4.2 Public Safety and Hazardous Materials

This section discusses potential public safety and hazardous materials impacts associated with the Proposed Project. Potential impacts include fires, explosions, and releases of hazardous materials from activities associated with the operation of the project facilities. Potential soil and groundwater contamination issues are also addressed. The information in this section outlines the environmental setting, regulatory setting, significance criteria, potential risk scenarios and their significance, and the levels of risk to the public or environment associated with these scenarios. A quantitative risk assessment (QRA) was used to evaluate the hazard impacts of the Proposed Project.

In addition, this section presents an analysis of the estimated frequency and volume of oil spills for the Proposed Project. For a discussion of odor impacts and health risk impacts, please see Section 4.1, Air Quality.

4.2.1 Environmental Setting

For the Proposed Project, environmental setting or baseline conditions reflect the baseline risks of upset associated with the existing pipeline system and facilities. Once these baseline risks are quantified, the significance criteria can be used to determine if there is an increased level of risk associated with the project or alternative, and if the proposed change in the system introduces a significant increase in the risk of upset or an increase in the severity of an already significant impact.

In general, oil and gas refinery facilities present hazards to employees and the public due to:

- The presence of flammable and toxic gases, as well as gas processing by-products, such as flammable propane and butanes;
- The storage and transport of crude oil, natural gas, propane, butane, or other gas liquids; and
- Crude oil spills.

Not all of these hazards are present at all facilities. The impact section discusses these hazards and their potential impacts, as well as their estimated frequency of occurrence based on industry-wide experience.

4.2.1.1 Study Area and Scope

For the public safety analysis, the study area includes the existing facilities and pipelines associated with the Proposed Project, its alternatives, and the areas in the immediate vicinity of the Proposed Project that could be affected by an upset at the facilities. The area that could be impacted by a release also includes any routes associated with proposed trucking of crude oil or associated project hazardous materials.

An upset condition at the listed facilities or along transportation routes could have an adverse impact to the public and environmental resources in the study area. Impacts to air, water, and biological resources are discussed in the appropriate sections of this Environmental Impact

Report. The study area that would be affected in terms of public safety by an upset condition includes:

- Residences and businesses near the Project Site;
- Residences and businesses located along the transportation routes; and
- Any population located along the pipeline routes, including those between the Santa Maria Pump Station and the Refinery, and north to the Rodeo Refinery (in the San Francisco Bay Area).

Oil spill volumes that would be released in the event of a pipeline spill are identified, with the assumption that the Supervisor Control and Data Acquisition (SCADA) system responds appropriately and activates isolation valves. Closing of the automatic isolation valves within the appropriate response time would considerably reduce spill volumes from the pipeline segment. Evaluation of spill volumes for the worst-case scenario when the SCADA system malfunctions, or is overridden by an operator, is also addressed.

4.2.1.2 Characteristics of Crude Oil and Natural Gas

This section discusses the properties of crude oil and produced gas as they relate to safety impacts, such as oil spills, toxic exposure, and fires.

A spill of crude oil from the pipeline could damage the environment if oil spilled on land, or in rivers, creeks, or the ocean, and could produce public safety concerns from fires that may arise if the oil burns. Flammable vapors (propane, butane, and pentane) may also emanate from the crude oil, and there may be safety hazards arising from toxic vapors in the crude oil (primarily benzene and hydrogen sulfide).

Crude oil, as it emerges from the wellhead, is a heterogeneous mixture of solids, liquids, and gases. This mixture includes sediments, water and water vapor, salts, and acid gases, including carbon dioxide and, sometimes, hydrogen sulfide. Flammable vapors that may emanate from crude oil include methane, propane, butane, and pentane.

Crude oil comes in a variety of forms and is characterized in several different ways. For example, oils are frequently classified by their American Petroleum Institute (API) gravity, which is a measure of how heavy or light they are compared to water. Oils with an API gravity greater than 10 will float on water, while those with an API gravity less than 10 will sink. Thin and volatile oils are "light," whereas thick and viscous ones are "heavy." Light oils have an API gravity of 30 to 40 degrees, whereas heavy oils may have an API gravity of less than 12 degrees. Some of heaviest crude oils even have API gravities that are less than 10 degrees and will therefore sink in water.

In addition to API gravity, crude oils are also characterized by Reid vapor pressure. Reid vapor pressure (ASTM Method D 323) is the absolute vapor pressure exerted by a liquid at 100 degrees Fahrenheit (°F). The higher the Reid vapor pressure, the more volatile the oil and the more readily it will evaporate.

Oils are typically mixtures of many different compounds, most of which are hydrocarbons. There are a series of main hydrocarbon groups in petroleum. Saturates are hydrocarbons with straight chains of carbon atoms, while aromatics are hydrocarbons consisting of rings of carbon. Asphaltenes are complex polycyclic hydrocarbons that contain many complicated carbon rings and nitrogen-, sulfur-, and oxygen-containing compounds.

Sulfur in crude oil occurs in many natural compounds including hydrogen sulfide (H_2S), a toxic gas that can cause injuries or fatalities if released to the atmosphere and subsequently inhaled. Total sulfur ranges from approximately one to four percent by weight in crude oils, while H_2S concentrations can reach 100 parts per million (ppm) in "sour" crudes. Fortunately, its strong, pungent odor is detectable at a level substantially below that which causes adverse health effects. However, H_2S also causes paralysis of the olfactory functions at levels below health effects. Other constituents of crude oil include nitrogen and oxygen compounds, as well as water- and metal-containing compounds, such as iron, vanadium, and nickel.

The processed gas at the Refinery is used in processes at the Refinery. The majority of the gas is methane with some smaller amounts of ethane and butane and inert compounds (such as CO_2). Produced gas presents hazards due to its flammability in the form of vapor cloud fires and explosions, and thermal radiation impacts due to flame jet fires emanating from a gas leak or rupture.

4.2.1.3 Risk Assessment Methodology

Risk assessment involves evaluating risks presented to the public by the facility in the form of hazardous materials releases resulting in explosions, flammable vapors, or toxic material impacts.

Facility Quantitative Risk Assessment Approach

The QRA analyzes the risks of immediate human safety impacts presented by industrial operations on nearby populations. The assessment follows commonly accepted industry standards including the recommendations of the Center for Chemical Process Safety (CCPS), the Health and Safety Executive of the United Kingdom, and the County of Santa Barbara Environmental Threshold and Guidelines for Public Safety.

The main objective of the QRA is to assess the facility's risk of generating serious injuries or fatalities to members of the public, to assess the risks of spill events, and to develop mitigation measures that could reduce these risks. The development of the serious injury and fatality aspects of the QRA involves five major tasks:

- Identifying release scenarios;
- Developing frequencies of occurrence for each release scenario;
- Determining consequences of each release scenario;
- Developing estimates of risk, including risk profiles; and
- Developing risk-reducing mitigation measures.

Figure 4.2-1 shows the steps in developing a QRA.

A QRA computer model, developed by Marine Research Specialists, is used to calculate the risk profiles and, in conjunction with Geographic Information System software, to manage the data in accordance with CCPS guidelines for hazard assessments (CCPS 1989). The model is based on a polar coordinate grid of cells. The grid extends at least 0.5 miles from the facility in all directions and has varying cell sizes depending on the populations and ignition sources. Hazard zones are then laid over the grid to determine populations impacted. The following sections discuss information developed as inputs to the model.

Meteorological conditions at the site are represented by two stability classes: F stability/2 meters per second (m/s) and D stability/4 m/s. Wind conditions are divided into 16 directions and the probability of wind in each direction, at each stability class and speed, is entered.

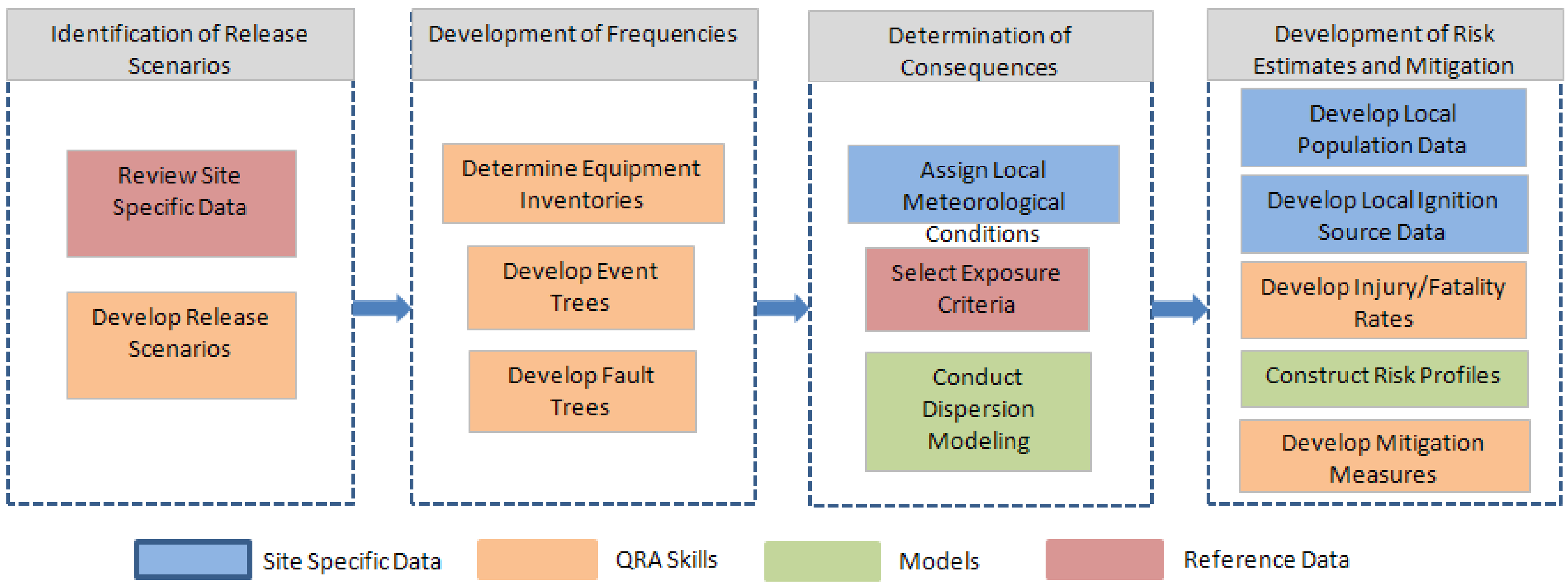
Fatality and serious injury probabilities are entered for each type of scenario (i.e., flame jets, fires, vapor clouds, including flammable and toxic clouds, explosions, and boiling liquid expanding vapor explosions), indicating the percentage of persons who are exposed to a scenario that would suffer serious injuries or fatalities.

Population density information developed for each receptor includes the number of persons present at each location, the area over which the persons are distributed, and the maximum number of persons that could be exposed. If a cloud covers only a portion of the area, the population density is used to determine the number of persons exposed.

A use factor is applied to each receptor based on the hours per day that persons are at the location. For example, a receptor that has persons at it 12 hours per day would have a use factor of 0.5. This factor reduces the frequency of a release scenario impacting persons.

An ignition probability at each receptor is applied, which defines the probability that a flammable cloud would reach the receptor and ignite and affect the receptor location. For example, if there are no ignition sources between the receptor and the release point and there is an ignition point at the receptor, such as a campfire, which has a high probability of igniting the cloud, then the ignition probability would be 1.0 at the receptor.

Figure 4.2-1 Steps Involved in Developing a Quantitative Risk Assessment



This would mean that any receptor farther from the release point would not be impacted. If there are ignition sources at the release location (such as flares or heaters), the ignition probability would be less than 1.0, meaning that part of the time the flammable cloud would not reach the receptors at all. The sum of ignition probabilities along any one path is equal to or less than 1.0.

A shielding factor is also applied to receptor locations. The shield factor is applicable to thermal scenarios only, such as flame jets, fires, or boiling liquid expanding vapor explosions. Thermal scenarios only produce impacts if the receptor is directly exposed to the flame and has a "line of sight." Buildings, vegetation, terrain, and other types of obstructions would prevent persons exposed to the fire from experiencing the full effects, and would reduce the probability that the person would suffer a serious injury or fatality.

Release scenario frequencies are determined though failure rate analysis and fault trees, which detail the general conditions and equipment-specific frequencies that could lead to a release. Event trees evaluate post-release behavior of the released material, such as whether it forms a flammable cloud, flame jet, toxic cloud, explosion, or a boiling liquid expanding vapor explosion.

The end products for the serious injury and fatality analysis are "risk profile" curves, one for fatalities and one for serious injuries, developed from the scenario frequencies and effected populations for each scenario. The risk profile curves estimate the risk that any existing population would suffer fatalities or serious injuries.

In general, a conservative (estimating more risk than would actually occur) approach is taken in conducting the analysis. Using a conservative approach ensures that risks are overestimated and ensures the focus of efforts are on the areas that produce the highest risk. Conservative assumptions include the following:

- Minimal piping friction effects. For flammable gas releases, consequence analysis assumed that release volumes were located at the break source and all releases were assumed to behave like a release from a short pipe length or a hole in a vessel. Piping lengths, which would increase the friction and reduce the release rates, were not included. For example, if a scenario includes two exchangers, nine vessels, two filters, and an estimated 240 meters of piping, it was assumed that this entire inventory was released as though it was contained within a single vessel at the unit temperature and pressure and released through a short pipe segment. In reality, the gas would have to travel through piping and equipment to get to the release point. This would reduce the release rate and the subsequent impact zone. In addition, for flammable releases, the peak release rate was used to determine the hazard zone. This approach produces larger hazard zones since the release rate would most likely decrease over time, thereby reducing the size of the impact zone over time.
- Minimum human intervention and shutdown systems included. It was assumed there would be no human intervention in the event of a crisis situation. Manual shutdown systems were assumed to not be activated, or activated only after a sufficient amount of material was released, which would allow the hazard zones to reach their maximum extents (given the dispersion and meteorological conditions at the time of the release). All automatic shutdown systems that can isolate portions of the plant were assumed to fail, and the failure rates of these automatic shutdown systems were included in the fault tree analysis. However, it was

assumed that compressor low pressure shutdown systems would prevent the system from continuing to operate and compress additional gas in the event of an equipment failure.

- Maximum release volumes were assumed. All releases were assumed to release the entire volume of the facility gas system. In reality, numerous valves and equipment designs would prevent a release of the majority of the gas inventory in the field through a given pipe or equipment rupture.

Spill Risk Analysis Approach

The approach for the spill analysis involved estimating the frequency of release events from the facilities and the release volumes. Spill volumes from a pipeline system rupture are based on the pipeline diameter and the terrain profile, which would limit the amount of oil that could drain out of the pipeline. In addition, the pumping rate also affects the size of a release since oil pumped into the pipeline would contribute to the release size until the pumps are shut down.
Spills that would be contained by the berms and drainage system valves and, for areas outside of berms, would be directed to the drainage basins (tertiary containment). A spill would only be directed outside of the field after a subsequent failure in the drainage basin discharge procedure or equipment.

Security Risk

Effective and comprehensive site security programs are a prudent aspect of reducing the risk of chemical releases at a facility. Although the Proposed Project area would not be considered a terrorist target compared to New York City or Washington, DC, it could be the subject of vandalism that could release hazardous materials.

The U.S. Department of Homeland Security established chemical facility anti-terrorism standards in 2007 (6 Code of Federal Regulations [CFR] Part 27). This rule established risk-based performance standards for the security of chemical facilities. It requires affected chemical facilities to prepare security vulnerability assessments that identify facility security vulnerabilities and to develop and implement site security plans, which include measures that satisfy the identified risk-based performance standards.

The security vulnerability assessments include analysis related to asset characterization, threat assessment, vulnerability analysis, risk assessment, and countermeasure assessments. Generally, facilities covered by the Occupational Safety and Health Administration (OSHA) Process Safety Management and Environmental Protection Agency Risk Management Plan rules are required to comply with these standards.

A number of industry groups, including the API, the Center for Chemical Process Safety, the Synthetic Organic Chemical Manufacturers Association, American Chemistry Council, and the Chlorine Institute have developed approaches for assessing security risk. Each of these methods involves analyzing the security systems at the facility in combination with the hazards and determining a level of security risk.

Security systems at the site could include:

- Security policies for employees and contractors including access control, pre-employment screening, information security, and post-employment issues;
- Appropriate signage preventing access;
- Fencing systems;
- Visitor sign-in and sign-out;
- Surveillance of hazardous material areas;
- Employee and contractor identification methods;
- Night lighting;
- Partnerships with local response agencies;
- System to report and collect security incidents;
- Communications equipment; or
- Employee vehicles and access keys, codes, and card security.

The Applicant indicates that the site has a comprehensive security system designed to address all security issues. The security system is periodically tested to confirm its effectiveness. It must meet or exceed Industry standards while addressing Homeland Security issues.

Release Scenarios

The approach to develop release scenarios is grouping the equipment and operations by operating parameters -- equipment with similar temperatures, pressure, and composition were grouped into one set of scenarios. This generally produced a set of release scenarios for each process. Each set of release scenarios contains at least one rupture release and one leak release. A rupture is defined as a large process inventory release over a short period caused, for example, by catastrophic equipment failure. Ruptures are generally associated with releases through holes larger than 1 inch. A leak is defined as a process inventory released due to a small valve failure or hole in a vessel, for example, generally less than 1 inch in diameter. This approach encompasses a range of risks by including a less frequent, more severe scenario, and a more frequent, less severe scenario. In some cases, the leak release actually produces a higher risk (i.e., combination of consequence and frequency) than the associated rupture release because leaks occur more frequently than ruptures.

The principal immediate hazards to public health at an oil refinery include:

- Releases of flammable gas causing vapor cloud explosions or thermal impacts from fire and flame jets;
- Releases of flammable gas causing vapor cloud explosions, thermal impacts from fire and flame jets, or thermal and overpressure impacts from explosions and boiling liquid expanding vapor explosions;
- Releases of odorant causing toxic impacts; and

- Releases of crude oil with subsequent fire causing impacts from thermal exposure to crude oil fires.

Failure Frequencies

Once the scenarios have been identified, the analysis attempts to estimate the frequency of each scenario. This is done by combining the series of events necessary for the scenario to be realized. These are called "fault trees." For example, a release from a simple pipe and valve system could be due to the pipe breaking or leaking, the valve breaking or leaking, or an operator leaving a valve open during a maintenance procedure. Any of these events would cause a release of the material. Failure rate databases quantify how often each of these events occurs.

Several failure rate databases are available that list failure rates for a long list of equipment types and operations. These databases are produced from a large dataset of industry-wide information from hundreds of facilities. Some rates are industry-specific, such as nuclear facilities, liquefied petroleum gas facilities, or oil and gas industries, whereas some are more general. The sources included the Center for Chemical Process Safety, Lees, WASH 1400, Hydrocarbon Leak and Ignition database, and the Rijnmond Public Authority risk analysis reports, which include both equipment failures and failures due to human error. These industry-wide failure rate databases incorporate a range of equipment, differing in design standards and equipment age. Therefore, the failure rates are considered an average of a group of equipment that might include some older equipment and some relatively new equipment.

Failure rates are developed, for example, from a listing of valve breaks that have occurred in an industry. Dividing the number of breaks per year by an estimate of the number of valves in that industry can generate a failure rate. For example, this rate may be 0.003 leaks per year per valve, so that if there are 100 valves at a facility, 0.3 leaks per year or approximately one leak every 3 years could be expected. The same information is available per meter of pipe length as a function of pipe size, for example. Other examples of this type of information include the number of times per year a pump might be expected to fail or a pump seal would develop a leak.

Rates can also be based on what is called a demand basis, which is a probability that if the equipment is called upon, it will not work. Good examples of this are the probability that a switch will not operate if it is used, or that a fire pump will not operate if it is needed.

Failure rate databases also include human error rates. These would include the frequency that a valve is not closed correctly, or that a series of instructions are not followed correctly, or that a hose is not connected properly. These human error rates are based upon industry-wide data and have been incorporated into the fault trees where applicable.

Table 4.2-1 shows frequencies for some common events in everyday life taken from the databases.

Table 4.2-1 Frequencies for Common Events

Event	Number	Type
Failure to follow instructions occurs once every	18	times it is done
Simple arithmetic error with self checking occurs once every	40	times it is done
Incorrect reading of a gauge occurs once every	222	times it is read
Fail to read a 10 digit number correctly occurs once every	167	times it is read
A switch fails to operate once every	3,333	times it is used
A welded connection leaks once every	1,142	years per weld
A computer fails to run once every	10.5	months
A propane tank explodes once every	10,000,000	years per tank

Sources: CCPS 1989b, R&MIP 1988

The failure rate databases that were used to estimate the base failure frequencies include a range of equipment types, services, and age. Many of the failure rates, for example, are based on services that are much more hazardous than oil and gas processing, such as boiler systems, piping, and Refinery reactor equipment.

Industry data on the correlation between equipment age and failure rates is sparse; in fact, several studies indicate that there is no correlation. In one study, 50 percent of failures were attributable to pressure vessels that were less than 10 years old and 50 percent were attributed to vessels that more than 10 years old (Lees 1996). This is primarily because failures occur during the first few years of equipment life due to manufacturing inadequacies. An examination of facilities regulated by the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) (formerly the Minerals Management Service) in the Gulf of Mexico over the past 10 years shows that equipment failure rates actually decrease even as the average equipment age increases.

However, other studies indicate an increase in failure rates with age. Thomas developed a quantitative method for determining the failure rates in process piping and vessels using empirical data from the process industry (Thomas 1981). That method involves examining the piping and vessel size, construction geometry, and number and length of welds, as well as the equipment age and maintenance practices. This method assigns an age factor as high as 1.4, meaning failure rates would increase by approximately 40 percent at the age of 20 years over the failure rate at 10 years. This method estimated that process piping leaks are due primarily to manufacture and materials selection (50 percent) and corrosion and erosion (25 percent), with fatigue, vibration, expansion, mal-operation, and shock making up the remainder (Medhekar 1993).

Since the Thomas report, a number of refinements and data development activities have occurred mostly focused on the nuclear industry. The worldwide nuclear industry has developed “risk informed in-service inspection” techniques. A number of approaches to risk informed in-service inspection have been proposed, but most of them rely on assessing the severity of process degradation mechanics and assigning a level of risk to specific processes. Developed databases, namely the SKI-PIPE for the worldwide nuclear industry, allow for a comparison to the Thomas model and databases. A study examining the SKI-PIPE database indicates that the age factor can range as high as 2.0 for larger diameter pipes in facilities older than 25 years, and as high as 2.5 for pipes subject to stress corrosion cracking environments (Lydel 2000).

The California State Fire Marshal (CSFM) pipeline study indicates that pipeline leak rates are relatively constant during the 30- to 40-year timeframe, and then increase substantially (CSFM 1993). The failure rates of the oldest pipelines are 2.8 times greater than the average.

For this study, it was assumed that as equipment ages beyond the first 10 to 20 years, to the age of more than 40 years, lack of proper maintenance would substantially increase failure rates. However, if proper maintenance practices are employed and equipment is repaired or replaced proactively, it would be assumed that base failure rates would be similar to the average rates seen in the industry. Since all age-related degradation issues (e.g., corrosion) cannot be captured by even the best maintenance programs, a factor of 2.0 has been included in the base failure rates for equipment more than 20 years old.

The average base failure rate for a group of equipment was quantified by examining the range of failure rates between the different databases (WASH, Lees, HLID, Rijnmond, and Center for Chemical Process Safety) and assigning the higher failure rates to equipment in corrosive service and receiving less maintenance. For example, the failure rates for a rupture of process piping, from a number of reputable studies range from a very high rate of once every 40,000 meter-years to a very low rate of once every 11 million meter-years (WASH1400, Lees, Center for Chemical Process Safety, and Rijnmond). This results in an average failure rate of about once every 1.9 million meter-years. The higher values are assumed to correlate to facilities that operate under corrosive service and below-standard maintenance. The lowest rates are assumed to correlate to facilities that have less- or non-corrosive service and the highest standards of maintenance. The Proposed Project facilities were assumed to be new with less- or non-corrosive service because they are associated with relatively sweet gas, rather than very sour gas.

Appropriate maintenance was determined from the State of California Safety Orders, the Uniform Fire Code, National Fire Protection Association (NFPA), and API, as well as industry practice. Appropriate maintenance would include:

- An established computerized maintenance management system, including record keeping, design review, maintenance checklists, diagnostics recording, preventative scheduling, and monitoring.
- For piping and pipelines, visual and ultrasonic or non-destructive testing inspections for corrosion (per API 574) and cathodic potential inspections (for underground piping), as is conducted on many pipelines utilizing smart pigs and cathodic potential systems. Pipe coating would be maintained to protect against weathering, and pipe bracing should be maintained for seismic considerations. The frequency of non-destructive testing of process piping would be a function of the corrosiveness of the service. However, a baseline should be established for older piping.
- For vessels, external and internal visual and ultrasonic testing should be conducted every 5 years. Maintenance of vessel bracing and bolting for seismic considerations. Pressure relief to safe locations, preferably closed systems.

- For atmospheric tanks, ultrasonic wall testing every 5 years, bottom examination every 10 years, and appropriate seismic design considerations to prevent failure in an earthquake.
- For valves, checking for small leaks more than once per year, since small leaks are frequently precursors to larger leaks and ruptures. Valves should also be exercised at least annually to ensure operational effectiveness, and should be refurbished periodically, including seal and seat refurbishment or replacement, according to manufacturer's recommendations. Pressure relief valves should be pressure checked annually. Pressure relief valves that fail the annual test should be retested within six months.
- For rotating equipment, such as pumps and compressors, appropriate maintenance may involve replacing seals, oil maintenance, and a number of other operations according to the manufacturers' recommendations. Also, design issues are important, such redundant systems that allow for more frequent maintenance activities, pressure relief systems that vent to a safe location, and seismic bracing for piping and equipment.
- For sensor equipment, such as lower explosion level, fire eyes, and H_2S sensors, appropriate maintenance would involve replacing sensors when new technology presents a significant improvement in reliability, and conducting quarterly inspections and testing to ensure operational effectiveness.
- For control systems, such as level, pressure, vibration, and temperature, annual testing including system actuation to ensure operation.
- Emergency shutdown systems should be checked and exercised annually.
- For fire water systems, testing and exercising annually, pressure testing water header, verification of flow alarms, fire pumps weekly inspection and annual performance test, foam system sampled and analyzed annually.

Earthquakes

During earthquakes, ground vibrations and subsequent liquefaction of the earth under structures can collapse and damage buildings and processing equipment. There is no exact correlation between earthquake Richter scale magnitude and ground acceleration values. Earthquakes measuring the same Richter scale value can generate different acceleration values, and thereby equipment damage, depending on the depth and type of ground shaking. For example, the 1994 Northridge earthquake had a magnitude of 6.7 and a peak ground acceleration of 0.94g (g being the acceleration of gravity), whereas the 1971 San Fernando earthquake had a magnitude of 6.7 and a peak ground acceleration of 1.25g.

The distance between the epicenter and the estimated peak acceleration location can also vary. The estimated distance to the peak ground acceleration in the Northridge earthquake was double the distance in the San Fernando earthquake. The distance to the peak acceleration value can be as much as 24 miles. This indicates that areas of damage are not limited to the epicenter of an earthquake.

Equipment damage can be understood by examining damage to equipment during past earthquakes.

This report examined reconnaissance reports published by the Earthquake Engineering Research Institute for these earthquakes (the reports are not available for all earthquakes):

- Imperial in 1979;
- Northridge in 1994;
- Coalinga in 1983;
- Santa Barbara in 1978;
- Whittier Narrows in 1987; and
- Loma Prieta in 1989.

The 1987 Whittier Narrows earthquake damaged more than 10,000 buildings in the Whittier area and destroyed 123 single-family homes. The earthquake measured 5.9 on the Richter scale and produced a peak measured acceleration of 0.63g more than 6 miles from the epicenter. During the Whittier Narrows earthquake process equipment was damaged, including a large chlorine tank dislodged while being filled, releasing 240 gallons of chlorine. The reports do not state whether it was anhydrous (in a pressurized tank) or aqueous chlorine (in an atmospheric tank), although both could produce a toxic cloud of chlorine.

Among the earthquakes examined for this report, most process industry equipment damaged during the earthquakes was related to atmospheric oil or water storage tanks that ruptured or developed severe seam leaks. Piping connected to the atmospheric tanks often ruptured. Vessels that were not anchored showed some sliding and pipes leaked when the equipment shifted. However, no pressurized vessels failed and no gas liquids (e.g., propane or natural gas liquids) were released during any of the studied earthquakes.

The California Department of Conservation's Division of Oil, Gas and Geothermal Resources (DOGGR) 1984 annual report presents results of drill operator surveys in the Coalinga area to assess damage to drilling and processing equipment after the 1983 magnitude 6.3 Coalinga earthquake (with a peak ground acceleration of 0.54g measured 5 miles away, although no accelerometers were located in Coalinga). The survey indicated that more than 40 atmospheric tanks significantly leaked due to the earthquake. Impact to vessels, compressors, and processing equipment was limited to some shifting and failed equipment tie-downs and fittings, but there were no significant material releases. Some wells sustained damage to downhole casing, but no releases occurred.

Earthquakes are difficult to assess in a QRA. Earthquakes can have a range of magnitudes and ground acceleration values, and their impact on equipment is a function of the ground shaking characteristics as well as acceleration. The approach taken in this study is similar to that used as part of the Environmental Protection Agency (EPA) Resource Management Plan and the California Accidental Release Program. Seismic probability assessments are conducted on a facility to estimate the maximum credible earthquake, and seismic engineers assess the equipment to ensure that it can withstand an earthquake of the maximum credible magnitude. Any deficiencies are corrected to ensure that the facility is seismically safe. This approach essentially assumes that, given good seismic engineering practices and design, a rupture release would not occur in the event of the largest credible earthquake. This approach is supported by the earthquake damage reports discussed that provide evidence of the advantages of good engineering design. However, it is assumed that atmospheric storage tanks would fail given a large magnitude earthquake producing peak ground acceleration values exceeding 0.50g. A peak ground acceleration value of 0.50g would occur approximately once every 5,000 years for the Project Site location, based on the US Geological Survey analysis, and this value is included in the atmospheric tank failure frequency. Failures of piping would occur if an earthquake occurred that produced a peak ground acceleration of more than 1.0 g, which would occur approximately every 30,000 years.

There are several sources of variation in the failure rate numbers. These sources include the equipment types and boundaries; the severity of the processes; the application and environment of the equipment; the equipment's age and maintenance history; construction suitability; and interpretations of data gathering at the facility levels.

It should be emphasized that the approach taken to estimate the equipment failure rates in this study is an approximation. The large number of variables involved and the relatively sparse information available, particularly related to age influences on equipment failure rates, necessitates a best estimate approach. Ideally, the most accurate data would be obtained from several facilities exactly like the Proposed Project, using the same methods to gather data, the same type of equipment, and the same services over many years. Unfortunately, failure data is not gathered specifically enough to obtain statistically significant numbers for the exact variables that match the facility. For example, all of the databases include some equipment that is old and some that is relatively new, so there is some duplication in the approach to estimating equipment failure rates and the associated rates as a function of age.

The Center for Chemical Process Safety includes the variability in frequency numbers and provides a high, low, and a mean value for a range of equipment. These ranges show that frequency numbers for equipment average a high of 3.6 times the mean, and a low of 0.0042 times the mean failure rate value.

Consequence Analysis

The consequence analysis and hazard modeling consider the physical effects of a release and its damage to people. The analysis judges the severity of potential hazards associated with accidents and their possible consequences.

Risk assessments typically evaluate fire, flammability, explosion, and toxicity. Fire and flammability hazards are relevant for flammable vapors with relatively low flash points, such as propane and methane; their hazard is usually thermal radiation from vapor jet or pool fires. In addition, larger vapor jet fires can also lead to a loss of structural integrity of other storage or process vessels. The temperature in flame jets is usually high, and flame impingement onto nearby equipment is of the greatest concern.

The release and ignition of flammable vapors may also cause an explosion. The blast overpressure hazard depends on the nature of the chemical, the strength of the ignition source, and the degree of confinement. Finally, toxic chemicals can produce adverse effects to humans. The degree of these effects depends on the toxicity of the material and the duration of the exposure.

Performing state-of-the-art hazard assessment requires a combination of sophisticated analytical techniques and extensive professional experience. The models in this analysis are the result of more than two decades of development, and they have been validated using large-scale field tests. They have also been computerized for ease of use; they operate on personal computers. While a large number of consequence models are available, only a few specific models were needed to assess the hazards identified as part of this study.

The hazard assessment models used as part of this analysis can be categorized into two groups:

- Release rate models; and
- Vapor dispersion models.

The following sections discuss the general characteristics of each of the models used in this analysis. Specific models used in the analysis were selected based on the scenarios identified in the hazard identification task.

Release Rate Models

Several models were utilized to simulate potential releases of gas, liquefied petroleum gas, natural gas liquids, and crude vapor, and two-phase releases from pipes and vessels.

One of the first steps in consequence modeling is to establish the source terms (i.e., release rate, temperature, pressure, and velocity) associated with each scenario. The release rate is the rate at which the material is released from the pipe or vessel to the atmosphere. Before the source terms can be estimated for each scenario identified in the hazard analysis, the thermodynamic and physical properties of each hydrocarbon stream must be characterized. The thermodynamic and physical properties of the hydrocarbon streams were estimated using the IoMosaic SuperChems™ model, which utilizes numerous thermodynamic and physical property estimation techniques.

The SuperChems™ model simulates the release of multi-component liquid and vapor streams characteristic of the potential releases associated with the facility. For this study, these models are useful in assessing the effect of multi-component streams on vapor cloud flammability characteristics.

<u>Two-Phase Flashing Flow Model</u>

This is a critical two-phase flashing flow and multi-component liquid discharge model based on methodology validated by experimental data in recent literature. The data have demonstrated that, for a pipe length exceeding approximately 4 inches, regardless of pipe diameter, there is enough residence time for a discharging flashing liquid to establish isentropic equilibrium in the pipe. Using an established method, the Slip Equilibrium Method, the model does a friction calculation based on average vapor and liquid mixture properties and sequentially solves the equilibrium and mechanical energy balance equations, accounting for the pressure reduction, and recalculating the mixture properties for adiabatic expansion. The output of the model gives a mass release rate and defines the properties of the exiting hydrocarbon aerosol mixture.

This model was used to estimate release rate characteristics for the scenarios where potential aerosol formation could occur as a result of rapid vessel or pipeline decompression and cooling, or where pressurized liquids (e.g., gas liquids) could be released.

Steady and Non-Steady Release from a Pressurized Vessel or Pipeline

These numerical steady and non-steady state flow models are used to compute multi-component liquid and vapor release rates from a ruptured valve or pipeline. The steady-choked and un-choked flow models compute a single release rate assuming uniform pressure and temperature in the vessel; in most blow-down processes from pressure vessels, the pressure inside is sufficiently high that choked flow (i.e., releases at sonic velocity) conditions exist during most of the blow-down period. However, in smaller pressure vessels, or for relatively larger release rates, the conditions inside the vessel are not steady. The pressure drop influences the flow velocity and, thus, the mass flow rate. In addition, the density and temperature inside the vessel are also changing. The unsteady state models compute a time-dependent release rate profile based on the chemical component properties.

The modeling method for release rate is to simulate the initial and the average release rate from a pipe or vessel rupture based on the operating conditions: the temperature, pressure, and composition. The initial release rate is then assumed to be steady for the duration of a flammable release (the average release rate is used for a toxic release) until the process inventory is expelled or a system shutdown intervenes.

Dispersion Models

Among the models required for hazard assessment, vapor dispersion models are perhaps the most complex. This is due to the varied nature of release scenarios, as well as the varied nature of the chemicals that may be released into the environment. The user must select the exposure limit carefully, to reflect both the impact of interest (e.g., fatality, serious injury, injury) and the scenario release conditions (particularly the duration of the release).

In dispersion analysis, gases and two-phase vapor-liquid mixtures are divided into three general classes:

- Positively buoyant;
- Neutrally buoyant; and
- Negatively buoyant.

These classifications are based on density differences between the released material and its surrounding medium (air) and are influenced by release temperature, molecular weight, ambient temperature, relative humidity, and the presence of aerosols.

Initially, density of the release affects the dispersion process. A buoyant release may increase the effective height of the source. By the same token, a heavier-than-air release will slump towards the ground. For heavier-than-air releases at or near ground level, the initial density determines the initial spreading rate. This is particularly true for large releases of liquefied or pressurized chemicals, where flashing of vapor and formation of liquid aerosols contributes to the initial effective vapor density and, therefore, to the density difference with the air. This is particularly true for gas releases where significant cooling of the released material occurs due to expansion of the gas from the pipe pressure to atmospheric pressure.

Results of recent research programs dramatically indicate the importance of heavy gas dispersion in the area of chemical hazard assessment:

- The initial rate of spreading is large and is dependent on the differences between the effective mean vapor density and the air density.
- The rapid mixing with ambient air due to slumping leads to lower concentrations at shorter distances than those predicted using neutral density dispersion models.
- There is very little mixing in the vertical direction and, thus, a vapor cloud hugging the ground is generated.
- When the mean density difference becomes small, the subsequent dispersion is governed by prevailing atmospheric conditions.

Since heavy gas dispersion occurs near the release, it is particularly important when considering large releases of pressurized flammable chemicals.

In addition, dispersion analysis is also a function of release modes, which are divided into several categories:

- Instantaneous release (puff);
- Continuous release (plume);
- Momentum-dominated continuous release (jet); and
- Time-dependent continuous releases (jet/plume).

For instance, a momentum-dominated jet will dilute much faster than a plume due to increased entrainment of air caused by the jet. This is especially important when simulating the release of compressed gases.

In addition to the effects of initial release density, the presence of aerosols, release rate and quantity, release duration, and mode of release, dispersion analysis also depends on:

- Prevailing atmospheric conditions;
- Limiting concentration;
- Elevation of the source;
- Surrounding roughness and terrain; and
- Source geometry.

Prevailing atmospheric conditions include a representative wind speed and an atmospheric stability class. Less stable atmospheric conditions result in shorter dispersion distances than more stable weather conditions. Wind speed affects the dispersion distance inversely. Because weather conditions at the time of an accident cannot be determined a priori, it is usually prudent to exercise the model, at a minimum, for both typical and worst-case weather conditions.

Limiting concentration is the concentration at which human health effects would begin to occur. It affects the dispersion distance inversely. Lower concentrations of concern lead to larger dispersion distances. As with source release rate, the effect is non-linear. For example, for steady state releases, a reduction factor of 100 in the limiting concentration results in an increase in the dispersion distance by a factor of approximately 10.

Source elevation is attributed to the physical height of the source (such as a tall stack). In general, the effect of source height is to increase dispersion in the vertical direction (since it is not ground restricted), and to reduce the concentration at ground level.

Surrounding roughness and terrain affect the dispersion process greatly. Roughness is defined as involving trees, shrubs, buildings, and structures, while terrain is defined as hills and general topology. Roughness usually enhances dispersion, leading to a shorter dispersion distance than predicted using a smoother, or lower, roughness factor.

Source geometry refers to the actual size and geometry of the source emission. For example, a release from a safety valve may be modeled as a point source. However, an evaporating pool may be very large in area and require an area source model. Source geometry effects are significant when considering near field dispersion (less than ten times the characteristic dimensions of the source). At farther distances, the source geometry effects are less significant and eventually negligible.

Plume Dispersion Models (Atmospheric)

For the estimation of hazard zones for low to zero velocity releases involving flammable or toxic materials, a set of neutrally buoyant Gaussian plume models are available. The effects of initial density are usually small in the computation of far field dispersion zones. The most relevant release characteristics affecting the extent of vapor dispersion are the release rate (or quantity), the release duration, the limiting concentration, and the ambient conditions.

Several mathematical variations are included in the models. They have also been computerized as part of the IoMosaic SuperChems™ modeling package for ease of use. Additional models, rigorously evaluated, are available in the public domain. These models have been validated using large-scale field tests and wind tunnel experiments. The variations in these models consider the details of the source effects (as opposed to the virtual source method). They include:

- A continuous line or plane source model (to approximate finite size source effects from evaporating pools, overflowing dikes);
- A continuous point source plume model (isolated stack) including effects of buoyancy and momentum (jets);
- A finite duration point source model for concentration;
- A finite source duration and receptor duration to model dose effects from a point source; and
- A finite duration "probit" model which accounts for a non-linear dose response relationship.

As a function of downwind distance, each of these models evaluates concentration and cloud width at both source and ground level.

Dense Gas Dispersion Model

The SLAB model for dense gas dispersion was used to model the high pressure gas releases and the gas liquids releases. This model has been validated against experimental data and is available in the public domain. It is appropriate for gas releases, which become cold when they expand from high pressure to atmospheric pressure upon escape from a pipe or vessel. The SLAB model includes the effects of air entrainment into high speed jets of gas, the gravity effects on cold dense gases which cause the cloud to slump and spread, the warming of the cloud and the transition to a passive Gaussian dispersion. NTIS publication DE91-008443, available from the EPA, contains more details on the SLAB model.

A number of sources discuss the effects of jet entrainment and momentum dominated jets, including Lees "Loss Prevention in the Process Industries," and the CCPS "The Use of Vapor Cloud Dispersion Models" and "Vapor Cloud Source Dispersion Models Workbook." The Center for Chemical Process Safety discusses jet entrainment and momentum dominated jets. For releases from pressurized pipes and vessels, if the pressure exceeds two times the ambient pressure, then the flows are generally sonic, with speeds up to 400 m/s, and produce significant jet entrainment issues.

Several studies have validated the jet models in large-scale controlled releases at the Burro trials, Coyote trials, Desert Tortoise, and the Goldfish trials (Chan and Ermak 1983, Koopman 1983, and Morgan 1983).

It should be noted that using a jet model for the near-field dispersion produces smaller hazard zones than a simplified Gaussian model because the jet effects of a gas released from a pressurized source entrain large amounts of air. This entrained air causes more rapid dilution of the streams and, in combination with temperature and density effects, subsequently smaller hazard zones. Jet effects can reduce hazard zone estimates by up to 50 times over the simplified Gaussian estimates (CCPS, Lee). Given the extensive field validation of the effects of jets and near-field air entrainment, it is believed that the jet models are a more realistic estimate of hazard distances than the simplified Gaussian models.

Flame Jet Model

This model is designed to simulate turbulent diffusion flames (flame jets) and can characterize the turbulent flame length, diameter, temperature, and thermal radiation effects. This model is capable of simulating inclined turbulent jets, radiation fields, and the aerodynamic effects on radiant energy and flame stability. This model was used for all scenarios where potential flammable vapor releases were identified.

Unconfined and Partially Confined Vapor Cloud Explosion Model

A partially confined deflagration model was used to estimate overpressure levels for each flammable vapor release considered. This model is a theoretical one-dimensional model for predicting overpressures within several geometric configurations, and it accounts for the non-ideal behavior of burnt and unburnt gaseous components during high-pressure venting and multi-reaction chemical equilibrium. The pressure-time histories within the explosion chamber (i.e., confined space or vapor cloud) are calculated by the model and are in generally good agreement with small- and large-scale experimental data on methane-air, propane-air, and hydrocarbon mixture vented and unvented explosions. Explosion potential is expressed in terms of trinitrotoluene (TNT) equivalence, and well-known shock wave propagation relationships are used to estimate overpressure levels at specified distances from the explosion.

The potential for unconfined vapor cloud fires and explosions were also assessed using the IoMosaic SuperChems™ model. The potential for a vapor cloud explosion versus a vapor cloud fire was assessed based on the physical characteristics of the hydrocarbon stream. Parameters that influence the potential for, and consequences of, a vapor cloud explosion include:

- Characteristics of ignition sources;
- Flame acceleration mechanisms;
- Deflagration to detonation transitions;
- Direct initiation of detonations;
- Overpressure levels within the combustion zone;
- Effects of pressure rise time dependency on structures versus TNT curves;
- Minimum amount of mass sufficient to sustain an unconfined vapor cloud explosion;
- Partial vapor cloud confinement and flame reflection characteristics; and
- Explosion efficiencies.

The SuperChems™ model was used to assess whether or not enough flammable mass could accumulate to sustain an unconfined vapor cloud explosion (a relatively large amount of flammable mass is required for the flame front in the vapor cloud to gain sufficient speed to result in a pressure wave within the vapor cloud). In most cases, the amount of flammable mass or the levels of confinement were not sufficient to sustain an unconfined vapor cloud explosion. In other cases, modeling results showed that vapor cloud ignition would be characterized by a deflagration (i.e., sub-sonic flame velocity) and would not transition to a full detonation (i.e., supersonic flame velocity).

Boiling Liquid Expanding Vapor Explosion Model

A boiling liquid expanding vapor explosion is a sudden loss of containment of a liquid that is above its boiling point (at atmospheric conditions). A boiling liquid expanding vapor explosion results in a sudden, vigorous liquid boiling and the production of a shock wave. Liquids stored under pressure (such as the gas liquids) fall into this category as well as any liquid that is stored at an elevated temperature above its boiling point. The main hazards presented by liquids stored under pressure are fireball and radiation.

Boiling liquid expanding vapor explosions were modeled using the SuperChems™ model for fireballs. The approach estimates the total energy that could be produced by the material combustion and the duration of the explosion. Impacts are estimated by integrating the energy flux over the time that the explosion occurs at different distances from the source of the explosion. Overpressure due to boiling liquid expanding vapor explosion was also estimated assuming the vessel fails due to overpressure, and the resulting shockwave is dissipated into the environment. The larger of the hazard zones pertaining to boiling liquid expanding vapor explosions (either overpressure or thermal radiation) was used to estimate risk.

Recent incidents indicate the extent to which gas liquid releases can cause impacts. In December 2006, a propane gas leak in a Milwaukee plant led to an explosion, killing three people and injuring 46 others. The explosion knocked workers off their feet, broke windows in nearby houses and businesses, and scattered burning debris over several blocks. Concussions from the blast were felt miles away (LA Times 2006).

A 1998 incident in Iowa provides valuable lessons regarding propane tank fires and boiling liquid expanding vapor explosions. Vehicle impact sheared ¾ liquid pipe off of an 18,000-gallon propane tank. The excess flow valve on the line was not sized correctly and did not close. The resulting fire engulfed the tank, subsequently causing a boiling liquid expanding vapor explosion. Fire department personnel set up too close to the tank (100 feet) and two people were killed. Fragments thrown from the blast caused additional fatalities.

An incident on October 6, 2007, in Tacoma, Washington, involved a propane tanker truck and propane storage vessels. Reports indicate that a propane-truck driver off-loaded propane that may have leaked. Nearby welding may have created sparks that ignited the fumes. The propane tanker subsequently exploded, apparently damaging the propane storage tanks. The thermal impacts to the propane storage tanks caused the pressure relief devices on the propane storage tanks to relieve, sending a flame jet high into the air. The tanks continued to vent propane and produce a flame jet for multiple hours. The explosion was so intense that part of the tanker truck landed on a nearby highway. Video of the explosion was available on the internet. Video taken approximately 0.25 miles from the explosion indicated a large fireball. However, no overpressure impacts were felt at the video location except for car alarms activated by the pressure wave.

This incident serves to highlight the type of impacts that external events can have on active firefighting equipment, such as deluge systems. The explosion of the propane truck or the flame jets and high thermal impacts of releases effectively would have destroyed any fire-fighting capability of the deluge system. This is why deluge systems are assigned a relatively high failure rate in the fault trees.

Fatality and Serious Injury Rates

Since the release streams are flammable, releases could potentially result in thermal radiation exposure from a fire, and also present an overpressure hazard due to explosions from flammable vapor clouds or boiling liquid expanding vapor explosions. Damage criteria were developed in order to quantify the potential consequences of an accidental release. Damage criteria are defined as the levels of exposure that could produce fatalities and produce serious injuries.

Serious injury is defined as an impact from the exposure that could require medical intervention and could produce effects that last significantly longer than the duration of the exposure. An injury such as lung damage that would require hospitalization and/or other types of therapy would be considered a serious injury.

Thermal Radiation Damage Criteria

The potential concern associated with large-scale compressed gas vapor jet fires is thermal radiation intensity, and its effects on persons, the surrounding structures, processes, and fire suppression equipment. Table 4.2-2 presents an overview of thermal radiation intensity and observed effects. Data presented in these tables show that no considerable physical effect would result from exposure to a radiation intensity between 1 and 1.6 kW/m^2 over extended periods. Exposure to a radiation intensity of 5 kW/m^2 would result in pain if the exposure period were to exceed 13 seconds, and it would result in second-degree burns after 40 seconds. Exposure to a radiation intensity of 10 kW/m^2 would result in pain (5 seconds) and second-degree burns after short exposure periods (i.e., 14 seconds), and death after longer periods.

Table 4.2-2 Thermal Radiation Serious Injury and Impacts

Intensity (kW/m^2)	Impact
1	Time for severe pain - 115 seconds Time for second-degree burns - 663 seconds [a]
1.6	No discomfort for long exposure [b]
2	Time for severe pain - 45 seconds Time for second-degree burns – 187 seconds [a]
3	Time for severe pain - 27 seconds Time for second-degree burns - 92 seconds [a]
4	Time for severe pain - 18 seconds Time for second-degree burns - 57 seconds [a]
5	Time for severe pain - 13 seconds Time for second-degree burns - 40 seconds [a]
10	Time for severe pain - 5 seconds Time for second-degree burns - 14 seconds Time for 100% fatality - 270 seconds [a c]
12.5	Melting of plastic tubing [b]
25	Minimum energy to ignite wood [b]
37.5	Damage to process equipment [b]
100	Time for severe pain - <1 seconds Time for second-degree burns - 1 sec Time for 100% fatality - 11 seconds [c]

a. Based on Handbook of Chemical Hazard Analysis Procedures, FEMA. b. CCPS Chemical Process Quantitative Risk Analysis. c. CCPS Chemical Process Quantitative Risk Analysis using probit equation by Eisenberg

The time required to reach pain, second-degree burn, and fatality thresholds were used to estimate radiation levels that would result in serious injury or fatality. Persons exposed to thermal radiation have the opportunity to move away from the hazard, unlike overpressure effects or vapor cloud fires and explosions, which are instantaneous. It was assumed in this analysis that some people not within the flame area would move away from the flame to get away from the heat. Analysis of the distances to various radiation levels indicates that this is feasible. Therefore, a less than 1 minute exposure was used as the basis for determining the damage criteria. Exposure to a thermal radiation level of 10 kW/m^2 could result in a serious injury (at least second-degree burns) if exposed for less than 1 minute, and it was, therefore, assumed that all persons exposed to 10 kW/m^2 would suffer serious injuries. Serious injuries would start to be realized at and above 5 kW/m^2. Exposure to thermal radiation levels in excess of 10 kW/m2 would likely begin to generate fatalities in less than 1 minute. All persons exposed to thermal radiation within the flame area were assumed to suffer fatalities regardless of exposure duration.

Flammable Vapor Criteria

A release of flammable material can produce impacts by producing a cloud of the flammable material that, if it encounters an ignition source, either explodes or burns (deflagration) back to the material source. Persons located within the cloud when it explodes or burns could be seriously impacted. Whether the cloud explodes or burns is a function of the material and the level of confinement in the environment in which the cloud is located (e.g., within pipe racks, between buildings).

All release scenarios from the Proposed Project could contain flammable vapors. Potential ignition sources onsite are primarily located in the gas plant with fewer ignition sources throughout the field mostly associated with drilling or well workover operations or compressors or pumps.

Several biological and structural explosion damage criteria were reviewed, specifically the Center for Chemical Process Safety "Evaluating Process Plant Buildings for External Explosions and Fires" and Center for Chemical Process Safety "Chemical Process Quantitative Risk Analysis." This reference indicates that persons within a structure suffer considerably more damage than persons in the open due to overpressures. This is primarily due to secondary object impacts. Table 4.2-3 details the levels of impacts at various overpressure levels to buildings, equipment and persons.

Table 4.2-3 Overpressure Damage

Overpressure Level	Impact
0.04	Loud noise, sonic boom (143 dBA)
0.15	Glass breakage
0.30	Center for Chemical Process Safety projectile limit, 10% broken window glass, 95% no serious damage
1.0	Wood trailer roof and walls collapse Unreinforced masonry building partial collapse Estimated 10% injury rate
5.0	Wood trailer completely destroyed Unreinforced masonry building completely destroyed Utility poles snapped Estimated 100% injury rate
6.0	Reinforced building major damage/collapse Estimated 40% fatality rate
7.0	Loaded train wagons overturned
12.0	Reinforced building completely destroyed Estimated 100% fatality rate
15.0	Lung hemorrhage, lower range of direct human fatalities

Source: CCPS 1989

An overpressure level of 0.3 psi would likely result in broken windows and some potential for serious injury. Complete structural damage and serious injury/fatality could occur for wooden buildings and unreinforced masonry as a result of exposure to an overpressure level of 1.0 psi. An overpressure level of 5.0 psi would result in structures being completely destroyed and an estimated 100 percent serious injury/fatality to building occupants.

Deflagration of the vapor cloud would produce impacts to persons located within the flammability limits of the vapor cloud. Persons located within the lower flammability limit would most likely suffer at least serious injuries. As there is some natural variability within the cloud, it is assumed that persons located within the area that would be encompassed by a level of concern equal to one-half the lower flammability limit (a larger area than the lower flammability limit area) would suffer serious injuries.

Table 4.2-4 details the criteria selected for the risk analysis for both fatalities and serious injuries. In this table, the zero percent fatality or serious injury level is the level at which fatalities or serious injuries could begin to occur.

Table 4.2-4 Fatality and Serious Injury Rates

Event	Fatality	Serious Injury	Reference
Vapor Cloud Fire	30% fatality within the lower flammability limit	100% injury within the lower flammability limit 50% injury within ½ lower flammability limit	Assumes 30% of the population is outdoors and would suffer 100% fatalities within the lower flammability limit. Assumes indoor population would not suffer more than serious injury due to subsequent fire and damage. Outdoor population percentage estimated.
Thermal Radiation Jet Fire or Pool Fire	100% fatality within flame jet area 10% fatalities at 10 kW/m^2	100% injury at 10 kW/m^2 10% injury at 5 kW/m^2	Based on Handbook of Chemical Hazards Analysis Procedures, exposure to 10 kW/m^2 produces second-degree burns in 14 seconds, 10% fatalities at 60 seconds based on Eisenberg Probit Equation (1975). Injury based on time to second-degree burns of less than 1 minute for 10 and 5 kW/m^2.
Boiling Liquid Expanding Vapor Explosion: Radiation Dosages	10% fatalities at 80 kJ/m^2	100% injury at 80 kJ/m^2 10% injury at 25 kJ/m^2	Based on total energy integration over boiling liquid expanding vapor explosion duration using the jet fire energy rate.
Explosion: Over Pressure	10% fatalities at 1 psi	5% injury at 0.3 psi	Based on Center for Chemical Process Safety Process Plant Buildings (Table 4.8) where occupants of a building experience 10% fatality at 1 psi for an unreinforced masonry or wood framed building. Injuries produced at 0.3 psi overpressure assumed to be 5% as per the probability of serious damage.
Toxic	1,000 ppm 10% fatality	100 ppm 10% injury	Estimated based on OSHA exposure limits and animal studies.

Notes: kW/m^2 = kilowatts per square meter; kJ/m^2 = kilojoules per square meter; psi = pounds per square inch; ppm = parts per million

Risk Analysis

The results of the failure rate and consequence analysis are finally combined to develop risk profile curves (plots of frequency versus the number of fatalities or serious injuries). These risk profile curves are commonly called risk profiles and represent "societal risk." This is the risk that a person could sustain serious injury or fatality. In calculating the risk profiles, a computer model of the pipelines, facility, and surrounding area was prepared. The population distribution and probabilities of ignition were specified across the area of the model; and the likelihood of an individual fatality or injury occurrence was calculated at each grid location in the model.

The analysis has assumed that the facilities are operating at their current levels and that the populations near the facility are at their current estimated levels.

To develop the risk profile, many factors were considered. Each release scenario was evaluated for all wind directions, and for each combination of stability and wind speed. In any given direction of travel, the chances of having the particular wind stability class, the cloud igniting on-site, and the cloud igniting offsite at every downwind location from the release site was evaluated. The frequency of attaining the maximum downwind distances for flammable vapor dispersion will be reduced if the vapor cloud encounters ignition sources at the point of release or at any point along its travel path.

The approach for general calculations followed these steps:

- Summarize meteorological data into representative wind direction, wind speed and stability conditions;
- Construct a model of the site and surrounding area, including populations and population densities;
- Identify the ignition sources and enter the ignition probabilities;
- Select the release events, along with the likelihood of release, consequence data and release locations;
- Determine the event trees; likelihood and consequences of immediate ignition, vapor cloud fires, jet fires, and explosions as appropriate, for each condition;
- Determine the probability of ignition at each point along the path of a dispersing vapor cloud;
- Select another release event and repeat the preceding three steps;
- Apply conditional probabilities of fatality given exposure, for each type of consequence (i.e., thermal exposure, vapor cloud exposure);
- Aggregate the likelihood of all probabilities of fatality at each location in the model for all the release scenarios; and
- Construct risk profiles, or frequency number, of fatality curves by summing the number of fatalities for each event outcome and plotting the results against the frequency. This was also done for serious injuries.

Meteorological Data

Meteorological data is used for the closest monitoring location. Atmospheric stability classes D and F are selected as characteristic wind stability conditions. Based on wind speed conditions for these stability classes, a wind speed of 4.0 m/s is usually selected for stability class D (neutral atmospheric stability), while a wind speed of 2.0 m/s was selected for stability class F (stable atmospheric conditions).

Population Data

Population information is gathered for locations within 0.5 miles of the Project Site. These locations are listed, along with the estimated populations, population densities, and ignition probabilities.

Populations at these areas were entered into the Quantitative Risk Assessment Model. Information was gathered from site visits, estimates of populations from housing counts generated from aerial photographs, and from Census data.

Ignition Probabilities

Flammable vapor clouds have the potential to ignite anywhere within their flammable limits. Hence, it is necessary to identify potential ignition sources that a cloud may encounter, and to quantify the likelihood of ignition if the cloud encompasses these sources. When determining ignition probabilities, there are two factors to take into account; source duration and source intensity. Source duration is the fraction of time that the source is present or in operation. Source intensity is the chance of the source actually causing ignition if contacted by a flammable cloud. For example, if a ground level flare is operating, it will almost always ignite a cloud, but it may only operate ten percent of the time. This would generate an overall chance of ignition by the ground level flare of 0.1 (or 10 percent).

In general, when trying to identify ignition sources, the search is primarily for open flames, hot surfaces and electrical sparks, and, to a lesser extent, friction sparks from both continuous and intermittent activities. Extensive listings of potential ignition sources and estimates of ignition probabilities may be found in the literature (CCPS 1989, UK 2004).

Typical ignition probabilities that were used in the analysis include:

- Cars – 0.06 per car; although many potential ignition sources within a car, such as faulty wiring or backfires, are due to fuel rich mixtures in intake air, they are not always present nor guaranteed to cause ignition. This value was also applied to golf carts (CCPS).
- Houses – 0.01 per house; while there are many ignition sources within a home (switches, doorbells, faulty wiring, pilot lights, smoking materials, fireplaces, and stoves), the flammable vapors must first penetrate the house before these ignition sources pose a hazard. Typical residence times of clouds are brief enough that this is relatively unlikely (CCPS).
- Industrial Areas – 0.1 for light industrial, 0.25 for medium industrial and 0.5 for heavy industrial areas. Heavy industrial areas are classified as having large motors, high temperature surfaces and open flames (UKHSE 2004).

In order to estimate the number of vehicles, traffic counts for particular roads were used along with average speeds to determine the density of vehicles per mile and probabilities of ignition along roadways.

The onsite equipment that would most likely produce ignition would be equipment such as compressor motors or flares. Releases of materials that, due to wind direction, move over these sources are assumed to experience ignition and not travel offsite.

Post Accident Event Trees

Event trees are used to determine the fate of a released material after the release has occurred. A release of a flammable material, for example, could experience instantaneous ignition leading to a flame jet. It could also disperse downwind, encounter an ignition source and burn or explode, or it could disperse safely. Table 4.2-5 shows the probability of each of these scenarios for rupture and leak events. These probabilities are based on Center for Chemical Process Safety recommendations (CCPS 1989). Larger releases, which involve greater energies associated with metal failure and/or impacts, have a higher probability of igniting at the source and causing a flame jet than smaller releases.

Table 4.2-5 Event Tree Probabilities

Event Tree: Rupture Events (large releases > 50 kilograms per second)

Event	Probability
Immediate Ignition	0.25
Vapor Cloud with Flash Fire	0.75

Event Tree: Leak Events (smaller releases <50 kilograms per second)

Event	Probability
Immediate Ignition	0.10
Vapor Cloud with Flash Fire	0.90

Event Tree: Gas Liquids Releases

Event	Probability
Immediate Ignition	0.08
Vapor Cloud with Flash Fire	0.90
Explosion/boiling liquid expanding vapor explosion	0.002 - .07*

* - depends on configuration
Source: CCPS 1989

Construction of Risk Profiles

Risk profiles display the frequency with which public safety impacts/consequences (e.g., fatalities or serious injuries) exceed a given magnitude. They can be used to show property damage (among others), but are generally used for public safety impacts. The risk profiles indicate accident size (based on numbers of persons affected) and display how the potential number of fatalities varies as a function of frequency. Risk profiles are generally plotted on logarithmic scales because they span multiple orders of magnitude.

There are many sources of uncertainty that affect the risk profiles. These uncertainties include:

- Release frequency;
- Release size;
- Population impacts, including distribution and likelihood of fatality/serious injury;
- Behavior of the release (jet mixing versus passive dispersion);
- Accuracy of the hazard models; and
- Ignition sources and probabilities.

The release frequencies and sizes are the most important contributors to overall uncertainty. Changes in failure rates will directly influence the risk profile. A doubling of the event frequencies would double the probability of fatalities. Changes in the relative sizes of leaks and ruptures will influence the risk profile, but to a lesser extent. The assumptions concerning population distribution and ignition probability also influence the risk profiles.

Release Scenarios

To develop the release scenarios, proposed equipment and operations were grouped by operating parameters. Specifically, equipment with similar temperature, pressure, and composition was grouped together to generally produce a set of release scenarios for each process. Each set of release scenarios contained at least one rupture release and one leak release. A rupture is a large release of material over a short period of time caused, for example, by catastrophic equipment failure, such as a large pipe breaking open or a vessel falling over and fracturing. Ruptures are generally associated with releases through holes greater than 1 inch in diameter. A leak is a small process inventory released from a small valve failure or hole in a vessel, for example, generally less than 1 inch in diameter.

This approach encompasses a range of risks by including a less frequent but more severe scenario, and a more frequent but less severe scenario. It is important to note that, in some cases, the leak release actually produces a higher risk (i.e., combination of consequence and frequency) than the associated rupture release because leaks occur more frequently than ruptures.

The principal hazards most likely to affect public health at the Project Site include:

- Releases of flammable gas causing vapor cloud explosions or thermal impacts from fire and flame jets; and
- Releases of crude oil with subsequent fire causing impacts from thermal exposure to crude oil fires.

Scenario 1: Rupture of Gas Piping

This scenario involves rupture of the gas piping within the Refinery. Failure would be due to piping ruptures or leaks. This scenario was modeled as both a rupture and a leak, with the entire contents of the gas system being released. The rupture case conservatively assumed a break equal to a three inches hole operating at 500 psig. The leak case assumed a hole size of one inch. The release was modeled at normal operating pressure and temperature and the gas composition was produced gas. Possible consequences include flame jets and flammable vapor clouds. Impact distances would be less than 200 feet for fatalities and less than 500 feet for injuries.

Scenario 2: Crude Oil Release with Fire

This scenario encompasses the crude oil storage systems at the Refinery. The equipment includes crude oil storage tanks and piping. The scenario assumes a catastrophic loss of the tank contents with subsequent ignition and fire within the tank berms. Possible consequences include large crude oil fire and thermal radiation. Impacts distances for a large crude oil fire would be less than 180 feet for fatalities and less than 220 feet for injuries.

Scenario 3: Crude Oil Spill

This scenario encompasses the crude oil pipelines that transport crude oil to/from the Refinery. The equipment includes crude oil pipelines between the Santa Maria Pump Station and the Refinery and the pipeline that runs from the Refinery to Rodeo. In the event of a pipeline rupture, the leak detection system should be capable of detecting and isolating the spill. Once the pipeline is shutdown, the oil would continue to spill until the oil was drained from the associated segments of the pipeline. The maximum spill volumes from the pipeline are a function of the location of the pipeline rupture in relationship to isolation valves (motor operated valves, or MOVs or manual valves), check valves, and the pipeline elevation profile, and the duration of the pumping that occurs before the rupture is detected. If the SCADA system is not operational, or is overridden by an operator, it is assumed that the pumping would continue for 60 minutes before a rupture would be detected.

4.2.1.4 Existing Operations

For the public safety analysis, the study area includes the existing facilities and pipelines. The sources of risks include current operations at the Refinery, truck transportation of hazardous materials, and crude oil pipelines.

Santa Maria Refinery Risk of Upset

The Santa Maria Refinery processes crude oil and produced gas, both of which could present risks to the public. Crude oil is processed and then stored in tanks that could spill and ignite, creating thermal radiation impacts. Thermal radiation impacts from crude oil tank fires could cause injury 220 feet away. The closest population to the crude oil tanks at the Refinery is industrial area 425 feet northeast of the crude oil storage facilities. The closest residence to the crude oil tanks, which is located within the industrial area, is 1,200 feet northeast of the tank storage area. The gas processing equipment and piping are within the Refinery, at least 1,700 feet from the Refinery fence line and the closest receptor on industrial property. Given the limited population and significant distance between these receptors and the Refinery, there would not be a significant risk level.

A search of historical release data for the Refinery through the Federal Emergency Response Notification System indicates that in the last 28 years a total of 16 reportable releases occurred (from 1982 through 2010). Fifteen of these releases were associated with releases of excess gases to the emergency-only flare stack due to several equipment failures, including boiler and compressor failures. In 2004, a leaking crude oil pipeline caused a release.

Transportation of Hazardous Materials on Roadways

Materials transported by truck and rail could cause impacts if those materials are spilled. Crude oil transported to the Santa Maria Pump Station, as well as sulfur and coke transported by truck and rail, would primarily cause environmental impacts in the immediate vicinity of the spill. Crude oil and solid sulfur are not acutely hazardous materials. Coke is not a hazardous material. If crude oil was spilled, fire could occur along the transportation route at the accident location. Given the properties of crude oil, the likelihood of an explosion is virtually non-existent and consequently explosion scenarios are not addressed further in this document. Fire thermal impacts would be limited to the immediately vicinity of the spill site. Risk levels would be minimal due to the properties of crude oil and impacts would be associated primarily with environmental issues.

Transportation of Hazardous Materials by Pipeline

Materials transported by pipeline could cause impacts if those materials are spilled. Crude oil transported from the Santa Maria Pump Station could cause primarily environmental issues in the immediate vicinity of the spill, which could include downstream areas if a spill drains into a creek area. Crude oil is not an acutely hazardous material. If crude oil was spilled, fire could occur along the transportation route at the accident location. Given the properties of crude oil, the likelihood of an explosion is virtually non-existent and consequently explosion scenarios are not addressed further in this document. Fire thermal impacts would be limited to the immediately vicinity of the spill site. Risk levels would be minimal due to the properties of crude oil and impacts would be associated primarily with environmental issues.

Statistics on public safety impacts related to crude oil transportation suggest that the potential for injuries is low. The DOT Office of Pipeline Safety (OPS) database indicates there have been no fatalities, and nine out of 841 crude oil pipeline incidents led to injuries over a 14-year period in the United States, although none of these injuries were to the public. For the period pre-1985 (1968 to 1985) there were eight incidents that produced fatalities, and 12 incidents that produced injuries on crude oil pipelines, although none of these were impacts to the public. But the OPS database is unclear if these incidents occurred at or near other processing equipment (i.e., within a facility). The California State Fire Marshal's Hazardous Liquid Pipeline Risk Assessment report (CSFM 1993) indicates that over a 10 year period there have been no injuries or fatalities associated with crude oil pipeline spills in California. In general, unlike a gas release (which occurs much quicker), the lack of public impacts from crude oil spills is due to the possibility that most persons move out of the way of a spill and are not directly affected if it catches fire.

Santa Maria Pump Station to Refinery Pipeline

The pipeline between Santa Maria Pump Station and the Refinery contains a manual check valve on the north side of the Santa Maria River, which would prevent the oil from flowing backwards along the downhill gradient from the Summit Pump Station in the event of a spill. The Santa Maria and Summit pump stations also have automatic valves.

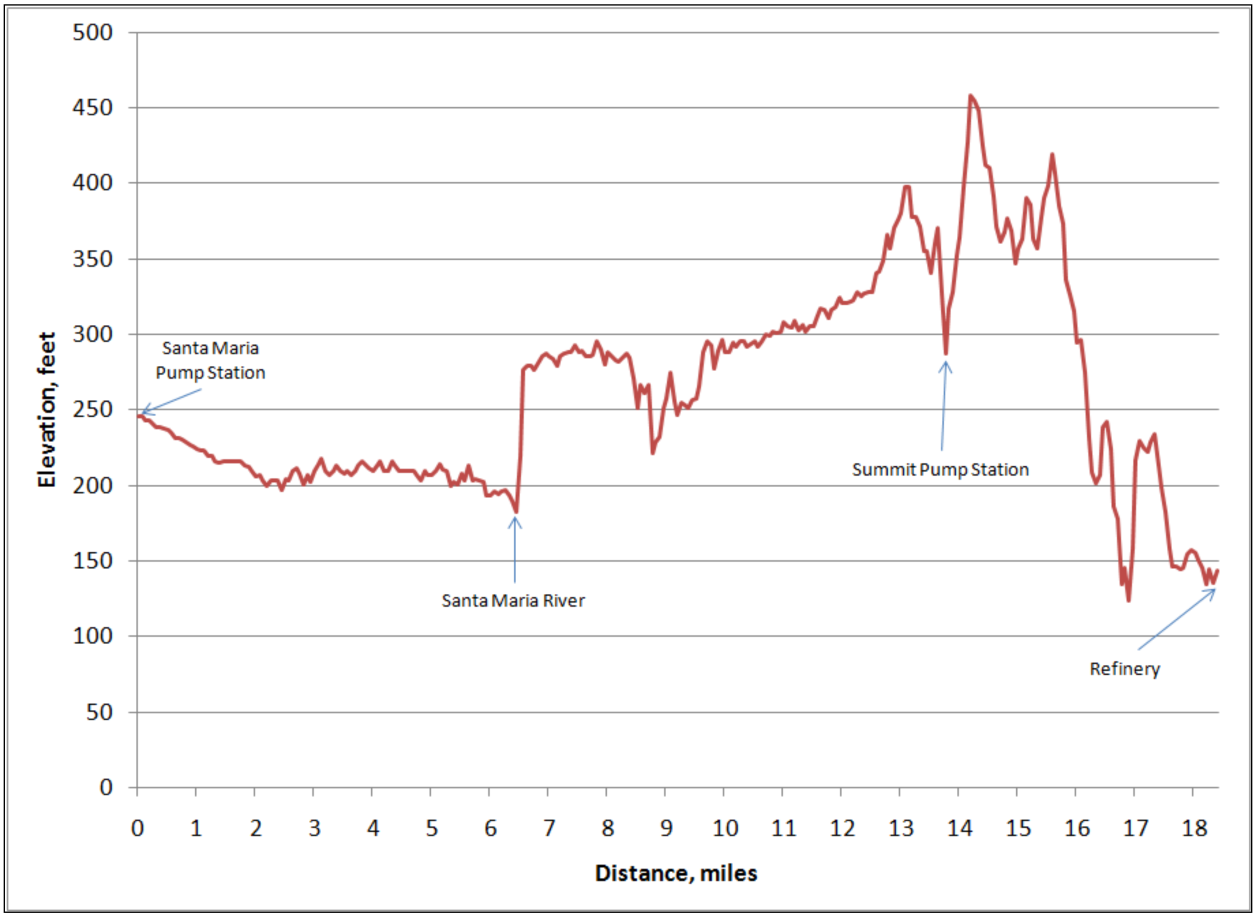
Spill volumes are calculated based on the pipeline elevation profiles shown in Figure 4.2-2 and previous environmental impact reports prepared for the pipeline (SBC 2001). Spill volumes could be as high as approximately 8,400 barrels between the Santa Maria Pump Station and the

Summit Pump Station. The most sensitive area would be the Santa Maria River crossing and the Nipomo Creek corridor.

Refinery to Rodeo Pipeline

Spills associated with the Refinery to Rodeo pipeline would be a function of the pipeline size, flow rates, and the pipeline elevation profile.

Figure 4.2-2 Santa Maria Pump Station to Refinery Pipeline Elevation Profile



Hazardous Materials Contamination and Transport

The Refinery must submit information on wastes generated, transported, or released offsite to the EPA as part of the Toxic Release Inventory Program and the Biennial Reporting System. Toxic Release Inventory reports indicate that the Refinery generates more than 155,000 pounds of waste annually; approximately 122,000 pounds are treated onsite, 300 pounds are recycled, 1,000 pounds are treated offsite, and 32,000 pounds are released (mostly into the air as sulfuric acid).

The Environmental Protection Agency has identified the Refinery as a "corrective action" site due to contamination. According to EPA Resource Conservation and Recovery Act reports, the site has human exposure "under control," but migration of contaminated groundwater is "not under control" (US EPA 2011b). Contacts with the RWQCB indicate that: 1) There has been regular groundwater monitoring at the site with the latest data from February, 2011; 2) Reports indicate low levels of TPH and metals; 3) The contaminated groundwater is associated with the coke piles; 4) DTSC is the lead agency on the coke pile clean up; and 5) RWQCB is the lead agency on the groundwater contamination (CSWRCB 2011).

Communication with the Regional EPA indicates that certification of the current status of the groundwater situation at the SMF has not been conducted in over 20 years and the status in terms of the level of control could not be verified through the EPA (communication with Kaplan by Applicant). As part of the responses to comments on the DEIR process, the RWQCB indicates that: "limited impacts to groundwater have been detected at the site during the past several years of groundwater monitoring, primarily due to low levels of metals and TPH that generally have not exceeded standards and do not appear to be migrating off site."

Phillips has been conducting groundwater monitoring at SMR under the regulatory authority of the RWQCB since 1994. In addition, Phillips conducted soil and groundwater assessments in 2001 at the request of the RWQCB of the coke piles, a former pond located in the coke piles, and the area around monitoring well BC-4 to evaluate whether the coke piles, the former coke pond, and a surface water runoff area near well BC-4 were impacting the underlying soil and groundwater. These studies indicated "slightly increased concentrations of metals in soil" but are relatively low and insignificant. Metals that are present in coke have been detected in groundwater at concentrations above the California Department of Health maximum contamination levels (MCL) in the area around the coke pile runoff area due to reduced pH levels (acidic) associated with the periodically saturated conditions in the runoff area. TPH was detected in the coke and process water samples and several groundwater samples. The concentrations of TPH were below 1,000 ppm in all samples, and the samples with elevated levels were determined to be naturally occurring organic materials (non-hydrocarbon based) by utilizing a silica-gel sampling technique (Secor 2001). These levels are below the RWQCB action levels.

The Biennial Reporting System database contains data on the generation, shipment, and receipt of hazardous waste (US EPA 2011a). The Refinery generated and shipped offsite approximately 46 tons of hazardous wastes annually, which is summarized in Table 4.2-6. Refinery-generated waste is shipped to several nearby facilities.

Table 4.2-6 Hazardous Wastes Generated by the Refinery

Material	Annual Amount, tons	Destination City, State
Activated Carbon	2.98	Veolia, Azusa, CA
Misc Debris	0.11	Veolia, Azusa, CA
Aqueous Waste from lab	2.25	Veolia, Azusa, CA
Oily Water Sewer Debris	37.17	Aragonite, UT
Paint Slops	0.90	Veolia, Azusa, CA
Refinery Sludge	0.75	Veolia, Azusa, CA
CEM Lead Acetate Tape	0.03	Veolia, Azusa, CA
Parts Washer Solvent	1.70	Safety-Kleen, Santa Ana, CA
Lead contaminated Material	0.10	Veolia, Azusa, CA

Source: Biennial Reporting System database search 2007 (most recent available)

Veolia ES Technical Solutions

Veolia ES Technical Solutions is a 7-acre, solvent recycling and resource recovery facility at 1704 West First Street in Azusa, California. The Veolia facility receives hazardous waste, including benzenes, dioxins, heavy metals, and other toxic organics and inorganics. The facility recycles used solvents, distributes new solvents, and blends used solvents and oils to produce fuel substitutes. Wastes are accepted in bulk and in drums. Veolia restricts the acceptance of dioxins, polychlorinated biphenyls, radioactive wastes, reactive wastes, biological wastes and infectious materials (CDTSC 2011). The process equipment for solvent reclamation includes two distillation units and a thin film evaporator. In 2009, total waste disposal in the landfill was 27,738 tons.

Veolia primarily serves paint and electronics companies, the aerospace industry, printers, and manufacturers in Los Angeles and Orange counties. A Part B permit was issued to this facility in August of 1983. Veolia's EPA ID is CAD008302903.

The Safety-Kleen Santa Ana

The Safety-Kleen Santa Ana facility has operated 2120 South Yale Street in Santa Ana, California, since the 1970s. The facility is within an industrial/commercial zoned area. The Safety-Kleen Santa Ana facility bulks and stores containers of hazardous wastes until it accumulates large enough quantities to cost effectively transport the waste to an authorized treatment, recycling, or disposal facility. Hazardous waste is not treated or disposed of at this location. In 2007, total waste disposal was 1,419 tons. The facility Spent Solvent Tank has a capacity of 12,000 gallon and the Container Storage Area has a capacity of 18,500 gallons. Safety-Kleen Santa Ana's EPA ID is CAT000613976 (CDTSC 2011).

The Aragonite Facility

The Aragonite Facility is a commercial incinerator, transfer, and storage facility in a remote area of Tooele County, Utah, approximately 2.5 miles south of Interstate 80. It was formerly known as Safety-Kleen (Aragonite) Inc., Laidlaw Environmental Services (Aragonite), Inc. and Aptus, Inc. The incinerator is a 140- million-British-thermal-unit slagging rotary kiln with a vertical afterburner chamber. The gas cleaning train consists of a spray dryer, baghouse, saturator, wet scrubber, and wet electrostatic precipitator. Permitted waste storage areas include a bulk liquid tank farm (16 approximately 30,000-gallon tanks); drum storage buildings (approximately 10,000-drum capacity); sludge storage tanks (approximately 38,000-gallon total capacity); and bulk solids storage tanks (approximately 1100-cubic-yard total capacity).

The facility handles hazardous wastes, polychlorinated biphenyls, industrial wastes, and other non-hazardous wastes. The facility is designed to handle high and low British thermal unit liquid wastes, sludges, bulk solids, and containerized wastes. The current permitted capacity of the incinerator is approximately 13 tons per hour. It typically processes approximately 50,000 tons per year, operating 24 hours per day (UDEQ 2011).

4.2.2 Regulatory Setting

Many regulations and standards exist to ensure the safe operation of oil and gas facilities, pipelines, and hazardous materials. This section provides an overview of the federal, state, and local regulations.

4.2.2.1 Federal Laws and Regulations

Federal laws address gas and liquid pipelines and oil and gas facilities.

Liquid Pipelines and Oil Facilities

Hazardous liquid pipelines are under the jurisdiction of the DOT and must follow the regulations in 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline, as authorized by the Hazardous Liquid Pipeline Safety Act of 1979 (49 USC 2004). Other applicable Federal requirements are contained in 40 CFR Parts 109, 110, 112, 113, and 114, pertaining to the need for Oil Spill Prevention Control & Countermeasures Plans; 40 CFR Parts 109–114 promulgated in response to the Oil Pollution Act of 1990.

Overview of the 49 CFR 195 Requirements.

Part 195.30 incorporates many of the applicable national safety standards of the:

- American Petroleum Institute (API);
- American Society of Mechanical Engineers (ASME);
- American National Standards Institute (ANSI); and
- American Society for Testing and Materials (ASTM).

Part 195.50 requires reporting of accidents by telephone and in writing for:

- Explosion or fire not intentionally set by the operator;
- Spills of 5 gallons or more or 5 barrels if confined to company property and cleaned up promptly;
- Daily loss of 5 barrels a day to the atmosphere;
- Death or injury necessitating hospitalization; or
- Estimated property damage, including cleanup costs, greater than $50,000.

The Part 195.100 series includes design requirements for the temperature environment, variations in pressure, internal design pressure for pipe specifications, external pressure and external loads, new and used pipe, valves, fittings, and flanges.

The Part 195.200 series provides construction requirements for standards such as compliance, inspections, welding, siting and routing, bending, welding and welders, inspection and nondestructive testing of welds, external corrosion and cathodic protection, installing in-ditch and covering, clearances and crossings, valves, pumping, breakout tanks, and construction records.

The Part 195.300 series prescribes minimum requirements for hydrostatic testing, compliance dates, test pressures and duration, test medium, and records.

The Part 195.400 series specifies minimum requirements for operating and maintaining steel pipeline systems, including:

- Correction of unsafe conditions within a reasonable time;
- Procedural manual for operations, maintenance, and emergencies;
- Training;
- Maps;
- Maximum operating pressure;
- Communication system;
- Cathodic protection system;
- External and internal corrosion control;
- Valve maintenance;
- Pipeline repairs;
- Overpressure safety devices;
- Firefighting equipment; and
- Public education program for hazardous liquid pipeline emergencies and reporting.

Overview of 40 CFR Parts 109, 110, 112, 113, and 114

The SPCCs covered in these regulatory programs apply to oil storage and transportation facilities and terminals, tank farms, bulk plants, oil refineries, and production facilities, as well as bulk oil consumers, such as apartment houses, office buildings, schools, hospitals, farms, and state and federal facilities as follows:

- Part 109 establishes the minimum criteria for developing oil-removal contingency plans for certain inland navigable waters by state, local, and regional agencies in consultation with the regulated community (i.e., oil facilities).
- Part 110 prohibits discharge of oil such that applicable water quality standards would be violated, or that would cause a film or sheen upon or in the water. These regulations were updated in 1987 to adequately reflect the intent of Congress in Section 311(b) (3) and (4) of the Clean Water Act, specifically incorporating the provision “in such quantities as may be harmful.”
- Part 112 deals with oil spill prevention and preparation of Spill Prevention Control and Countermeasure Plans. These regulations establish procedures, methods, and equipment requirements to prevent the discharge of oil from onshore and offshore facilities into or upon the navigable waters of the United States. These regulations apply only to non-transportation-related facilities.
- Part 113 establishes financial liability limits; however, these limits were preempted by the Oil Pollution Act of 1990.
- Part 114 provides civil penalties for violations of the oil spill regulations.

Overview of 6 CFR Part 27

Chemical Facility Anti-Terrorism Standards, 6 CFR 27. The Federal Department of Homeland Security established the chemical facility anti-terrorism standards of 2007. This 2007 rule established risk-based performance standards for the security of chemical facilities. It requires covered chemical facilities to prepare Security Vulnerability Assessments, which identify facility security vulnerabilities, and to develop and implement Site Security Plans, which include measures that satisfy the identified risk-based performance standards.

Hazardous Waste Handling Requirements

Resource Conservation and Recovery Act and Associated Hazardous and Solid Waste Amendments, 40 CFR 260

Implementation of Resource Conservation and Recovery Act (RCRA) resulted in the creation of a major federal hazardous waste regulatory program that is administered by the EPA. Under RCRA, the EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA was amended by the Associated Hazardous and Solid Waste Amendments (HSWA), which affirmed and extended the concept of regulating hazardous wastes from generation through disposal. HSWA specifically prohibits the use of certain techniques for the disposal of some hazardous wastes. Under RCRA, individual states may implement their own hazardous waste programs instead of RCRA, as long as the state program is at least as stringent as the Federal RCRA requirements. The EPA approved California's program to implement Federal hazardous waste regulations on August 1, 1992.

Asbestos and Lead

National Emissions Standards for Hazardous Air Pollutants, 40 CFR 61 Subpart M

Under Subpart M, an asbestos containing materials survey must be performed prior to renovation or demolition activities. Notification to the lead agency is required 10 working days prior to the start of work (disturbance of asbestos containing materials). Additional federal- and state-level asbestos requirements related to OSHA standards in 29 CFR 1926.1101 are covered by the Asbestos Construction Standard, Title 8, CCR Section 1529, which is described separately below.

The Worker Protection Rule (40 CFR 763, Subpart G, and 29 CFR 1910.1001) provides worker protection measures through engineering controls, worker training, labeling, respiratory protection, and waste management; the rule also defines asbestos containing materials and sets the permissible exposure level for asbestos.

Emergency Planning and Community Right-to-Know Act

Under the Emergency Planning and Community Right-to-Know Act, or Title III of the Superfund Amendments and Reauthorization Act of 1986, the EPA requires local agencies to regulate the storage and handling of hazardous materials and requires development of a plan to mitigate the release of hazardous materials. Businesses that handle any of the specified hazardous materials must submit to government agencies (i.e., fire departments or Public Health

Departments), an inventory of the hazardous materials, an emergency response plan, and an employee training program. The business plans must provide a description of the types of hazardous materials/waste onsite and the location of these materials. The information in the business plan can then be used in the event of an emergency to determine the appropriate response action, the need for public notification, and the need for evacuation.

In 1990, Congress passed the Pollution Prevention Act which requires facilities to report additional data on waste management and source reduction activities to EPA under Toxics Release Inventory Program. The goal of the Toxics Release Inventory is to provide communities with information about toxic chemical releases and waste management activities and to support informed decision making at all levels by industry, government, non-governmental organizations, and the public.

Hazardous Materials Management Planning

Section 112(r) of the Clean Air Act Amendments of 1990, 40 CFR 68

The EPA requires facilities that handle listed regulated substances to develop Risk Management Programs (RMP) to prevent accidental releases of these substances. RMP materials are submitted to both local agencies (generally the fire department) and the Federal EPA. Stationary sources with more than a threshold quantity of a regulated substance shall be evaluated to determine the potential for, and impacts of, accidental releases of that substance. Under certain conditions, the owner or operator of a stationary source may be required to develop and submit a Risk Management Program. Risk Management Programs consist of three main elements: a hazard assessment that includes off site consequences analyses and a five-year accident history; a prevention program; and an emergency response program.

National Contingency Plan Requirements

Spill Prevention Control and Countermeasures Plans, 40 CFR 112.3 and 112.7

Facilities that store large volumes of hazardous materials are required to have a Spill Prevention Control and Countermeasures Plans (SPCCP) per the requirements of 40 CFR 112 submitted to the EPA. The SPCCP is designed to prevent spills from onsite facilities and includes requirements for secondary containment, provides emergency response procedures, and establishes training requirements.

Hazardous Materials Transportation

The Hazardous Materials Transportation Act, 49 CFR 171, Subchapter C

The DOT, Federal Highway Administration, and the Federal Railroad Administration regulate transportation of hazardous materials at the Federal level (state requirements are discussed in following sections). The Hazardous Materials Transportation Act requires that carriers report accidental releases of hazardous materials to DOT at the earliest practical moment. Other incidents that must be reported include deaths, injuries requiring hospitalization, and property damage exceeding $50,000.

Worker Health and Safety

Occupational Safety and Health Act, 29 CFR et seq.

Under the authority of the Occupational Safety and Health Act of 1970, the federal OSHA has adopted numerous regulations pertaining to worker safety (29 CFR) and provides oversight and enforcement (along with CalOSHA in California). These regulations set standards for safe workplaces and work practices, including the reporting of accidents and occupational injuries. Some OSHA regulations contain standards relating to hazardous materials handling, including workplace conditions, employee protection requirements, first aid, and fire protection, as well as material handling and storage.

Hazard Communication, 29 CFR 1910.1200

The purpose of the OSHA Hazard Communication law is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning any potential hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets, and employee training.

Process Safety Management, 29 CFR 1910.119

Under this section, facilities that use, store, manufacture, handle, process, or move hazardous materials are required to:

- Conduct employee safety training;
- Have an inventory of safety equipment relevant to potential hazards;
- Have knowledge on use of the safety equipment;
- Prepare an illness prevention program;
- Provide hazardous substance exposure warnings;
- Prepare an emergency response plan; and
- Prepare a fire prevention plan.

In addition, 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, OSHA specifically requires prevention program elements to protect workers at facilities that have toxic, flammable, reactive or explosive materials. Prevention program elements are aimed at preventing or minimizing the consequences of catastrophic releases of chemicals and include process hazard analyses, formal training programs for employees and contractors, investigation of equipment mechanical integrity, and an emergency response plan.

4.2.2.2 California Laws and Regulations

State laws address gas and liquid pipelines, oil and gas facilities and hazardous materials and waste. The following sections discuss each of these.

California Health and Safety Code

- Division 20, Chapter 6.5, §25100-25249, Hazardous Waste Control (administered by the CalEPA and the California Department of Toxic Substances Control);
- Division 20, Chapter 6.95, §255500, et seq. Hazardous Materials Management Plan and Community Right-to-Know and Hazardous Materials Release Response Plans and Inventory (Business Plan Program, administered by local fire departments and the Certified Unified Program Agencies [CUPA]);
- Proposition 65 Compliance, H&SC §25249.5 et seq., administer by the CARB and the local APCD;
- H&SC §§25340-25392, Carpenter-Presley-Tanner Hazardous Substance Account Act (administered by the CalEPA and the California Department of Toxic Substances Control); and
- H&SC §§25531-255413, California Accidental Release Prevention Program, administered by local fire departments and the CUPA.

California Water Code

- Division 7, Water Quality (Porter-Cologne Water Quality Control Act), administered by the State Water Resources Control Board.

California Code of Regulations

- Title 8, §5189 and §5192, Accidental Release Plan administered by local fire departments and the Certified Unified Program Agencies (CUPA);
- Title 14, Division 2, Department of Conservation, administered by DOGGR;
- Title 19, §2729, Employee Training Program, administered by the California Office of Emergency Services and local fire departments and departments of public health;
- Title 22, Division 4, Chapter 30, Hazardous Wastes (administered by the CalEPA and the California Department of Toxic Substances Control);
- Title 22, Division 4.5, §§66260-67786, Hazardous Waste Requirements (administered by the CalEPA and the California Department of Toxic Substances Control); and
- Title 22, §66265.50-.56, Contingency/Emergency Response Plan administered by local fire departments and the Certified Unified Program Agencies (CUPA).

Gas and Liquid Pipelines and Oil Facilities

Overview of California Pipeline Safety Regulations

State of California regulations Part 51010 through 51018 of the Government Code provide specific safety requirements that are more stringent than the Federal rules. These include:

- Periodic hydrostatic testing of pipelines, with specific accuracy requirements on leak rate determination;
- Hydrostatic testing by state-certified independent pipeline testing firms;
- Pipeline leak detection; and

- Reporting of all leaks required.

Recent amendments require pipelines to include means of leak prevention and cathodic protection, with acceptability to be determined by the California State Fire Marshall (CSFM). All new pipelines must also be designed to accommodate passage of instrumented inspection devices (smart pigs) through the pipeline.

California Pipeline Safety Act of 1981

The California Pipeline Safety Act gives regulatory jurisdiction for the safety of all intrastate hazardous liquid pipelines and all interstate pipelines used for the transportation of hazardous or highly volatile liquid substances to the CSFM. The law establishes the governing rules for interstate pipelines to be the Federal Hazardous Liquid Pipeline Safety Act and Federal pipeline safety regulations.

Oil Pipeline Environmental Responsibility Act (Assembly Bill 1868)

This Act requires every pipeline corporation qualifying as a public utility and transporting crude oil in a public utility oil pipeline system to be held strictly liable for any damages incurred by "any injured party which arise out of, or are caused by, the discharge or leaking of crude oil or any fraction thereof ...." The law applies only to public utility pipelines for which construction would be completed after January 1, 1996, or that part of an existing utility pipeline that is being relocated after the above date and is more than three miles in length. The major features signed into law in October 1995 include:

- Each pipeline corporation that qualifies as a public utility that transports any crude oil in a public utility oil pipeline system shall be absolutely liable, without regard to fault, for any damages incurred by any injured party that arise out of, or are caused by, the discharge or leaking of crude oil.
- Damages for which a pipeline corporation is liable under this law are: all costs of response, containment, cleanup, removal, and treatment, including monitoring and administration cost; injury or economic losses resulting from destruction of, or injury to, real or personal property; injury to, destruction of, or loss of natural resources, including but not limited to, the reasonable cost of rehabilitating wildlife habitat, and other resources and the reasonable cost of assessing that injury, destruction, or loss, in any action brought by the State, County, city, or district; loss of taxes, royalties, rents, use, or profit shares caused by the injury, destruction, loss, or impairment of use of real property, personal property, or natural resources; and loss of use and enjoyment of natural resources and other public resources or facilities in any action brought by the State, County, city, or district;
- A pipeline corporation shall immediately clean up all crude oil that leaks or is discharged from a pipeline.
- No pipeline system subject to this law shall be permitted to operate unless the State Fire Marshal certifies that the pipeline corporation demonstrates sufficient financial responsibility to respond to the liability imposed by this section. The minimum financial responsibility required by the State Fire Marshal shall be seven hundred fifty dollars ($750) times the maximum capacity of the pipeline in the number of barrels per day up to a maximum of one

hundred million dollars ($100,000,000) per pipeline system, or a maximum of two hundred million dollars ($200,000,000) per multiple pipeline system. For the Pacific Pipeline, the Bill specifically requires $100,000,000 for the financial responsibility (Section l.h.(l)).

- Financial responsibility shall be demonstrated by evidence that is substantially equivalent to that required by regulations issued under Section 8670.37.54 of the Government Code, including insurance, surety bond, letter of credit, guaranty, qualification as a self-insurer, or combination thereof or any other evidence of financial responsibility. The State Fire Marshal shall require that the documentation evidencing financial responsibility be placed on file with that office.
- The State Fire Marshal shall require evidence of financial responsibility to fund post-closure cleanup spots. The evidence of financial responsibility shall be 15 percent of the amount of financial responsibility stated above.

California Accident Release Prevention

The California Accident Release Prevention program mirrors the Federal Risk Management program, except that it adds external events and seismic analysis to the requirements and includes facilities with lower inventories of materials. A California Accident Release Prevention or Risk Management Plan, as administered by the Fire Departments and the EPA, if applicable, is a document prepared by the owner or operator of a stationary source containing detailed information including:

- Regulated substances held onsite at the stationary source;
- Offsite consequences of an accidental release of a regulated substance;
- The accident history at the stationary source;
- The emergency response program for the stationary source;
- Coordination with local emergency responders;
- Hazard review or process hazard analysis;
- Operating procedures at the stationary source;
- Training of the stationary source's personnel;
- Maintenance and mechanical integrity of the stationary source's physical plant; and
- Incident investigation.

Hazardous Materials and Hazardous Waste

Hazardous Waste Control Law

The Hazardous Waste Control Law is administered by the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). DTSC has adopted extensive regulations governing the generation, transportation, and disposal of hazardous wastes. These regulations impose cradle-to-grave requirements for handling hazardous wastes in a manner that protects human health and the environment. The Hazardous Waste Control Law regulations establish requirements for identifying, packaging, and labeling hazardous wastes. They prescribe management practices for hazardous wastes; establish permit requirements for hazardous waste treatment, storage, disposal, and transportation; and identify hazardous wastes that cannot be disposed of in landfills. Hazardous waste is tracked from the point of generation to the point of disposal or treatment using hazardous waste manifests. The manifests list a description of the waste, its intended destination, and regulatory information about the waste.

Hazardous Materials Management Planning

The Office of Emergency Services, in support of local government, coordinates overall state agency response to major disasters. The office is responsible for assuring the State's readiness to respond to and recover from natural, manmade, and war-caused emergencies, and for assisting local governments in their emergency preparedness, response, and recovery efforts. During major emergencies, Office of Emergency Services may call upon all State agencies to help provide support. Due to their expertise, the California National Guard, California Highway Patrol (CHP), Department of Forestry and Fire Protection, Conservation Corps, Department of Social Services, and Caltrans are the agencies most often asked to respond and assist in emergency response activities.

Hazardous Materials Transportation in California

California regulates the transportation of hazardous waste originating or passing through the State in Title 13 of the California Code of Regulations. The CHP and Caltrans have primary responsibility for enforcing Federal and State regulations and responding to hazardous materials transportation emergencies. The CHP enforces materials and hazardous waste labeling and packing regulations that prevent leakage and spills of material in transit and provide detailed information to cleanup crews in the event of an incident. Vehicle and equipment inspection, shipment preparation, container identification, and shipping documentation are all part of the responsibility of the CHP. The CHP conducts regular inspections of licensed transporters to ensure regulatory compliance. Caltrans has emergency chemical spill identification teams at locations throughout the State.

Hazardous waste must be regularly removed from generating sites by licensed hazardous waste transporters. Transported materials must be accompanied by hazardous waste manifests.

Hazardous Material Worker Safety, California Occupational Safety and Health Act

The California Occupational Safety and Health Administration (Cal/OSHA) is responsible for assuring worker safety in the handling and use of chemicals in the workplace. Cal/OSHA assumes primary responsibility for developing and enforcing workplace safety regulations in Title 8 CCR. Cal/OSHA hazardous materials regulations include requirements for safety training, availability of safety equipment, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation.

Cal/OSHA also enforces hazard communication program regulations, which contain training and information requirements, including procedures for identifying and labeling hazardous substances. The hazard communication program also requires that Material Safety Data Sheets be available to employees and that employee information and training programs be documented.

County of San Luis Obispo Regulations

Energy Element and Conservation and Open Space Element

In 1995, the County of San Luis Obispo adopted the Energy Element as part of the County's General Plan, subsequently merged with the Conservation and Open Space Element. The Conservation and Open Space Element contains a goal of protecting public health, safety, and environment and several policies that promote the stated goal. The applicable policies include:

- Policy 56. Encourage existing and proposed facilities to focus on measures and procedures that prevent oil, gas, and other toxic releases into the environment. This policy is to ensure that facilities: (1) take measures to prevent releases and spills; (2) prepare for responding to a spill or release; and (3) provide for the protection of sensitive resources. A review of a facilities spill response plan, or reports from other agencies, should be completed to monitor compliance.
- Policy 64. Guideline 64.1. To reduce the possibility of injury to the public, facility employees, or the environment, the applicant shall submit an emergency response plan which details response procedures for incidents that may affect human health and safety or the environment. The plan shall be based on the results of the comprehensive risk analysis. In the case of a facility modification, the existing response plan shall be evaluated by the safety review committee and revisions made as recommended.
- Flammable and Combustible Liquid Storage. County Coastal Zone Land Use Ordinance Section 23.06.126 includes requirements for flammable and combustible liquid storage relating to: applicability, permit requirements, limitation on use, limitation on quantity, setbacks, and including California Department of Forestry and Fire Prevention (CAL FIRE) recommendations, as applicable. Without approval through a Development Plan, aboveground storage limits of combustible liquid is 20,000 gallons and 2,000 gallons for flammable liquids.

4.2.2.3 Other Applicable Guidelines, National Codes, and Standards

Safety and Corrosion Prevention Requirements — American Society of Mechanical Engineers, National Association of Corrosion Engineers, American National Standards Institute, API

The following design requirements are generally enforced by local building departments, fire departments and public health departments during plan review and permit issuance. The code requirements address a range of issues that would reduce impacts, including equipment design, material selection, and use of safety valves.

- ASME & ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings;
- ASME & ANSI B16.9, Factory-Made Wrought Steel Butt Welding Fittings;
- ASME & ANSI B31.1a, Power Piping;
- ASME & ANSI B31.4a, addenda to ASME B31.4a, Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols;

- NACE Standard RP0190, Item No. 53071. Standard Recommended Practice External Protective Coatings for Joints, Fittings, and Valves on Metallic Underground or Submerged Pipelines and Piping Systems;
- NACE Standard RP0169, Item No. 53002. Standard Recommended Practice Control of External Corrosion on Underground or Submerged Metallic Piping Systems;
- API 510 Pressure Vessel inspection Code;
- API 570 Piping Inspection Code, applies to in-service metallic piping systems used for the transport of petroleum products;
- API 572 Inspection of Pressure Vessels;
- API 574 Inspection Practices for Pipe System Components;
- API 575 API Guidelines and Methods for Inspection of Existing Atmospheric and Low-pressure Storage Tanks;
- API 576 Inspection of Pressure Relieving Devices;
- API 650 Welded Steel Tanks for Oil Storage;
- API 651 Cathodic Protection of Aboveground Storage Tanks;
- API 653 Tank Inspection, Repair, Alteration, and Reconstruction;
- API 2610, Design, Construction, Operation, Maintenance, and Inspection of Terminal & Tank Facilities; and
- API Spec 12B - Bolted Tanks for Storage of Production Liquids.

API 653, atmospheric tank inspection and repair, is particularly applicable to the Proposed Project and addresses the following issues:

- Tank suitability for service;
- Brittle fracture considerations;
- Inspections;
- Materials;
- Design considerations;
- Tank repair and alteration;
- Dismantling and reconstruction;
- Welding;
- Examination and testing;
- Marking and recordkeeping;
- Pertinent issues related to tank inspections in API 653;
- External inspections by an authorized inspector every 5 years;

- Ultrasonic inspections of shell thickness every 5 years (when corrosion rate not known);
- Internal bottom inspection every 10 years, if corrosion rates not known; and
- Appendix C – detailed checklists for in-service and out-of-service inspections.

Fire and Explosion Prevention and Control, National Fire Protection Agency

The following design requirements are generally enforced by fire departments during plan review and permit issuance. The code requirements address a range of issues that would reduce impacts, including fire fighting system design, and water supply requirements.

- NFPA 30 Flammable and Combustible Liquids Code and Handbook;
- NFPA 11 Foam Extinguishing Systems;
- NFPA 12 A&B Halogenated Extinguishing Agent Systems;
- NFPA 15 Water Spray Fixed Systems;
- NFPA 20 Centrifugal Fire Pumps; and
- NFPA 70 National Electrical Code.

4.2.3 Significance Criteria

As defined in Appendix G (the Environmental Checklist Form) of the California Environmental Quality Act (CEQA), a significant safety effect is one in which the Proposed Project "create[s] a potential health hazard or involve[s] the use, production or disposal of materials which pose a hazard to people, animal or plant populations in the area affected." The San Luis Obispo County Initial Study Checklist defines significant risk if the project will "result in a risk of explosion or release of hazardous substances (e.g. oil, pesticides, chemicals, radiation) or exposure of people to hazardous substances," or "create any other health hazard or potential hazard."

San Luis Obispo County does not have a process to address risk of upset and CEQA thresholds. Therefore, the Santa Barbara County thresholds have been applied. Santa Barbara County established a quantitative, risk-based criteria that has been utilized by various state agencies, including the California Coastal Commission and the California State Lands Commission. Santa Barbara County adopted Public Safety Thresholds in August 1999. The thresholds provide specific zones (i.e., green, amber, and red) on a risk profile curve to guide the determination of significance or insignificance based on the estimated probability and consequence of an accident. In general, risk levels in the green area would be less than significant and therefore acceptable, while risk levels in the amber and red zones would be significant. Risk profiles plot the frequency of an event against the consequence in terms of fatalities or injuries; frequent events with high consequence have the highest risk level.

The criteria used in this section are based on the potential risk associated with the facilities. Therefore, an impact would be considered significant if any of the following were to occur:

- Be within the amber or red regions of the Santa Barbara County Safety Criteria; or
- Non-compliance with any applicable design code, regulation, NFPA standard, or generally acceptable industry practice.

Issues related to fire protection and emergency response are discussed in Section 4.4, Public Services.

A significant impact associated with existing site contamination and hazardous waste would be determined if the project would:

- Result in mobilization of contaminants currently existing in the soil and groundwater, creating potential pathways of exposure to humans or other sensitive receptors that would result in exposure to contaminant levels that would be expected to be harmful; or
- Result in the presence of contaminated soils or groundwater within the project area, and as a result, expose workers and/or the public to contaminated or hazardous materials during construction activities at levels in excess of those permitted by California Occupational Safety and Health Administration (Cal/OSHA) in CCR Title B and the Federal Occupational Safety and Health Administration (OSHGA) in Title 29 CFR Part 1910.

4.2.4 Project Impacts and Mitigation Measures

Impacts from the Proposed Project on public safety are associated with increased throughput processes at the Santa Maria Refinery (SMF).

Impact #	Impact Description	Phase	Residual
PSHM.1	The Proposed Project could introduce risk to the public associated with accidental releases of hazardous materials from the SMF processing operations.	Operations	Class III

Releases of hazardous materials from the Proposed Project Site would not acutely impact nearby residences, agriculture, or industrial facilities since the SMF is far away from these receptors. Releases that could impact air quality, such as odor or health risk, are addressed in Section 4.1, Air Quality.

Some releases at facilities are caused by vandalism, such as opening valves or sabotaging equipment integrity. This could increase the frequency of releases. These impacts can be reduced by securing the facilities to reduce the probability of vandalism. The refinery currently has gated access and 24-hour security measures to reduce vandalism.

However, as discussed, impacts from releases at the refinery would not impact sensitive receptors. Therefore, impacts would be *less than significant* (Class III).

Mitigation Measure

None required.

Residual Impacts

Site security issues could increase the likelihood of vandalism and subsequent failure of equipment resulting in spills or releases of material. Appropriate site security would minimize these incidents. Fatality and injury impacts would be remain *less than significant* (Class III).

Impact #	Impact Description	Phase	Residual
PSHM.2	The Proposed Project could introduce risk to the public associated with the transportation of SMF product along local and area roadways.	Operations	Class III

Accidents that generate spills of hazardous materials that could impact public receptors along roadways produce the risks associated with transportation. These risks are associated with the transportation of solid petroleum coke and recovered solidified sulfur.

Products leave the SMF as solid petroleum coke by rail or haul truck and as recovered sulfur by haul truck as well as some hazardous wastes. Shipments of coke and sulfur would be expected to increase with the proposed Project. However, transportation of hazardous waste under the Proposed Project would be expected to be the same as the current operations.

Petroleum coke is shipped via truck or railcar to customers as fuel or onto ships for export. Major petroleum coke destinations include Mojave, Victorville, Cupertino, Fontana, Lebec, and Gorman, and Long Beach for export.

Sulfur is shipped via truck to customers in the agricultural industry or loaded on ships for export. All products are shipped outside of SLOC. Sulfur truck destinations are in the San Joaquin Valley from Bakersfield to Fresno, as well as Long Beach for export.

Pipeline transportation of crude oil presents a low risk to public health since crude oil spills generally do not catch fire and the public has sufficient time to move away from spills in the unlikely event of ignition. Generally, spills of crude oil produce environmental impacts as opposed to public safety impacts.

Risk levels associated with transportation would be minimal due to the properties of crude oil, sulfur, and coke and impacts would primarily affect environmental resources. The nominal increase in flow rates associated with the Proposed Project would produce environmental impacts similar to current operations. Impacts would be *less than significant* (Class III).

Impact #	Impact Description	Phase	Residual
PSHM.3	The Proposed Project could introduce contamination to groundwater through exacerbation of existing contamination issues.	Operations	Class II

The proposed Project could increase the amount of coke produced and stored at the coke piles. The coke piles have been identified by the RWQCB as a source of localized, low-level groundwater contamination. Based on a review of the most recent (May 2011) Coke and Sulfur Storage and Handling Plan, the coke pile is limited in its extents to the area in the layout figure in the plan. As long as coke is deposited within this designated area, then the extent of coke affected area would not increase with the proposed increase in coke throughput associated with the Proposed Project. However, any increased coke storage outside of this area could exacerbate this groundwater contamination and thereby produce a potentially significant impact.

Mitigation Measure

PSHM-3 Prior to issuance of the updated permit and increase in Refinery throughput, the Applicant shall ensure that any additional coke produced shall be deposited within designated areas as specified by the Coke and Sulfur Storage and Handling Plan and that these areas shall be clearly delineated to all operators. Storage of coke outside these existing delineated areas shall be only within lined areas or other equivalent measures to prevent any additional groundwater contamination, as per consultation with the RWQCB.

Residual Impacts

With measures to ensure that any additional coke produced would not contribute to the existing groundwater contamination issues, impacts would remain *less than significant with mitigation* (Class II). The County may also choose to include a requirement for the liner under the coke piles under their consistency review with the Local Coastal Plan.

4.2.4.1 Other Issue Area Mitigation Measure Impacts

None of the mitigation measures proposed for other issue areas would change the impacts discussed in this section. Therefore, the mitigation measures would not result in additional significant impacts, and additional analysis or mitigation is not required.

4.2.5 Cumulative Impacts and Mitigation Measures

Cumulative projects that could impact the current analysis include those projects listed in Section 3.0, Cumulative Projects Description. Impacts of cumulative projects are realized either by increasing the frequency or volume of oil spills into the same environment as the Proposed Project, increasing the public safety risks to the same populations as the Proposed Project, or increasing the risks due to an increase in the receptor populations within the Proposed Project impact zones. None of the cumulative projects would affect the same populations or increase the number of populations that could be exposed to the Proposed Project scenarios. Impacts associated with accidental spills from trucks hauling crude oil could be realized if cumulative projects (such as the Excelaron project in the Huasna Valley) haul crude oil along the same routes as the Proposed Project. These impacts would primarily cause environmental impacts in the immediate vicinity of the spill and would therefore not be cumulatively significant. Therefore, there are no cumulative significant impacts.

4.2.6 Mitigation Monitoring Plan

Mitigation Measure	Requirements	Compliance Verification		
		Method	Timing	Responsible Party
PSHM-3	Prior to issuance of the updated permit and increase in Refinery throughput, the Applicant shall ensure that any additional coke produced shall be deposited within designated areas as specified by the Coke and Sulfur Storage and Handling Plan and that these areas shall be clearly delineated to all operators. Storage of coke outside these existing delineated areas shall be only within lined areas or other equivalent measures to prevent any additional groundwater contamination, as per consultation with the RWQCB.	Inspection of coke storage area	During operations	San Luis Obispo County Planning and Building Department, SLOCAPCD, DTSC, RWQCB