4.1 OPERATIONAL SAFETY/RISK OF ACCIDENTS

Section 4.1 describes those aspects of the existing environment that may impact operational safety, or that may be affected by an accident associated with the operation of the Amorco Marine Oil Terminal (Amorco Terminal), including transportation of crude oil and petroleum products to and from the Amorco Terminal. A summary of the existing vessel traffic levels and patterns and other marine terminals within the San Francisco Bay Area (Bay Area), and a summary of the historical casualties involving tank vessels and marine terminals within the Bay Area, are provided. This is followed by a description of measures in place to allow the safe movement of marine vessels within the San Francisco Bay and to respond to emergency situations. Also included is a summary of laws and regulations that may affect the safety and potential risk from the facility and its operation. Finally, this section analyzes the potential for impacts and presents appropriate mitigation.

4.1.1 ENVIRONMENTAL SETTING

4.1.1.1 Bay Area and Amorco Terminal Vessel Traffic

Bay Area

Many types of marine vessels call at terminals in the Bay Area, including passenger vessels, cargo vessels, tankers, tow/tug vessels, dry cargo barges, and tank barges. Section 2.2.2 (refer to Figure 2.2) describes the regional setting for the Bay Area, including a discussion of the five refineries, eight ports, 14 marine oil terminals, and other terminal facilities.

Table 4.1-1 presents information on vessel visits to the Bay Area during 2011 (USACE 2012), which is the most recent year of data available and is generally representative of the baseline conditions for the Project. The numbers in the table represent inbound transits, and numbers for outbound transits are approximately the same. A vessel that visits multiple terminals is counted at each terminal. With the exception of San Francisco Harbor, these numbers do not reflect vessel traffic transits originating in San Francisco Bay. Excluding San Francisco Harbor, over 39,000 vessels called at terminals in the Bay Area in 2011. Of these, 3,435 vessels transited up the Carquinez Strait, which includes the general area of the Amorco Terminal.

Table 4.1-2 presents information on tanker traffic in the Bay Area for 2003 through 2012 and tank barge traffic for 2008 through 2012, as presented in the San Francisco, San Pablo, and Suisun Bay Harbor Safety Plans for the years 2004 through 2013 (Harbor Safety Committee). As can be seen from the table, tanker traffic has been fairly constant ranging from a high of 868 in 2006 to a low of 699 in 2010. The average over the 10-year period was 760 tanker arrivals per year. Tank barge arrivals were only available for the 5-year period from 2008 through 2012. Tank barge arrivals varied from a high of 474 in

2008 to a low of 306 in 2011 with an annual average of 388. For the 5-year period from 2008 through 2012, the total annual tank vessel traffic (tanker and tank barge) varied from 1,012 to 1,243 with an average of 1,148. Table 4.1-3 summarizes the volume of the various petroleum products that were loaded and discharged at marine terminals in the Bay Area in 2012. Vessel calls to marine oil terminals in San Francisco Bay in 2008 and 2012 are shown in Table 4.1-4. For comparison, there were 2,863 and 2,363 vessel calls to marine oil terminals in 2008 and 2012, respectively.

Table 4.1-1: Inbound Vessel Traffic in San Francisco Bay (2011)

Location	Type of Vessel					Total Number of Vessels
	Dry Cargo	Tanker	Tow or Tug	Dry Cargo Barge	Tank Barge	
San Francisco Bay Entrance	2,658	757	284	9	257	3,965
San Francisco Harbor	45,282	3	937	152	67	46,441
Oakland Harbor	10,734	2	1,607	156	747	13,246
Richmond Harbor	91	410	4,353	44	1,216	6,024
San Pablo Bay and Mare Island Strait	10,062	375	1,074	383	236	12,131
Carquinez Strait	1,524	342	1,086	251	232	3,435
Suisun Bay Channel	162	82	426	255	68	993
Sacramento River Deepwater Channel	17	2	4	1	0	24

Source: USACE 2012

Table 4.1-2: Tank Vessel Traffic within San Francisco Bay

Year	Annual Number of Trips		
	Tankers	Barges	Tank Vessels
2012	712	333	1,045
2011	706	306	1,012
2010	699	371	1,070
2009	758	455	1,213
2008	769	474	1,243
2007	854	Not Available	Not Available
2006	868	Not Available	Not Available
2005	716	Not Available	Not Available
2004	760	Not Available	Not Available
2003	763	Not Available	Not Available
Annual Average	**760**	**388**	**1,148**

Source: San Francisco, San Pablo, and Suisun Bay Harbor Safety Plans

1 **Table 4.1-3: Petroleum Product Transfers in San Francisco Bay (2012)**

Product	Load (in barrels)	Discharge (in barrels)
Additives - Alkylate	471,000	1,373,210
Additives - Carbob		175,000
Additives – Denatured Ethanol	163,000	336,500
Additives - Ethanol	1,321,000	774,000
Additives - Isomerate	0	460,000
Additives – Iso-Octane	0	40,000
Additives - Naphtha	2,442,000	86,775
Additives - Other	810,630	497,650
Additives - PenHex	0	64
Additives – Reformate	972,600	216,000
Additives – Toulene	10,000	47,000
Crude – ANS	0	24,172,587
Crude – Import	415,000	112,724,729
Crude – Other	0	847,996
Cutter Stock	47,250	19,300
DECANT	3,500	413,500
Diesel	23,062,463	5,910,484
Fuel Oil	15,218,413	8,607,572
Gasoline	29,391,781	10,631,943
Jet Fuel	8,203,903	6,401,815
Light Cycle Oil	5,211,000	27,744,925
Lube Oil	3,187,956	247,800
Other	147,951	150,899
TRANSMIX	14,000	1,000
Totals:	**91,178,807**	**202,233,679**

Source: Harbor Safety Committee 2013

Table 4.1-4: Vessel Calls to Marine Oil Terminals in San Francisco Bay (2008 and 2012)

Marine Oil Terminals	2008			2012		
	Tankers	Barges	Total	Tankers	Barges	Total
Shell	67	130	197	69	96	165
Tesoro Amorco	82	3	85	67	0	67
Tesoro Avon	30	80	110	51	25	76
Phillips 66 Rodeo (formerly ConocoPhillips)	77	179	256	48	100	148
Phillips 66 Richmond	0	177	177	0	127	127
Plains All American Martinez	87	119	206	33	73	106
Shores Terminals Crockett	34	24	58	50	24	74
Plains All American Richmond	10	333	343	15	307	322
Chevron	410	370	780	380	247	627
BP West Coast Richmond	22	8	30	24	11	35
BP Lubricants	0	12	12	0	11	11
Kinder Morgan Richmond	5	0	5	13	0	13
Valero	134	22	156	116	91	207
IMTT Richmond	5	443	448	3	382	385
Total all Marine Oil Terminals	**963**	**1,900**	**2,863**	**869**	**1,494**	**2,363**

Sources: CSLC 2011a, CSLC 2013a

Lightering (transfer of oil from one vessel to another) takes place in Anchorage No. 9, located south of the San Francisco–Oakland Bay Bridge between China Basin and Central Basin. Lightering is normally conducted from a large tanker, whose draft is too deep to allow it to call at a certain terminal with a full load, to a smaller tanker. Lightering has decreased in the Bay Area since the inception of air quality regulations requiring receiving vessels to be equipped with vapor recovery systems

Amorco Terminal

Section 2.3 describes the Amorco Terminal and Section 2.4 describes its operation. Table 2-2 in Section 2.4.7 shows the annual vessel calls and throughput for the Amorco Terminal for the years 2008 through 2012 in barrels per year. As presented, over the last 5 years, annual vessel calls have ranged from 53 to 85, averaging 69 calls per year (between 2008 and 2012). The level of shipment activity and throughput is not expected to change substantially during the proposed 30-year lease agreement period. Hence, an annual ship and barge traffic level of approximately 60 vessels to approximately 90 vessels (anticipated maximum) has been used as the basis for the impact analysis.

Outer Coast

Vessels entering and leaving the Golden Gate entrance to San Francisco Bay do so through the Traffic Separation Scheme (TSS), which consists of a circular Precautionary Area with three traffic lanes (northern, main or western, and southern) exiting from the Precautionary Area. This TSS was recently modified to enhance navigational safety and mitigate the co-occurrence of endangered marine species with commercial vessel traffic. This modification became effective June 1, 2013. Figure 4.1-1 shows the TSS with the recent modifications. In a special one-time study, data compiled by the U.S. Coast Guard (USCG) Vessel Traffic Center for November 1993 through July 1994 show that approximately 50 percent of the tankers used the western lane, while approximately 25 percent of the tankers used the northern and southern lanes, respectively. For all types of vessel traffic, approximately 25 percent used the western lane, while 37 percent used the northern and southern lanes, respectively.

Limited information is available on vessel routes after the vessels leave the traffic lanes. Tankers essentially remain at least 50 miles offshore when transiting to and from Alaska, and 25 miles offshore when transiting to and from other locations. Tank barges normally transit at least 15 miles offshore.

4.1.1.2 Vulnerable Resources

Vulnerable resources are those resources that could potentially be harmed by an accident or spill. These resources are addressed in Section 4.2, Water Quality, and Section 4.3, Biological Resources. Besides commercial vessel traffic in the San Francisco Bay, a great deal of fishing and recreational boating traffic occurs, as well as ferry service.

High-speed commuter ferries frequently operate in central/south San Francisco Bay and San Pablo Bay. Concentrations of these ferries are highest around the San Francisco Ferry Building on San Francisco’s north shore, where most Central Bay routes terminate. Ferry routes in the San Francisco Bay and San Pablo Bay are shown on Figure 4.1-2. Many ferries also operate between San Francisco’s north shore, Alcatraz, and Sausalito/Tiburon. These ferries do not run along charted routes. The San Francisco Harbor Safety Committee, in conjunction with the USCG, has established a Ferry Traffic Routing Protocol for: (1) the area surrounding the Ferry Building terminal along the waterfront of San Francisco, (2) the waters of central San Francisco Bay, and (3) the waters of San Pablo Bay. The protocol is intended to increase safety in the area by reducing traffic conflicts and, while not compulsory, the guidelines set forth in the protocol are strongly recommended. The Bay Area ferry system annually makes over 85,000 trips (Harbor Safety Committee 2012).

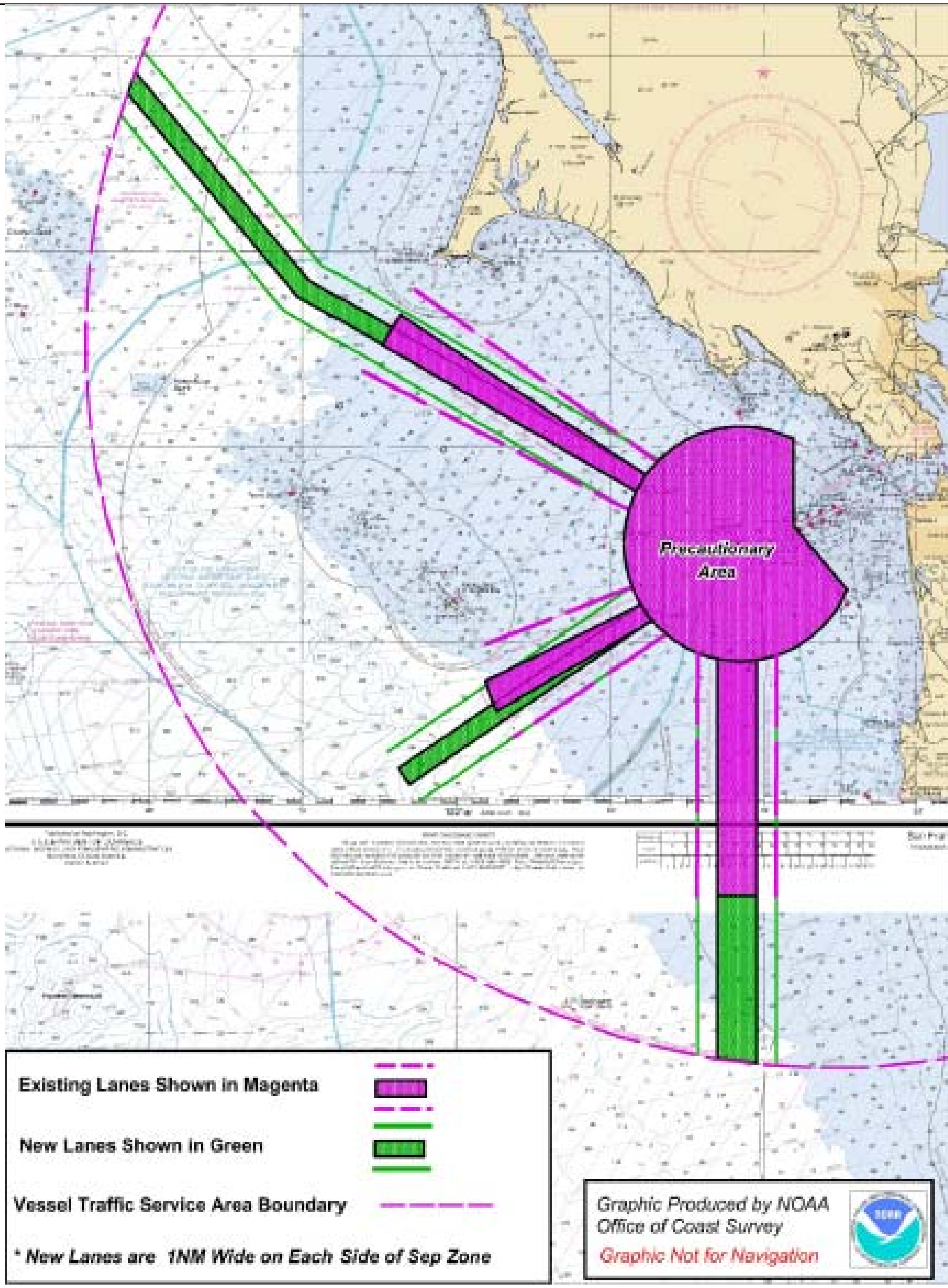


Figure 4.1-1: San Francisco Bay Entrance TSS

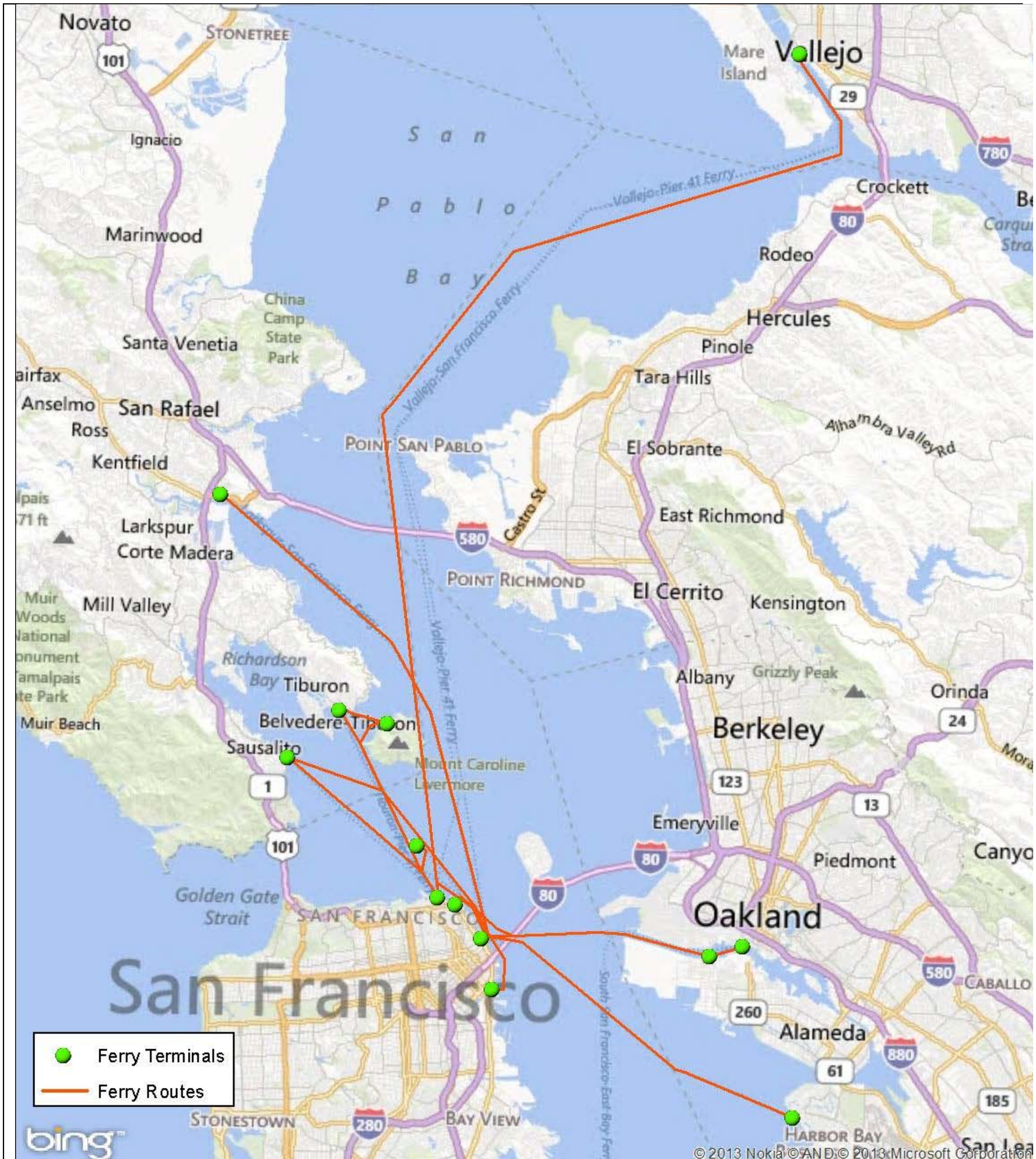


Figure 4.1-2: San Francisco Bay Ferry Routes

There are approximately 20,000 boat berths around the San Francisco Bay, exclusive of the Sacramento and San Joaquin Rivers, as well as numerous boat-launch sites. Two-thirds of these are located in the Central Bay. Motorized vessels occupying berths in the San Francisco Bay Area constitute only 15 percent of registered vessels using the Central Bay. Numerous boat ramps and launches encourage use of the San Francisco Bay by smaller motorized vessels and increasingly popular non-motorized vessels such as canoes, kayaks, windsurfers, and paddleboards. While only a small percentage of boat owners and renters are on the San Francisco Bay at any given time, sunny weekends may bring thousands of pleasure boat users on the San Francisco Bay's waterways. Fishing and recreational boating are discussed in more detail in Section 6.0, Commercial and Sport Fisheries.

Tank vessels transiting between the San Francisco Bay entrance and the Amorco Terminal must pass beneath the Carquinez Bridge complex located at the western end of the Carquinez Strait. There are two separate bridges, one suspension bridge (the Alfred Zampa Memorial Bridge) completed in 2003 carrying southbound traffic, and one completed in 1958 carrying northbound traffic. Since the new bridge is a suspension bridge, the channel opening and height restrictions are governed by the older bridge. The channel on each side of the center pier is 998 feet wide. The minimum vertical clearances are 146 feet through the north span and 134 feet through the south span.

Storage tanks and vacant land are located on the shore south of the Amorco Terminal. The Shell Martinez Marine Oil Terminal (Shell Terminal) is located west of the Amorco Terminal, and the Benicia-Martinez Bridge is located approximately 600 feet to the east. The nearest residence is located over a mile southwest, and a marina and park are located approximately 3,000 feet southwest on the western side of the Shell Terminal.

4.1.1.3 Bay Area and Amorco Oil Spill Response Capability

Bay Area

All of the marine terminals and all vessels calling at the marine terminals are required to have oil spill response plans and a certain level of initial response capability. However, it is not economically feasible or practical for individual terminal operators and vessels to each have their own equipment to respond to more than minor spills. Therefore, operators rely on pooled or contract capabilities. The vessel and terminal owners use various companies and organizations to provide their response capability. The USCG and California Department of Fish and Wildlife’s (CDFW) Office of Spill Prevention and Response (OSPR) have created the Oil Spill Response Organization (OSRO) classification program so that facility and tank vessel operators can contract with and list an OSRO in their response plans in lieu of providing extensive lists of response resources to show that the listed organization can meet the response requirements. Organizations that want to receive a USCG OSRO classification submit an extensive list of their resources and capabilities to the USCG for evaluation. The State of California has a similar OSRO classification program to allow facility and tank vessel operators to list OSROs in meeting State oil spill response requirements. OSROs currently listed in the Bay Area that provide on water services include, Marine Spill Response Corporation (MSRC), National Response Corporation, and Clean Harbors.

The MSRC is the largest, dedicated, standby oil spill response program in the United States, including open water, shoreline, and mid-continent river operations. MSRC response services are available to all Marine Preservation Association members, companies that have contracted with MSRC, and on a reimbursable basis. The MSRC has an extensive inventory of response equipment located throughout the Bay Area, including Benicia, Concord, Martinez, Pittsburg, Richmond, and Vallejo. Equipment located near Benicia/Martinez is listed in Table 4.1-5.

Table 4.1-5: MSRC Benicia/Martinez Spill Response Equipment

Equipment Type	Description
Response Boats	• Raider II (38 feet) • Raider IV (38 feet) • Sentinel (90 barrels storage, skimmer, boom) • Mini Spoiler I (18 barrels storage, skimmer, boom) • Mini Spoiler II (18 barrels storage, skimmer, boom)
Other Vessels	• 4 Mini Barges (100 barrels storage each) • 2 Shallow Water Push Boats • 2 Fast Tank (35 and 37 barrel storage) • 2 21-foot Small Boats • 6 12-foot Punts • 1 Kepner Sea Curtain (12 barrel) • 1 Shallow Water Barge (self propelled @ 400 barrel)
Skimmers	• 1 Marco Class III (18,450 barrel/day EDRC[1]) • 2 Marco Class I (7,176 barrel/day EDRC) • 1 6” Oil Mop (480 barrel/day EDRC) • 7 4” Oil Mop (266 barrel/day EDRC) • 1 GT-185/w adapter (1,371 barrel/day EDRC) • 2 Walosep mini (596 barrel/day EDRC) • 2 Oil Hawg 6-foot (1,372 barrel/day EDRC) • 1 Skim Pac (240 barrel/day EDRC)
Boom	• 14,850-foot, 10-inch Curtain Internal Foam • 5,000-foot, 18-inch Curtain Internal Foam • 9,600-foot, 20-inch Harbor Boom

Source: MSRC 2013

[1] EDRC = Effective Daily Recovery Capacity

Amorco Terminal

Tesoro Refining and Marketing Company, LLC (Tesoro) has contracted with Bay Area Ship Services to assist with initial oil spill response services, including the immediate execution of approximately 600 feet of harbor boom in approximately 30 minutes. In addition, Tesoro contracts with the MSRC to serve as the primary OSRO contractor in its Oil Spill Response Plan for offshore, onshore, and shallow-water response services. Section 2.6.4 discusses Tesoro's oil spill response capability in more detail and Table 2-3 lists available oil spill response equipment as listed in their Oil Spill Response Plan.

The Tesoro Spill Response Team has approximately 25 personnel trained in oil spill containment and recovery procedures. Training is ongoing on a monthly basis. Key areas of training are boom deployment and boat handling.

Federal and State regulations specify response capability requirements for marine facilities. In response to these regulations, Tesoro was required to submit an oil spill response manual, which included calculations to establish a worst-case discharge (WCD) from the Amorco Terminal; and to show how and with what assets Tesoro would respond to such a spill. WCD calculations are required by OSPR, USCG, and U.S. Environmental Protection Agency (USEPA) regulations. Tesoro is also required to calculate maximum most probable and average most probable release sizes for response planning.

The USEPA WCD is the contents of the largest tank located on the Tesoro property and is 283,000 barrels. The largest tank at the Amorco Terminal is 120,000 barrels. None of the storage tanks are located in the California State Lands Commission (CSLC) lease area and, hence, are not addressed in this document. However, responses to these WCD spills are presented in Tesoro's Oil Spill Response Plan.

The USCG/OSPR WCD for the Amorco Terminal consists of the volume of the pipeline plus the amount of oil that can be pumped out before the pumps are shut down. The Tesoro Oil Spill Response Plan lists the WCD as 22,178 barrels. This volume was determined by calculating the pipeline volume in barrels from the end of the pipeline on the wharf to the first onshore isolation valve (757 barrels) and the amount of oil that could be released from continued pumping until the release is discovered, pumps are shut down, and the isolation valves closed. Tesoro assumed a maximum pumping rate of 30,000 barrels per hour and 30 minutes to detect the release and shut down the line, which would result in 15,000 barrels of pumping loss. As described in Section 2.6.5, the pipeline is equipped with pressure sensors that should detect any large releases very quickly because of the pressure drop. In accordance with regulations, the pipeline is equipped with motor operated valves, which can be activated remotely and closed within 30 seconds. The 30-minute detection time used by Tesoro to calculate the WCD is extremely conservative. As a comparison, a detection and shutdown time of two minutes was assumed in the Shell Martinez Oil Spill Response Plan.

CSLC regulations (Cal. Code Regs., tit. 2, § 2395) require that all onshore marine terminals, except those “subject to high-velocity currents,” be able to deploy a boom in a specified manner to enclose the water surface surrounding the vessel prior to transfer operations. An “onshore marine terminal subject to high-velocity currents” is defined as an onshore terminal at which the maximum current velocities are 1.5 nautical miles per hour (knots) or greater for the majority of the days in the calendar year. The Amorco Terminal fits into this category. Onshore marine terminals subject to high-velocity currents must provide sufficient boom appropriate to the conditions at the terminal, trained personnel, and equipment maintained in a standby condition at the berth for the duration of the entire transfer operation, so that a length of at least 600 feet of boom can be deployed within 30 minutes of a spill. Tesoro maintains 2,400 feet of boom on the wharf that can be deployed within 30 minutes.

The USCG requires that marine terminals must be able to respond to a small (50 barrels) spill with the following equipment:

- 1,000 feet of containment boom and a means of deploying it within 1 hour;
- oil recovery devices within 2 hours; and
- oil storage capacity for recovered oily material.

4.1.1.4 Spills from Bay Area Marine Terminals and Amorco Terminal

Bay Area

The CSLC maintains a database of all tanker and tank barge calls to marine oil terminals and of all spills from marine terminals in the San Francisco Bay. This includes spills of all sizes no matter how small. During the past 10 years (2003-2012), there have been a total of 80 spills, varying from a teaspoon to 115 gallons (2.74 barrels). During this same 10-year period, annual tank vessel traffic has ranged from a high of 3,168 in 2006 and a low of 2,369 in 2001, with an average of 2,659 calls per year. This equates to eight spills per year, or one spill every 332 vessel calls.

Terminals were the responsible party for approximately 66 percent of the spills, while vessels were responsible for the remaining 34 percent. The largest spill from a marine oil terminal in the San Francisco Bay since 1992, the year CSLC started tracking such spills, was 1,092 gallons (26 barrels).

Amorco Terminal

Tesoro reported in its Oil Spill Response Plan that there has only been one reportable spill at the Amorco Terminal since 1991. This spill occurred on February 4, 2000, and involved a release of less than one barrel of gasoline/diesel from the D line to the water. The spill was cleaned up and the line was taken out of service.

4.1.1.5 Other Major Vessel Incidents

Over the past 40 years, several incidents involving vessels have drawn public attention.

- In 1971, a collision of the Oregon Standard and the Arizona Standard under the Golden Gate occurred in heavy fog and resulted in a spill of approximately 27,600 barrels of bunker heavy fuel oil. Spilled oil impacted the outer coast to the north as far as Double Point (north of Point Reyes Bird Observatory) in Marin County, and to the south near San Gregorio Beach in San Mateo County, as well as within San Francisco Bay. Approximately 4,000 seabirds died as a result of the spill. This incident led to the Bridge to Bridge Radiotelephone Act, which requires all vessels to monitor Channel 14 VHF-FM, and the development of the Vessel Traffic Service in San Francisco Bay.

- In 1984, the chemical tanker Puerto Rican experienced an explosion in a void space surrounding a cargo tank while the vessel was in open waters about 8 miles west of the Golden Gate Bridge. The accident resulted in injury to crew members and the release of over 30,000 barrels of lubricating oil and fuel oil, impacting the Farallon Islands, Point Reyes, and Bodega Bay.

- In 1989, the tug Standard IV with an oil barge in tow lost control while approaching its berth at the Richmond Long Wharf. The barge struck the pier, destroying a catwalk and parting the bow lines on the tanker “Overseas Juneau.” The tanker’s bow began to swing away from the pier. The tanker dropped an anchor and hailed a passing light tug. The tug held the tanker’s bow against the dock while it made preparations to get underway. The tanker transited to anchorage without any further damage. The barge suffered minor damage and the tug none.

- The partially laden tanker Overseas Philadelphia was moored portside at the Wickland (now Shore) Selby marine oil terminal on February 20, 1997, when the vessel broke loose from her mooring lines and drifted without power into the Carquinez Strait. As a result, the terminal sustained severe damage to the fixed loading arms and the concrete wharf. Reportedly, 420 gallons of jet fuel were released into the Carquinez Strait. The cause may have been due to a surge from the passing of another vessel that caused the breast lines to part and allowed the vessel to swing outward away from the dock. Since no cargo transfer operations were in process at the time of the incident, the spilled contents consisted of jet fuel remaining in the loading arms. Within approximately eight minutes of the incident, the drifting vessel started her engines and then safely anchored approximately one nautical mile from the Wickland (now Shore) Selby terminal.

- The Singapore-flagged Neptune Dorado was detained in San Francisco on September 24, 2000, by the USCG after port State inspections revealed safety deficiencies. The four safety deficiencies cited were two inoperative main fire pumps, a leaking starboard boiler oil settling tank, inoperative main vent blowers for the engine room, and leaking fuel oil lines to the main diesel engine. The vessel was allowed to proceed to a terminal and offload its cargo of crude oil in early October after repairs were made.
- In November 2007, a container ship, the Cosco Busan, struck the San Francisco-Oakland Bay Bridge and released almost 1,400 barrels of fuel oil into the water. Oil contamination occurred on the waterfront in the San Francisco Bay, and several beaches in San Francisco and in Marin County were closed due to the oil. On-water and shoreline oil cleanup activities were undertaken, and many beaches have since been cleaned up and re-opened. As a result of this spill, State legislation was passed in 2008 to improve spill preparedness and response measures, including assigning responsibility for cleanup in the event of a spill.

4.1.1.6 Factors Affecting Vessel Traffic Safety

This section summarizes environmental conditions described in the USCG Pilot, Volume 7, 45th Edition, 2013 (NOAA 2013a), the San Francisco, San Pablo and Suisun Bays Harbor Safety Plan Year 2012 (Harbor Safety Committee 2013), and San Francisco Bar Pilots Operations Guidelines for the Movement of Vessels on San Francisco Bay and Tributaries that could have an impact on vessel safety in the Bay Area. More detailed information on many of the areas can be found in the existing conditions description in other sections of this document (e.g., detailed meteorological data can be found in Section 4.6, Air Quality).

Winds

San Francisco Bay Area weather is seasonably variable. Winter is the season with the most significant seas, both in terms of locally driven wind waves as well as open-ocean swells that are generated by long fetches of strong winds over the eastern Pacific. Winter winds from November to February shift frequently and have a wide range of speeds depending on the procession of offshore high and low-pressure systems. Spring tends to be the windiest season, with average speeds in the San Francisco Bay of 6 to 12 knots, with wind speeds of 17 to 28 knots up to 40 percent of the time. Summer winds are the most constant and predictable. Wind speed can affect track keeping, mooring operations, and can cause strain on mooring lines during transfer operations.

Fog

Fog is a well-known problem in the Bay Area, particularly around the entrance to the San Francisco Bay (known as the Golden Gate). It is most common during the summer, occasional during fall and winter, and infrequent during spring. The long-term fluctuations are not predictable, but daily and seasonal cycles generally come at expected intervals. The foggiest months are usually July and August while June is the least foggy. Under normal summer conditions, a sheet of fog appears in the early forenoon and becomes more formidable as the day wears on. This type of fog is normally referred to as sea fog. Fog signals in the Golden Gate operate 15 to 25 percent of the time during August.

Another type of fog, referred to as Tule fog, forms in low, damp places such as the Delta, and is most prevalent in late December and January. This type of fog tends to drift seaward through the Carquinez Strait and other gaps in the Berkeley Hills. Fog signals tend to operate 10 to 20 percent of the time during these months.

The reduced visibility caused by fog can increase the potential for collisions and allusions.

Currents

The currents at the entrance to San Francisco Bay are variable and uncertain, and at times attain considerable velocity. The ebb current has been observed to reach a velocity of over 6.5 knots. Immediately outside the San Francisco Bar, a horseshoe-shaped area of shallow water that begins north of the Golden Gate in Marin County, runs out approximately 5 miles, and curves back to shore just south of the Golden Gate, is a slight current to the north and west known as the Coast Eddy Current. The currents that have the greatest effect on navigation in the Bay and out through the Golden Gate are tidal in nature, i.e., due to the tide rushing in and out of San Francisco Bay. Currents can affect track keeping, mooring operations, and oil spill response operations.

Tides

Tides in the San Francisco Bay Area are mixed. Usually two cycles of high and low tides occur daily, but with inequality of the heights of the two. Occasionally, the tidal cycle will become diurnal (only one cycle of tide in a day). Depths in the San Francisco Bay are based on mean lower water level (MLLW), which is the average height of the lower of the two daily low tides. The mean range of the tide at the Golden Gate is 4.1 feet, with a diurnal range of 5.8 feet. During the periodic maximum tidal variations, the range may reach as much as 9 feet and have lowest low waters 2.4 feet below MLLW datum. Tides affect water depth, which in turn can have potential impact groundings. In addition, tidal action has an impact on currents in the San Francisco Bay.

Water Depths

Water depths in the San Francisco Bay are generally shallow and subject to silting from river runoff and dredge spoil recirculation. Therefore, channel depths must be regularly maintained, and shoaling, the deposition of silt and sand that decreases water depth, must be prevented to accommodate deeper-draft vessels. The U.S. Army Corps of Engineers (USACE) attempts to maintain the depth of the main ship channel from the Pacific Ocean into the San Francisco Bay at 55 feet; however, the continual siltation results in actual main-channel depths ranging between 49 and 55 feet. Deep-draft vessels in the San Francisco Bay must carefully navigate many of the main shipping channels because channel depths in some areas are barely sufficient for navigation by some modern larger vessels, depending upon how deeply laden the vessel is. While the USACE surveys specific areas of concern on a frequent basis, recent survey charts may not show all seabed obstructions or shallow areas due to highly mobile bottoms (due to localized shoaling). In addition, recent observations indicate that manmade channels may influence tidal currents to a greater degree than earlier anticipated. Water depth impacts under-keel-clearance and groundings are a potential impact. Additional information on water depth and quality at the Amorco Terminal is found in Section 4.2, Water Quality.

4.1.1.7 Bay Area Vessel Traffic Control Systems

Navigational Description

The USCG has established a TSS off the entrance of San Francisco Bay (refer to Figure 4.1-1). It includes three directed traffic areas, each with one-way inbound and outbound traffic lanes separated by defined separation zones, and a Precautionary Area. The TSS is recommended for use by vessels approaching or departing the San Francisco Bay, but is not necessarily intended for tugs, tows, or other small vessels that traditionally operate outside the usual steamer lanes or close to shore. The TSS has been adopted by the International Maritime Organization (IMO).

The USCG established the Vessel Traffic Service (VTS) in San Francisco Bay in 1972. The USCG operates the VTS and monitors nearly 400 vessel movements per day. The region is considered a difficult navigation area because of its high-traffic density, frequent episodes of fog, and challenging navigational hazards. The VTS for the San Francisco Bay region has six components: (1) automatic identification system, (2) radar and visual surveillance, (3) VHF communications network, (4) a position reporting system, (5) traffic schemes within the San Francisco Bay, and (6) a 24-hour center that is staffed with specially trained vessel traffic-control specialists.

The VTS area is divided into two sectors: Offshore and inshore. The offshore sector consists of the ocean waters within a 38-nautical-mile radius of Mount Tamalpais, excluding the offshore Precautionary Area. The inshore sector consists of the waters of the offshore Precautionary Area eastward to San Francisco Bay and its tributaries extending inland to the ports of Stockton, Sacramento, and Redwood City. In sum, the geographic area served by the VTS includes San Francisco Bay, its seaward approaches, and its tributaries as far as Stockton and Sacramento.

There are seven Regulated Navigation Areas (RNAs) in San Francisco Bay. These RNAs were established in 1993 by the USCG with input from the Harbor Safety Committee, and are based on the voluntary traffic-routing measures that were previously in existence. The RNAs are codified in 46 Code of Federal Regulations 165.1116. RNAs organize traffic-flow patterns to reduce vessel congestion where maneuvering room is limited; reduce meeting, crossing, and overtaking situations between large vessels in constricted channels; and limit vessel speed. All vessels 1,600 gross tons or more, and tugs with a tow of 1,600 gross tons or more (referred to here as large vessels) navigating in the RNAs are required by the regulations to: (1) not exceed a speed of 15 knots through the water; and (2) have engine(s) ready for immediate maneuver, and operate engine(s) in a control mode and on fuel that will allow for an immediate response to any engine order by the Captain.

Position Reporting, Communication, and Surveillance

The USCG VTS at Yerba Buena Island is the communications center for the TSS. The TSS was extensively upgraded in 1997. The upgraded system includes state-of-the-art computer-digitized radar displays shown on electronic charts. The new system automated many of the controller's duties, allowing more time for monitoring traffic. There are three classes of VTS user: passenger vessels, power-driven vessels, and towing vessels. There are four report types that may be required of each. In general, communications with VTS are brief, succinct, and to the point. Power-driven vessels over 40 meters in length are required to call VTS 15 minutes prior to entering a VTS area, when getting underway, at certain specified points, when there are changes to the sailing plan, and when leaving the VTS area.

Pilotage

Pilotage in and out of the San Francisco Bay and adjacent to the waterways is compulsory for all vessels of foreign registry and United States vessels under enrollment not having a federal licensed pilot on board. The San Francisco Bar Pilots provide pilotage to ports in San Francisco Bay and to ports on all tributaries to the Bay. Pilots board the vessels in the Pilot Boarding Area outside the Golden Gate entrance, and then pilot the vessels to their destinations. Pilots normally leave the vessels after docking and reboard the vessels when they are ready to leave and pilot them to sea or other destinations within the Bay Area.

Physical Oceanographic Real Time System (PORTS)

PORTS is designed to provide real-time information to mariners, oil spill response teams, coastal resource managers, and others about San Francisco Bay's water levels, currents, salinity, and winds. The National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service, OSPR, U.S. Geological Survey, local community, and Marine Exchange of the San Francisco Bay operate PORTS as a partnership to provide service to those who must make operational decisions based on oceanographic and meteorological conditions in the Bay. Instruments are deployed at strategic locations in the San Francisco Bay to collect and provide data at critical locations and to allow nowcasting and forecasting using a mathematical model of the Bay's oceanographic processes. Data from these sensors are fed to a central data-collection point; raw data from the sensors are integrated and synthesized into information and analysis products, including graphical displays of PORTS data. These displays are available over the Internet and through a voice-response system. Station S0601 is located at the Amorco Pier (NOAA 2013b).

4.1.2 REGULATORY SETTING

Federal and State laws that may be relevant to the Project are identified in Table 4-1.

4.1.3 IMPACT ANALYSIS

4.1.3.1 Significance Criteria

For the purposes of this analysis, an impact was considered to be significant and to require mitigation if it would result in any of the following:

- The existing facility does not conform to its oil spill contingency plans or other plans that are in effect; or if current or future operations may not be consistent with federal, State, or local regulations (Note: conformance with regulations does not necessarily mean that there are not significant impacts).
- There is a significant risk for fires, explosions, releases of flammable or toxic materials, or other accidents from the Amorco Terminal or from vessels that could cause injury or death to members of the public.
- The Project is located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5 and, as a result, would create a significant hazard to the public or the environment.
- Existing and proposed emergency response capabilities are not adequate to effectively mitigate spills and other accident conditions, such that a level of concern would be reached at shoreline environments.

The Project site is not on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5 (the Cortese list), so this significance criterion is not discussed further in this Environmental Impact Report (EIR) (No Impact).

4.1.3.2 Approach to Analyzing Impacts of Upset Conditions

System safety/risk-of-upset impact assessment is different than those of other environmental issue areas because an accident must occur before an impact can occur. The expected frequency of accidents must be factored into the analysis. Furthermore, even the occurrence of an accident does not mean significant impacts will result. Whether or not a significant impact may be expected depends on the magnitude of the accident, and as the magnitude of a given potential accident scenario increases the probability of that accident scenario occurring decreases. Thus, the system safety/risk-of-upset impact analysis considers both probability and potential magnitude of reasonably foreseeable upset scenarios, including: (1) spills that can potentially impact the environment, and (2) incidents that can potentially impact the safety of the public.

The expected frequency of spills occurring as a function of volume was estimated, as was the extent of area that may be impacted by these spills using available oil spill trajectory modeling results. Note that a spill itself does not necessarily impact the environment unless specific resources are impacted. How a spill impacts the environment is addressed in other resources sections of this EIR. Any deficiency in Tesoro's ability to respond to upset conditions and the potential for impacts to public safety is assessed in this section.

The analysis quantifies the probability of an accident due to the Project from both the tank vessel traffic and the Amorco Terminal. The analysis considers the specific type, such as tankers, barges, and number of vessels that will be calling at the Amorco Terminal over the lease period; specific design features of the Amorco Terminal; and the historical accident record. Information regarding potential hazards during vessel approaches and departures is evaluated based on historical data, information from agencies and organizations knowledgeable of the area, and information available from the Harbor Safety Committee.

Risk/safety analysis of types of incidents that can occur at the Amorco Terminal, the consequences of spill incidents, and their expected frequency of occurrence are based on Amorco Terminal operations. The worst-case and most likely spill sizes that could occur from the various components of the Amorco Terminal have been estimated. The Tesoro Oil Spill Response Plan approved by the OSPR serves as the basis for this analysis, including a worst-case spill and risk and hazard analysis. Tesoro's ability to respond to and mitigate potential incidents has also been evaluated.

4.1.3.3 Impacts Analysis and Mitigation Measures

The following subsections describe the Project's potential impacts on the environment and public safety. Where impacts are determined to be significant and there are feasible means to reduce or avoid the impact, mitigation measures (MMs) are identified.

Proposed Project

Impact Operational Safety (OS)-1: Potential for spills and response capability for containment of oil spills from the Amorco Terminal during transfer operations. (Significant and unavoidable.)

The presence of oil and handling of oil associated with the Project would result in the potential for spills. Consequences would depend on the spill conditions and could range from relatively small spills that can be contained during first-response efforts with rapid cleanup and no significant impacts, to spills that are larger or difficult to clean up with significant residual impacts after remediation. Tesoro would be required by regulations to maintain response capabilities for containment of the reasonable WCD spill event.

Potential for Spills from the Amorco Terminal

Spills may originate from the Amorco Terminal or from the tank vessel and may be due to natural factors (earthquake, tsunami, severe environmental conditions, etc.), human error (berth collision, bad hose connection, ineffective mooring line tending, etc.), or equipment failure. Potential sources of a spill from the Amorco Terminal include drip pans, hydraulic hoses, loading hoses and fittings, pipelines and fittings, and valves.

The transfer area on the wharf is impounded by a raised berm that drains into a collection system that engages automatically by level control switches. Collection pans are located under all piping manifolds at the berth and are designed to collect potential drips from bolted flanges, fittings, and expansion joints. A description of the drip and recovered oil facilities is contained in Section 2.3.2. A description of the oil/product transfer procedures is contained in Section 2.4.6. The emergency shutdown system is described in Section 2.6.1, with activation of the emergency shutdown system able to close the pipeline block valves within 30 seconds.

The Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) minimum engineering, inspection, and maintenance standards apply to all existing and new marine oil terminals in California, and include criteria for maintenance, inspection, structural and seismic analysis and design; mooring and berthing; geotechnical considerations (including site-specific assessment); and analysis and review of the fire, piping, mechanical, and electrical systems. Tesoro is required to comply with the MOTEMS, which became effective on February 6, 2006. A discussion of MOTEMS is contained in Section 2.3.5.

A detailed MOTEMS Audit of the Amorco wharf was recently completed (Eichleay and Gerwick 2011). In addition, a detailed geotechnical investigation was performed (Treadwell and Rollo 2010). These two audits/studies found that the wharf did not meet MOTEMS seismic standards and, in addition, found other MOTEMS deficiencies. Tesoro has implemented a program to upgrade the wharf to meet MOTEMS seismic standards and to fix the other deficiencies. To date, the seismic upgrades are reportedly complete and most of the other deficiencies have been corrected.

A release from a vessel while at the Amorco wharf is also possible. As a worst case, the entire contents of a vessel could be released; however, this is not considered a realistic scenario. The CSLC spill database (refer to Section 4.1.1.4) differentiates between spills from marine terminals and spills from tank vessels at marine terminals. The largest release from a tank vessel in the San Francisco Bay between 1992 and 2001 was 420 gallons of jet fuel oil (10 barrels). The largest release from a tank vessel between 2001 and 2013 was 58,082 gallons of fuel oil (1,383 barrels) in 2007.

Spill Planning Volumes

The USEPA, USCG, and OSPR have specified methods for calculating three levels of spill planning volumes for use in determining the minimum amount of spill response equipment/capability that must be available within specified timeframes to respond to the release. These are discussed below.

- **Reasonable Worst-case Discharge.** The WCD volume is discussed in Section 4.1.1.3, and equates to 22,178 barrels of oil.
- **Maximum Most Probable (Medium Volume) Discharge.** The USCG defines this discharge as the lesser of 1,200 barrels, or 10 percent of the volume of the WCD. The WCD is 22,178 barrels and thus, the maximum most probable discharge is 1,200 barrels.
- **Average Most Probable (Small Volume) Discharge.** The USEPA defines the average most probable discharge as 50 barrels, not to exceed the WCD, while the USCG defines it to be the lesser of 50 barrels or 1 percent of the WCD (222 barrels in this case). Thus, the average most probable (small) discharge planning volume is 50 barrels.

Probability of Release

The CSLC spill data, augmented by additional data for larger spills, were used to estimate the probability of spills from the Amorco Terminal. The average number of tank vessel calls to marine oil terminals in the San Francisco Bay over the past 10 years (2003 through 2012) has been approximately 2,659 per year, resulting in a probability of a spill per vessel call of 3.0×10^{-3} (refer to Section 4.1.1.4). The largest spill between 2003 and 2012 was 115 gallons. The largest recorded spill from a tank vessel or marine oil terminal since 1992, the year the CSLC began collecting these data, was 1,092 gallons (26 barrels). While the probability of a spill is presented in terms of spills per vessel transfer, the database includes spills that occur even when a vessel is not present. However, the vast majority of spills occur when vessels are present and it is generally believed that including other spills in the calculations does not bias the results.

Therefore, the cited probability reflects the probability of spills at Bay Area marine oil terminals from all causes and not just those associated with transfer operations. Because very few large spills have occurred at terminals within the San Francisco Bay, the CSLC (2011a) integrated worldwide data with the CSLC data to estimate the potential for large spills from marine oil terminals. Figure 4.1-3 presents a graph of the percent of spills as a function of size. Because the majority of spills are small, a logarithmic scale was used for the spill size axis. As the figure indicates, 54 percent of spills are less than 1 gallon, 70 percent are less than 10 gallons, 86 percent are less than 100 gallons, and 95 percent are less than 1,000 gallons.

The maximum number of vessels projected to call annually at the Amorco wharf is 90. Using the spill probability presented above, one spill approximately every 3.7 years (an annual probability of spill of 0.27) is anticipated. A spill larger than 1 gallon would be expected approximately every 7.9 years. The probability of a spill larger than 1,000 gallons from the Amorco Terminal is 0.01, or one spill every 73 years. These probabilities as applied to the Amorco Terminal are very conservative because the spill data used are for all marine oil terminals, many of which are not or were not in compliance with MOTEMS.

The consequences of a spill would depend on the size of the spill; the effectiveness of the response effort; and the biological, commercial fishery, shoreline, and other resources affected by the spill. A spill of 1 gallon or less would result in an adverse impact that can be mitigated, while a large spill of 1,000 barrels (42,000 gallons) most likely would result in a significant, adverse impact that would have residual effects after mitigation. The impacts of spills between 1 gallon and 1,000 barrels (42,000 gallons) depend on the effectiveness of response efforts and the resources impacted.

Worst-case Release Spill Trajectory

Tesoro (2012) conducted oil spill trajectory modeling for a reasonable worst-case oil spill release of 22,178 barrels at the wharf. The area at risk from a release was evaluated using the OILMAP™ trajectory and fates model. A sensitivity analysis was performed on these results to evaluate possible seasonal environmental and weather impacts. This was performed using a stochastic evaluation technique for trajectories over each seasonal period. The identified pessimistic conditions were used to develop trajectory plots depicting the projected areas of impact over a 72-hour period. The trajectory and fates mode of modeling predicts both the movement and weathering of surface oil. The fate processes simulated are spreading, evaporation, entrainment, emulsification, and shoreline stranding.

Seasonal variations have been evaluated through the stochastic model. Historical winds for the period were categorized into summer and winter seasons. Wind velocity and direction vectors representative for the seasons were evaluated creating a range of probable spill trajectories.

Generally, the regional weather has two seasonal conditions, summer and winter. In the summer, winds are dominated by the prevailing west wind and thermal induction from the valley. In the early morning and evening, winds can be light and variable. In the winter or fall, the winds are generally light and variable, with occasional stronger winds representative of passing winter storm systems. Generally, a strong wind across the tidal flow tends to act as a driving function forcing the spill out of the main tidal flow. This can result in earlier grounding on the shoreline and may result in less travel and shoreline area impact.

Appendix B provides maps summarizing results of modeling for the worst-case spill using both summer and winter wind influences on the spill trajectory. The maps represent a summary of 100 iterations of spill trajectories from various states of tidal currents and seasonal environmental factors. Results are depicted on color maps delineating time contours in 0.25-day (6-hour) increments. A legend to the color scale is provided on each map. Shoreline impacts are identified by red markings or by the overrun of the time contour across the shoreline. Either name or colored shoreline identifies key geographic and sensitive environmental site references. A legend of the color key is also provided on each map. Each trajectory is presented with information displaying the extent of oiling by time periods. In addition, a separate map describes the relative probability of oiling for those geographic areas identified to be at risk.

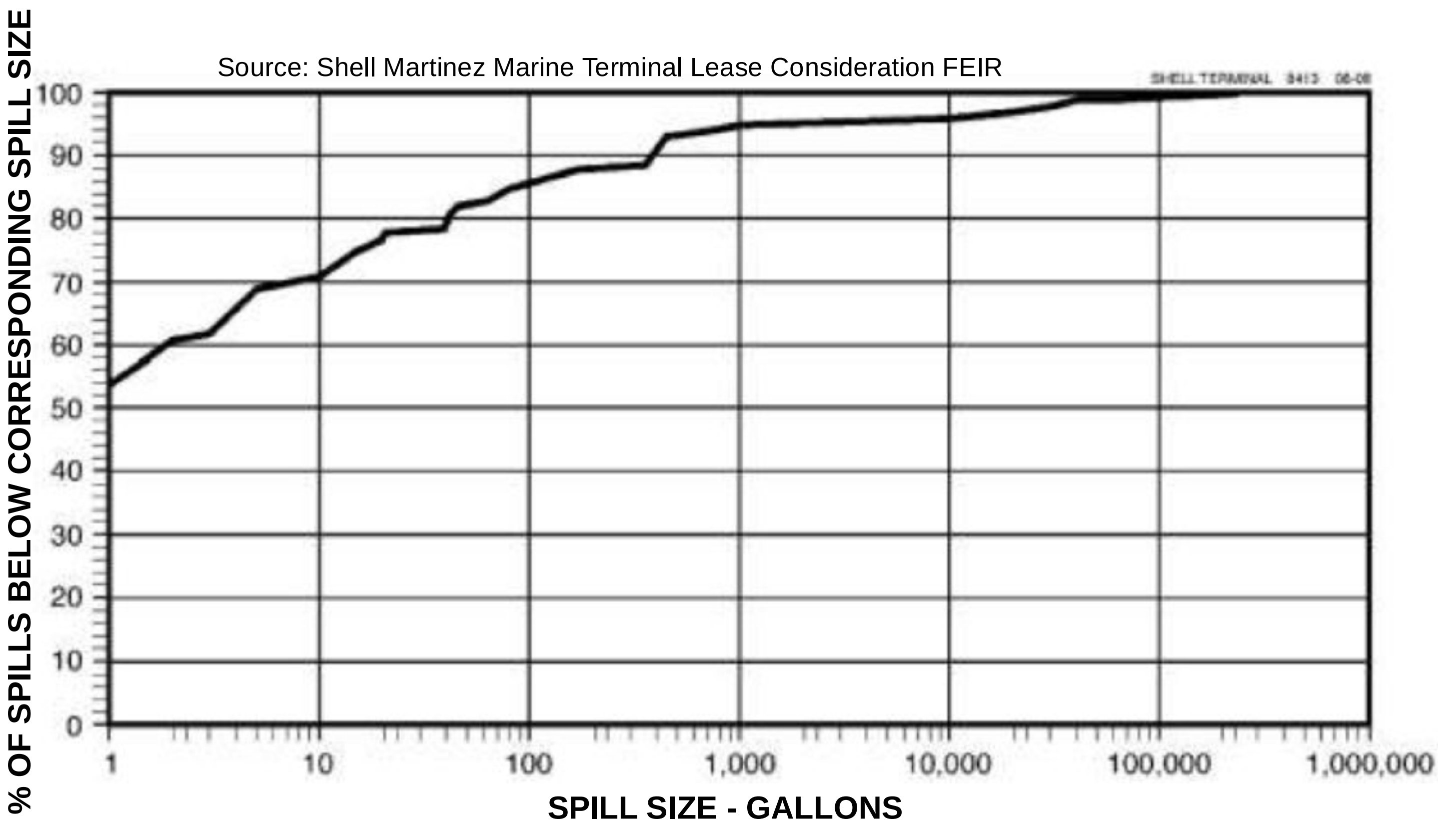
It can be observed from Figures D.13 and D.15 in Appendix B that the greatest shoreline impact occurs during the winter season with increased impact to the northern reaches of Honker, Suisun and Grizzly Bays and further propagation outside the Carquinez Strait into San Pablo Bay.

A summary of Tesoro’s oil spill response capabilities is presented below. The impacts of a release on other resources are addressed in the other resources sections of this EIR, including Section 4.2, Biological Resources; Section 4.3, Water Quality; Section 4.5, Geology, Sediments, and Seismicity; Section 4.8, Land Use and Recreation; Section 4.10, Visual Resources, Light and Glare; and Section 6.0, Commercial and Sport Fisheries.

Response Capability

Tesoro’s response assets are described in Section 4.1.1.4. The following describes the steps Tesoro would most likely follow in the event of a spill and the potential effectiveness of the response. The responses described below are for releases of crude oils and persistent products, which are the only products handled at the Amorco Terminal.

Source: Shell Martinez Marine Terminal Lease Consideration FEIR



X:\CSLC\Amorco MOT\4.1 Operational Safety\mxd\Figure 4_1-3 Worldwide Spill Size Cumulative Distribution at Large Marine Terminals.mxd

Figure 4.1-3
Worldwide Spill Size Cumulative Distribution at Large Marine Terminals
California State Lands Commission
Amorco Marine Oil Terminal Lease Consideration Project

TRC

8/27/2013

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CSLC regulations (Cal. Code Regs., tit. 2, § 2395) require that all onshore marine terminals, except those "subject to high-velocity currents," deploy boom to enclose the water surface at the waterline when discharging and either of the following: (1) the entire dock, or (2) portions of the dock where oil may spill into the water, prior to transfer operations. An "onshore marine terminal subject to high-velocity currents" is defined as an onshore terminal at which the maximum current velocities are 1.5 knots or greater for the majority of the days in the calendar year. The Amorco Terminal is in this category.

This conditional exemption from the pre-booming requirement is based upon the lack of effectiveness of a boom in containing oil at higher-current velocities, and the considerable difficulty that is encountered in deploying boom under such conditions. When water moves at speeds greater than 1.5 knots, oil on the surface is entrained under (and, dependent upon wind, sometimes overtops) containment boom, thus reducing the effectiveness of oil containment. Deployment of boom in open water and against the current is highly labor-intensive and creates personnel hazards. Additionally, there is constant difficulty in providing a stand-off (a gap between the side of the vessel and the boom), so that oil does not merely flow over the boom.

Tesoro's first step upon discovering a release would be to attempt to stop it (e.g., by activating the emergency shutdown system). Tesoro would then activate its spill-response team. This would include the personnel on duty at the Amorco Terminal and spill-response personnel at the Golden Eagle Refinery (Refinery), as well as its initial response contractor, Bay Area Ship Services. The next step would most likely be to deploy the boom on the Amorco wharf. Bay Area Ship Services maintains spill-response boats that are capable of deploying 600 feet of boom at the Amorco wharf within approximately 30 minutes. The boom would be deployed on the down-current side of the spill in an attempt to prevent the oil from drifting to where it could impact sensitive environmental resources and commerce. Additional fast-response vessels, boom-carrying/deploying vessels, boom, personnel, and other response equipment are available from MSRC. The current itself would assist in deploying the boom in the shape of a catenary curve. Oil would be recovered with sorbent material and/or skimmers.

Tesoro maintains sorbent material at the Amorco Terminal. Numerous skimming vessels and additional sorbent material are available from MSRC. A number of response boats are berthed in Martinez, including the Spill Spoiler and Sentinel, both of which are equipped with skimmers, boom, and 90 barrels of storage. MSRC can also supply oil storage devices to collect the recovered oil. Even though Tesoro is compliant with USCG regulations for spill response, a spill could have significant effects if the spill is large or if sensitive biological resources are affected. The use of dispersants would need to be authorized in consultation with the Environmental Unit within the Planning Section of a Unified Command; due to a number of concerns, it is not likely that dispersant use would be authorized within the San Francisco Bay/Delta Estuary; although offshore use may be considered.

The MOTEMS have set minimum requirements for preventative maintenance that includes periodic inspection of all components related to transfer operations. Tesoro is required to comply with those requirements. In addition, MM OS-1a requires Tesoro incorporate a remote release system that would allow the quick release of mooring lines in the event of an emergency. In the event of a fire, tsunami, explosion or other emergency, simultaneous and expeditious release of mooring lines (within 60 seconds) would allow a vessel that is not also connected by product transfer hoses to quickly leave the Amorco Terminal which could help prevent damage to the Amorco Terminal and a vessel and avoid and/or minimize spills. A remote release system may also help isolate an emergency situation, such as a fire or explosion, from spreading between the terminal and vessel, reducing oil spill potential. By providing mooring release devices capable of being engaged by a locally initiated electric/push button release system and by a remotely-operated release mechanism, Tesoro shall have several different options to cover emergency situations.

MM OS-1b proposes the installation of Tension Monitoring Systems (TMSs) to monitor mooring line tension and integrated environmental conditions. As the Amorco Terminal is located in a high velocity current area in the Carquinez Strait, monitoring moored vessels line strains and environmental conditions enables informed and controlled transfer operations to continue in harsh weather conditions, high velocity current conditions and/or other conditions where excessive tension or slack in the mooring lines could result in failure of mooring lines and/or significant movement of the vessel, resulting in damage to the Amorco Terminal and/or vessels. (Note, however, TMSs cannot directly monitor vessel movements; this is addressed in MM OS-1c.)

Devices able to continuously monitor moored vessels' movements, line strains and alarm at preset limits can warn operators of the development of dangerous mooring situations, allowing time to take corrective action and minimize the potential for the parting of mooring lines, which can escalate to the breaking of hose connections, the breakaway of a vessel, and/or other unsafe mooring conditions, that could ultimately lead to an oil spill. Real time data monitoring and control room information provide the Terminal Person-In-Charge with immediate knowledge of whether safe operating limits of the moorings are being exceeded. Backed up by an alarm system, mooring adjustments can be made to prevent damage and accidental conditions.

Located in a high velocity current area, the Amorco Terminal is subject to "unfavorable" site conditions in accordance with the MOTEMS section 3103F.6.7. At present, the docking system relies on the pilot's judgment to determine the vessel's approach speed and angle. As proposed as part of MM OS-1c, Allision Avoidance Systems (AASs) would monitor an approaching vessel's speed, approach angle, and distance from the dock to keep the potential impact velocity within the maximum elastic allowable limits of the fender and/or structural system, and thus help to prevent damage to the Amorco Terminal and/or vessel due to vessel impact, which could lead to an oil spill. Monitoring these factors will ensure that all vessels can safely berth at the Amorco Terminal and comply with the minimum standards required in the MOTEMS. Furthermore, monitoring moored vessels' movements and passing vessels ensures that all vessels can remain securely moored against the Amorco Terminal and comply with the minimum standards required in the MOTEMS. Excessive surge or sway of vessels (motion parallel or perpendicular to the wharf, respectively) and/or passing vessel forces may result in sudden shifts/redistribution of mooring forces through the mooring lines, which can quickly escalate to the failure of mooring lines, breaking of hose connections, the breakaway of a vessel, and/or other unsafe mooring conditions, that could ultimately lead to an oil spill.

Nevertheless, a release from the Amorco Terminal or a given tank vessel berthing at the Amorco Terminal could result in significant impacts on the environment depending on the size of the spill and the resources impacted. A release would not present a safety hazard to members of the public.

Mitigation Measures: The following shall be completed by Tesoro within 24 months of lease implementation, unless otherwise specified. In addition, equipment and systems described in MM OS-1a through MM OS-1c shall require documented procedures and training for systems used, and shall require documented communications between Amorco Terminal and vessel operator(s). Routine inspection, testing and maintenance of all equipment and systems shall be conducted in accordance with manufacturers' recommendations and necessity.

MM OS-1a: Remote Release Systems. Provide and maintain mooring line quick release devices that shall be able to be activated within 60 seconds.

- These devices shall be capable of being engaged by electric/push button release mechanism and by integrated remotely-operated release system.
- Tesoro shall document procedures and training for systems use and communications between Amorco Terminal and vessel operator(s).
- Routine inspection, testing and maintenance of all equipment and systems in accordance with manufacturers' recommendations and necessity are required to ensure safety and reliability, to the satisfaction of CSLC staff.
- Tesoro may install alternate technology that provides an equivalent level of protection, as reviewed by CSLC staff and approved by the Commission at a publicly noticed meeting.

This measure would allow a vessel to leave the Amorco Terminal as quickly as possible in the event of an emergency (fire, explosion, accident, or tsunami that could lead to a spill) that could impact the Amorco Terminal or the vessel.

MM OS-1b: Tension Monitoring Systems. Provide and maintain TMSs to effectively monitor all mooring line and environmental loads, and avoid excessive tension or slack line conditions that could result in damage to the terminal structure and/or equipment and/or vessel mooring line failures that could result in spills.

- Line tensions and environmental data shall be integrated into systems that record and relay all critical data in real time to the control room, terminal operator(s) and vessel operator(s).
- This system shall include, but not be limited to, quick release hooks only (with load cells), site-specific current meter(s), site-specific anemometer(s), and visual and audible alarms that can support effective preset limits and shall be able to record and store monitoring data.
- Tesoro shall document procedures and training for systems use and communications between Amorco Terminal and vessel operator(s).
- Routine inspection, testing and maintenance of all equipment and systems in accordance with manufacturers' recommendations and necessity are required to ensure safety and reliability, to the satisfaction of CSLC staff.
- Tesoro may install alternate technology that provides an equivalent level of protection, as reviewed by CSLC staff and approved by the Commission at a publicly noticed meeting.

MM OS-1c: Allision Avoidance Systems. Provide and maintain AASs at the Amorco MOT to prevent damage to the pier/wharf and/or vessel during docking and berthing operations.

- The AASs shall be used and alarmed to monitor vessel drift (both surge and sway) during all mooring operations, and shall be equipped with an AIS receiver to capture passing vessel parameters.
- This shall be integrated with the TMSs such that all data collected are available in the Control Room and to Amorco Terminal operator(s) at all times and vessel operator(s) during berthing operations. The AASs shall also be able to record and store monitoring data.
- Tesoro shall document procedures and training for systems use and communications between Amorco Terminal and vessel operator(s).
- Routine inspection, testing and maintenance of all equipment and systems in accordance with manufacturers' recommendations and necessity are required to ensure safety and reliability, to the satisfaction of CSLC staff.

Impact OS-2: Amorco Terminal spills from pipelines during non-transfer periods. (Significant and unavoidable.)

Spills from the Amorco Terminal during non-transfer periods would most likely be associated with a leak or spill from pipelines. Tesoro has an extensive pipeline inspection and maintenance program in place (refer to Section 2.5, Inspection and Maintenance). California Code of Regulations, Title 2, Article 5.5 and MOTEMS have set requirements for preventative maintenance that include periodic testing of oil pipelines and inspection of all Amorco Terminal pipeline components. Tesoro reports fully complying with those requirements. Nevertheless, leaks or spills are possible and considering the Amorco Terminal pipeline volume of 757 barrels, a substantial spill is possible. Tesoro would respond to a pipeline leak or spill as described for OS-1 according to the extent of the spill and affected area. Even with response measures in place, depending on the size of the spill and the environmental resources affected, impacts of a spill could be significant.

The Project pipelines are reportedly fully compliant with California Code of Regulations, Title 2, Article 5.5 and MOTEMS release prevention requirements and Tesoro is already required to ensure readiness of spill response capabilities for the worst case discharge from the Amorco Terminal, which far exceeds any leak or spill that could occur from the pipeline. These prevention and response capabilities are considered to be inclusive of feasible measures to reduce the risk of oil spills from the MOT during non-transfer periods. No feasible mitigation measures have been identified that would be capable of substantial further reduction of the risk from releases during non-transfer periods.

Mitigation Measure: No additional mitigation measures available.

Impact OS-3: Potential for fires and explosions and response capability. (Significant and unavoidable.)

The closest populated public areas are residential areas, parks, and marinas that are all located too far away to be impacted by heat from a potential fire or flying debris from a potential explosion at the Amorco Terminal. Therefore, the risk to the public from such an event at the Amorco Terminal is less than significant. If an oil spill were to occur from the Amorco Terminal and become ignited it could drift toward residential, park, or marina areas and present a hazard to the public or property. The intervening distance would provide time to respond and evacuate public areas if needed for safety so the risk to persons from a potential ignited oil spill is low. Furthermore, because of the extremely low probability of an oil spill with fire, the risk of such an event to the public is less than significant. However, a major fire at the Amorco Terminal could result in an oil spill with significant impacts similar to Impact OS-1.

Risk Potential and Safety Features

There have been no reported fires or explosions at the Amorco Terminal during the past 10 years; however, fires and explosions involving vessels and/or at the Amorco Terminal are possible.

Tank vessels have the potential to be a source of fire or explosion. Tankers are required by 46 Code of Federal Regulations Part 34 to have sophisticated firefighting systems, which include fire pumps, piping, hydrants, and foam systems. Tank barges are required to have portable fire extinguishers, and some are equipped with built-in systems. The tank vessel crews are trained in the use of the firefighting equipment, and the onboard firefighting equipment is sufficient to extinguish most fires.

Tank vessels loading or unloading low-flash cargoes (cargoes having a flash point of less than 150 degrees (º) Fahrenheit (F)) are required to have properly operating inert gas systems (IGS). An IGS generates an inert gas that is injected into the cargo tanks to displace the oxygen to a level that will not support ignition. The Vessel Person-in-Charge is required to verify that the tanks are inerted and that the IGS is working properly before transfer operations can commence. Products with flash points greater than 150ºF do not generate enough vapors to support ignition unless the product is heated to a temperature above 150ºF. The Amorco Terminal does not transfer any products that would produce gas cloud hazard footprints that would cause health and safety risks to the public.

The potential for a tank vessel explosion at the Amorco Terminal is considered to be reduced because of the USCG regulations requiring that tank vessels be equipped with IGS. The CSLC (2011a) calculated the potential hazard areas from a tanker fire and explosion. The radiant-heat footprint capable of causing second-degree burns to exposed skin after 30 seconds of exposure (1,600 British thermal units per square foot per hour) was calculated to be 300 feet around the vessels. The radiant-heat hazard footprint would not pose a significant hazard to the public because there are no public areas within 300 feet of the wharf area. An explosion involving one of the cargo tanks could send flying debris up to 1,500 feet from the ship (Reese-Chambers 1981, CSLC 2011a). The closest marina and park are approximately 3,000 feet from the wharf and the closest residence is located more than a mile away. Hence, these areas would not be expected to be impacted by flying debris from a vessel explosion. Considering the separation distance, the fire or explosion risk to the public is less than significant. Furthermore, the very low (less than one in a million per vessel call [CSLC 2011a]) probability of such an incident makes its occurrence unlikely.

Fire Response Capability

In response to the MOTEMS Audit (Eichleay and Gerwick 2011), Tesoro upgraded the fire protection system on the wharf to meet the requirements of MOTEMS. In addition, Tesoro has developed a comprehensive Fire Protection Plan for the Amorco wharf (HYT

Corporation 2011). Tesoro also maintains its own fire/emergency response department with full-time trained personnel at the Refinery. These personnel are trained in fighting petroleum fires at the Amorco Terminal.

Tesoro is also a member of the local Petro-Chemical Mutual Aid Organization, an agreement between large industries in the San Francisco Bay Area to provide aid in the form of spill/hygiene/fire-response equipment and assistance. In addition, the Contra Costa County Fire Protection District would respond to a marine fire and provide support.

The USCG (2008) prepared and issued a Marine Fire Fighting Contingency Plan that addresses risk assessment, including damage potential, strategic planning, management of response efforts, and available response resources. The plan outlines the resources that the USCG provides to manage and coordinate response in the event of a tanker fire.

Minimal discussion of procedures for dealing with tank vessel fires could be found in Tesoro's manuals addressing fires, emergency response, or for conducting periodic fire drills. This has been identified as a deficiency in the manual and in planning for emergency response, therefore, the potential for a significant, adverse (Class II) impact results.

The risk to the public from fire or explosion at the Amorco Terminal is less than significant due to separation distance. If an oil spill were to occur at the Amorco Terminal and become ignited, it could drift away from the Amorco Terminal toward residential, park, or marina areas and present a significant hazard. Consequences of an ignited spill would depend on the spill conditions. The distances between the Amorco Terminal and the closest residence, park, and marina would provide time to respond and evacuate areas if needed for safety so the risk to persons from a potential ignited oil spill is low. Furthermore, because of the extremely low probability of an oil spill with fire, such an event is not a significant public safety risk. However, a major fire at the Amorco Terminal could result in a significant oil spill similar to that addressed in Impact OS-1. Tesoro would be required by regulations to maintain response capabilities for containment of the reasonable WCD spill, but significant impacts are still possible. The potential for a spill to occur that could become ignited would be decreased to the extent feasible through the spill prevention measures that would be implemented through MM OS-1, but the risk of significant impacts cannot be eliminated.

As discussed above under MM OS-1a, quick release of mooring lines would allow a vessel to quickly leave the Amorco Terminal, which could help prevent damage to the Amorco Terminal and vessel, avoid and/or minimize spills (and/or associated fires or explosions), and help to prevent spreading of fire between the terminal and vessel.

In addition, MM OS-3 requires the development of adequate procedures, including the steps to follow in the event of a tank vessel fire that describe how Tesoro and a vessel will coordinate activities. Procedures required per California Code of Regulations, Title 2, Article 5, Article 5.3, Article 5.5 and the findings of the MOTEMS Audit is expected to provide guidance for fire safety practices. Tesoro's existing Operations Manual, Fire Protection Plan, and MOTEMS Audit provide additional discussion of procedures for dealing with tank vessel fires and/or emergency response. The procedures shall also identify other capabilities that can be procured if necessary in the event of a major incident. Procedures, training, and drills need to be in place in planning for emergency response, so that the Amorco Terminal operations crew has the appropriate steps to follow to ensure that emergency response measures are implemented without incident in an emergency situation. These measures will help to reduce the probability of a fire or increase response capability. Implementation of these measures can reduce impacts to less than significant.

Mitigation Measure:

MM OS-3: Fire Protection Assessment. Tesoro shall develop a Fire Protection Assessment, including a set of procedures, training and drills consistent with Marine Oil Terminal Engineering and Maintenance Standards (Cal. Code Regs., tit. 24, §3108F2.2). Tesoro shall also develop a set of procedures and conduct training and drills for dealing with tank vessel fires and explosions for tank vessels berthed at the terminal. The procedures shall include the steps to follow in the event of a tank vessel fire and describe how Tesoro and the vessel will coordinate activities. The procedures shall also identify other capabilities that can be procured if necessary in the event of a major incident. The Fire Plan and procedures shall be submitted to the California State Lands Commission (CSLC) staff within 90 days of lease renewal. The CSLC staff shall have final approval of the plan.

Impact OS-4: Response capability for accidents in the San Francisco Bay and outer coast. (Significant and unavoidable.)

Spills from accidents in the San Francisco Bay or outer coast could result in impacts to water quality or biological resources. Impacts could be limited by spill response to a less than significant level for those spills that can be contained during first-response efforts without lasting impacts to sensitive resources; however, impacts from larger spills or spills affecting sensitive resources could be significant and adverse even considering response capabilities.

Probability of San Francisco Bay Vessel Traffic Accidents

Probability estimates for tanker and barge spills from vessel traffic accidents are based primarily on data obtained from the Unocal San Francisco Refinery Marine Terminal EIR (Chambers Group 1994), Gaviota Terminal Company EIR (Aspen 1992), the Port Needs Study (John A. Volpe National Transportation Center 1991), and the Shell Martinez Marine Lease Consideration Final EIR (CSLC 2011a). Table 4.1-6 presents oil spill probabilities from barges and tankers from three causes: (1) collisions, which are impacts between two or more moving vessels; (2) rammings (or allisions), for which moving vessels run into stationary objects; and (3) groundings.

These probabilities were calculated from the individual probabilities of small, medium, and large vessels, considering the volume of traffic in each category (derived from data in John A. Volpe National Transportation Center 1991). In accordance with the methodology in Aspen (1992), a 0.10 reduction factor has been applied to tanker and barge groundings for double-bottom and double-hull vessels, and a 0.71 reduction factor has been applied to tanker and barge collisions for double-hull vessels. Regulations prohibit single-hull vessels from operating in United States navigable waters, and double-bottom and double-sided vessels cannot operate after the end of 2015. Hence, it has been assumed that all tank vessels calling at the Amorco Terminal will be double hull. The estimated probabilities of spills from tankers and barges, after applying the reduction factors, are presented in Table 4.1-7.

Table 4.1-6: Spill Probabilities by Vessel Type

Vessel Type	Probability of Spill Greater than 100 Gallons, per Vessel Calling			
	Collision	Ramming	Grounding	Total
Tanker	9.12×10^{-7}	1.42×10^{-7}	5.58×10^{-7}	1.61×10^{-6}
Barge	4.86×10^{-6}	1.50×10^{-6}	6.02×10^{-7}	6.96×10^{-6}

Source: Derived from Volpe, 1991

Table 4.1-7: Spill Probabilities per Vessel Type per Vessel Calling

Vessel Type	Spill Probability per Vessel Calling
Tanker	8.4×10^{-7}
Barge	5.0×10^{-6}

The probability estimates in Table 4.1-7 have been used to estimate the probability of a release in the San Francisco Bay from a tank vessel transiting to the Amorco Terminal. The maximum number of tank vessels that will call at the Amorco Terminal is 90. In 2008, 3 of the 85 tank vessels that called at the Amorco Terminal were barges, while in 2012 no barges called at the Amorco Terminal. For estimating the probability of a release from Amorco Terminal-bound tank vessels, it has been assumed that five are tank barges and the other 85 are tankers. Table 4.1-8 presents the annual probabilities of spills from tank vessels calling at the Amorco Terminal while transiting the San Francisco Bay. This equates to one spill every 10,400 years.

Table 4.1-8: Expected Number of Annual Spills from Vessels Calling at the Amorco Terminal While Transiting the San Francisco Bay

Vessel Type	Probability of Release
Tanker	7.1×10^{-5}
Barge	2.5×10^{-5}
Tankers and Barges	9.6×10^{-5}

Release Extent and Impacts

A spill of crude oil from a vessel would not normally present a safety hazard to members of the public. A large spill could shut down vessel traffic in portions of the San Francisco Bay while responders attempt to mitigate the spill. Impacts to water quality, biology, aesthetics, and other resources are discussed in other applicable sections of this EIR.

To provide a basis for evaluating where an oil spill from a vessel could flow and how large an area could be impacted, results from a 20,000-barrel tanker spill scenario near the Carquinez Bridge complex, conducted using the NOAA Trajectory Analysis Planner II (TAPII) software for the Shell Crude Tank Replacement Project Final EIR (Contra Costa County 2011) are summarized here and presented in detail in Appendix C. Both a summer spill and winter spill were modeled.

In accordance with TAPII, the level of concern for the oil spill impact analysis was based on crude oil sheen thickness for a “silvery sheen,” which equates to approximately 50 gallons present in 1 square nautical mile, or 0.6 barrel per “shoreline zone” as pre-defined in the TAPII model system. Modeling results indicate that probabilities of exceeding the levels of concern range from 75 to 100 percent along the shoreline east and west of the Carquinez Bridge in both summer and winter, with higher probabilities of exceedance extending into San Pablo Bay and Suisun Bay for the winter scenario. Results are presented graphically in Appendix C.

Although a spill could become ignited, this is an unlikely scenario. If a fire were to occur, the potential for safety impacts to members of the public is low, because of the isolated nature of spill locations on the water, away from residential areas. The potential for a tank vessel explosion is remote, because tankers are required to be equipped with IGS that maintain an inert gas in the vapor space of the cargo tanks, preventing the formation of a flammable gas-oxygen mixture in the explosive range.

Response to a spill from a tanker is the responsibility of the vessel owner/operator. Under the National Contingency Plan and National Incident Management System, a Unified Command would be formed, with the Federal On-Scene Coordinator (USCG Captain of the Port) and the State On-Scene Coordinator (CDFW/OSPR) coordinating priorities, resources, and efforts to protect the public; facilitating commerce; and mitigating the impacts of the spill. As a result of the Oil Pollution Act of 1990 (OPA 90), each vessel is required to have an oil plan that identifies the worst-case spill (defined as the entire contents of the vessel) and the assets that will be used to respond to the spill. The response capability of tanker companies and barge companies has not been analyzed in detail, but must be documented in their oil spill response manuals. All tanker companies operating within California waters must demonstrate by signed contract to the USCG and CDFW that they have, either themselves or under contract, the necessary response assets to respond to a worst-case release as defined under federal and State regulations.

Response to a vessel spill would most likely consist of containment (deploying booms), recovery (deploying skimmers), and protection of sensitive resources. If the oil were to reach the shore and/or foul wildlife, the shoreline and wildlife would be assessed to determine what level, if any, of cleaning would present the least detrimental impacts. MSRC would make its local equipment and manpower available. If required, additional equipment and manpower would be made available from local contractors, OSROs, and MSRC at other locations.

While MSRC can provide the equipment and manpower required by OPA 90 and OSPR, it is unlikely that they could prevent a large spill from causing significant effects on the shoreline potentially including sensitive resources. The Regional Resource Manual and the Area Contingency Plan identify sensitive resources within the Bay Area and methodologies for protecting and cleaning up those areas. A large spill from a tank vessel could result in significant adverse impacts depending on spread of the spill and resources impacted as presented in other sections of this document.

The responsibilities and organization for releases outside the San Francisco Bay would essentially be the same as for those inside the Bay; however, response to spills outside the Bay would be somewhat different from that inside the Bay. First, the environment outside the San Francisco Bay may be more difficult to work in because of sea conditions. Booms become less effective as wave heights increase, losing much of their effectiveness once waves exceed 6 feet. There may be conditions when it would be impossible to provide any response actions. However, when wave energy is such that it is impossible to deploy response equipment, the wave energy causes the oil to be dispersed much more rapidly.

Second, it may not be necessary to try to contain a spill if it does not threaten the shoreline or a sensitive area, although impacts upon sea life and navigation must be considered. In this case, the spiller would monitor the trajectory of the spill in accordance with methodologies presented in the Area Contingency Plan. If the spill could affect the shoreline or sensitive area, then the response efforts would be based upon assessments to determine what level, if any, of cleaning would present the least detrimental impacts.

The MSRC large response vessels are located inside the San Francisco Bay. It would take the vessels a minimum of 2 hours to get underway and exit the Bay, and up to 24 hours to reach areas as distant as offshore of Fort Bragg, approximately 150 miles to the north. Again, additional resources would be available from other response cooperatives and other MSRC sites. While the response capability meets the minimum requirements of OPA 90 and OSPR, a large spill could still result in significant, adverse impacts to sensitive resources as described in other resources sections of this document.

Vessel owners/operators are responsible for spills from their tanker. Tanker and barge owners/operators are required by federal and State regulations to demonstrate that they have, or have under contract, sufficient response assets to respond to worst-case releases. Tankers and tank barges operating in United States and California waters must certify that they have the required capability under contract. All terminals are under contract with one or more OSROs to respond to spills with all the necessary equipment and manpower to meet the response requirements dictated by regulations. MM OS-4a would further reduce the risk of spills in the San Francisco Bay or near approaches to the Bay by requiring Tesoro's participation in USCG Ports and Waterways Safety Assessment (PAWSA) workshops for the San Francisco Bay Area to improve transit issues and response capabilities in general, and to support overall safety improvements to the existing VTS in the future.

While vessel owners/operators are responsible for their own spills, if a spill were to occur near the Amorco Terminal, Tesoro and its contractors may be in a better position to provide immediate response to a spill using their own equipment and resources, rather than waiting for mobilization and arrival of the vessel's response organization. The Tesoro staff is fully trained to take immediate actions in response to spills. Such action could result in a quicker response and more effective control and recovery of spilled product. MM OS-4b would require Tesoro to respond to any spill from a vessel traveling in the San Francisco Bay to or from the Amorco Terminal or moored at its wharf, without assuming liability, until such time as the vessel's response organization can take over management of the response actions in a coordinated manner. This requirement would further reduce the potential impacts of spills in the San Francisco Bay.

Even with the implementation of MMs OS-4a and OS-4b, the consequences of a spill could result in significant, adverse impacts in the San Francisco Bay or outer coast. This is an unavoidable risk of the Project. No additional feasible mitigation measures have been identified that would further reduce the potential for significant impacts.

Mitigation Measures:

MM OS-4a: U.S. Coast Guard (USCG) Ports and Waterways Safety Assessment workshops. Tesoro shall participate in USCG PAWSA workshops for the San Francisco Bay Area to support overall safety improvements to the existing Vessel Traffic Service in the Bay Area or approaches to the Bay, if such workshops are conducted by the USCG during the life of the lease.

MM OS-4b: Spill response to vessel spills. Tesoro shall respond to any spill from a vessel traveling in the San Francisco Bay to or from the Amorco Terminal or moored at the Amorco Terminal, as if it were its own, without assuming liability, until such time as the vessel's response organization can take over management of the response actions in a coordinated manner.

Alternative 1: No Project

Impact OS-5: Risk of spills, fire, or explosion from displaced product transit. (Significant and unavoidable.)

Under the No Project Alternative, Tesoro's lease for the Amorco Terminal would not be renewed and the existing Amorco Terminal would be subsequently decommissioned with its components abandoned in place, removed, or a combination thereof. The decommissioning of the Amorco Terminal would follow an Abandonment and Restoration Plan. During decommissioning of the Amorco Terminal there would be a risk of a spill during the pipeline purging and removal process; however, the Amorco Terminal contains the necessary equipment to contain and recover the size spills that would be most likely during decommissioning without lasting impacts, so it is expected that impacts if such a spill were to occur would be less than significant.

It is likely that under the No Project Alternative, Tesoro would pursue transitioning the Avon Marine Oil Terminal to absorb all import operations from the Amorco Terminal, thereby increasing the throughput at the Avon Marine Oil Terminal to the Refinery to meet regional refining demands. Tesoro's Avon Marine Oil Terminal is capable of operating as both an import and export facility, and similar to the proposed Project, is currently subject to California Environmental Quality Act evaluation for a new 30-year lease of sovereign land to continue operations.

With no lease renewal for the Amorco Terminal, there would be no potential for related spills, fire, explosion (at the Amorco Terminal), or from vessel transit associated with the

Amorco Terminal. However, the potential for spills, fire, or explosion would likely be transferred to the Avon Terminal OR other transportation methods such as pipelines, rail, or trucks.

Use of Avon Terminal or Other Marine Oil Terminals

Using the Avon Terminal to absorb the tank vessel traffic from the Amorco Terminal would present terminal accident risks similar to those described for the proposed Project in Impacts OS-1 through OS-4. Vessel transit risks would also be similar, but there would be a slightly higher probability of an upset occurrence in transit due to the slightly longer distance the tank vessels would have to travel in the San Francisco Bay including passage through the Benicia-Martinez bridge complex. The Avon Terminal is also currently undergoing an upgrade to be compliant with MOTEMS. The Avon Terminal is located in an area similar to that of the Amorco Terminal (away from residences, parks, and marinas) and, therefore, would not present a significant safety hazard to members of the public.

Import to other marine oil terminals may either increase or decrease the potential risk of accident to various areas, depending on the characteristics and locations of the terminals used. Characteristics that could alter the risk include:

- tankers may travel a shorter distance to reach other terminals, since most are located closer to the San Francisco Bay entrance;
- the added tanker traffic at other terminals may create congestion and increase the risk for a collision or other incident;
- other terminals may have a different (better or worse) level of spill response; and
- use of other marine terminals would require application of mitigation measures comparable to the mitigation for the proposed Project because there would likely be a lease renewal or permit modification for the change/increase in operation.

Once the crude oil is imported at one of the marine oil terminals, it would then have to be transported to the Refinery. Sources may include land-based transportation, such as railcars, trucks, pipeline connections to other San Francisco Bay Area terminals, or a combination thereof. Pipeline delivery may require construction of new pipelines and/or the purchase of existing pipeline capacity from other local petroleum refinery competitors. The potential risk from land-based transportation would be in addition to the tank vessel and terminal risk transferred to other terminals in the Bay Area. The potential risk from land-based transportation is discussed below.

Use of Pipelines

Pipeline spills of crude oil generally result in less of an impact on the environment than tank vessel transportation spills. The probability of a spill is not necessarily less; however, the maximum amount of oil that can be released from a pipeline is generally less than that which can be released from a tanker. In addition, oil spilled on land generally causes less environmental impact than oil spilled on water; although this is a function of the size and location of the spill and the environment impacted by the spill.

Failure rates for pipelines are generally described in terms of spills per unit length per year and factor in pipeline characteristics of age, design, depth of burial, corrosion protection, wall thickness, and operating temperature. A failure rate range of 0.03 to 0.5 releases per year per 100 miles of pipeline has been cited (CSLC 2011a). In addition, the following spill estimates for pipelines with diameters greater than 16 inches have been cited:

Leaks:
- 0.08 per 100 miles per year for pipelines 40 years or older
- 0.03 per 100 miles per year for “existing” pipelines (approximately 20 years old)
- 0.012 per 100 miles per year for “new” pipelines (in first 10 years)

Ruptures
- 0.04 per 100 miles per year for “old” pipelines
- 0.016 per 100 miles per year for “existing” pipelines
- 0.006 per 100 miles per year for “new” pipelines

A leak is defined as a relatively small rate of release from a pipeline. A typical cause would be a small hole that results in corrosion pitting, a leaking flange, or valve. A rupture represents a relatively high rate of release as might occur if the pipe were breached by an external force.

The maximum spill volume is a combination of drainage potential and the pumping rate for the period of time before the breached segment can be isolated. Worst-case calculations of spill volumes are normally based on the assumption of complete drainage by gravity of the section of pipe between high ground and the point of rupture (called drainage volume). Additional spillage depends on the flow rate and response time to shut down the pipeline. The drainage volume assumes that the drainage will be complete. This may not necessarily be the case because: (1) the breach may be less than a full rupture, (2) a block valve within the affected pipe section may be successfully closed before complete evacuation occurs, or (3) a check valve in an uphill stretch can prevent backflow of oil between high ground and the valve. The gradient of the terrain determines the hydrostatic force available to drain the pipe after the pumps are turned off. Draining will take much longer in nearly flat terrain. The average spill size from 16-inch diameter crude oil pipelines, as reported to OSPR between 1980 and 1990, was 2,680 barrels (USDA

1991). This is the volume in 2 miles of 16-inch diameter pipe. A pipeline leak or rupture, depending on its size and location, could result in a significant, adverse impact where sensitive resources are affected. Spills in areas where they can be contained and cleaned up (such as roadways) could be remediated to a level such that impacts would be less than significant.

While there is an existing infrastructure of pipelines among the various marine oil terminals and refineries in the Bay Area, additional pipelines and/or pipeline connections most likely would be required. Pipeline construction work would result in a risk of accidents during construction, such as construction equipment fuel spills and releases from damage to third-party utilities, including oil and gas pipelines. Pipeline construction typically results in less than significant risk of release impacts because of the requirement for detailed construction planning and the preconstruction identification of utilities in the area.

Truck and/or Rail Transportation

The shipping of petroleum products via pipeline is generally considered to be the safest means of bulk transportation. The California State Fire Marshal, Hazardous Liquid Pipeline Risk Assessment (EDM 1993) indicated that the fatality rate for bulk transportation by rail was 40 times higher than by pipeline. The same study indicated that the fatality rate for bulk transportation by truck was 300 times higher than by pipeline. As a result, any increased volumes being shipped by truck or rail will increase the impacts to the public compared to using a pipeline. When comparing the relative safety of pipeline, truck, and rail transportation of bulk hazardous liquids, Aspen (2003) noted the following:

- The frequency of unintentional releases was three to four times higher for a mix of rail and truck transportation than for similar volumes being transported exclusively by pipeline.
- The frequency of all injuries, regardless of severity, was roughly 30 times higher for a mix of rail and truck transportation than for similar volumes being transported exclusively by pipeline.
- The frequency of fatalities was approximately 50 times higher for a mix of rail and truck transportation than for similar volumes being transported exclusively by pipeline.
- The frequency of small releases was higher for truck and rail transportation, while the frequency of large spill volumes was higher for pipeline transportation. This was due primarily to the limited size of the truck and rail car volumes; the release size is limited to the volume of the damaged car(s).

As with the proposed Project, the mitigation applied to the other terminals would lower the probability of spills and increase response capabilities at the other terminals if and when such time occurred that each lease was renewed and mitigation implemented. Mitigation measures would not apply to pipelines, rail, or trucks. Even with mitigation, risk of impacts from spills, fire, or explosion under this alternative would be higher than for the proposed Project due to the similar volumes of oil being imported by vessels to other terminals and increased risk of onshore transportation methods.

Alternative 2: Restricted Lease Taking Amorco Out of Service for Oil Transport

Impact OS-6: Risk of spills, fire, or explosion from displaced product transit. (Significant and unavoidable.)

Refer to Impact OS-5.

Cumulative Impact Analysis

Impact CUM-OS-1: Upset conditions. (Significant and unavoidable.)

All terminals and tanker/barge operators are required by federal and State regulations to demonstrate that they have, or have under contract, sufficient response assets to respond to worst-case releases. Even so, oil spills can still result in significant, adverse impacts to the environment depending on whether first-response efforts can contain and clean up the spill without lasting impacts to sensitive resources. The renewal of the Amorco Terminal lease would contribute incrementally to the cumulative risk environment.

Spills from a Marine Terminal

As discussed in Section 4.1.1.3, a total of 80 spills have occurred from marine terminals in the San Francisco Bay between 2003 and 2012. The potential exists for spills at all marine terminals operating within the Bay. The actual probability varies depending on the design and operational procedures in place. The potential impacts of spills vary depending on the location of the terminals and the response equipment and procedures available.

Spills from Tank Vessels Inside and Outside the San Francisco Bay

Chambers Group (1994) analyzed historical data to estimate tanker and barge traffic within the San Francisco Bay. Based on the amount of tanker and tank barge traffic along the various routes within the San Francisco Bay, cumulative probabilities of a spill were developed for various sections within the Bay. These probabilities were then used to conduct the probabilistic oil spill modeling for cumulative tanker and tank barge traffic within the Bay.

The expected mean time between spills for all tanker and tank barge traffic inside the San Francisco Bay for three minimum-size spills is presented in Table 4.1-9. Based on estimated mileage traveled within the San Francisco Bay, vessel traffic associated with the Amorco Terminal is approximately 4.7 percent of the total probability of a spill from tanker and tank barge traffic in the Bay. This percentage was estimated based estimating the distance from the Golden Gate Bridge to each of the marine terminals in the Bay and then estimating the total distance traveled by all tank vessels by multiplying the distance to each marine oil terminal by the number of tank vessel calls during 2012. It was assumed that there would be 90 tank vessel calls to the Amorco Terminal. The total distance traveled by tank vessels calling at the Amorco Terminal was then divided by the total miles traveled by all tank vessels to get the percentage for the Amorco Terminal.

Chambers Group (1994) also used data from the Marine Exchange that listed the last and next ports of call for all tankers calling at marine terminals in the San Francisco Bay Area to estimate the number of annual tanker trips along various routes outside the Bay. The expected mean time between spills outside the San Francisco Bay is also shown in Table 4.1-9.

Table 4.1-9: Expected Mean Time between Spills Inside and Outside the San Francisco Bay—All Tank Vessels

Spill Size (barrels)	Expected Mean Time Between Spills (Years)	
	Inside Bay	Outside Bay
238	36	Not calculated
1,000	48	42
10,000	238	123

Spill Response

An impact on spill response capability could occur if there were two or more spills at the same time; however, the probability of this is extremely small. Having many marine terminals and extensive vessel traffic in the San Francisco Bay tends to increase the total amount of spill response equipment and services available.

All terminals and tanker/barge operators are required by federal and State regulations to demonstrate that they have, or have under contract, sufficient response assets to respond to worst case releases. All terminals are under contract with one or more OSROs. These OSROs can provide all the necessary equipment and manpower to meet the requirements of existing regulations; however, oil spills can result in significant, adverse impacts to the environment depending on whether first-response efforts can contain and clean up the spill without lasting impacts to sensitive resources. Mitigation measures previously described for Project Impacts OS-1, OS-4a, and OS-4b would reduce the potential for significant cumulative impacts to the extent feasible. No further mitigation for potential cumulative impacts is recommended. Even with mitigation applied, there is a cumulative risk of oil spills that could have significant environmental impacts to sensitive resources as described in other sections of this EIR.

Mitigation Measures: No additional mitigation measures available.

4.1.4 SUMMARY OF FINDINGS

Table 4.1-10 includes a summary of anticipated impacts to operational safety and associated mitigation measures.

Table 4.1-10: Summary of Operational Safety Impacts and Mitigation Measures

Impact	Mitigation Measure(s) (MM[s])
Proposed Project	
OS-1: Potential for spills and response capability for containment of oil spills from the Amorco Terminal during transfer operations	OS-1a: Remote Release Systems. OS-1b: Tension Monitoring Systems. OS-1c: Allision Avoidance Systems.
OS-2: Amorco Terminal spills from pipelines during non-transfer periods	No additional mitigation measures available. (Refer to MMs OS-1a, OS-1b, OS1c, OS4a, and OS-4b.)
OS-3: Potential for fires and explosions and response capability	OS-3: Fire Protection Assessment. (Refer to MM OS-1a.)
OS-4: Response capability for accidents in the San Francisco Bay and outer coast**.**	OS-4a: USCG Ports and Waterways Safety Assessment workshops. OS-4b: Spill response to vessel spills.
Alternative 1: No Project	
OS-5: Risk of spills, fire, or explosion from displaced product transit	Should this alternative be selected, mitigation measures would be determined during a separate environmental review under CEQA.
Alternative 2: Restricted Lease Taking Amorco Out of Service for Oil Transport	
OS-6: Risk of spills, fire, or explosion from displaced product transit	Should this alternative be selected, mitigation measures would be determined during a separate environmental review under CEQA.
Cumulative Impacts	
CUM-OS-1: Upset Conditions	No additional mitigation measures available. (Refer to MMs OS-1a, OS-1b, OS1c, OS4a, and OS-4b.)