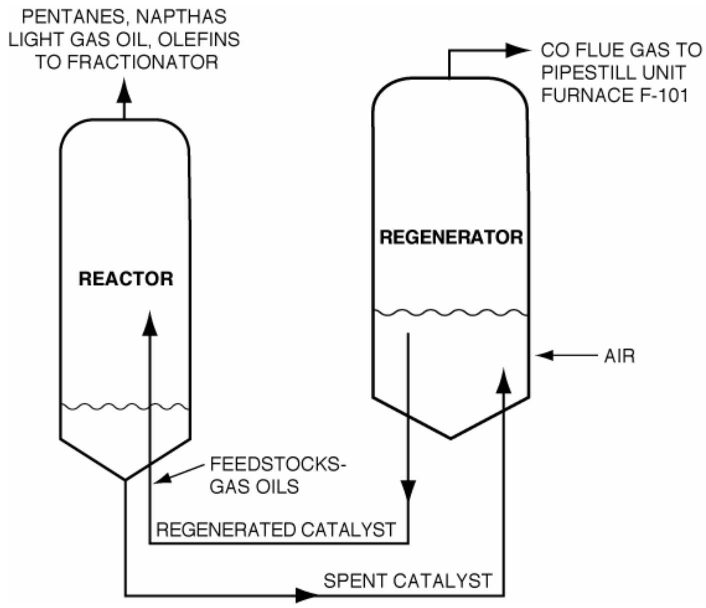


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Figure 3-10
Fluid Catalytic Cracker Unit Process

<u>*Equipment Changes*</u>. 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.

<u>Schedule</u>. 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

Introduction *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.*

Current Operations

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.

Proposed Changes

Operational Changes. 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.

Equipment Changes. 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.

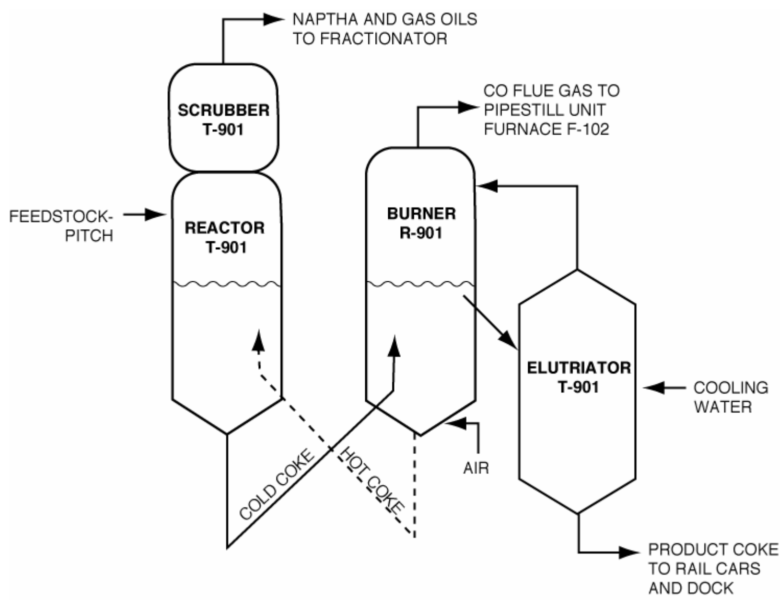

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Figure 3-11
Fluid Coker Process

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*.

<u>Schedule</u>. 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.

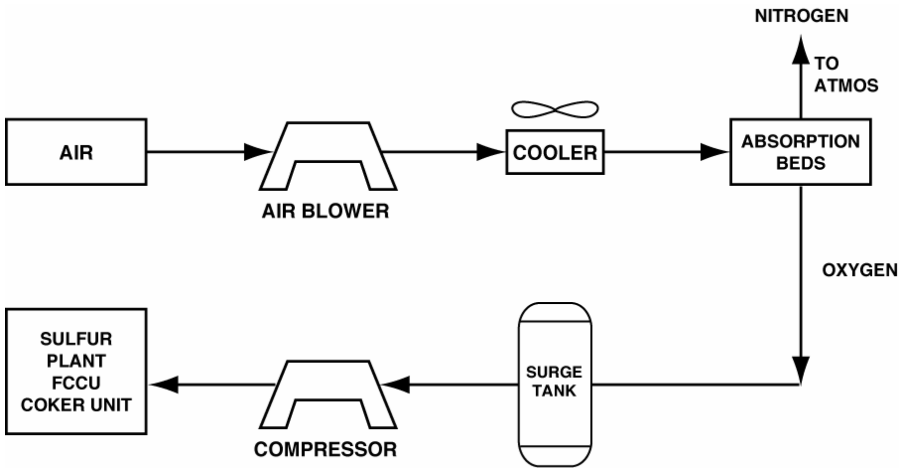

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Figure 3-12
Oxygen Generator Package Unit

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

<u>*Introduction*</u> *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.*

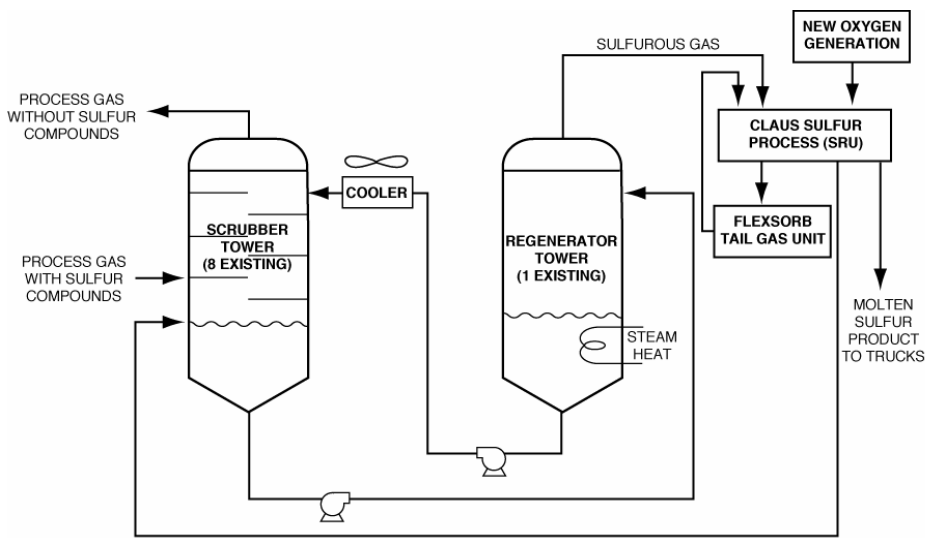
<u>Current Operations</u>

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*).

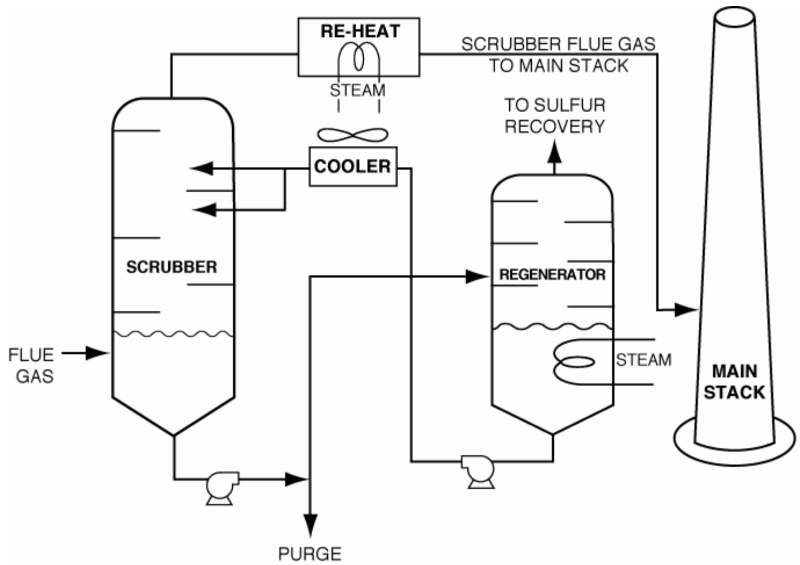


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Figure 3-14
Flue Gas Scrubber Process

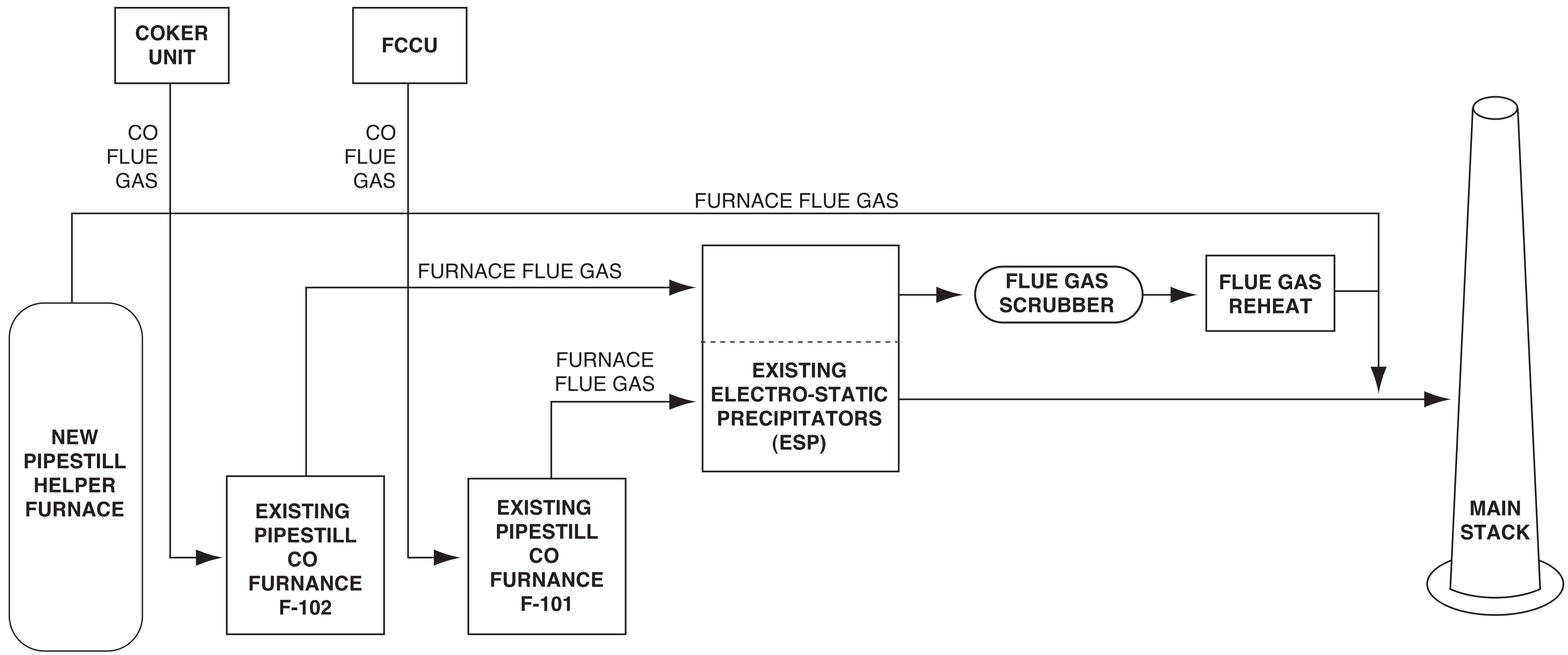
The gas that flows through the scrubber would then be exhausted through the refinery's existing main stack, which would continue to be used. No new exhaust stack would be required, although a new exhaust stack heater may be added, which would reheat the flue gas downstream of the scrubber to minimize 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

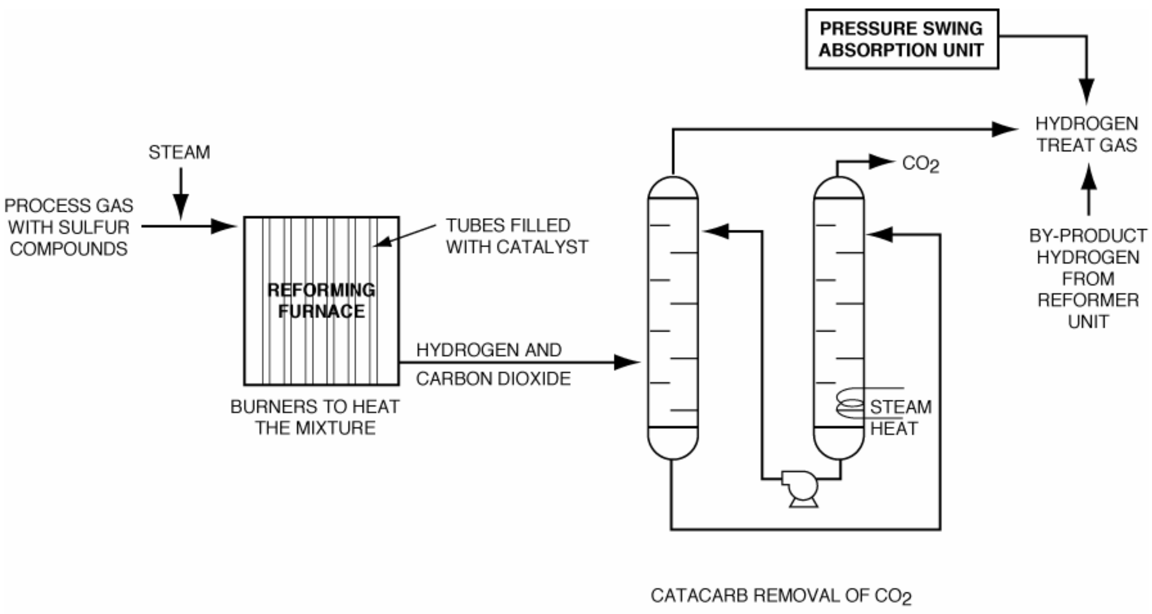


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Figure 3-16
Hydrogen Production Process

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.

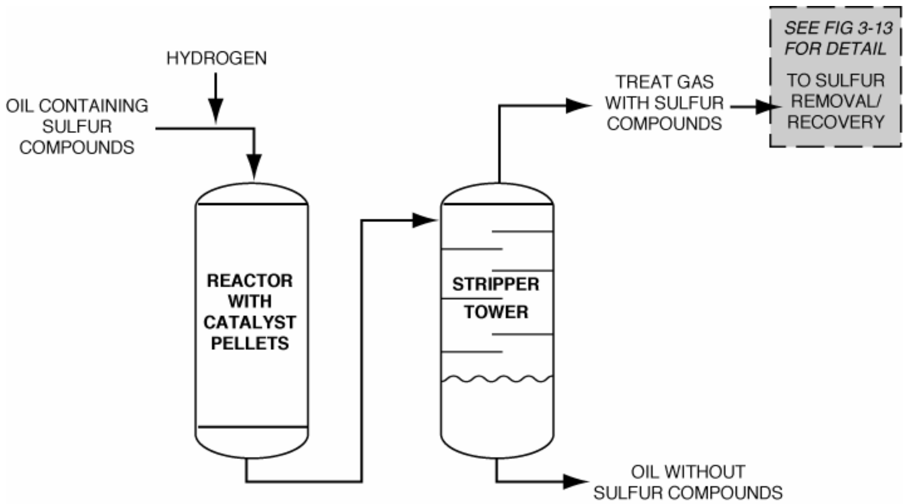

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Figure 3-17
Hydrofining Process

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

<u>Introduction</u> *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.*

<u>Current Operations</u>

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.

<u>Proposed Changes</u>

<u>Operational Changes</u>. 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

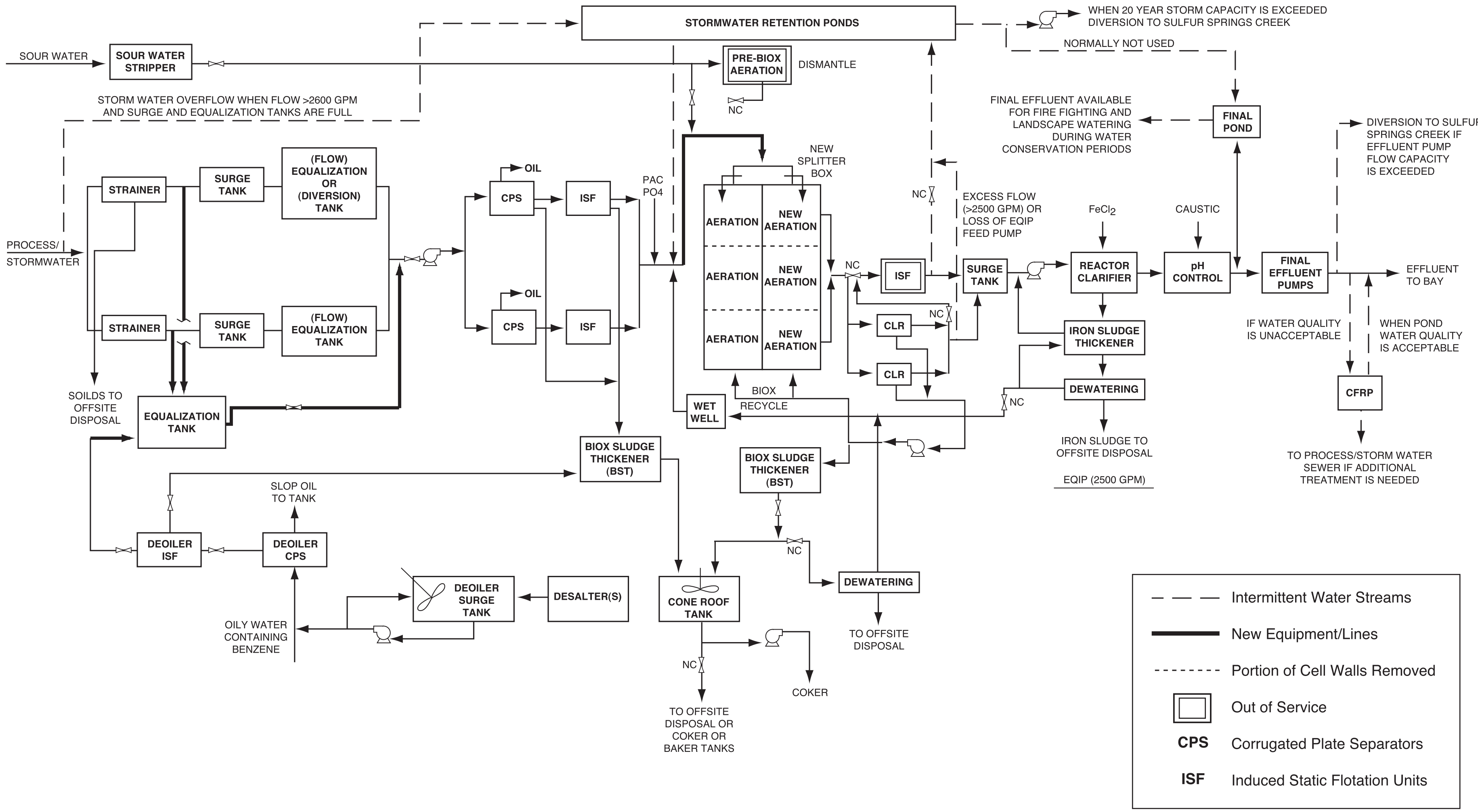
Introduction *The operation of the VIP would require certain additional infrastructure and support facilities.*

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

Introduction *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.*

Current Operations

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.

Proposed Changes

Operational Changes. 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.

Equipment Changes. 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.

Schedule. The tanks would be installed as they are needed.

3.4.3.16 IMPORT AND EXPORT LOGISTICS

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

Current Operations

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.

Proposed Changes

Operational and Equipment Changes. 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.

2004 Refinery-wide Turnaround

- 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).

By Year End 2004

- 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.

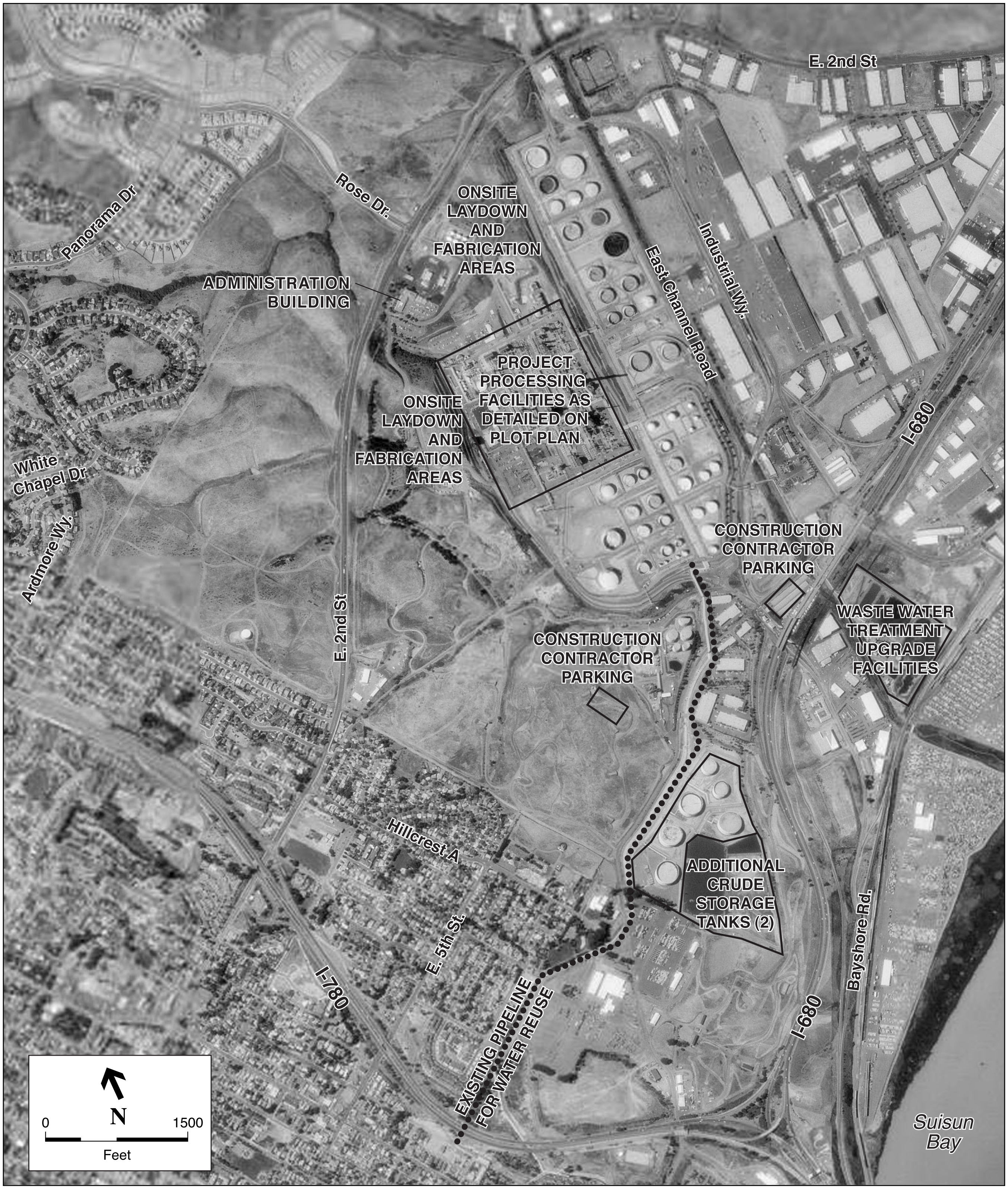
In summary, the components of the project can be roughly divided in two groups - the Main Stack Components and the other optimizing and supporting components. The Main Stack Components are targeted for installation during 2004 and are tied closely to turnaround schedules. The other optimizing and supporting 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).

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[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.