9. ENVIRONMENTAL HEALTH

This section describes the baseline conditions and potential direct and indirect impacts on environmental health associated with the proposed project, and the measures to mitigate these potential impacts. Environmental health means the environmental conditions, due to the proposed project, that could impact human health in communities near the proposed project. For this proposed project, the environmental health analysis considered exposure to air emissions, increases in terrestrial vehicle traffic and noise, and spills.

9.1. LAWS, REGULATIONS, AND GUIDANCE FOR ENVIRONMENTAL HEALTH

Table 9-1 provides a summary of the laws, regulations and guidance applicable to environmental health. Regulations specific to noise exposures are discussed in Section 9.5.

Table 9-1: Laws, Regulations, and Guidance for Environmental Health

Regulation, Policy, or Guideline	Description
Federal	
Clean Air Act (CAA) of 1963 (42 USC 7401) as amended	Refer to Chapter 4, Air Quality and Climate Change, for description.
National Air Quality Standards (NAAQS)	Refer to Chapter 4, Air Quality and Climate Change, for description.
Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (40 CFR 355)	This law is designed to help local communities plan for potential chemical emergencies. It requires companies to report on the "storage, use and releases of hazardous substances" to federal, state, and local governments.
Criteria for State, Local and Regional Oil Removal Contingency Plans (40 CFR Part 109)	Requirements for establishing and implementing spill contingency plans that include defining authorities and levels of responsibility in the event a spill response action is needed.
Toxic Substances Control Act (15 USC 2601–2629)	Provides USEPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to toxic substances and/or mixtures.
State	
Washington Ambient Air Quality Standards (WAAQS) (WAC 173-476)	Refer to Chapter 4, Air Quality and Climate Change, for description.
Washington State Controls for New Sources of Toxic Air Pollutants (WAC 173-460)	Refer to Chapter 4, Air Quality and Climate Change, for description.
Washington Industrial Safety and Health Act (WISHA) of 1973	This statute empowers the Washington State Department of Labor and Industries (L&I) to create and enforce safety and health regulations for workers other than federal employees, employees on deferral reservations and military basis, employees working on tribal employers or on tribal lands, and employees working on floating worksites. The Division of Occupational Safety and Health (DOSH) is the division of the L&I that develops and enforces safety and health rules.

Regulation, Policy, or Guideline	Description
Local	
Local Emergency Planning Committee (LEPC) - Skagit County	To implement EPCRA, Congress requires each state to appoint a State Emergency Response Commission (SERC). The SERCs are required to divide their states into Emergency Planning Districts and to name an LEPC for each district. Skagit County is the local LEPC and requires businesses that use, manufacture, store, or transport hazardous materials to have procedures for the safe handling of these materials as well as emergency response procedures. Fire departments and other response agencies are also required to have procedures in place for hazardous materials spills.

9.2. STUDY AREA AND METHODOLOGY

This section describes the specific considerations used to assess potential impacts of the proposed project on environmental health.

9.2.1. Study Area

The environmental health study area evaluated in this assessment encompassed the following:

- Those living within the area evaluated for increases in air pollution shown on Figure 4-1 in Chapter 4, Air Quality and Climate Change. This area includes the city of Anacortes and unincorporated Skagit County close to the refinery.
- The study areas for traffic, noise, and refinery spills are localized areas within the approximate boundaries shown on Figure 4-1.
  - The traffic study area includes the routes used during construction for the haul of infrastructure from the Port of Anacortes (see Figure 2-16 in Chapter 2, Proposed Action and Alternatives); the routes for the import of fill (see Figure 2-18), personnel, and materials, during construction (see Figure 9-1); and routes for materials during operations (see Figure 9-1).
  - The noise study area includes potential noise impacts up to 2 miles from the refinery.
  - The refinery spills study area includes property immediately adjacent to the refinery boundaries.
- For marine spill-related environmental health impacts, the study area also included the communities along the shoreline of the marine vessel transportation route. The study area for marine transportation includes the marine vessel transportation route and adjacent waters and shorelines from the Tesoro Anacortes Refinery wharf structure to the edge of U.S. territorial waters in the Pacific Ocean, approximately 12 nautical miles seaward of the entrance to the Strait of Juan de Fuca (see Figure 2-4 in Chapter 2, Proposed Action and Alternatives).

9.2.2. Methodology

To evaluate potential impacts on environmental health, baseline conditions were documented from proposed project plans and procedures (Chapter 2, Proposed Action and Alternatives) and public records and scientific studies, including the Center for Disease Control (CDC), the

Washington State Department of Health, USEPA, National Cancer Institute, and Washington State Department of Transportation (WSDOT).

Potential impact topics on environmental health that were evaluated as part of this analysis were determined through a public scoping process and by considering the proposed project's potential to impact environmental health. Potential impacts on environmental health that could occur during both construction (short-term) and operations (long-term) of the proposed project were considered in the analysis. A series of scoping meetings were conducted during the scoping period for the proposed project, with the public, tribes, and government agencies providing verbal and written comments. The primary issues related to environmental health that are addressed in this section include:

- Impacts on public health from air emissions due to construction and operations of the proposed project components in the proposed project area (within the refinery)
- Impacts on traffic safety due to increases in vehicle traffic along local roads during construction and operations
- Impacts on nearby sensitive areas from noise emissions due to an increase in noise during construction and the increased noise at the refinery from the proposed project components during operation
- Impacts on health and safety from fires and explosions associated with transport and management of additional materials such as xylene at the refinery during constructions and operations
- Impacts on health in the event of an spill at the refinery, or a spill in the marine environment (operations only for marine spill)

Potential impacts were evaluated by assessing whether the changes in air emissions, traffic levels, or noise would result in impacts on public health. A significant impact on environmental health is one that would result in one of the following conditions:

- Air emissions that exceed health-based regulatory limits of the Clean Air Act (CAA)
- Increases in traffic on local roads that result in a measurable increase in the risk of potential traffic-related accidents to drivers who regularly use the impacted roads
- Increases in noise levels of 5 dB above baseline noise levels in noise sensitive areas (NSAs)[1]

The impact analysis results are summarized using a significance for each potential impact on environmental health. The process for characterizing the significance of each potential impact involved analyzing the magnitude, geographic extent, and duration of the impact (see Chapter 1, Section 1.7, Methodology). Based on the analysis results, the impact significance was defined as either ***less than significant*** or ***potentially significant***. Criteria for assessing the significance of potential adverse impacts on environmental health are included in Table 1-B.7 in Appendix 1-B, Impact Criteria Tables.

[1] Noise sensitive areas (NSAs) include residences, hotels/motels/inns, hospitals, places of worship, schools, recreational areas, and wilderness/protected areas.

In addition to the potential impacts that could occur during regular and routine construction and operations activities over the life of the proposed project, impacts may also result from an unplanned event. In the case of this chapter, land-based fires and spills occurring at the refinery and during road transport, and spills of xylenes or reformate in the marine environment as a result of the proposed project fall into this category. The methodology for evaluating impacts related to spills and fires/explosions follows the same methodology as for planned events– impacts are characterized as to their potential magnitude, geographic extent, and duration. For spills in the marine environment, the likelihood of a spill event occurring was also assessed. The likelihood, or probability, of an event occurring is assigned using a qualitative scale of probability categories described as Negligible, Low, Medium, or High (see the spill likelihood analysis in Chapter 13, Marine Transportation).

9.3. AIR EMISSIONS AND HEALTH

The proposed project would increase air emissions due to the new infrastructure installed at the refinery. There also would be an increase in vehicle emissions during both construction and operations and an increase in emissions associated with marine vessel traffic during operations. Increases in air pollution could impact public health, depending on the amount of increase in concentration and the toxicity of the pollutant.

9.3.1. Affected Environment

This section describes baseline health conditions for Skagit County, specifically for those health conditions related to air pollution most likely to be influenced by the proposed project activities. This health profile is based on a review of various publicly-available data sources, including the CDC, the Washington State Department of Health, and the USEPA. The majority of the environmental health data is only available at the County level, and is therefore not broken into smaller communities.

9.3.1.1. Air Quality

As described in Chapter 4, Air Quality and Climate Change, the proposed project would emit several criteria air pollutants regulated under the National Air Quality Standards (NAAQS; carbon monoxide [CO], nitrogen oxides [NOx], sulfur dioxide [SO_2], and particulate matter [PM]) and some volatile organic compounds (VOCs) that fall into the toxic air pollutant category (see Table 4-10 in Chapter 4, Air Quality and Climate Change). Skagit County is currently in attainment with the NAAQS for all six criteria pollutants: ozone, PM, SO_2, lead, CO, and NOx. Emissions of CO, precursors of ozone (in the presence of sunlight, CO, NOx, and VOCs react to form ozone), PM_{10}, and $PM_{2.5}$ are the criteria pollutants of most concern in the state of Washington. Portions of the state have previously been in nonattainment with at least one of these pollutants, although Skagit County is currently in attainment. Major sources of air pollution in the state of Washington are motor vehicles, wood smoke, and outdoor burning (Ecology 2016).

Emissions from motor vehicles contribute to ground level ozone, especially on hot summer days. Ground-level ozone is the prime ingredient of smog and causes a variety of health problems, including, but not limited to, chest pain, coughing, throat irritation, and congestion.

Fireplaces and woodstoves are sources of PM_{10} and $PM_{2.5}$ during the winter. The year-round average $PM_{2.5}$ concentration in Skagit County is higher in comparison to much of the rest of the state of Washington (11.6 micrograms per cubic meter [$\mu g/m^3$] as an annual average), although concentrations are below the health-based NAAQS (12 $\mu g/m^3$ annual average). The range of year-round average $PM_{2.5}$ concentrations within the state is 9.9 to 11.8 µg/m3, with the average at 11.0 $\mu g/m^3$ (County Health Rankings 2016).

9.3.1.2. Health Conditions Associated with Air Pollution Exposures

The health impacts associated with environmental exposures to hazardous and toxic substances vary with the type of substance and its environmental concentration, as well as the duration and route of exposure. Criteria pollutants designated by the USEPA under the NAAQS can have acute impacts, particularly in sensitive subpopulations. PM_{10} and $PM_{2.5}$ exposures are linked to a variety of health problems including aggravated asthma, decreased lung function, increased respiratory symptoms such as coughing or difficulty breathing, and premature death in people with heart or lung disease (USEPA 2016). Populations particularly sensitive to impaired air quality include the following:

- Individuals with chronic respiratory diseases such as asthma and chronic obstructive pulmonary disease, particularly children and the elderly
- Individuals with acute respiratory infections, particularly children and the elderly
- Individuals with chronic heart disease
- Diabetics

The Behavioral Risk Factor Surveillance System (BRFSS) is a yearly health survey run by the CDC that collects state data on health-related risk behaviors and health conditions. Health surveillance data from the BRFSS are presented in Table 9-2, and indicate that rates of asthma and adult diabetes in Skagit County are comparable to rates in the state of Washington and the nation as a whole (Washington DOH 2012), while rates of heart disease in Skagit and the state of Washington are higher than in the U.S.

Behavioral Risk Factor Surveillance System

The Center for Disease Control uses an annual telephone survey to collect information from the U.S. population regarding their health-related risk behaviors, chronic health conditions, and use of preventive services. The Behavioral Risk Factor Surveillance System has been collecting health information since 1984, and the survey now includes all 50 states with more than 400,000 adult interviews each year. The results of the survey are used to track disease rates and health trends across the country.

Table 9-2: Health Conditions Affected by Air Pollution

Health Condition (data years)	Skagit County (percent)	State of Washington (percent)	U.S. (percent)
Adult asthma prevalence (2011-2013)	9	10	9
Adult heart disease prevalence (2011-2013)	6	6	4
Adult diabetes prevalence (2012)	9	9	10

Sources: Washington DOH 2015; National Center for Health Statistics 2016

Hazardous substances associated with the proposed project that have been linked to cancer are primarily $PM_{2.5}$ and diesel exhaust, both of which are suspected risk factors for lung cancer (ATSDR 1999, USEPA 2009). Heavy exposures to diesel exhaust may also be a risk factor for bladder cancer (American Cancer Society 2016). Additionally, inhalation of ethylbenzene vapors may be a possible carcinogen to humans. There is currently insufficient evidence to show carcinogenic impacts of ethylbenzene (a component of reformate and also found in mixed xylenes) in humans, but sufficient evidence in experimental animals, specifically kidney tumors in rats exposed to high concentrations of ethylbenzene vapors to indicate a potential link to cancer (IARC 2000). Incidence rates for lung and bladder cancers are listed in Table 9-3.

Table 9-3: Average Incidence Rates of Lung and Bladder Cancers (per 100,000 population), by Gender, 2008-2012

	Lung		Bladder	
	Skagit	Washington	Skagit	Washington
All	64.1	61.6	29.8	22.0
Male	76.7	69.2	51.2	37.9
Female	54.1	55.9	11.7	9.5

Source: National Cancer Institute 2016

The data show that Skagit County has higher cancer incidence rates for lung cancer and bladder cancer than the state of Washington as a whole. When the rates are reviewed for males and females separately, females in Skagit County have lower cancer rates than males, and female cancer rates are lower than the state of Washington as a whole for lung cancer. The data also show higher rates of lung cancer in Skagit County than in the state of Washington as a whole for males, but lower rates for females. Males in Skagit County have a significantly higher rate of bladder cancer compared to the state of Washington. Female bladder cancer is also elevated when compared to Washington as a whole thus Skagit County has a high incident rate for bladder cancer overall.

While long-term health outcomes such as cancer are objective health endpoints that can be quantified, establishing a correlation between cancer incidence and specific environmental exposures is challenging. Environmental exposures are only one of a number of important risk factors for cancer, and it can be difficult to assess which risk factor was the cause, or primary cause of a cancer outcome. Other important risk factors are smoking, radiation (including cancer therapy radiation), genetic predisposition, and history of other diseases and infections (American Cancer Society 2014). Populations with high levels of poverty may also be more vulnerable to increases in air pollution, as lower socioeconomic status is associated with poorer baseline health (Hadley 2003, Hadley and Cunningham 2005, Gresenz and Escarce 2011, Phelan et al. 2010). As shown on Figure 11-3 and 11-5 in Chapter 11, Social and Economic Environment, there are no

census blocks in the vicinity of the proposed project with high levels of poverty in comparison to the rest of the state of Washington.

9.3.2. Potential Impacts on Health

This section evaluates the potential direct and indirect impacts on health from air emissions as a result of planned activities during construction and operations of the proposed project. The proposed project would generate air emissions during the construction phase from construction machinery and transportation, and during the operations phase from material transportation and facility operations. A detailed description of air emission sources and characteristics from the proposed project is presented in Chapter 4, Air Quality and Climate Change.

9.3.2.1. Impacts on Health from Air Emissions during Construction

During construction, the emissions of health concern are primarily $PM_{2.5}$. Particulate emissions would be emitted during construction due to the following factors:

- Generation of dust from earth moving activities
- Use of on-site, diesel-powered equipment and diesel trucks bringing material to and from the site[2]

Construction emissions are expected to be intermittent during the construction period. Emissions would be of short-term duration (approximately 19 months total), would occur intermittently, and, except for traffic increases, would occur primarily within the refinery footprint.

> ***Refinery Maintenance Turnarounds***
>
> Routine major maintenance turnarounds occur about once every 2 years and involve shutting down and inspecting refinery process equipment. The duration of the turnaround and the amount of additional traffic at the refinery varies according to the specific activities required. The duration of a routine maintenance turnaround lasts several weeks and can involve contract labor forces ranging between 150 to well over 650 additional contractors.

Construction phase transportation would consist of personal commute trips by construction employees, which would be 190 round trips per day on average, and up to 270 round trips at peak construction (peak construction is expected to last three to four months). Deliveries of materials to the construction site would range from 10 to 50 truck trips per day. If fill material is required at the site, this would consist of about 70 trucks per day over a four-month period. The maximum number of vehicle round trips per day (personal vehicles and trucks combined) during the construction phase is therefore estimated to be 390 round trips. As discussed in Chapter 4, Air Quality and Climate Change, no equipment emissions during the construction phase would exceed NAAQS.

Air pollution from mobile sources is managed primarily through vehicle and fuel standards. Vehicle standards set limits for fuel efficiency and are the basis for state vehicle emissions inspection programs. Fuel standards regulate the amount of sulfur in gasoline and diesel fuels.

[2] Diesel exhaust is composed of a complex mixture of hundreds of compounds emitted both as particulates and as gases. However, the particulate portion of the exhaust, measured as $PM_{2.5}$, is the measure selected in the health literature as a surrogate for exposure of all the components of diesel exhaust (Ecology 2008; USEPA 2002).

All vehicles and fuels used by the proposed project would be subject to applicable state of Washington emission and fuel standards.

Controls such as wetting exposed soils would be used to minimize dust and, in turn, minimize potential health impacts (Chapter 4, Air Quality and Climate Change).

The magnitude of health impacts is expected to be low because the concentrations of air emissions would not result in NAAQS or Acceptable Source Impact Levels (ASILs)[3] exceedances in the city of Anacortes or Skagit County and would be primarily confined within the refinery boundaries and on roadways currently used for industrial traffic. Peak traffic increases of 390 vehicles per day are within the range of current activity at the refinery because extra workers are regularly on site during maintenance turnarounds, which have between 150 and 600 vehicle trips per day (Chapter 2, Proposed Action and Alternatives). Portions of the construction work would occur during a planned major maintenance turnaround, but total construction traffic would not exceed the typical range of vehicle trips during major maintenance turnaround events (Tesoro 2016b). Duration of the impact is short-term and intermittent. Therefore the health impact from the increase in air emissions from construction is considered ***less than significant***.

9.3.2.2. Impacts on Health from Air Emissions during Refinery Operations

The proposed project components that would generate the greatest volume of air emissions are the new boiler and the new MVEC System. Installation of the new MVEC System would reduce emissions of VOCs; however, combustion of the collected vapors and natural gas support/enrichment gases would result in emissions of other criteria pollutants as well as toxic air pollutants (TAPs). There would also be minor increases in vehicle traffic (20 new workers, and approximately 50 additional truck deliveries per year) and marine vessel traffic (five marine vessels traveling to and from the refinery wharf per month).

Estimated concentrations of criteria pollutants that would be generated by the proposed project are presented in Chapter 4, Air Quality and Climate Change, in Tables 4-8 and 4-9, and concentrations of toxic air pollutants generated by the proposed project are shown in Table 4-10. By the time the proposed project begins operations, new air emissions standards for Category 3 marine vessels would have come into effect, resulting in reduced emissions of air pollutants from marine vessels. Chapter 4, Air Quality and Climate Change, summarizes estimated emissions of criteria pollutants from operation of marine vessels associated with the proposed project. The additional emissions from the proposed project are not expected to result in any exceedances of health-based air criteria.

Since emissions of NO_2, PM_{10}, $PM_{2.5}$, CO, SO_2 and all air toxics would meet the health-based NAAQS and ASIL standards and would not cause an exceedance of health-based standards when combined with current concentrations in the air shed, the magnitude and geographic extent of the impact is considered low and the frequency is constant as emissions would occur over the life of the proposed project. Air dispersion modeling of the proposed project's criteria and toxic

[3] Acceptable source impact level (ASIL) is a screening concentration of a toxic air pollutant in the ambient air for each toxic air pollutant listed in WAC 173-460-150. ASILs are derived using a health risk assessment process.

emissions indicate the proposed project would not cause an exceedance for any NAAQS, the state of Washington Ambient Air Quality Standards (AAQS), or ASILs within state of Washington or tribal lands. Because the proposed project's emissions result in only small increases in baseline air concentrations and no exceedances of health-based standards, the health impacts from refinery operations air emissions are considered ***less than significant.***

9.3.2.3. Impacts on Sensitive Sub-populations from Air Emissions

The health-based criteria developed for air pollutants are designed to prevent health impacts from occurring for the public. USEPA goes through a rigorous process every few years to examine the latest health literature for the criteria pollutants and conducts extensive health risk analysis when establishing the NAAQS levels (USEPA 2009, 2013). However, a "No Observed Adverse Effects Level" has not been definitively established for $PM_{2.5}$ or NO_2 (HEI 2010; USEPA 2009, 2013; Levy et al. 2002); therefore, there is some uncertainty as to whether populations with compromised respiratory and circulatory systems might experience some level of adverse health impacts, even at levels below the NAAQS. Asthmatics may be the most sensitive sub-group for both $PM_{2.5}$ and NO_2 (USEPA 2009, 2013; Nishimura et al. 2013; Patel and Miller 2009). Because the 24-hour predicted maximum increase in $PM_{2.5}$ is only 1 $\mu g/m^3$ (see Table 4-8 in Chapter 4, Air Quality and Climate Change), and cumulative concentrations in the ambient air near the refinery are less than the ASIL, the potential health risk to sensitive sub-populations is considered to be very low.

For the most sensitive sub-populations to air pollution, rates of asthma and adult diabetes in Skagit County are comparable to rates in the state of Washington and the U.S. as a whole (see Table 9-2 and Washington DOH 2012) and there does not appear to be a significant sub-group that might be disproportionately impacted by the increase in pollutants due to an existing disease or due to higher levels of poverty. Therefore, there do not appear to be environmental justice concerns related to air quality and health (see also related discussions in Chapter 11, Social and Economic Environment).

9.3.2.4. Summary of Potential Impacts on Health from Air Emissions

The potential impacts from the proposed project discussed in this section are summarized in Table 9-4.

Table 9-4: Summary of Potential Impacts on Health from Air Emissions

Impact Topic	Impact Summary	Potential Impact Significance	
		Less than Significant	***Potentially Significant***
Construction			
Impacts on human health from air emissions	There could be impacts on human health from air emissions due to increased levels of traffic and generation of dust during construction. Concentrations of air emissions would not result in NAAQS exceedances in the city of Anacortes or Skagit County. Impacts would be short term during the 19 month construction period, and localized to the refinery property or to the area adjacent to SR20 south of the refinery. Controls such as wetting exposed soils to minimize dust would be used to minimize potential air emissions.	√	
Operations			
Impacts on human health from air emissions	There could be impacts on health from air emissions from the new refinery components, from increased vehicle traffic, and from increased marine traffic. Concentrations of air emissions would meet NAAQS and ASIL standards for health and air dispersion modeling found that operations-related emissions would result in no exceedance for any air quality standard within the state of Washington or tribal lands.	√	

9.3.3. Potential Impacts of the No Action Alternative

Under the no action alternative, Tesoro would not proceed with the proposed project and would not be producing Tier 3 standard fuels. Because no construction or operations would take place under the no action alternative, the overall health impact from air emissions would be unchanged. The Tier 3 standards implementation is expected to result in major health improvements in the U.S. on a nationwide basis. By 2030, the Tier 3 standards implementation is predicted to prevent up to 2,000 premature deaths, avoid up to 2,200 hospital admissions, and eliminate 19,000 asthma attacks each year (Union of Concerned Scientists 2016).

9.3.4. Additional Mitigation Measures

No additional mitigation measures are recommended beyond the embedded controls already incorporated into the proposed project design (see the embedded controls and design feature discussion in Chapter 4, Air Quality and Climate Change).

9.4. TRAFFIC SAFETY

The refinery is accessible by road from SR20 to the south and local roads on March Point. The proposed project would increase traffic on these roads during both construction and operations. Temporary periods of traffic congestion could increase the potential for vehicle-related accidents and injuries.

The proposed project would also introduce additional marine vessel traffic in the Strait of Juan de Fuca, Rosario Strait, Guemes Channel, and Fidalgo Bay. Vessel traffic-related impacts are addressed in Chapter 13, Marine Transportation; this section only addresses land-based vehicle traffic.

9.4.1. Affected Environment

Annual average daily traffic data from WSDOT indicates that the sections of SR20 closest to March Point and routes that would be used to access the proposed project experienced approximately 32,000 vehicle trips per day in 2015. Skagit County reports average daily traffic volumes on March Point Road in the vicinity of the refinery entrance of 790 trips (CRAB 2016). Figure 9-1 shows average annual daily traffic volumes on the major roads leading to the refinery, and Table 9-5 provides the daily traffic volumes for primary project roads.

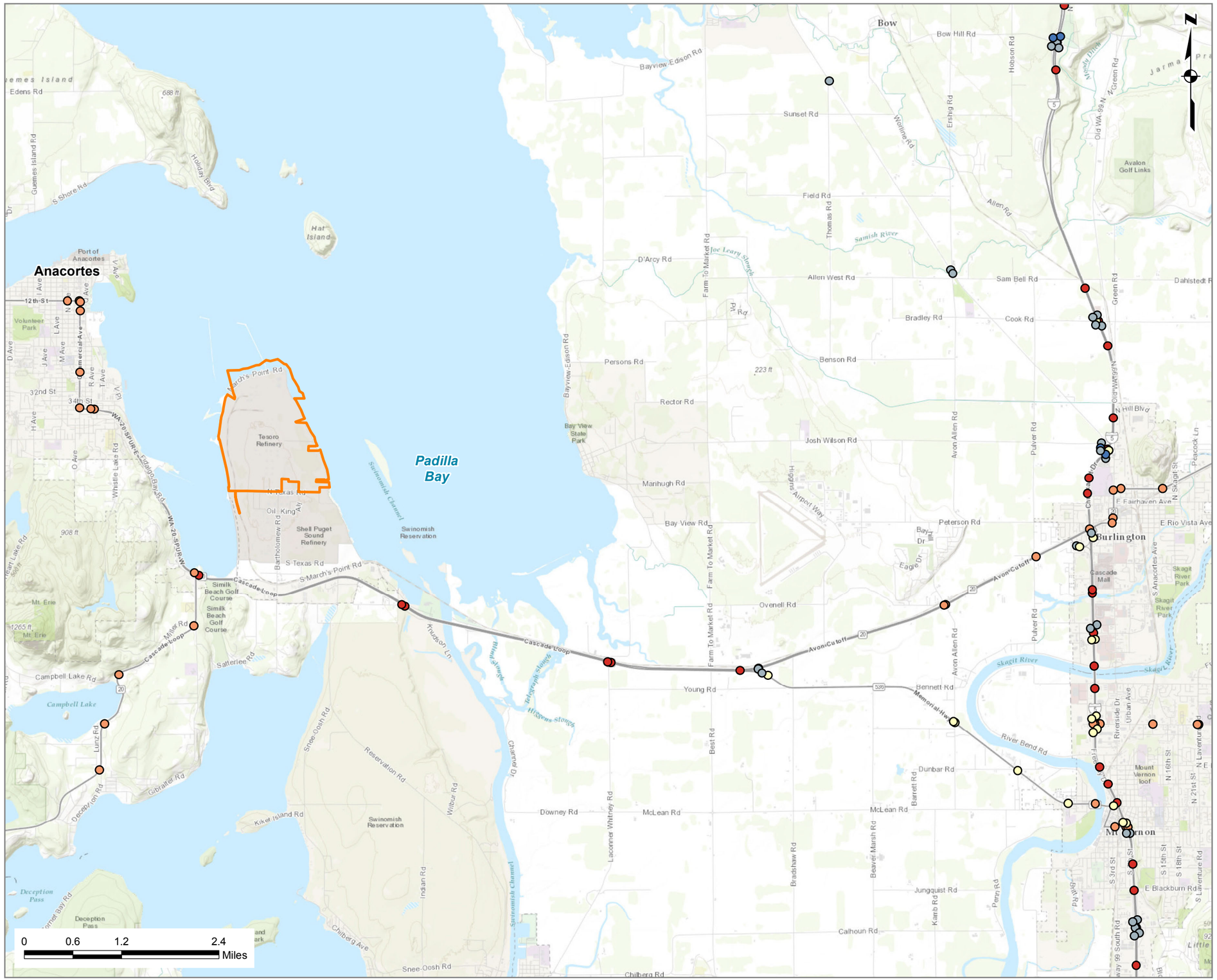
Table 9-5: Average Daily Traffic on Primary Proposed Project Transport Roads

Road Name	General Location	Average Daily Traffic	ADT data year
March Point Road	401 ft SW of Tesoro's main entrance	790	2015
North Texas Road	At March Point Road crossing	130	2015
SR20	Before junction with March Point Road	32,000	2015

Source: CRAB 2016
ADT = average daily traffic; ft = feet; SW = southwest

The Washington Traffic Safety Commission has produced an analysis of counties where Native American populations are disproportionately impacted by traffic fatalities (a potential environmental justice concern; also see the discussion in Chapter 11, Social and Economic Environment). Skagit County is not considered to have a disproportionate number of Native American deaths related to traffic fatalities (Washington Traffic Safety Commission 2014).

Page Intentionally Left Blank



Legend

Traffic Counts

- 29,001 - 242,000
- 12,001 - 29,000
- 6,101 - 12,000
- 2,401 - 6,100
- 20 - 2,400
- Tesoro Refinery Boundary

Notes:
Data provided by TPT Traffic Counts 2015, WSDOT-Statewide Travel and Collision Data Office (STCDO). Data represents 2015 annual average daily traffic counts.
Source:
ESRI Topographic Web Mapping Service
NAD 1983 UTM Zone 10N

Figure 9-1
Average Annual Daily Traffic in the Vicinity of the Proposed Project Site 2015
Tesoro Anacortes Refinery
Clean Products Upgrade Project
Draft Environmental Impact Statement
Anacortes, Washington

Page Intentionally Left Blank

9.4.2. Potential Impacts on Traffic Safety

Increased traffic volumes, with associated congestion and delays, can increase the risk of traffic accidents, although accident causes can be the result of many factors, and traffic volume alone is not always a strong predictor of the potential for traffic accidents to increase (Marchesini and Weijermars 2010; Innamaa et al. 2014). There is evidence, however, that increases in truck traffic can increase the severity of any accidents that do occur (Dong et al. 2013). Increases in proposed project traffic, much of which is truck traffic, are therefore used to predict changes in accident severity, which in turn is used as a measure for estimating overall changes in traffic safety.

9.4.2.1. Impacts on Traffic Safety from Construction

During the construction phase, traffic would consist of four main types: worker commutes, construction material deliveries, transport of cut and fill materials, and delivery of proposed project components on the self-propelled modular transporters (SPMTs) from the port in the city of Anacortes. Figures 2-16 and 2-18 in Chapter 2, Proposed Action and Alternatives, show the haul routes for the SPMTs and the source of fill materials, respectively. For the fill materials, there are three locations that could be used to obtain the fill needed in the New Tanks Area. The proposed project could use any one of those three.

The maximum proposed project-related traffic volume (passenger vehicles and trucks combined) during construction is estimated at 390 round trips per day.[4] This represents an increase of 1.3 percent over average daily volumes on SR20, a 50 percent increase on West March Point Road, and a more than 200 percent increase in average volumes on North Texas Road. While traffic impacts are likely to be largest near the refinery as that is where the highest proposed project-related traffic volumes would occur, there would also be temporary increases on local roads between the potential fill source sites and Interstate-5 that could be noticeable (see Figure 2-18 in Chapter 2, Proposed Action and Alternatives). Fill source sites would be accessed by up to 70 trucks per day (approximately nine trucks per hour) for a four-month period; however, all the potential fill source areas currently experience regular truck traffic as part of their business.

In addition to the traffic described above, 52 non-routine SPMT trips between the Port of Anacortes and the refinery would be required during the 19-month construction period. Figure 2-16 in Chapter 2, Proposed Action and Alternatives, shows the haul route from the Port of Anacortes to the refinery.

[4] An average of 190 workers is expected on-site throughout the construction phase, with up to 270 at peak construction. Transport of construction materials would range from 10 to 50 truck trips per day, depending on the construction stage. Transport of cut and fill materials would constitute an average of 70 roundtrips per day over a four-month period, using an average of 14 dump truck/trailer combos. This number could be decreased by 10 percent if trucks could be run loaded both inbound and outbound.

The magnitude of the traffic increases on West March Point Road and North Texas Road would be high; however, the geographic extent would be limited (with most traffic volume increases occurring very close to the refinery) and the duration would be short term (approximately 19 months). While traffic, in particular on North Texas Road, would see a significant increase during the construction period above the average daily baseline levels, the road is not used regularly by the general public providing access to the Tesoro Anacortes Refinery and the nearby Chemtrade chemical plant; this road is used primarily for industrial traffic. No residences or sensitive public locations, such as schools or hospitals, are present on either road between SR20 and the refinery. In addition, the increase on these two roads is within routine variations in refinery traffic during periodic maintenance turnarounds, which have extra workers on-site representing between 150 and 600 vehicle trips per day.

Key embedded controls detailed in Chapter 2, Proposed Action and Alternatives, include the following procedures:

- Routine construction traffic: Truck traffic would only use roads designated for truck use by the city of Anacortes.
- SPMT hauls: Transport permits would be required from the city of Anacortes and Skagit County and a Superload Transport Permit would be required from the WSDOT for the SPMT heavy haul moves from the Port of Anacortes to the refinery. Moves of prefabricated proposed project components would travel at slow speeds and moves are planned to occur at night to minimize disruptions along the transport route. Additionally, Tesoro would coordinate with the local utility companies to ensure proper permits and approvals are obtained from the city of Anacortes, Skagit County, and WSDOT for clearance and/or relocation of utility equipment as needed.

In summary, the increase in traffic during construction would not constitute a noticeable change (1.3 percent increase) on SR20. Increases in traffic during peak construction would be noticeable on March Point Road and North Texas Road (50 and 200 percent, respectively), and would likely be noticeable on the roads from the fill source sites to Interstate-5; however, the increases would be short term in duration and would occur on roads primarily used for industrial traffic. Therefore, the potential decrease in traffic safety is considered to be a ***less than significant*** impact.

9.4.2.2. Impacts on Traffic Safety from Operations and Maintenance

During operations, road traffic generated by the proposed project would be minimal, consisting of commuting workers (approximately 20 additional round trips per workday) and truck traffic for process material deliveries. Truck traffic would increase over current levels to deliver the commodity chemicals (sulfolane, aqueous ammonia, and perchloroethylene) and other supplies to the refinery. Based on expected usage rates and typical truck capacity, the proposed project would generate approximately 50 truck trips per year (health risks associated with an accidental spill of materials transported via truck are discussed in Section 9.6, Unplanned Events) (Tesoro 2016b). This represents a long-term increase of 0.1 percent over average daily volumes on SR20 and a 6 percent increase on West March Point Road. This level of increased traffic volume

would not constitute a perceptible change over current baseline traffic volumes. The roads traveled are routinely used for industrial traffic to the March Point refineries. The potential decrease in traffic safety is therefore considered a ***less than significant*** impact.

9.4.2.3. Summary of Potential Impacts on Traffic Safety

The potential impacts of the proposed project discussed in this section are summarized in Table 9-6.

Table 9-6: Summary of Potential Impacts on Traffic Safety

Impact Topic	Impact Summary	Potential Impact Significance	
		Less than Significant	***Potentially Significant***
Construction			
Traffic safety	There could be impacts on traffic safety during construction due to a 1.3 percent increase of traffic volume on SR20, a 50 percent increase in traffic volume on West March Point Road, and a 200 percent increase in North Texas Road. In addition, 52 non-routine SPMT trips to move prefabricated components between the Port of Anacortes and the refinery would be required. The SMPT moves are planned for nighttime to minimize disruptions along the transport route. All routine truck traffic would occur on roads designated for truck use. The impacts would be short term during the 19-month construction period and within established trucking routes.	√	
Operations			
Traffic safety	There could be impacts on traffic safety during operations and maintenance due to an increase of less than 0.1 percent of the traffic volume above the current traffic volume on SR20, and less than 6 percent increase above the current traffic volume on West March Point Road. All routine truck traffic would occur on roads designated for truck use.	√	

9.4.3. Potential Impacts of the No Action Alternative

Under the no action alternative, Tesoro would not proceed with the proposed project. Because no new road or vessel traffic would be added, there would be no new impact on human health and safety as a result of the proposed project.

9.4.4. Additional Mitigation Measures

No additional mitigation measures are recommended beyond the embedded controls already incorporated into the proposed project design.

9.5. NOISE

Increased noise levels can impact public health as a potential source of stress or disturbance, including sleep disturbance. The proposed project would generate new noises during construction and operations. Airborne noise impacts on terrestrial wildlife are addressed in

Chapter 6, Terrestrial Vegetation and Wildlife, and underwater noise impacts on aquatic species are discussed in Chapter 7, Marine and Nearshore Resources.

9.5.1. Affected Environment

Noise is generally defined as unwanted sound. Sound can be perceived as pleasant or annoying, and as loudness/intensity, in terms of decibels (dB). Since human hearing is not equally sensitive to all sound frequencies, certain frequencies are given more weight. This process is referred to as "weighting" the frequency. A-weighting (dBA), used in most noise ordinances and standards, corresponds to the range in frequency related to human hearing response. Typically, an increase of less than 3 dBA is barely noticeable, an increase of 5 dBA is noticeable, an increase of 10 dBA is perceived as a doubling in apparent loudness, and an increase of 20 dBA is perceived as a four-fold increase in apparent loudness.

Perceptible increases in noise, while below levels associated with hearing impairment, could still impact human health as a potential source of disturbance or stress. Noise-related disturbance and stress are subjective factors, and therefore there is no defined threshold at which a noise disturbance is considered to result in stress levels representing a measurable health impact.

Table 9-7 shows typical noise levels generated by common indoor and outdoor activities, and provides possible human impacts.

Table 9-7: Typical Noise Levels and Possible Human Response

Common Noises[a]	Noise Level (dBA)	Impact
Rocket launching pad (no ear protection)	180	Irreversible hearing loss
Carrier deck jet operation	140	Painfully loud
Air raid siren		
Thunderclap	130	Painfully loud
Jet takeoff (200 feet)	120	Maximum vocal effort
Auto horn (3 feet)		
Pile driver	110	Extremely loud
Loud concert		
Garbage truck	100	Very loud
Firecrackers		
Heavy truck (50 feet)	90	Very annoying
City traffic		Hearing damage (8 hours of exposure)
Alarm clock (2 feet)	80	Annoying
Hair dryer		
Noisy restaurant	70	Telephone use difficult
Freeway traffic		
Business office		
Air conditioning unit	60	Intrusive
Conversational speech		
Light auto traffic (100 feet)	50	Quiet
Living room	40	Quiet
Bedroom		
Quiet office		
Library/soft whisper (15 feet)	30	Very quiet
Broadcasting studio	20	Very quiet
	10	Just audible

Common Noises[a]	Noise Level (dBA)	Impact
Threshold of hearing	0	Hearing begins

Source: WSDOT 2015
dBA = A-weighted decibel
[a] No common 10 dBA source was available, but expected noise impacts for this decibel value were included.

Typically, noise levels vary over time, and the following indices are used to account for these variations:

- **L_{eq}** is the steady, continuous equivalent sound pressure level, which has the same acoustic energy as the actual varying sound levels over the same time period. Time periods commonly used for L_{eq} measurements and criteria are 1 hour up to a few hours, or the entire daytime (07:00 to 22:00 hours) and nighttime (22:00 to 07:00 hours) periods.
- **L_{90}** represents the sound pressure level exceeded for 90 percent of the measurement period and is used to indicate the background sound level.
- **L_d** is the daytime L_{eq} level (07:00 to 22:00 hours).
- **L_n** is the nighttime L_{eq} level (22:00 to 07:00 hours).
- **L_{dn}** is the day-night average sound pressure level with a 10 dB penalty added for nighttime noise to compensate for nighttime sensitivity.

9.5.1.1. Noise Sensitive Area Locations

The proposed project area is in an industrial area (i.e., within the existing refinery) and is adjacent to eight NSAs within approximately 2 miles (10,560 feet) of the proposed project's property boundary. The NSAs considered for this study and their respective distances from the proposed project's property boundary are described and shown in Table 9-8 and on Figure 9-2.

Table 9-8: Noise Sensitive Areas in the Proposed Project Vicinity

NSA ID	Distance from Property Boundary (feet)	NSA Description
NSA #1	5,940	Swinomish Golf Links south of proposed project property boundary (near proposed Samish Casino March Point site)
NSA #2	4,185	Residential area southwest of proposed project property boundary
NSA #3	3,925	Fidalgo Bay Resort east of proposed project property boundary
NSA #4	5,620	Residential area east of proposed project property boundary
NSA #5	7,475	St. Mary Parish east of proposed project property boundary
NSA #6	9,945	Residential Area northwest of proposed project property boundary
NSA #8	7,675	Hat Island north-northeast of proposed project property boundary (Natural Resources Conservation Area)
NSA #9	8,930	Swinomish Casino and Lodge southeast of proposed project property boundary

ID = identification; NSA = noise sensitive area

The closest NSA to the proposed project area is the Fidalgo Bay Resort, which is approximately 3,925 feet east of the refinery property boundary and on the opposite side of Fidalgo Bay (see Figure 9-2).

9.5.1.2. Noise Criteria

The Skagit County Code and the city of Anacortes Municipal Code both state that noise levels are not to exceed the permissible noise levels established by the state of Washington, as contained in WAC 173-60. These permissible noise levels are based on the environmental designation for noise abatement (EDNA), which is defined as "an area or zone (environment) within which maximum permissible noise levels are established." There are three EDNA designations (WAC 173-60-030) that roughly correspond to residential, commercial/recreational, and industrial/agricultural land uses:

- Class A EDNAs are lands where people reside and sleep (such as residential).
- Class B EDNAs are lands requiring protection against noise interference with speech (such as commercial, educational, and recreational).
- Class C EDNAs are lands involving economic activities of such a nature that higher noise levels are anticipated (such as industrial/agricultural).

Table 9-9 lists the permissible noise levels established in WAC 173-60-040. These noise limits are not applicable to construction activities. The Federal Transit Administration (FTA) construction noise criteria (1-hour L_{eq}) would be used to assess impacts of construction noise on the nearest NSAs. The FTA construction noise criteria for daytime (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.) at residential areas are 90 and 80 dBA, respectively (FTA 2006).

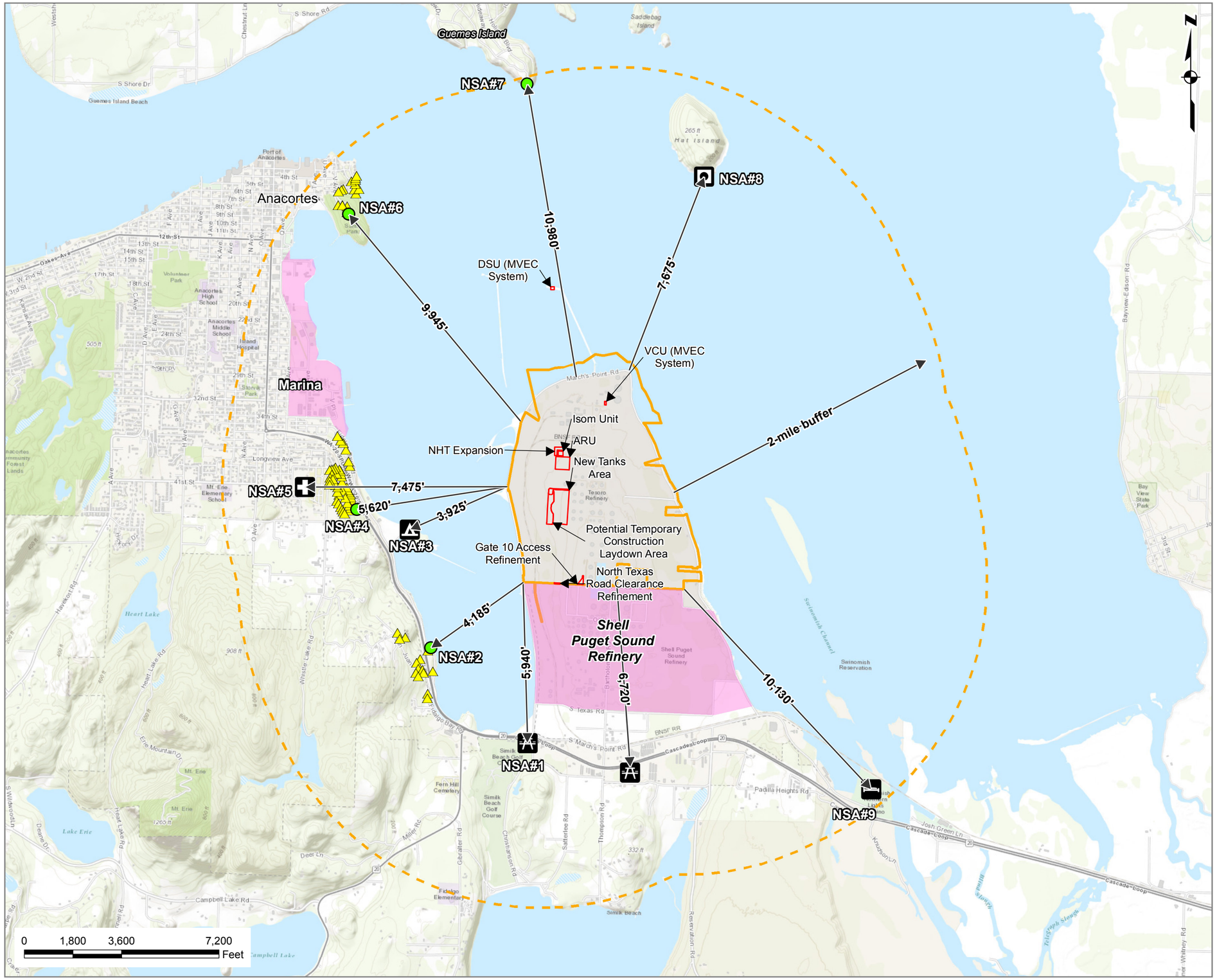
Table 9-9: Washington Maximum Permissible Noise Levels[a]

EDNA of Noise Source	EDNA of Receiving Property (dBA)		
	Class A[b] (Residential)	Class B (Commercial)	Class C (Industrial)
Class A	55	57	60
Class B	57	60	65
Class C	60	65	70

Source: WAC 173-60-040
dBA = A-weighted decibel; EDNA = environmental designation for noise abatement
[a] Applicable to operation of a facility, not construction.
[b] Sound limits shall be reduced by 10 dBA between the hours of 10 p.m. and 7 a.m. at Class A EDNAs (WAC 173-60-040 (b)).

The proposed project area is considered a Class C (industrial) noise source located in a mixed land use area (industrial/residential/commercial) and the baseline ambient noise levels are expected to be high. The major source of ambient noise at the proposed project area are the existing Tesoro Anacortes Refinery, Shell Puget Sound Refinery, vehicle traffic on SR20 and other nearby roadways, and marine vessel traffic.

Typical outdoor sound levels by land use category are presented in Table 9-10. Ambient day–night noise levels in a large city such as Anacortes as well as areas with dense traffic or some commerce or industry are expected to range from 55 to 65 dBA. Ambient day–night noise levels in rural and suburban towns in the state of Washington with infrequent traffic are expected to range from 40 to 45 dBA (Cavanaugh and Tocci 1998; Bies and Hansen 2009).



Legend

- Noise Sensitive Area (NSA)
- Residence
- Island
- Camping Area
- Church
- Lodging Area
- Recreational Area
- Distance
- Proposed Project Areas
- Industrial Area
- 2-Mile Buffer from Project Boundary
- Property Boundary

Source:
ESRI Topographic Web Mapping Service
NAD 1983 StatePlane Washington North FIPS 4601 Feet

Figure 9-2
Noise Sensitive Areas in the Vicinity of the Proposed Project
Tesoro Anacortes Refinery
Clean Products Upgrade Project
Draft Environmental Impact Statement
Anacortes, Washington

Page Intentionally Left Blank

Table 9-10: Typical Outdoor Sound Levels by Land Use Category

Land Use Category	L_d (dBA) [a]	L_n (dBA) [b]	L_{dn} (dBA) [c]
Wilderness areas	35	25	35
Rural and outer suburban areas with negligible traffic	40	30	40
General suburban areas with infrequent traffic	45	35	45
General suburban areas with medium density traffic or suburban areas with some commerce or industry	50	40	50
Urban areas with dense traffic or some commerce or industry	55	45	55
City or commercial areas or residences bordering industrial areas or very dense traffic	60	50	60
Predominantly industrial areas or extremely dense traffic	65	55	65

Sources: Cavanaugh and Tocci 1998; Bies and Hansen 2009
dBA = A-weighted decibel
[a] L_d, or daytime L_{eq}, is the average equivalent sound level for daytime (7 a.m. to 10 p.m.).
[b] L_n, or nighttime L_{eq}, is the average equivalent sound level for nighttime (10 p.m. to 7 a.m.).
[c] L_{dn}, or day-night average sound level, is the average equivalent A-weighted sound level during a 24-hour period with a 10-dB weighting applied to equivalent sound level during the nighttime hours of 10 p.m. to 7 a.m.

The existing noise environment at two nearby properties was characterized by sound level measurements taken for another project in September and November of 2011 at two locations near the proposed project area (Samish Indian Nation 2013). Table 9-11 presents existing ambient noise levels at the March Point Site in the city of Anacortes (near NSA 1) and at the Flats Site (near NSA 3), which is in the Fidalgo Bay Resort (see Figure 9-2 for NSA locations).

Table 9-11: Noise Level Measurements in the Vicinity of the Proposed Project

Site	Date	Start Time	End Time	Noise Source	Receptor	Measured Noise Level, L_{eq} (dBA)
March Point Site	9/14/11 – 9/15/11	6:08 PM	10:41 AM	Vehicles on Stevenson Road	Residences	47.7
Flats Site (Fidalgo Bay Resort)	11/21/11	5:00 PM	5:13 PM	RV Park	Condominium	69.5[a]

Source: Table 3.11-6 in Samish Indian Nation 2013
AM = ante meridian (morning); dBA = A-weighted decibel; L_{eq} = steady, continuous equivalent sound pressure level; PM = post meridian (afternoon); RV = recreational vehicle
[a] Jets passed location during noise level measurement.

Measured sound levels at the March Point site (47.7 dBA) correspond to general suburban areas with medium density traffic or suburban areas with some commerce or industry (as presented in Table 9-10). However, the measured sound levels at the Flats Site/Fidalgo Bay Resort (69.5 dBA) are much higher due to its close proximity to SR20 and resort activities. These sound levels correspond to predominantly industrial areas or extremely dense traffic areas as presented in Table 9-10.

Existing noise data from the adjacent Shell refinery was selected as an estimate of baseline noise in the vicinity of the proposed project given the proximity of the Shell refinery to Tesoro and comparable noise-generating industrial activities. A review of 2016 noise data from a study conducted at the Shell refinery indicated that daytime noise levels (L_{eq} [day]) in Shell's project site range from 60 to 64 dBA and nighttime noise levels (L_{eq} [night]) ranged from 59 to 60 dBA (Skagit County and Ecology 2016).

9.5.2. Potential Impacts from Proposed Project Noise

This section evaluates the potential direct and indirect impacts on health from increased exposure to noise as a result of construction and operations of the proposed project. Impacts are summarized in Section 9.5.2.4.

9.5.2.1. Impacts from Construction Noise

During construction, noise would be generated primarily from heavy construction machinery (loader, dozers, tractors, cranes, excavators, paver, vibratory rollers, air compressors, backhoe, motor grader, etc.), and truck transportation (dump trucks, flatbed trucks, water truck, pickup trucks). Construction would be temporary in nature. The ARU, Isom Unit, and NHT would take the longest time to construct, up to 19 months in total, with the other proposed project components taking an average of 6 months to complete. All construction equipment will have appropriate mufflers installed to minimize noise.

The closest NSA to the proposed project area is the Fidalgo Bay resort, which is 3,925 feet east of the refinery property boundary and on the opposite side of Fidalgo Bay (see Figure 9-2). Construction noise levels at and near the proposed project area could fluctuate depending on the particular type, number, and duration of uses of various pieces of construction equipment.

The FTA Noise and Vibration Impact Assessment methodology was used to evaluate impacts from construction noise (FTA 2006). The FTA methodology suggests combining the two noisiest pieces of equipment and assumes they are operating continuously. Using this approach, the loudest equipment to be used to construct the proposed project would be two scrapers (89 dBA maximum sound level [L_{max}] at 50 feet), which would generate a combined Lmax of 92 dBA at 50 feet. The closest NSA to the proposed construction site is the Fidalgo Bay Resort, which is approximately 3,925 feet east of the refinery property boundary. The received sound level at this location under assumed worst-case conditions (i.e., assumes full power operation and free field conditions) would be 54 dBA, much less than the FTA construction noise criteria for daytime (90 dBA) and nighttime (80 dBA) periods. Construction noise levels at NSAs located farther away would be lower; therefore, impacts on NSAs from noise emissions associated with construction activities are therefore considered ***less than significant***.

9.5.2.2. Impacts from Operations and Maintenance Noise

During operation and maintenance of the proposed project, the following sources or activity would generate noise:

- New natural gas-fired steam boiler to be installed adjacent to the ARU
- Air coolers/overhead condensers associated with the ARU, Isom Unit, and NHT
- Heat exchangers/reboilers associated with the ARU, Isom Unit, and NHT
- Pumps associated with the ARU, Isom Unit, NHT, and MVEC System
- Vapor blower associated with the MVEC System

- Three-inch aboveground natural gas line routed from an existing line within the refinery to the onshore VCU and the DSU located on the refinery wharf structure
- On-road vehicle traffic associated with delivery of commodities and other supplies to the refinery (50 truck trips per year)

Considering the existing baseline noise levels are in a range consistent with levels produced from existing industrial activities (baseline levels range between 54 to 64 dBA) and that the majority of the proposed project activities would occur within developed areas of the refinery, the addition or replacement of the project-related noise sources (e.g., steam boilers, air coolers, pumps, vapor blower, etc.) are not expected to result in significant increases in noise levels from baseline levels. Therefore, impacts on NSAs associated with noise during operations and maintenance are considered ***less than significant***. Airborne noise impacts on terrestrial wildlife are addressed in Chapter 6, Terrestrial Vegetation and Wildlife.

9.5.2.3. Impacts from Vessel Noise during Operations

Marine vessel traffic along the Strait of Juan de Fuca and marine vessel loading and unloading at the wharf would generate some noise in its immediate vicinity. The refinery's marine terminal received an average of 335 vessels per year from 2002 to 2014, with the greatest marine vessel traffic volume in 2003 (486 vessels). The proposed project would result in an additional five marine vessels traveling to and from the refinery wharf per month (60 vessels per year). At the wharf, the additional marine vessels represent an increase in traffic above current levels of approximately 18 percent.

Because decibels are logarithmic values, they cannot be combined by normal algebraic addition. For example, the combined sound level of two noise sources, each having a sound level of 60 dBA would be 63 dBA, not 120 dBA. This means that doubling of sound with equal decibel values only results in a 3 dB increase. To achieve a 3 dB increase from current sound levels at the refinery wharf from the new marine vessels, the number of vessels per year would have to double (i.e., 100 percent increase). Since the marine vessel traffic would increase by 18 percent annually, the noise increases would be less than 3 dB (likely not more than 1 dB increase from existing levels). Section 9.5.1 indicates that an increase of less than 3 dB is barely noticeable; therefore, noise increases associated with the 18 percent increase in marine vessel traffic would not be noticeable. When considering the increase in noise in the marine vessel transportation route from the proposed project vessels (once the marine vessels leave the wharf), the percent increase is lower than 18 percent due to the large numbers of marine vessels in the marine vessel transportation route (see Chapter 13, Marine Transportation).

Therefore, noise associated with the additional marine vessel traffic (including vessel loading and unloading at wharf) would not result in a significant impact. Impacts on NSAs due to noise generated from vessel traffic are considered ***less than significant***.

Underwater noise impacts on aquatic species are discussed in Chapter 7, Marine and Nearshore Resources.

9.5.2.4. Summary of Potential Impacts from Noise

The potential impacts of the proposed project discussed in this section are summarized in Table 9-12.

Table 9-12: Summary of Potential Impacts on Noise

Impact Topic	Impact Summary	Potential Impact Significance	
		Less than Significant	*Potentially Significant*
Construction			
Noise	NSAs could be impacted by noise emissions generated primarily by heavy machinery use and truck transport during the construction period (19 months). Construction activities could generate fluctuations in noise, but are expected to be less than 5 dBA increase above baseline noise levels in areas where NSAs are located. All construction equipment will be required to use appropriate mufflers. The nearest receptor is in Fidalgo Bay; however, noise emissions are not expected to impact Fidalgo Bay Resort.	√	
Operations			
Noise	Impacts on NSAs from noise emissions from new operations and systems, including increases in vessel traffic, would generate less than 5 dBA change in NSAs above ambient noise levels.	√	

9.5.3. Potential Impacts of the No Action Alternative

Under the no action alternative, Tesoro would not proceed with the proposed project. Because no construction or operations would take place under the no action alternative, there would be no change in existing noise levels, and therefore no new impacts on environmental health conditions.

9.5.4. Additional Mitigation Measures

No additional mitigation measures are recommended beyond the embedded controls already incorporated into the proposed project design.

9.6. UNPLANNED EVENTS

The sections above describe impacts from planned activities associated with the proposed project. This section outlines potential impacts on health from unplanned events such as a potential fire or explosion at the refinery, a spill during land transport of new materials (sulfolane and ammonia) and increased materials (perchloroethylene), or a spill of xylenes or reformate in the marine vessel transportation route.

In evaluating the potential impacts of unplanned events such as spills or fires at the refinery during construction or operations, the impacted environment study area is the same as that described in Section 9.3.1.

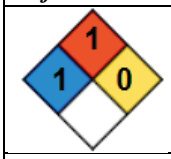
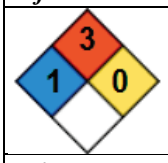
9.6.1. Potential Impacts on Health from Fires at the Refinery During Operations and Maintenance

Of the three new materials that would be present at the refinery due to the proposed project, sulfolane and ammonia are of low flammability, while xylenes are highly flammable. Sulfolane and ammonia will be transported to the refinery via truck and loaded into their on-site tanks for use. Xylenes will be produced on site and transferred to the refinery wharf via piping, where they will be loaded on to vessels. The proposed project would increase the use of reformate, brought to the facility via marine vessels and unloaded at the wharf, where it is transferred via piping to the storage tanks. Reformate backhaul (material with xylenes removed), will also be off-loaded to marine vessels at the wharf.

The National Fire Protection Association (NFPA) rates flammability on a five-point scale ranging from "0" to "4," with 0 representing a non-flammable substance, and 4 representing a highly flammable material. Within this rating system, sulfolane and ammonia are classified as a 1, i.e., they must be pre-heated before ignition can occur; and xylenes are classified as a 3, i.e., it can be ignited under almost all ambient temperature conditions (NFPA 2016). Reformate is also rated a 3 in the NFPA system. In addition to already using reformate at the refinery, the facility contains many flammable materials with associated fire and explosion risks. For example, Figure 2-7 in Chapter 2, Proposed Action and Alternatives, indicates that approximately 60 percent of the materials currently produced at the facility are gasoline and jet fuels, both these products are a 3 in the NFPA rating system. Diesel fuel, which currently constitutes approximately 20 percent of the products produced at the refinery, is rated a 2 in the NFPA system, i.e., it must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. The proposed project would not substantially change the amount of flammable materials used or produced at the refinery.

Table 9-13 provides the NFPA hazard ratings for the three new materials and the increased usage materials.

Table 9-13: NFPA Ratings for Ammonia, Perchloroethylene, and Sulfolane

Diamond	Hazard	Value	Description
Sulfolane			
	Health	1	Can cause significant irritation
	Flammability	1	Must be preheated before ignition can occur
	Instability	0	Normally stable, even under fire conditions
	Special		No special requirements
Ammonia			
	Health	3	Can cause serious or permanent injury.
	Flammability	1	Must be preheated before ignition can occur
	Instability	0	Normally stable, even under fire conditions
	Special		No special requirements
Perchloroethylene			
	Health	2	Can cause temporary incapacitation or residual injury
	Flammability	0	Will not burn under typical fire conditions
	Instability	0	Normally stable, even under fire conditions
	Special		No special requirements
Reformate			
	Health	1	Can cause significant irritation.
	Flammability	3	Can be ignited under almost all ambient temperature conditions.
	Instability	0	Normally stable, even under fire conditions.
	Special		No special requirements
Xylene			
	Health	2	Can cause temporary incapacitation or residual injury.
	Flammability	3	Can be ignited under almost all ambient temperature conditions.
	Instability	0	Normally stable, even under fire conditions.
	Special		No special requirements

Source: NFPA 2016

Because the refinery handles a large amount of flammable materials on a daily basis, a robust fire prevention and fire response system is in place to prevent fires and to respond to fires in the event that a fire should occur (see Tesoro's Oil Spill Contingency Plan and the emergency response information in Appendix 2-A, Existing Programs and Operations). A xylene fire would be handled in the same manner as a gasoline or reformate fire. Tesoro maintains its own trained 24-hour fire response brigade and would immediately address any fires at the facility.

Heat Exchanger Explosion

On April 2, 2010, a heat exchanger ruptured after a maintenance restart, causing an explosion and an ensuing fire that killed seven Tesoro workers. The fire burned for more than 3 hours and resulted in a 7-month shutdown of the refinery. Based on the results of the accident investigation, which included multiple agencies as well as industry experts, Tesoro developed and implemented a number of additional safety measures. These additional measures included changes to the refinery's process hazard analysis program, pre-start up safety reviews, and the damage mechanism hazard review programs. Per recommendations from the U.S. Chemical Safety Board, Tesoro has developed a more robust process safety culture program (see Section 2.14 of Appendix 2-A, Existing Programs and Operations, for details on the safety culture program).

Considering the implementation of BMPs for on-site spill prevention and response, including fire suppression activities outlined in Tesoro's Oil Spill Contingency Plan, it is considered unlikely that a fire would become established in the proposed project area or spread beyond the refinery in a manner that could impact the public. The 2010 heat exchanger explosion at the refinery did not extend beyond the refinery bounds, although there were very serious impacts within the refinery.

The second step in spill response, after identification and stoppage of the spill source, is to eliminate/reduce the fire hazard by eliminating ignition sources and using a water fog to knock down explosive vapors (see also the spill response discussion in Chapter 13, Marine Transportation). Considering the controls that are now in place and the lack of a significant change in the presence of flammable materials at the refinery, impacts on public health as a result of a fire during construction or operation of the proposed project would be ***less than significant***.

9.6.2. Potential Impacts on Health from Spills

The proposed project would use two new chemicals at the refinery, sulfolane and ammonia, and would also produce a new product, mixed xylenes, which would be transported from the facility following production via marine vessels. The manufacture of mixed xylenes also requires an increase in the use of perchloroethylene and reformate above their current refinery use levels. Reformate would be transported to the refinery via marine vessels while sulfolane, ammonia, and perchloroethylene would be shipped to the refinery via truck. This section discusses the potential health impacts that could occur as a result of a xylene or reformate spill in the marine environment or a spill of sulfolane, ammonia, or perchloroethylene at the refinery or during land transport.

9.6.2.1. Toxicity Information

Exposure to hazardous chemicals can result in both acute and chronic health impacts, depending on the substance type, exposure dose, duration, and frequency. Because spills last for a short time, chronic health impacts are unlikely and the toxicity discussion below focuses on short-term impacts (also called acute impacts) since prolonged human exposure is not expected.

Xylenes and Reformate

Mixed xylenes are currently not present in pure form at the existing refinery and would be produced and shipped when the proposed project operations begin (xylenes and ethylbenzene are components of the petroleum materials currently in use at the refinery). The mixed xylenes would contain about 18 percent ethylbenzene[5] (CH2M Hill 2016). Human health impacts from mixed xylenes and ethylbenzene would depend on the route and duration of exposure. While xylenes are not carcinogenic, direct contact can cause skin or eye irritation and xylenes do affect the central nervous system (motor coordination, confusion). Inhalation of xylene-related vapor can cause respiratory irritation, headaches, dizziness, difficulty breathing, and even death if the

[5] Ethylbenzene is also present in reformate.

concentrations are sufficiently high. Ethylbenzene has the same health impacts as xylenes that are described above–irritation of eyes and skin, headaches, dizziness, similar central nervous system affects. In addition to these impacts, ethylbenzene may also be carcinogenic to humans (no human data, high doses of the chemical caused cancer in rodents, see Section 9.3.1). Reformate contains many of the same compounds found in gasoline, including ethylbenzene and xylenes, and has the same short-term health impacts as described above.

Reformate and xylenes rapidly evaporate to the atmosphere and are readily broken down to less harmful compounds, carbon dioxide and water, by sunlight. Containment could allow explosive concentrations to accumulate; therefore, the preferred response is to knock down the vapors during a spill to prevent the buildup of explosive concentrations of the spill materials as they evaporate to the atmosphere. In contrast to other petroleum-based materials such as crude oil, xylene and ethylbenzene evaporate so quickly that they generally are not persistent in the environment and do not bioaccumulate in plants or animals, including fish and shellfish (ATSDR 2007; ATSDR 2010).

Ammonia

The only chemicals that would be transported to the facility via truck that are not used in current refinery operations are sulfolane and ammonia. Information on sulfolane and ammonia's health impacts and behavior in the environment was presented in Chapter 2, Section 2.8.3.1, Sulfolane, and Section 2.8.3.2, Aqueous Ammonia, respectively, and are summarized here.

Ammonia, which would be used to control nitrogen oxide emissions from the new boiler, is naturally present in small amounts in air, soil, and water. If the aqueous ammonia were spilled at the refinery, high concentrations are severely corrosive and are irritating to the skin, eyes, and respiratory tract, causing permanent damage at point of contact if concentrations are sufficiently high. Ammonia is not considered carcinogenic and quickly breaks down in the environment (ATSDR 2004).

Sulfolane

Sulfolane is most commonly used in gas production and oil refining, and may also be used in other manufacturing industries. Sulfolane dissolves readily in water rather than evaporating or sticking to soil. Once it enters the environment, it tends to move into groundwater where it becomes diluted. The most likely human exposure is therefore through ingestion of sulfolane contaminated drinking water. Sulfolane does not bioaccumulate in animals, but may be taken up by some plants.

There is limited information about toxicity in animals showing that very high ingested doses caused nervous system damage (oral exposure). Some inhalation studies found lung irritation, but longer term studies provide no evidence indicating the compound is carcinogenic (Alaska DHSS 2010; Blystone 2011; Farland 2014). When consumed, sulfolane enters the bloodstream quickly and is also rapidly excreted, with a half-life of 3.5 to 5 hours (Alaska DHHS 2010; Blystone 2011).

Perchloroethylene

The manufacture of xylenes also requires an increase in the use of perchloroethylene, a chemical currently used at the refinery. Short-term health impacts associated with exposure to perchloroethylene can include eye and respiratory irritation, shortness of breath, nausea, dizziness, and lightheadedness (ATSDR 2015). Perchloroethylene may be carcinogenic in humans (bladder cancer and lymphoma).

9.6.2.2. Affected Environment–Vulnerable Communities along the Marine Vessel Transportation Route

Communities with high rates of poverty may have poorer health than the general population (see Section 9.3.1). As shown on Figure 9-3 and Table 9-14, some census blocks along the marine vessel transportation route have high percentages of poverty where people might have poorer health than the general population. Chapter 11, Social and Economic Environment, defines an environmental justice concern as an area where the minority population or low-income population of an impacted area is "meaningfully greater" than the minority percentage in a "reference area." In this case, the reference area is the state of Washington. Federal guidance does not define "meaningfully greater" and there is no broad consensus of that term.

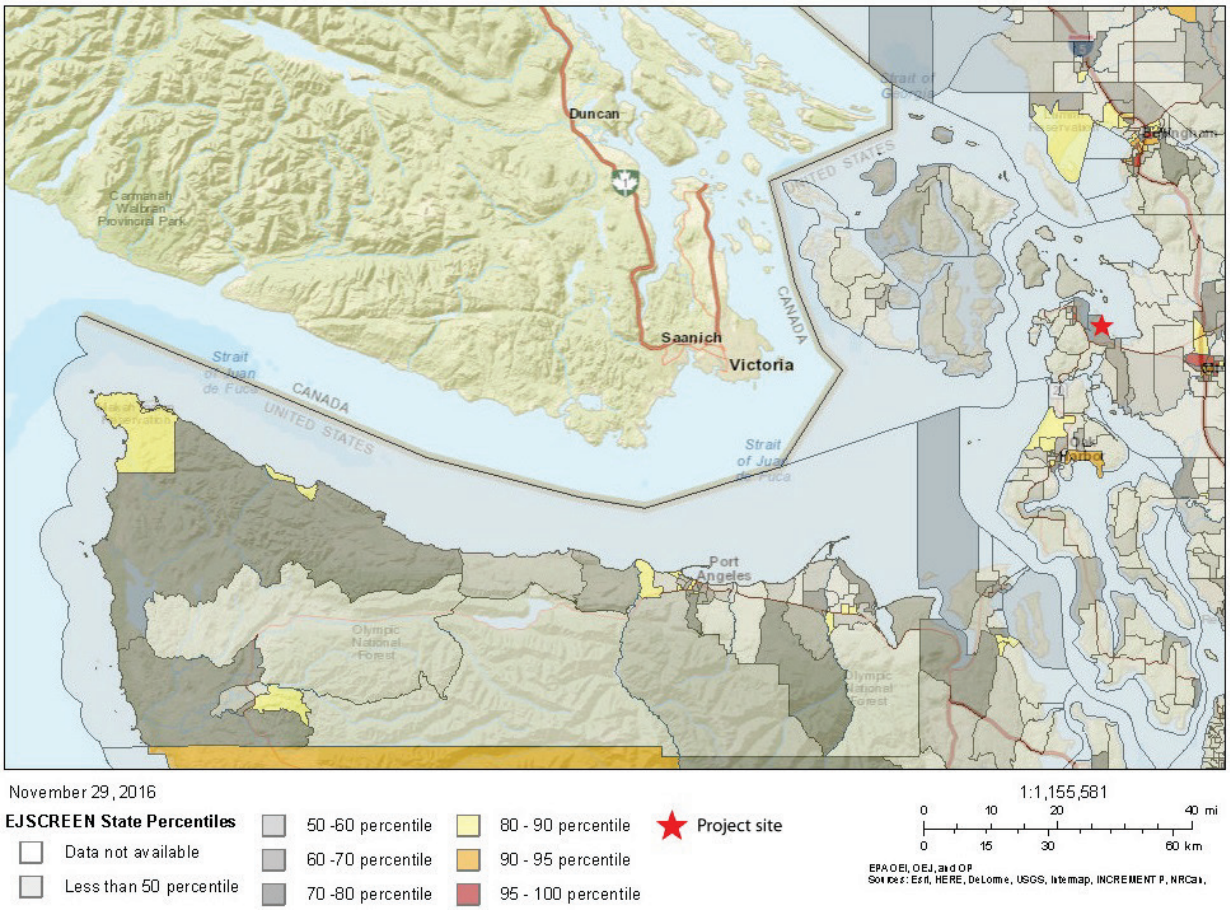


Figure 9-3: EJSCREEN Output: Census Blocks with Low-Income Population along the Marine Vessel Transportation Route

Table 9-14: Census Blocks Along the Marine Vessel Transportation Route with Estimated Poverty Rates Above the 80th Percentile for the State of Washington

Census Block	Total Number of Households	Households below Poverty Level in Last 12 Months	
		Number	Percentage
BG 2, CT 2, Clallam County	294	105	42.2
BG 1, CT 7, Clallam County	481	97	20.2
BG 1, CT 9, Clallam County	453	72	15.9
BG 2, CT 15, Clallam County	475	129	27.1
BG 1, CT 9400, Clallam County	305	74	24.3
BG 2, CT 2 9400, Clallam County	182	45	24.7
BG 1, CT 9702, Island County	208	26	12.5
State of Washington (reference area)	2,668,912	322,552	12.1

Source: 2011-2015 American Community Survey 5-Year Estimates (U.S. Census Bureau 2017)
BG = Block Group; CT = Census Track

9.6.2.3. Impacts on Health from Refinery Spills during Construction and Operations

Construction activities present a risk of an unplanned release of hazardous materials, such as fuels, lubricants, oils or hydraulic fluids. Spills during construction would most likely be associated with material storage or fueling, and would be small in volume. Operation of the proposed project could result in releases of hazardous materials such as xylene, reformate, sulfolane, ammonia, perchloroethylene and other petroleum products. Spills could occur during transfer operations, from transfer pipeline or valve leaks, pump or sump failures, overfilling storage tanks or from routine maintenance activities. Spills during operation could involve larger spill volumes than during construction.

The impact analysis in Chapter 5, Freshwater Resources, identified that, if one or more controls failed, spills at the refinery during construction and operation could temporarily impact surface waters. Surface waters within the refinery are not used for drinking water or swimming, and it is therefore unlikely that humans would come into contact with contaminated surface waters. Further, in the event of a spill, the spilled material would either occur on an impermeable surface and/or would be directed to the refinery's wastewater treatment plant as described below.

In the event of a spill, humans could be exposed to spilled materials, primarily through inhalation of vapors as the materials evaporate. Such inhalation could result in the acute toxic impacts noted above–headaches, nausea, and severe irritation, including permanent damage if exposed to sufficiently high concentrations.

Multiple layers of spill prevention and response measures are currently in place at the refinery, and would continue to be implemented during future operation of the proposed project. These include the following measures:

- Spills would be prevented by constructing facilities in accordance with relevant standards, and undertaking regular monitoring and maintenance of equipment.
- Secondary containment would be used so that if material was released it would be held at the immediate release location.

- Stormwater in developed portions of the refinery would be captured in a sewer system, which routes stormwater runoff and oily water to the Wastewater Treatment Plant (WWTP) for treatment.
- For areas outside developed portions of the refinery, temporary stormwater controls would be used during construction.
- Trained personnel would be available to support spill response activities.

These measures are described in further detail in Chapter 2, Section 2.7.6, Construction Site Controls, and Section 2.8.5, Operational Site Controls.

The proposed project would add two new tanks of xylenes and one new tank of sulfolane in the New Tanks Area. Ammonia would be stored with the new boiler as part of the ARU. As sulfolane is not very volatile, vapors would be unlikely to extend far and would not reach the public. Mixed xylenes, ammonia, and other volatile components of petroleum products do evaporate quickly into the air, and could be inhaled depending on the volume of the spill and whether someone from the public was close enough to be affected.

There are no public retail or commercial outlets immediately adjacent to the refinery that would be impacted. There is a single residence near the refinery on West March Point Road, approximately one-quarter mile or more from the new refinery components, other than the wharf improvements. The volatile compounds are not persistent in the environment and would break down within hours of release.

Worker exposure to toxic materials could occur during a spill event, with the most likely exposure pathway being inhalation. However, precautions would be taken for workers to leave the area to a location upwind of the spill. Spill response crews would have the appropriate training and personal protective equipment to avoid exposure to toxic materials in responding to a spill event at the refinery.

The duration of exposure would be short as trained personnel would respond rapidly and the spill would be contained. Additionally, xylenes and ammonia break down quickly in the atmosphere and would likely be removed by natural process in less than 24 hours (see Chapter 4, Air Quality and Climate Change).

With the availability of trained and protected personnel to respond to spills and the physical spill containment systems in place, any spilled materials would be expected to remain within the refinery footprint and not pose a significant risk to the public. Therefore, potential impacts on public health from a spill at the refinery are considered ***less than significant.***

9.6.2.4. Impacts on Health from Marine Spills from Vessels during Operations

Impacts on public health from marine spills could occur if people are near enough to a spill to inhale vapors or be injured if a fire/explosion occurred (due to the vapors reaching an ignition source). A 1,000 bbl xylenes spill on the Mississippi River in 2007 reached people on the shore, approximately a half mile away, in high enough concentrations to result in some short-term health effects. Mixed xylenes do not accumulate in fish; therefore, people would not be exposed

to the spilled materials from eating fish (see Chapter 7, Marine and Nearshore Resources). Other than fires/explosions, short-term inhalation is the exposure route of concern for the public, as mixed xylenes or reformate are not viscous and do not persist in the environment. Dermal exposure is not a concern because the products evaporate too rapidly to be significantly absorbed through the skin (ATSDR 2007).

Computer models were used to simulate hypothetical, uncontrolled releases of mixed xylene and reformate into the environment for three spill scenarios based on theoretical spill volumes consistent with volumes used for spill response planning purposes: a worst-case scenario, a maximum most probable scenario, and an average most probable scenario (see Chapter 13, Section 13.5, Marine Spills and Spill Response). The spill scenarios were modeled assuming that no response actions would occur; resulting in an uncontrolled release. If an actual spill were to occur, however, response measures governed by regulatory agencies and provided by the refinery, local and regional response organizations would be implemented to avoid or minimize impacts from a spill.

Xylene Tanker Spill in the Mississippi River

In Louisiana in 2007, a 1,000–bbl xylene spill to water occurred from a barge–vessel collision on the Mississippi River. The collision occurred mid-channel and the Mississippi River is about one mile wide in this area. Impacts as a result of this spill were short-term and no xylenes were detected in the aquatic environment 2 days after the spill. Wharf workers and other people in commercial buildings near the wharf were briefly hospitalized for a short time with symptoms of sore throats and runny eyes, but were quickly released with no long-term ill effects. A public information officer from the Louisiana Department of Environmental Quality stated that no one was seriously hurt (Professional Mariner 2007).

Marine spill modeling of a worst-case scenario spill indicated that spilled material may reach the shoreline, depending on the location, season and tidal conditions of the spill (see Chapter 13, Marine Transportation, Section 13.5.5). Due to the rapid rate at which xylenes, ethylbenzene, and the volatile components of reformate break down, high concentrations would be present in the air for only a short duration in the spill vicinity.

Chapter 4, Air Quality and Climate Change, presents further modeling of air emissions, based on the spill scenarios presented in Chapter 13, Marine Transportation.

Modeling presented in Chapter 4, Air Quality and Climate Change, found that health-protective ASILs would not be exceeded in the average most probable spill scenario, if the materials were spilled near people. Therefore, potential impacts on human health from an average most probable spill scenario would be ***less than significant***.

Modeling presented in Chapter 4, Air Quality and Climate Change, found that health-protective ASILs would potentially be exceeded for up to 24 hours in the event of a worst-case or maximum most probable spill at the wharf or in the shipping channel. Air concentrations could be sufficiently high during the first 24 hours following the spill, that evacuation and the establishment of an exclusion zone would be required to prevent acute health impacts. Immediate response to a large spill event would be coordinated by the Washington State Department of

Emergency Management. Depending on the location of a potential spill, members of residential or other populated areas located within the exclusion zone would be required to evacuate or shelter in place for a 24-hour period until the ASILs were no longer exceeded.

VOC constituent concentrations from a spill of xylene or reformate to marine waters could exceed health-based air quality criteria for up to 24 hours under the worst-case and maximum most probable spill scenarios. Therefore, the potential magnitude of the concentrations would be ***potentially significant*** to human health depending on the volume of material spilled and the proximity of people to the spill event.

Because a spill is an unplanned event, the significance of a spill is examined within the context of the likelihood of a spill occurring and the potential for the proposed project's vessel traffic to change the current spill risk (see Section, 13.5.6, Spill Likelihood and Section 13.3, Vessel Traffic, respectively). Based on both the historical record and a spill risk analysis study by the Department of Ecology, there is a negligible to low likelihood of a spill occurring, depending on the specific location in the study area. In addition, the risk of a spill occurring at the refinery wharf or along the marine vessel transportation route would not significantly change from existing conditions as a result of the proposed project.

The potential impacts and significance of a spill described above were derived from an uncontrolled spill scenario (i.e., no spill response) of mixed xylenes or reformate into the marine environment. The estimated potential impacts presented in this section are therefore conservatively high. If an actual spill were to occur, response measures governed by regulatory agencies and provided by the refinery, local and regional response organizations would be implemented to avoid or minimize the potential impacts from a spill.

Safety measures are in place to prevent spills from marine vessels transiting the marine vessel transportation route and for loading/unloading petroleum products safely at the wharf (see Chapter 13, Section 13.4, Vessel Safety, and Appendix 2-A, Existing Programs and Operations). In addition, spill response resources (both equipment and personnel) are available to respond immediately in the event of a spill throughout the study area as described in Chapter 13, Section 13.5.2.2.

9.6.2.5. Impacts on Health from Spill Response

Spill response activities could impact public safety in the event of a spill from impacts on traffic and therefore traffic safety, and/or increases in noise. Spill response personnel could also be exposed to toxics in responding to a marine spill event. Spill response methods and removal techniques are determined based on the type of material spilled, the environment contaminated, and the potential impacts of response actions. All personnel involved in response would be trained in the appropriate procedures and equipped with personal protective equipment (PPE) to protect against exposure to toxic hazards.

Response to marine spills of xylenes or reformate would consist of eliminating sources of ignition, taking steps to notify people and vessels in downwind areas of the potential hazards (fire and inhalation risks), short-term evacuations (if warranted) for the downwind general public and vessel crew, and placement of sorbent booms, if needed, to protect sensitive areas. These

activities would be short in duration–3 days or less–which is the time estimated for 99.5 percent of the spill material to evaporate and break down via natural processes in the worst-case scenario (330,000 bbl). Air concentrations would be acceptable to breathe within 24 hours. The size of the exclusion zone where evacuations would be required would be dependent on the location and volume of the spill and the tidal and meteorological conditions at the time of the event. Based on the Mississippi River spill, the needed exclusion zone could be larger than a half mile in a worst-case or maximum most probable spill scenario. These types of spills do not use any cleaning agents (such as dispersants) and cleanup would not require the use of additional chemicals.

Impacts on public health due to spill response activities are therefore considered ***less than significant***.

9.6.2.6. Impacts on Health from Land Transport Spills during Operations

The transport via truck of ammonia, sulfolane, and perchloroethylene to the refinery during operations could impact health through potential inhalation exposures in the event of a spill during transport. None of these materials are considered flammable by the NFPA (NFPA flammability rating of 0 or 1); therefore, a fire or explosion risk due to transport is not a concern. Table 9-13 provides the NFPA hazard ratings for the three materials that are either new or have increased usage and would be shipped to the refinery via trucks.

Should a spill occur, inhalation of the chemicals, particularly ammonia, could cause adverse effects. A spill would be localized (in the area around the truck); however, if ammonia vapors were venting, evacuations in a wider area could be required. Some people were evacuated along Interstate-90 in 2016 when a crash involving an anhydrous ammonia truck released ammonia vapors. No member of the public was harmed. First responders promptly responded (in this case, a fire department), an exclusion zone was established, and some people were evacuations (Buhr 2016). The proposed project will use aqueous ammonia, not anhydrous. Aqueous ammonia is safer to transport and handle (WAHLCO 2017).

Human receptors could be temporarily exposed to spill vapors via inhalation if they are present where the spill occurs. Ammonia is very volatile and would rapidly evaporate, and its vapors are also the most acutely toxic of the three materials. Perchloroethylene is much less volatile, so the potential for inhalation risk with perchlorate is much less reduced. Given that materials would be transported via roads that do not pass through highly populated areas (from I-5 to the refinery via SR20 and West March Point Road), public receptors are not anticipated to be significantly impacted by a truck spill should it occur.

Washington State Department of Transportation and trained people and equipment would immediately respond to any spill. Washington State Patrol would

Anhydrous Ammonia Spilled in Crash

A tanker truck carrying anhydrous ammonia was involved in a crash on Interstate-90 in August of 2016. One of four tanks on the truck was ruptured and vented ammonia. Members of the Cle Elum fire department were on the scene within 10 minutes. One fire fighter reported breathing problems and was treated by a medic and released. The nearby rest stop and nearest downwind residences were evacuated, other residents in the area were instructed to shelter in place. Interstate 90 was closed for about 6 hours (Buhr 2016).

assist in establishing an exclusion zone around the spill, rerouting traffic as needed, and notifying the Department of Ecology for hazardous material clean-up (Skagit County 2005).

To prevent road transport-related accidents that could lead to a spill, Tesoro conducts monthly audits of truck drivers' loading practices to ensure they comply with safety and spill prevention procedures (refer to Appendix 2-A, Existing Programs and Operations). Ammonia, perchloroethylene, and sulfolane are regulated by the U.S. Department of Transportation as hazardous materials; therefore, the packaging, labeling, and transportation of these materials follow federal safety requirements. Considering the limited size of potential transportation related spills, the short duration, and the available response organizations, the potential impact is considered ***less than significant.***

9.6.3. Summary of Potential Impacts on Health from Unplanned Events

The potential impacts of the proposed project discussed in this section are summarized in Table 9-15.

Table 9-15: Summary of Unplanned Events Risk and Potential Impacts on Health

Impact Topic	Impact Summary	Potential Impact Significance	
		Less than Significant	***Potentially Significant***
Construction and Operations			
Fire and explosion at the refinery	There would be less than significant impacts on public health and safety for people outside the refinery in the event of a fire or explosion during construction or operations as a fire/explosion is not likely to extend beyond refinery boundaries. On-site workers could be impacted. These workers have proper training and protective equipment to prevent/minimize exposure. The refinery maintains an on-site trained fire-fighting unit and a fire or explosion would be quickly contained within the refinery property as demonstrated by the historical record at the refinery.	√	
Spills at the refinery	There would be less than significant impacts on public health for people outside the refinery in the event of a fuel spill during construction or a spill of xylenes, sulfolane, or ammonia during operations because of the spill containment and response measures in place. On-site workers could be impacted; however, workers have proper training and protective equipment to prevent/minimize exposure. A spill would be quickly contained and cleaned up and is unlikely to extend outside the refinery property.	√	

Impact Topic	Impact Summary	Potential Impact Significance	
		Less than Significant	***Potentially Significant***
Operations			
Marine spills – Worst Case and Maximum Most Probable scnearios	There could be impacts on public health from inhalation of xylenes or reformate spilled into the marine environment due to a vessel collision or allision in the marine vessel transportation route or at the refinery wharf. Worst-case or maximum most probable spill volumes could result in public exposures exceeding health-based air quality criteria for up to 24 hours if people were located near a spill. There is a negligible to low likelihood of these spill scenarios occurring and significant spill prevention and spill response measures are in place (see Chapter 13, Marine Transportation)		√
Marine spills – Average Most Probable scenario	The average most probable volume spills would not result in concentrations exceeding health-based levels. There is a negligible to low likelihood of this spill scenario occurring.	√	
Marine spill response	There could be less than significant public health impacts during spill response efforts from inhalation of spilled materials, increased traffic, and noise. Such impacts could include short-term evacuations if needed to prevent inhalation exposures, short-term traffic delays due to re-routing, potential minor increases in noise expected to be a 5 dBA change or less in NSAs. Spill responders would also have a less than significant exposure as spilled materials break down completely within 60 hours, responders will have proper training and protective equipment, and responders will be limiting the potential for worker and public exposure to spilled materials.	√	
Land transport spills	There could be impacts on public health in the event of a spill of ammonia, sulfolane, or perchloroethylene during road transport. A spill would most likely occur on an industrial road (on SR 20 or West March Point between I-5 and the refinery) not close to any residential or densely populated areas; therefore, only minimal exposure of human receptors to hazardous substances is expected and the spill would be contained to the area around the truck. The duration of exposure for any spill would be short given the relatively small volume and the emergency response efforts (1 day).	√	

9.6.4. Potential Impacts of the No Action Alternative

Under the no action alternative, Tesoro would not proceed with the proposed project. Because no construction or operations would take place under the no action alternative, there would be no new risk of unplanned events that could impact human health.

9.6.5. Additional Mitigation Measures

Air emissions from a worst-case spill scenario or a maximum most probable spill scenario would be ***potentially significant*** for 24 hours if the spill occurred near a populated area. There are no additional recommendations for mitigation measures due to the following:

- The extensive marine vessel safety measures that are in place in the marine vessel transportation route and for loading/unloading safety at the wharf
- The resources (both equipment and personnel) available for spill response throughout the study area

Vessel safety measures and spill response procedures are detailed in Chapter 13, Marine Transportation.

9.7. CUMULATIVE IMPACTS

As described above, construction and operation of the proposed project could result in less than significant impacts to environmental health resources, with the exception of marine spills, which would result in a potentially significant impact. Within the study area, there has been significant past agricultural, industrial, commercial, and residential growth that has resulted in impacts on air quality, vehicle traffic, and ambient noise levels. Given this development, the proposed project's modifications to the refinery would have a limited cumulative additive impact with respect to increasing potential risk to public health and safety. There are no present or reasonably foreseeable future actions that would impact environmental health resources in the March Point area; therefore, cumulative impacts as a result of the proposed project in addition to the past impacts on environmental health resources associated with refinery development on March Point are considered to be negligible.

Cumulative impacts from increased vessel traffic on the risk of a marine spill are addressed in Chapter 13, Section 13.6, Cumulative Impacts from Marine Transportation.

9.8. REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1999. *Public Health Statement for Total Petroleum Hydrocarbons (TPH).*

_____. 2004. T*oxicological Profile for Ammonia*. US Department of Health and Human Services. September 2004. Accessed on March 10. 2017. Retrieved from: https://www.atsdr.cdc.gov/toxprofiles/tp126.pdf

_____. 2007. *Toxicological Profile for Xylene.* Accessed: December 2016. Retrieved from: https://www.atsdr.cdc.gov/ToxProfiles/tp71.pdf

_____. 2010. *Toxicological Profile for Ethylbenzene.* Accessed: December 2016. Retrieved from: https://www.atsdr.cdc.gov/ToxProfiles/tp110.pdf

_____. 2015. *Toxicological Profile for Tetrachloroethylene.* Accessed: December 2016. Retrieved from: https://www.atsdr.cdc.gov/PHS/PHS.asp?id=263&tid=48

American Cancer Society. 2014. *Cancer Facts & Figures 2014*. Atlanta: American Cancer Society. Accessed: July 2016. Retrieved from: http://www.cancer.org/acs/groups/content/@research/documents/webcontent/acspc-042151.pdf

_____. 2016. *Key Statistics for Bladder Cancer.* Atlanta: American Cancer Society. Accessed: August 2016. Retrieved from: http://www.cancer.org/cancer/bladdercancer/detailedguide/bladder-cancer-risk-factors

Alaska DHSS (State of Alaska Department of Health and Social Services). 2010. *Sulfolane Fact Sheet*. Accessed: July 2016. Retrieved from: http://dhss.alaska.gov/dph/Epi/eph/Documents/sulfolane/SulfolaneHealthFactSheet.pdf

Bies, David A., and Colin H. Hansen. 2009. *Engineering Noise Control: Theory and Practice.* Fourth Edition, School of Mechanical Engineering, University of Adelaide, South Australia.

Blystone. 2011. *National Toxicology Program Board of Scientific Counsellors Meeting, Sulfolane*. December 2011.

Buhr, T. 2016. Anhydrous Ammonia Spilled in Crash. The Daily Record. August 4, 2016. http://www.dailyrecordnews.com/news/anhydrous-ammonia-spilled-in-crash/article_4180c71a-abd0-5eb5-b3e9-60dc68eb30e1.html

Cavanaugh, William J., and Gregory C. Tocci. 1998. *Environmental Noise the Invisible Pollutant*. Accessed: April 14, 2016. Retrieved from: http://www.nonoise.org/library/envarticle/

CH2M Hill, Rodino, Inc., and Peterson Resources. 2016. *Tesoro Anacortes Refinery Clean Products Upgrade Project Vessel Traffic Assessment*.

County Health Rankings (County Health Rankings & Roadmaps). 2016. *How Healthy is Your Community?* Accessed: July 2016. Retrieved from: http://www.countyhealthrankings.org/

CRAB (County Road Administration Board). 2016. *Skagit County Roads Traffic Volumes*. August 10, 2016. Accessed: Retrieved from: ftp://www.crab.wa.gov/Mobility/Skagit/pdf's/2016%20ADT.pdf

Dong, Chunjiao, Stephen H. Richards, Baoshan Huang, and Ximiao Jiang. 2013. *Identifying the Factors Contributing to the Severity of Truck-Involved Crashes***.** International Journal of Injury Control and Safety Promotion*,* October 18, 2013.

Ecology (Washington State Department of Ecology). 2008. *Concerns about Adverse Health Effects of Diesel Engine Emissions White Paper*. Accessed March 10, 2017. Retrieved https://fortress.wa.gov/ecy/publications/documents/0802032.pdf

Ecology (Washington State Department of Ecology). 2016. *Air Quality*. Accessed March 30, 2016. Retrieved from: http://www.ecy.wa.gov/programs/air/airhome.html

Farland, W. 2014. *Perspective on the Journal of Applied Toxicology Article, Development of a chronic non-cancer oral reference dose and drinking water screening level for sulfolane using benchmark dose modeling*. Toxicology Excellence for Risk Assessment (TERA) May 30, 2014. Accessed: Retrieved from: http://www.tera.org/Peer/sulfolane/

FTA (Federal Transit Administration). 2006. *Transit Noise and Vibration Impact Assessment.* May 2006. Accessed: March 10, 2017. Retrieved from: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Noise_and_Vibration_Manual.pdf

Gresenz, C., and J. Escarce. 2011. *Spillover effects of community uninsurance on working-age adults and seniors, an instrumental variables analysis*. Medical Care, Volume 49, No. 9 pp14-21. September 2011.

Hadley, Jack. 2003. *Sicker and Poorer–The consequences of being uninsured: a review of the research on the relationship between health insurance, medical care use, health, work, and income.* Medical Care Research and Review, vol. 60 No. 2 (Supplement to June 2003) pp 3S-75S.

Hadley, J., and P. Cunningham. 2005. *Perception, reality and health insurance: uninsured as likely as insured to perceive need for care but half as likely to get care.* Issue Brief, Findings from HSC, No. 100. Center for Studying Health System Change. October 2005.

HEI (Health Effects Institute). 2010. *Traffic-related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects*. Special Report 17: HEI Panel of the Health Effects of Traffic-Related Air Pollution.

IARC (International Agency for Research on Cancer). 2000. *Ethylbenzene*. Monographs on the Evaluation of Carcinogenic Risks to Humans, 77: 227–66. Accessed: July 2016. Retrieved from: http://monographs.iarc.fr/ENG/Monographs/vol77/mono77-10.pdf

Innamaa, S., I. Norros, P. Kuusela, R. Rajamäki, and E. Pilli-Sihvola. 2014. *Road Traffic Incident Risk Assessment, Accident Data Pilot on Ring I of The Helsinki Metropolitan Area.* VTT TECHNOLOGY, 172. Accessed: September 2016. Retrieved from: http://www.vtt.fi/inf/pdf/technology/2014/T172.pdf

Levy, J.I., S.L. Greco, and J.D. Spengler. 2002. *The Importance of Population Susceptibility for Air Pollution Risk Assessment: A Case Study of Power Plants near Washington, DC*. Environmental Health Perspectives, 110(12): 1253-1260.

Marchesini, P., and W. Weijermars. 2010. *The Relationship between Road Safety and Congestion on Motorways*. Leidschendam: SWOV Institute for Road Safety Research, The Netherlands. R-2010-12.

National Center for Health Statistics. 2016. *Health Indicators Warehouse.* Accessed: July 2016. Retrieved from: www.healthindicators.gov

National Cancer Institute. 2016. *State Cancer Profiles--Washington: Brain & ONS, 2008-2012; Leukemia, 2008-2012; and Non-Hodgkin Lymphoma, 2008-2012*. Accessed: May 5, 2016. Retrieved from: https://www.statecancerprofiles.cancer.gov

NFPA (National Fire Protection Association). 2016. *NFPA Code 704 - Standard System for the Identification of the Hazards of Materials for Emergency Response.* Accessed: Retrieved from: http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards?mode=code&code=704

Nishimura, Katherine K., Joshua M. Galanter, Lindsey A. Roth, Sam S. Oh, Neeta Thakur, Elizabeth A. Nguyen, Shannon Thyne, Harold J. Farber, Denise Serebrisky, Rajesh Kumar, Emerita Brigino-Buenaventura, Adam Davis, Michael A. LeNoir, Kelley Meade, William Rodriguez-Cintron, Pedro C. Avila, Luisa N. Borrell, Kristen Bibbins-Domingo, Jose R. Rodrigues-Santana, Saunak Sen, Fred Lurmann, John R. Balmes, and Esteban G. Burchard. 2013. *Early Life Air Pollution and Asthma Risk in Minority Children: The GALA II and SAGE II Studies*. AJRCCM Article in press.

Patel, M.M., and R.L. Miller. 2009. *Air Pollution and Childhood Asthma: Current Advances and Future Directions*. Current Opinion in Pediatrics**,** 21(2): 235-42.

Phelan J., B. Link, and P. Tehranifar. 2010. *Social conditions as fundamental causes of health inequalities: theory, evidence, and policy implications*. Journal of Health and Social Behavior 51(s) s28-s40.

Professional Mariner. 2007. *Tanker spills xylene in Mississippi after colliding with barges.* February 28, 2007. Accessed: Retrieved from: http://www.professionalmariner.com/February-2007/Tanker-spills-xylene-in-Mississippi-after-colliding-with-barges/

Samish Indian Nation. 2013. *Draft Environmental Impact Statement: Samish Indian Nation Trust Acquisition and Casino Project*. Prepared by Analytical Environmental Services. June 5, 2013.

Skagit County. 2005. *LEPC Hazardous Materials Contingency Plan, Draft.* May 2005. Retrieved from: https://www.skagitcounty.net/EmergencyManagement/Documents/SkagitLEPCPLAN.pdf

Skagit County and Ecology (Skagit County and Washington Department of Ecology). 2016. *Shell Anacortes Rail Unloading Facility EIS*. October 2016.

Tesoro (Tesoro Refining & Marketing Company LLC). 2016a. *Anacortes Refinery Oil Spill Contingency Plan*. Revision 10. February 2016. First Approved July 10, 2013. Expires March 24, 2019.

_____. 2016b. *Traffic Numbers (Construction/Operations)*. March 2, 2016.

U.S. Census Bureau. 2017. *2011-2015 American Community Survey 5-Year Estimates*. Accessed: March 2017. Retrieved from: https://www.census.gov/programs-surveys/acs/news/data-releases.2011.html

Union of Concerned Scientists. 2016. The EPA's Tier 3 Standards. http://www.ucsusa.org/clean-vehicles/vehicles-air-pollution-and-human-health/epa-tier-3-standards.html#.WJeCdLU0PIU

USCG (U.S. Coast Guard). 2016. *USCG Dock Operations Manual*. WAC 173-180-415 (1). March 2, 2016.

USEPA (U.S. Environmental Protection Agency). 2002. *Health Assessment Document for Diesel Engine Exhaust*. U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington, DC. EPA/600/8-90/057F, 2002. Accessed March 10, 2017. Retrieved from: https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=17881

_____. 2009. EPA/R-08/139B: *Integrated Science Assessment for Particulate Matter.* Second External Review Draft. National Center for Environmental Assessment, Office of Research and Development.

_____. 2013. *Integrated Science Assessment for Nitrogen Dioxide.* EPA National Center for Environmental Assessment, Office of Research and Development.

_____. 2016. *Particulate Matter and Health*. Accessed: May 5, 2016. Retrieved from: https://www3.epa.gov/pm/health.html

WAHLCO. Accessed 2016. *Aqueous Ammonia Delivery System: A Safer Alternative to Anhydrous Ammonia*. https://wahlco.com/products/aqueous-ammonia-systems/

Washington DOH (Washington State Department of Health). 2012. *Health of Washington State: Asthma*. Updated June 29, 2012.

_____. 2015. *Skagit County Chronic Disease Profile*. Accessed: July 2016. Retrieved from: http://www.doh.wa.gov/portals/1/Documents/Pubs/345-271-ChronicDiseaseProfileSkagit.pdf

Washington Traffic Safety Commission. 2014. *Native American Traffic Fatality Proportions, 2005-2014.* Accessed: March 10, 2017. Retrieved from: http://wtsc.wa.gov/research-data/crash-data-materials/

WSDOT (Washington State Department of Transportation). 2015. *2014 Traffic Planning Trends (TPT)Traffic Counts*. WSDOT- Statewide Travel and Collision Data Office (STCDO) Geospatial_Data_Presentation_Form: vector digital data. Published:May 31, 2015 Accessed: March 30, 2016. Retrieved from: http://www.wsdot.gov/mapsdata/geodatacatalog/Maps/noscale/DOT_TDO/TrafficGeoportal/2014_TPTTrafficCounts.htm

_____. 2015. *Biological Assessment Preparation for Transportation Projects - Advanced Training Manual*. Version 10-2015. October 2015. Accessed: April 2016. Retrieved from: http://www.wsdot.wa.gov/Environment/Biology/BA/BAguidance.htm#manual