4.7 Hazards and Hazardous Materials

This section discusses potential public safety and hazardous materials impacts associated with the Rail Spur Project. Potential impacts include train derailments and unloading accidents that could lead to fires and explosions. The information in this section outlines the environmental setting, regulatory setting, significance criteria, potential risk scenarios and their significance, and the levels of risk to the public associated with these scenarios.

In addition, this section presents an analysis of the estimated frequency and volume of oil spills for the Rail Spur Project. For a discussion of air toxic health risk impacts, please see Section 4.3, Air Quality.

Trains could enter California at least five different locations (one at the north end of the state from Oregon, two at the northeast from Nevada, one at the southeast from Nevada, and one at the south from Arizona). Depending upon the route taken by the train they could arrive at the SMR from the north or the south. It is unknown what route UPRR would use to deliver the trains to the SMR. Coming from the north the routes merge at the UPRR Roseville Rail Yard. From the south the routes merge at the Colton Rail Yard. Given that the route the trains would travel to get to these two UPRR yards is speculative, the EIR has evaluated in more detail the impacts of trains traveling from these two UPRR yards to the SMR.

Beyond the two UPRR Yards, trains could travel any number of routes (refer to Figure 2-8). Also, crude oil delivered to California by UPRR would generally pass through either of these two rail yards in route to the SMR. Depending upon the source of the crude oil, crude oil trains could use any portion of the UPRR network between Roseville/Colton and the source location for the crude oil. The exact route that would be taken would depend upon a number of factors, that could include the source of the crude oil, weather conditions, train traffic conditions, etc. Since the routes past Roseville and Colton are somewhat speculative, the EIR has discussed in a more qualitative nature the potential public safety impacts of train traffic beyond these two rail yards.

4.7.1 Environmental Setting

For the Rail Spur Project, environmental setting or baseline conditions reflect the baseline risks of upset associated with the existing refinery and rail operations. For the public safety analysis, the study area includes the mainline rail corridors, the rail spur at the SMR, and the rail unloading facilities and associated pipelines.

An upset condition at the listed facilities or along transportation routes could have an adverse impact to the public and environmental resources in the study area. Impacts to air, water, cultural, agricultural, and biological resources are discussed in the appropriate sections of this Environmental Impact Report. The study area that would be affected in terms of public safety by an upset condition includes any population located in the vicinity of the SMR and along the mainline rail routes. This would include residences, businesses, educational institutions, etc.

4.7.1.1 Mainline Rail

This section discusses the existing rail operations along the mainline route that could be used by crude oil trains servicing the SMR.

Existing Rail Traffic

The UPRR mainline routes that could be used to move crude oil to the SMR are currently used for both freight and passenger trains. The level of traffic on these mainlines varies by location. In the Bay Area and Los Angeles there are higher levels of train traffic then along the Coast Line. In these two metropolitan areas trains volumes (freight and passenger trains) varies between 10 and 75 trains per day depending upon location and track (Caltrans 2013). Freight trains carry a variety of freight, including crude oil, automobiles, lumber, hazardous materials, etc.

Rail traffic on the UPRR Coast Line through San Luis Obispo County is relatively light. Currently, there are no more than 6 freight trains per day (Caltrans 2013) and six passenger trains daily. The average number of freight trains running the length of the Coastal Route is about two per day. Local freight trains operate along various sections of the Coast Line, primarily from Salinas north and Oxnard south. Freight trains travelling through San Luis Obispo County carry a variety of freight, including crude oil, automobiles, lumber, and hazardous materials. One crude oil unit train currently traverses San Luis Obispo County traveling from San Ardo to Los Angeles, which occurs two to three times per week. This crude oil train has been in operation for about 20 years.

Rail Track Type

Rail track is classified into six categories with Class 6 having the most stringent track tolerances and maintenance schedules. With the advent of higher speed trains additional classifications have been defined for Classes 7 and 8. Mainline tracks are generally Class 4 or 5 and typically have lower accident rates per million miles. Class 6 track is used for high speed trains up to 110 mph, and is found in the Northeast Corridor between Washington D.C. and New York. Class 4 track is the dominant class for mainline track used in passenger and long-haul freight service. The Class of a track determines the maximum speed that freight and passenger trains can travel. Higher class tracks have higher allowable speeds.

The Federal Railroad Administration (FRA) establishes minimum design standards for each of the various track classes. Each railroad establishes their own design standards for their tracks that meet or exceed the FRA standards. The FRA standards cover the track roadbed, track geometry, track structure (ballast, cross-ties, joints, switches, etc.). These minimum track safety standards are specified in 49 CFR 213.

For the route from Roseville to the SMR via Oakland 94.9% of the tack is Class 4 and 5. For the route from Roseville to the SMR via Altamont Pass 95.2% of the track is Class 4 and 5. For the route from Colton to the SMR 96.7% of the track is Class 4 and 5. Appendix H.1 provides more information on the track class for each of the possible mainline rail routes to the SMR. The mainline track along the three routes has an allowable gross weight rating of 315,000 lbs per car, with the exception of the track from Niles Junction to near Stockton (Altamont Pass), which has an allowable gross weight rating of 286,000 lbs per car (UPRR 2013). The weight of the Rail Spur Project cars would be limited to a maximum of 286,000 lbs.

Rail Accident Rates

Train accidents are required to be reported to the Federal Railroad Administration (FRA) and typically identify the causes and contributing factors as shown in Table 4.7.1.

The transportation of hazardous substances poses a potential for fires, explosions, and hazardous materials releases. In general, the greater the miles traveled the greater the potential for an accident. Statistical accident frequency varies. The size of a potential release is related to the maximum volume of a hazardous substance that can be released in a single accident, should an accident occur, and the type of failure of the containment structure, e.g., rupture or leak. The potential consequences of the accident are related to the size of the release, the population density at the location of the accident, the specific release scenario, the physical and chemical properties of the hazardous material, and the local meteorological conditions.

Table 4.7.1 Rail Incidents - Initiating and Contributing Causes

Human Errors	Equipment Failures	System or Procedural Failures	External Events
Humping	Non-dedicated car	Routing	Vandalism/sabotage
Switching	Crossing guard failure	Control	At-grade crossing
Coupling	Overpressure	-yards	Flood/washout
Transloading	Leaking valve	-mainline	Earthquake
lnerting	Roller bearing failure	-in-plant	Rockslide/landslide
Contamination	Coupling failure	Interim storage at holding track	Avalanche
Heating and cooling	Broken rail	Car tracking	Fire on rail siding
Overfilling	Brake failure	Container specification	Fog/blizzard
Speeding	Roadbed failure	Emergency response training	Bridge failure
Ignoring closed	Protective coating/ insulation/thermal protection failure	Maintenance	
Block signals	Relief device failure	Inspection	
Driver impairment	Track sensor failure	Circuitous routing	
	Switchgear failure		
	Signal failure		
	Communications system failure		
	Broken wheel		
	Suspension failure		
	Fitting defect		
	Corrosion		
	Material defect		
	Bad weld		

Source: CCPS, 1995.

The FRA regulations on reporting railroad accidents/incidents are found primarily in 49 CFR Part 225. The purpose of the regulations is to provide FRA with accurate information concerning the hazards and risks that exist on the nation's railroads. The FRA uses this information for regulatory and enforcement purposes, and for determining comparative trends of railroad safety. These regulations preempt states from prescribing accident/incident reporting requirements.

The FRA compiles data on railroad-related accidents, injuries and fatalities to depict the nature and cause of rail-related accidents and improve safety. Train accident data reported in the United States, in California, and accidents reported by UPRR between 2003 and 2012 are summarized in Table 4.7.2. Based on the train accident data for the United States, the train accident rate varied from 2.3 accidents per million miles traveled to 4.4 accidents per million miles traveled over the 10-year period from January 2003 to December 2012. The train accident rate for 2012 was 2.3 train accidents per million miles traveled.

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Train Accident Data for United States										
Total Accidents/ Incidents(1)	14,371	14,523	14,311	13,803	13,936	12,958	11,263	11,628	11,434	10,747
Accident Rate(2)	19.3	18.9	18.1	17.0	17.6	16.7	16.9	16.5	15.9	14.5
Train Accidents	3,019	3,385	3,266	2,998	2,693	2,482	1,911	1,902	2,019	1,712
Train Accident Rate(2)	4.1	4.4	4.1	3.7	3.4	3.2	2.9	2.7	2.8	2.3
Train Accidents on Main Line	976	1,033	1,021	981	854	767	619	616	619	489
Accident Rate on Main Line	1.5	1.5	1.5	1.4	1.2	1.1	1.1	1.0	1.0	0.7
Hazmat Releases(3)	30	31	39	30	46	22	22	21	21	25
Cars Carrying Hazmat(4)	7,790	8,185	8,034	9,000	8,562	8,451	6,440	7,509	7,582	6,680
Hazmat Cars Damaged/Derailed	1,072	998	915	1,047	1,056	751	749	719	666	661
Cars Releasing	41	49	52	71	76	38	44	40	66	45
Total Train Miles(5)	743.3	770.2	789.0	813.6	793.6	774.1	668.0	704.8	717.6	740.4
Train Accident Data for UPRR										
Total Accidents/ Incidents(1)	2,562	2,708	2,747	2,749	2,597	2,287	1,696	1,708	1,738	1,718
Train Accidents	801	960	955	891	723	637	444	447	547	501
Hazmat Releases	8	7	12	5	6	5	3	4	4	6
Train Accident Data for California										
Total Accidents/ Incidents(1)	1,002	865	965	944	950	843	727	720	704	807
Train Accidents	175	185	199	191	155	120	101	87	88	83
Hazmat Releases	1	3	2	3	4	1	1	1	0	0
Train Accident Data for San Luis Obispo County										
Total Accidents/ Incidents	9	10	3	7	15	7	9	8	7	6
---Total fatalities	2	.	2	1	1	.	1	3	.	2
---Total nonfatal	6	10	1	6	12	6	8	6	7	5
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	3	3	.	2	2	3	.	1	.	.
EOD illnesses	.	.	.	.	1	.	.	.	.	.
Total EOD cases	3	3	.	2	3	3	.	1	.	.
Cases with days absent from work	3	3	.	2	1	2	.	1	.	.
Trespasser deaths, not at Rail Crossing	2	.	2	1	1	.	.	3	.	.

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Trespasser injuries, not at Rail Crossing	.	.	.	3	3	1	1	4	.	1
Train Accidents	.	.	.	.	.	.	.	.	.	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	.	.	.	.	.	.	.	.	.	.
--- Hazmat cars	.	.	.	.	.	.	.	.	.	.
--- Cars damaged	.	.	.	.	.	.	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	1	2	.	.	2	2	1	.	.	1
--- deaths	.	.	.	.	.	.	1	.	.	2
--- injuries	.	2	.	.	.	1	.	.	.	.
--- at public crossing	.	.	.	.	1	.	1	.	.	.
Other Accidents/ Incidents[1]	8	8	3	7	13	5	8	8	7	5
--- deaths	2	.	2	1	1	.	.	3	.	.
--- injuries	6	8	1	6	12	5	8	6	7	5
Train Accident Data for Monterey										
Total Accidents/ Incidents	3	4	4	10	3	.	1	1	3	.
---Total fatalities	.	.	1	2	.	.	.	1	.	.
---Total nonfatal	.	2	1	1	2	.	.	.	1	.
EOD deaths	.	.	.	1	.	.	.	.	.	.
EOD injuries	.	1	1	1	1	.	.	.	.	.
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	.	1	1	2	1	.	.	.	.	.
Cases with days absent from work	.	1	1	1	1	.	.	.	.	.
Trespasser deaths, not at Rail Crossing	.	.	1	.	.	.	.	1	.	.
Trespasser injuries, not at Rail Crossing	.	.	.	.	1	.	.	.	.	.
Train Accidents	1	.	.	4	1	.	.	.	1	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	.	.	.	1	1	.	.	.	1	.
--- Hazmat cars	.	.	.	2	.	.	.	.	.	.
--- Cars damaged	.	.	.	1	.	.	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	1	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
--- at public crossing	.	.	.	.	.	.	.	.	.	.
Other Accidents/	1	.	.	4	.	.	.	.	1	.

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Incidents[1]										
--- deaths	.	.	.	.	1	.	.	.	.	.
--- injuries	1	.	.	2	.	.	.	.	.	.
Train Accident Data for Santa Clara County										
Total Accidents/ Incidents	5	3	9	6	7	3	4	2	1	.
---Total fatalities	.	.	2	3	1	.	.	.	.	.
---Total nonfatal	2	.	6	1	2	3	3	.	1	.
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	1	.	3	1	1	.	1	.	.	.
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	1	.	3	1	1	.	1	.	.	.
Cases with days absent from work	1	.	1	.	.	.	1	.	.	.
Trespasser deaths, not at Rail Crossing	.	.	2	3	1	.	.	.	.	.
Trespasser injuries, not at Rail Crossing	.	.	2	.	.	2	1	.	.	.
Train Accidents	3	2	1	2	3	.	1	.	.	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	2	1	.	.	1	.	1	.	.	.
--- Hazmat cars	1	1	1	1	2	.	.	.	.	.
--- Cars damaged	.	.	.	.	.	.	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	.	.	.	1	.	.	.	.	.	.
--- injuries	.	1	.	.	.	.	.	.	.	.
--- at public crossing	.	.	.	.	.	.	.	.	.	.
Other Accidents/ Incidents[1]	3	1	1	2	3	.	1	.	.	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	1	.	.	1	.	.	.	.	.
Train Accident Data for Alameda County										
Total Accidents/ Incidents	12	13	22	14	16	16	10	12	13	8
---Total fatalities	.	.	2	.	.	2	3	.	1	1
---Total nonfatal	8	9	11	5	10	7	8	7	9	4
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	7	6	6	3	7	4	2	1	5	1
EOD illnesses	.	.	.	1	.	.	.	.	.	.
Total EOD cases	7	6	6	4	7	4	2	1	5	1
Cases with days absent from work	5	5	3	3	1	1	.	1	3	.
Trespasser deaths,	.	.	1	.	.	2	3	.	1	1

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
not at Rail Crossing										
Trespasser injuries, not at Rail Crossing	.	1	3	1	1	.	1	.	.	1
Train Accidents	4	5	9	6	3	5	1	5	3	3
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	1	3	2	4	1	.	.	3	2	2
--- Hazmat cars	3	1	4	2	2	4	1	1	.	.
--- Cars damaged	.	.	.	.	.	.	.	1	.	.
--- Cars releasing	.	.	1	.	.	1	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	.	1	2	.	.	.	.	.	1	1
--- injuries	.	.	.	.	.	.	.	.	1	.
--- at public crossing	.	.	.	.	.	.	.	.	.	.
Other Accidents/ Incidents[1]	3	5	8	6	3	5	1	5	1	1
--- deaths	1	.	1	.	.	.	.	.	1	2
--- injuries	.	.	1	.	.	.	.	.	1	.
Train Accident Data for Contra Costa County										
Total Accidents/ Incidents	9	5	1	11	9	4	5	5	1	2
---Total fatalities	.	1	1	1	2	1	.	.	.	.
---Total nonfatal	5	2	.	3	1	2	2	5	1	2
EOD deaths	.	.	.	.	1	.	.	.	.	.
EOD injuries	2	1	.	2	1	2	2	1	.	2
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	2	1	.	2	2	2	2	1	.	2
Cases with days absent from work	2	.	.	2	1	2	1	1	.	2
Trespasser deaths, not at Rail Crossing	.	1	1	1	1	1	.	.	.	.
Trespasser injuries, not at Rail Crossing	1	1	.	1	.	.	.	2	.	.
Train Accidents	4	2	.	7	5	1	3	.	.	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	1	.	.	3	4	.	1	.	.	.
--- Hazmat cars	2	.	.	3	.	.	.	.	.	.
--- Cars damaged	.	.	.	.	.	.	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	1	2	.	1	1	1	2	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
--- at public crossing	.	.	.	.	.	.	.	.	.	.

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Other Accidents/ Incidents[1]	3	.	.	7	4	1	2	.	.	.
--- deaths	1	2	.	.	1	.	1	.	.	.
--- injuries	1	.	.	.	2	1	1	.	.	.
Train Accident Data for Solano County										
Total Accidents/ Incidents	2	2	3	3	4	2	4	2	1	.
---Total fatalities	.	.	.	1	2	.	1	.	.	.
---Total nonfatal	2	.	2	1	1	2	4	2	1	.
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	1	.	2	1	1	1	3	1	.	.
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	1	.	2	1	1	1	3	1	.	.
Cases with days absent from work	1	.	.	1	.	.	2	1	.	.
Trespasser deaths, not at Rail Crossing	.	.	.	1	2	.	.	.	.	.
Trespasser injuries, not at Rail Crossing	1	.	.	.	.	.	.	.	.	.
Train Accidents	.	1	.	.	1	1	.	.	.	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	1	.	.	.	.
HAZMAT Releases	.	.	.	.	.	.	.	.	.	.
--- Hazmat cars	.	.	.	.	.	.	.	.	.	.
--- Cars damaged	.	.	.	.	.	1	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	.	1	.	.	1	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
--- at public crossing	.	.	.	.	.	.	.	.	.	.
Other Accidents/ Incidents[1]	.	.	.	.	.	.	.	.	.	.
--- deaths	.	1	.	.	1	1	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
Train Accident Data for Yolo County										
Total Accidents/ Incidents	4	2	.	2	5	2	1	1	2	.
---Total fatalities	2	.	.	.	1	.	.	.	.	.
---Total nonfatal	.	1	.	.	1	1	2	1	1	.
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	.	1	.	.	1	1	.	1	.	.
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	.	1	.	.	1	1	.	1	.	.
Cases with days absent from work	.	1	.	.	.	1	.	1	.	.

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Trespasser deaths, not at Rail Crossing	2	.	.	.	.	.	.	.	.	.
Trespasser injuries, not at Rail Crossing	.	.	.	.	.	.	2	.	1	.
Train Accidents	1	1	.	2	3	1	.	1	1	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	1	.	.
HAZMAT Releases	1	.	.	.	1	1	.	1	.	.
--- Hazmat cars	.	.	.	2	2	.	.	.	.	.
--- Cars damaged	.	.	.	.	.	.	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	.	1	.	.	.	.	.	.	1	.
--- injuries	.	.	.	.	.	.	.	.	.	.
--- at public crossing	.	.	.	.	.	.	.	.	.	.
Other Accidents/ Incidents[1]	1	1	.	2	2	1	.	.	.	.
--- deaths	.	.	.	.	1	.	.	1	1	.
--- injuries	.	.	.	.	.	.	.	.	1	.
Train Accident Data for Sacramento County										
Total Accidents/ Incidents	12	11	9	10	15	12	4	7	8	5
---Total fatalities	4	1	2	.	2	6	.	2	2	4
---Total nonfatal	2	6	4	9	11	8	2	3	6	1
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	1	3	1	5	1	2	1	.	1	.
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	1	3	1	5	1	2	1	.	1	.
Cases with days absent from work	1	2	1	3	.	1	1	.	1	.
Trespasser deaths, not at Rail Crossing	4	1	2	.	2	5	.	1	2	4
Trespasser injuries, not at Rail Crossing	1	1	3	4	3	5	.	3	1	.
Train Accidents	6	3	3	1	3	1	1	1	.	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	1	1	1	.	2	.	.	1	.	.
--- Hazmat cars	4	1	2	1	1	.	1	.	.	.
--- Cars damaged	.	1	.	.	.	.	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	1	.	.	.	.	1	.	.	.	.
--- injuries	1	1	.	.	.	.	.	.	.	.

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
--- at public crossing	1	1	.	.	.	.	.	.	.	.
Other Accidents/ Incidents[1]	4	2	3	1	3	1	1	.	.	.
--- deaths	1	.	.	.	.	.	.	1	.	.
--- injuries	1	.	.	.	.	.	.	.	.	.
Train Accident Data for San Joaquin County										
Total Accidents/ Incidents	12	18	33	23	21	23	12	13	16	19
---Total fatalities	.	2	1	2	3	2	2	1	1	4
---Total nonfatal	7	5	13	7	8	12	5	8	11	7
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	2	3	12	4	6	5	1	2	3	5
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	2	3	12	4	6	5	1	2	3	5
Cases with days absent from work	2	2	8	1	5	2	.	2	1	4
Trespasser deaths, not at Rail Crossing	.	1	1	2	2	1	2	1	1	2
Trespasser injuries, not at Rail Crossing	3	1	1	1	1	.	3	1	3	.
Train Accidents	5	8	19	14	8	4	4	2	4	3
--- deaths	.	.	.	1	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	3	4	7	2	2	1	1	1	1	2
--- Hazmat cars	2	1	11	6	3	3	1	.	3	.
--- Cars damaged	.	.	.	1	3	.	1	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	.	3	1	5	.	.	1	1	.	1
--- injuries	2	.	.	.	.	.	1	.	.	.
--- at public crossing	.	.	.	.	.	.	1	.	.	.
Other Accidents/ Incidents[1]	3	5	18	11	7	3	3	2	4	2
--- deaths	.	3	1	3	1	1	.	.	.	1
--- injuries	.	1	2	1	1	.	1	.	1	1
Train Accident Data for Santa Barbara County										
Total Accidents/ Incidents	5	.	1	5	5	4	2	2	2	.
---Total fatalities	3	.	.	3	1	2	1	.	.	.
---Total nonfatal	2	.	.	2	1	2	1	2	1	.
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	.	.	.	1	1	2	.	2	.	.
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	.	.	.	1	1	2	.	2	.	.
Cases with days	.	.	.	.	1	1	.	1	.	.

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
absent from work										
Trespasser deaths, not at Rail Crossing	2	.	.	3	1	2	1	.	.	.
Trespasser injuries, not at Rail Crossing	2	.	.	.	.	.	1	.	1	.
Train Accidents	1	.	.	.	2	.	.	.	1	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	.	.	.	.	2	.	.	.	.	.
--- Hazmat cars	.	.	.	.	.	.	.	.	.	.
--- Cars damaged	.	.	.	.	.	.	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	1	.	.	.	.	.	.	.	1	.
--- injuries	.	.	.	.	.	.	.	.	.	.
--- at public crossing	.	.	.	.	.	.	.	.	.	.
Other Accidents/ Incidents[1]	.	.	.	.	2	.	.	.	.	.
--- deaths	1	.	.	.	.	.	.	.	1	.
--- injuries	.	.	.	.	1	.	.	.	.	.
Train Accident Data for Ventura County										
Total Accidents/ Incidents	2	4	.	4	2	4	2	2	.	.
---Total fatalities	1	1	.	2	1	2	.	.	.	.
---Total nonfatal	.	2	.	1	.	2	1	.	.	.
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	.	1	.	1	.	2	.	.	.	.
EOD illnesses	.	.	.	.	.	.	.	.	.	.
Total EOD cases	.	1	.	1	.	2	.	.	.	.
Cases with days absent from work	.	.	.	.	.	1	.	.	.	.
Trespasser deaths, not at Rail Crossing	1	1	.	1	1	2	.	.	.	.
Trespasser injuries, not at Rail Crossing	.	1	.	.	.	.	1	.	.	.
Train Accidents	.	.	.	.	1	.	1	1	.	.
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
HAZMAT Releases	.	.	.	.	.	.	.	.	.	.
--- Hazmat cars	.	.	.	.	.	.	.	.	.	.
--- Cars damaged	.	.	.	.	.	.	.	.	.	.
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	.	.	.	.	1	.	1	1	.	.

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
--- injuries	.	.	.	.	.	.	.	.	.	.
--- at public crossing	.	.	.	.	.	.	.	.	.	.
Other Accidents/ Incidents[1]	.	.	.	.	.	.	.	.	.	.
--- deaths	.	.	.	.	1	.	1	1	.	.
--- injuries	.	.	.	.	.	.	.	.	.	.
Train Accident Data for Los Angeles County										
Total Accidents/ Incidents	76	72	82	75	92	76	66	47	48	51
---Total fatalities	3	6	6	5	4	2	4	6	3	6
---Total nonfatal	60	42	63	50	71	54	45	31	34	30
EOD deaths	.	.	.	1	.	.	.	1	.	.
EOD injuries	52	28	45	35	55	35	28	14	17	13
EOD illnesses	1	.	2	.	6	2	.	.	.	.
Total EOD cases	53	28	47	36	61	37	28	15	17	13
Cases with days absent from work	41	16	33	26	37	17	21	7	11	10
Trespasser deaths, not at Rail Crossing	3	3	4	1	1	1	3	3	.	6
Trespasser injuries, not at Rail Crossing	2	5	8	4	3	4	2	5	3	1
Train Accidents	6	15	13	13	14	17	11	9	9	11
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	3	.	1	.	1	3	.	.	.	.
HAZMAT Releases	6	6	5	4	7	12	3	4	5	2
--- Hazmat cars	.	5	4	5	4	5	6	4	2	6
--- Cars damaged	.	.	.	1	1	.	1	.	.	1
--- Cars releasing	.	.	.	.	.	.	.	.	.	.
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	.	4	4	3	2	.	1	1	2	2
--- injuries	2	.	1	.	.	1	.	.	.	1
--- at public crossing	.	.	.	.	.	1	.	.	.	.
Other Accidents/ Incidents[1]	4	13	9	11	9	12	10	8	7	10
--- deaths	.	2	3	2	5	4	1	1	2	.
--- injuries	1	2	3	2	.	4	.	2	2	3
Train Accident Data for San Bernardino County										
Total Accidents/ Incidents	57	42	51	52	45	49	29	35	32	36
---Total fatalities	2	1	1	2	1	3	2	1	3	1
---Total nonfatal	40	25	27	30	27	28	15	25	15	20
EOD deaths	.	.	.	.	.	.	.	.	.	.
EOD injuries	36	23	20	20	25	26	12	21	10	14
EOD illnesses	.	.	1	3	1	.	.	.	.	.
Total EOD cases	36	23	21	23	26	26	12	21	10	14

Table 4.7.2 Summary of National and California Train Accident Data

Category	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cases with days absent from work	27	18	11	13	17	16	7	17	5	12
Trespasser deaths, not at Rail Crossing	2	1	1	2	1	3	2	.	3	1
Trespasser injuries, not at Rail Crossing	3	1	2	1	.	.	.	1	2	2
Train Accidents	16	17	21	21	15	14	12	11	11	15
--- deaths	.	.	.	.	.	.	.	.	.	.
--- injuries	2	.	.	2	.	.	.	3	.	.
HAZMAT Releases	3	5	3	4	5	1	2	3	5	4
--- Hazmat cars	6	4	10	10	7	7	1	4	4	5
--- Cars damaged	2	2	1	1	1	1	3	1	.	1
--- Cars releasing	.	.	2	1	.	2	2	.	.	2
Highway Rail Incidents	.	.	.	.	.	.	.	.	.	.
--- deaths	5	6	5	5	2	3	4	3	2	3
--- injuries	.	1	1	.	.	.	.	2	.	1
--- at public crossing	.	1	.	.	.	.	.	1	.	.
Other Accidents/ Incidents[1]	16	14	18	15	14	12	8	8	9	14
--- deaths	.	2	2	6	1	2	4	1	2	.
--- injuries	5	4	5	5	6	3	4	4	2	2

Source: Federal Railroad Administration, Office of Safety Analysis data reports.
http://safetydata.fra.dot.gov/officeofsafety/publicsite/query/tenyr1a.aspx

(1) Total accident/incidents include train accidents, highway-rail accidents, and other incidents.
(2) Events per million train miles.
(3) Number of accidents involving a hazmat release.
(4) Number of rail cars that released hazardous materials.
(5) Number in million train miles.

Of the train accidents reported during the 10-year period (a total of 128,974), less than one percent of the train accidents resulted in a release of hazardous materials (287/128,974 = 0.0022 or 0.22%).

Train accident data reported for each of the Counties along the mainline routes that could be used by the Rail Spur Project crude oil trains are also presented in Table 4.7.2.

Local Safety Hazard Sites in California

The CPUC has identified a number of local safety hazard sites (LSHS) within California along the mainline rail routes and adopted rules governing operations at some of these sites. Table 4.7.3 provides a list of these LSHS. These sites consist of steep grades and tight curves, and also have historically high frequencies of derailments. As described in California Public Utilities Code § 7711, factors that the CPUC considers in determining a LSHS includes at a minimum the following:

1. The severity of grade and curve of track.
2. The value of special skills of train operators in negotiating the particular segment of railroad line.
3. The value of special railroad equipment in negotiating the particular segment of railroad line.
4. The types of commodities transported on or near the particular segment of railroad line.
5. The hazard posed by the release of the commodity into the environment.
6. The value of special railroad equipment in the process of safely loading, transporting, storing, or unloading potentially hazardous commodities.
7. The proximity of railroad activity to human activity or sensitive environmental areas.

Table 4.7.3 List of Local Safety Hazard Sites in California

Generic Name	County	Track Length (miles)	Number of Derailments 2009-13
UPRR Yuma Line	San Bernardino/Riverside	56.4	32
UPRR Bakersfield Line	Kern	24.9	10
UPRR Shasta Line	Siskiyou	26.9	4
UPRR Bakersfield Line	San Bernardino	23.0	4
UPRR Roseville District	Placer	10.0	3
UPRR Feather River Division	Butte and Plumas	93.1	2
UPRR Yuma Line	Riverside	6.0	1
BSNF Gateway	Plumas	10.0	1
BNSF San Diego	San Diego	4.0	1
UPRR Coast Line (Cuesta Grade)	San Luis Obispo	14.0	0
Central Oregon and Pacific Railroad	Siskiyou	9.7	0
UPRR Feather River Division	Plumas	29.0	0
UPRR Cima Grade	San Bernardino	18.1	0
BNSF Cajon	San Bernardino	15.0	0
BNSF Cajon	San Bernardino	0.5	0
BNSF Cajon	San Bernardino	25.6	0

Source: Adapted from CPUC Annual Railroad Local Safety Hazard Site Report 2014.

Depending upon the route that is taken to get from the California border to the SMR, the crude oil train would have to traverse a number of LSHS. LSHS account for a disproportionate share of derailments occurring in California. Within the previous five calendar years, California has experienced 342 derailments. Of that amount, 58 derailments, or 17 percent, have occurred at or near local safety hazard sites (includes the LSHS track plus the distance of track one mile on each side of the local safety hazard site (CPUC 2014).

A train traveling from the north from Roseville would have to use the track along Cuesta Grade in San Luis Obispo County. Over the past five years (2009-2013) no derailments occurred on Cuesta Grade. From Colton to the SMR no LSHS would be used. Between Roseville or Colton and the California Border the train would have to traverse a number of other LSHS depending upon the route taken.

4.7.1.2 Existing Refinery Operations

The SMR processes crude oil and produced gas, both of which could present risks to the public. Crude oil is processed and then stored in tanks that could spill and ignite, creating thermal radiation impacts. Thermal radiation impacts from crude oil tank fires could cause injury 220 feet away. The closest population to the crude oil tanks at the Refinery is industrial area 425 feet northeast of the crude oil storage facilities. The closest residence to the crude oil tanks, which is located within the industrial area, is 1,200 feet northeast of the tank storage area. The gas processing equipment and piping are within the Refinery, at least 1,700 feet from the Refinery fence line and the closest receptor on industrial property. Given the limited population and significant distance between these receptors and the Refinery, there would not be a significant risk level. A search of historical release data for the Refinery through the Federal Emergency Response Notification System indicates that in the last 28 years a total of 16 reportable releases occurred (from 1982 through 2010). Fifteen of these releases were associated with releases of excess gases to the emergency-only flare stack due to several equipment failures, including boiler and compressor failures. In 2004, a leaking crude oil pipeline caused a release. Additional information on the existing hazards at the SMR can be found in the Throughput Increase EIR (SLOC 2012).

Currently, the rail operations associated with the Phillips 66 Refinery consist of the export of petroleum coke from the SMR for commercial use throughout the U.S. and abroad. A train typically arrives every Wednesday and drops off 18 to 20 empty cars. After delivering the empty cars, the engine picks up any full cars and leaves the SMR (the engine operates for approximately a half hour on site). Each full car hauls approximately 100 tons. The delivered empty cars are filled with coke during the following week and moved around on site by the ‘shuttlewagon.’ The shuttlewagon, also referred to as a ‘switching locomotive’ is a small unit compared to an actual train locomotive. The shuttlewagon operates less than two hours per week. Fuel consumption is typically less than five gallons of diesel per week.

4.7.1.3 Population Density

Figures 4.7-1 and 4.7-2 show the population densities along the mainline rail routes that could be used by the Rail Spur Project crude oil trains between the SMR and the Roseville and Colton rail yard . Each of the rail routes were divided into numerous segments based on population density using the categories listed in Table 4.7.4.

Table 4.7.4 Representative Default Population Densities

Designation	Density	Description
Remote	20 people/sq mile	Non-metropolitan area with scattered housing; farms
Rural	100 people/sq mile	Small village or town; recreation areas
Suburban	1,000 people/sq mile	Typical suburbs; mixed use areas
Urban	3,000 people/sq mile	Small city; densely populated suburbs; congested commercial areas
High	10,000+ people/sq mile	Very dense city area

Source: CCPS, 1995.

Figure 4.7-1 UPRR Route and Population Densities (Roseville to SMR Routes)

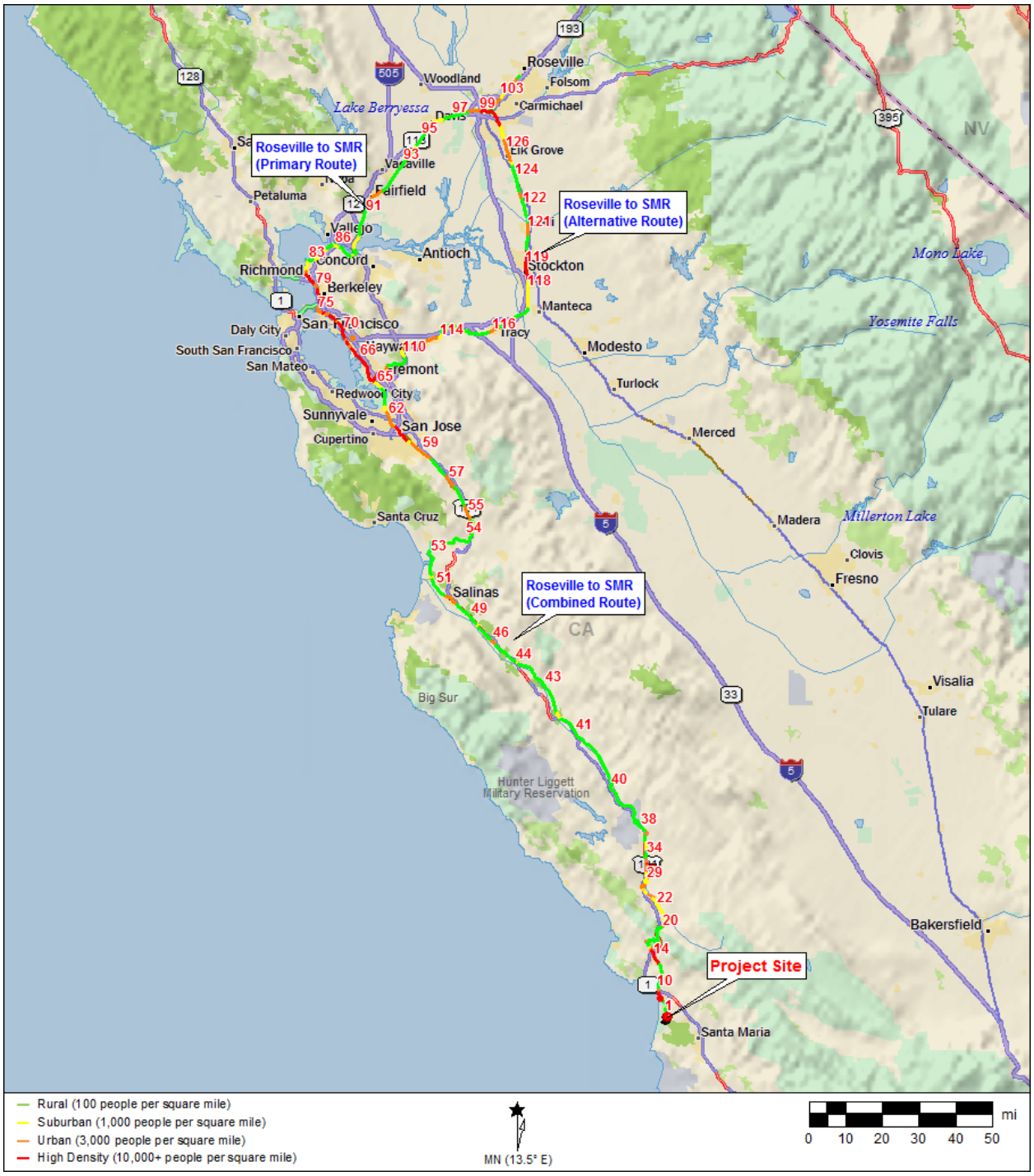
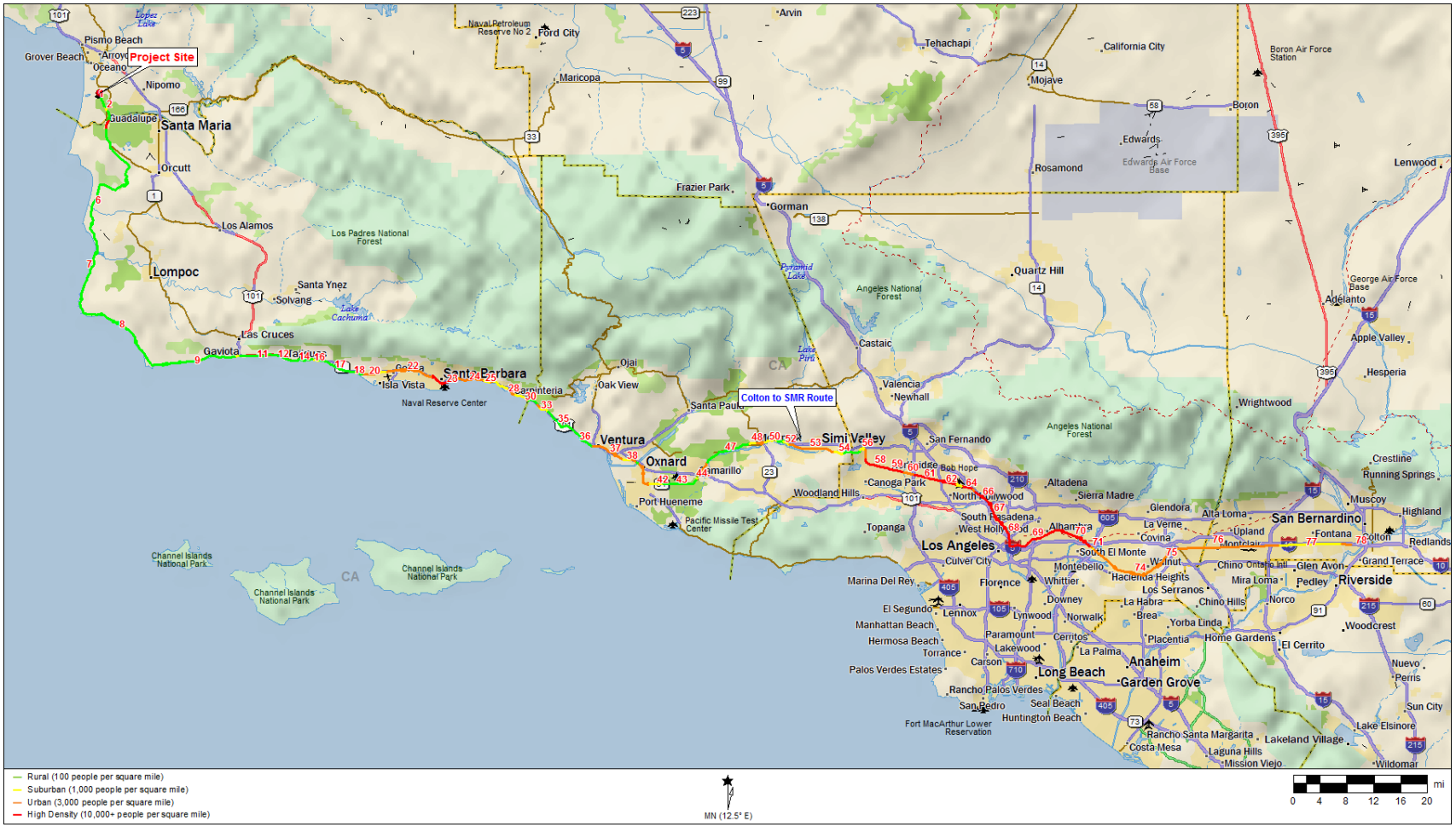


Figure 4.7-2 UPRR Route and Population Densities (Colton to SMR Route)



4.7.2 Regulatory Setting

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

4.7.2.1 Federal Laws and Regulations

Federal Regulation of Oil Transportation by Rail

The Federal Railroad Administration (FRA), which is part of the US Department of Transportation (USDOT), is responsible for regulating the safety of the nation's railroad system. FRA promulgates railroad safety regulations (49 CFR subtitle B, chapter II (parts 200-299)) and orders, enforces those regulations and orders as well as the Hazardous Materials Regulations at 49 CFR Parts 171-180, and the Federal railroad safety laws, and conducts a comprehensive railroad safety program.

FRA's regulations promulgated for the safety of railroad operations involving the movement of freight address: (1) railroad track; (2) signal and train control systems; (3) operating practices; (4) railroad communications; (5) rolling stock; (6) rear-end marking devices; (7) safety glazing; (8) railroad accident/incident reporting; (9) locational requirements for the dispatch of U.S. rail operations; (10) safety integration plans governing railroad consolidations, mergers, and acquisitions of control; (11) alcohol and drug testing; (12) locomotive engineer and conductor certification; (13) workplace safety; (14) highway-rail grade crossing safety; and other subjects. The FRA inspects rail facilities throughout the country in order to ensure compliance with its own regulations, and those adopted by the Pipeline and Hazardous Materials Safety Administration (PHMSA).

The FRA is also responsible for conducting inspections of rail lines and bridges throughout the United States. However, they have a limited number of inspectors. In July 2010, new federal rules on railroad bridge safety standards were issued (49 CFR Parts 213 and 237). The bridge safety standards final rule requires the railroad companies that own the bridges to:

- Implement bridge management programs that include at minimum annual inspections of railroad bridges,
- Conduct special inspections if the weather or other conditions warrant such inspections,
- Maintain an inventory of all railroad bridges and know their safe load capacities,
- Maintain design documents and to document all repairs, modifications, and inspections of each bridge,
- Ensure bridge engineers, inspectors and supervisors must meet minimum qualifications,
- Make sure bridge inspections are conducted under the direct supervision of a designated railroad bridge inspector, and
- Conduct internal audits of bridge management programs and inspections.

PHMSA is another department within the USDOT. Pursuant to the Hazardous Materials Transportation Act, PHMSA adopts regulations governing the transport of hazardous materials by rail, highway, air, and water. The PHMSA regulations are set forth in Chapter I of Subtitle B of Title 49 of the Code of Federal Regulations (CFR). The FRA enforces the requirements set forth in PHMSA regulations.

The National Transportation Safety Board (NTSB) is an independent federal agency. The NTSB reviews transportation accidents, including rail accidents, and makes recommendations to FRA and PHMSA for regulatory changes.

The American Association of Railroads (AAR) is an industry trade association that represents railroads, including the major freight railroads in the United States, Canada, and Mexico. AAR adopts standards for the design and construction of tank cars used by its members. In some cases, these standards are more stringent than the requirements set forth in FRA or PHMSA regulations.

The PHMSA regulations classify hazardous materials based on each material's hazardous characteristics. Crude oil is assigned to hazard Class 3, based on specified characteristics of flammability and combustibility (49 CFR 173.120). The key PHMSA regulations governing rail transport are summarized below:

- 49 CFR 172, *Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans*, addresses numerous aspects of safe rail transport, including requirements pertaining to the hazardous materials classification of crude oil.

- 49 CFR 173, *General Requirements for Shipments and Packages*, specifies requirements for bulk packaging including the type of tank car a hazardous material must be transported in based on its assigned Packing Group.

- 49 CFR 174, *Carriage by Rail*, specifies handling, loading, and unloading requirements for the safe transport and shipping of hazardous materials, which must be performed by qualified personnel. This part also addresses correct placarding of rail cars to indicate the hazard classifications of the materials, and segregation of incompatible materials.

- 49 CFR 176, *Carriage by Vessel*, provides further details on vessel carriage requirements for different classes of hazardous materials.

- 49 CFR 179, *Specifications for Tank Cars*, provides design standards and construction requirements for rail tank cars including tank wall thickness, tank mounting, welding certification, pressure relief devices, protection of fittings, loading/unloading valve requirements, coupler vertical restraints systems, tank-head puncture-resistance systems, and thermal protection systems.

Under PMHSA regulations, all crude oil must be shipped in a tank car built to the "DOT-111" specification. DOT-111 tank cars are non pressure tank cars. The cars have a minimum shell thickness of 7/16 inch and a design pressure of up to 500 pounds per square inch gage (psig).

DOT-111 tank cars are used to transport a variety of hazardous materials, including crude oil and ethanol. The DOT-111 design has been in use since the 1960's. Different "packaging" requirements apply to different crude oils transported by rail. PHMSA regulations assign hazardous materials to "Packing Groups" based on the risks posed by the transport of each hazardous material. Packing Group I indicates great danger; Packing Group II indicates medium danger; and Packing Group III indicates minor danger (49 CFR 171.8).

Materials assigned to Packing Group I are subject to the most stringent packaging requirements, while crude oils assigned to Packing Group III are subject to the least stringent requirements. Individual crude oils can be classified as Packing Group I, II, or III materials depending on their boiling points and flash points. Any crude oil with a boiling point below 95° Fahrenheit is assigned to Packing Group I. Packing Group II includes any crude oil with a boiling point above 95° and a flash point below 73° Fahrenheit. Packing Group II crude oils are less volatile than Packing Group I, although more volatile than Packing Group III crude oils. Packing Group III includes any crude oil with a boiling point above 95° and a flash point between 73° and 140° Fahrenheit.

Recent and Ongoing Development in the Regulation of Crude Transportation by Rail

As a result of recent train accidents involving the derailment of crude oil trains a number of recent regulatory actions by the Federal government and voluntary actions by the railroads have taken place.

A summary of some of the recent crude oil rail accidents are listed below.

- On March 27, 2013, a train derailed in Parkers Prairies Minnesota. Fourteen cars on a Canadian Pacific Railway train caring Canadian crude derailed, and one car was heavily damaged, An estimated 30,000 gallons of crude spilled, but the was no fire or explosion.
- May 21, 2013, a train derailed near Jansen Saskatchewan Canada. A Canadian Pacific Railway mixed freight train jumped the tracks and five cars derailed, with one leaking its content. An estimated 24,000 gallons spilled, but there was no fire or explosion.
- On July 6, 2013, a train carrying Bakken crude oil in 72 DOT-111 Legacy Tank Cars derailed in the downtown area of Lac-Mégantic, Canada. The waybills described the Bakken crude oil as a Class 3 hazardous material, assigned to Packing Group III. The engineer stopped the train at a designated crew change point, left the lead locomotive engine idling, and departed the area leaving the train unattended on the mainline track. A fire was later reported on one of the train's unattended locomotive engines and local emergency personnel responded. An employee of the rail line also arrived on scene. After the responders departed, the unattended train began to move and gather speed, travelling uncontrolled for 7.4 miles down a descending 1.2% grade into the town of Lac-Mégantic. The train reached a top speed of 60-70 miles per hour. Sixty-three of the tank cars derailed and, of these, at least 60 released a total of 1.6 million gallons of crude oil. The spilled oil ignited immediately, and the resulting fire engulfed the tank cars and the surrounding area. A total of 47 people died in the accident. Thirty buildings were destroyed and 2,000 people were evacuated. Approximately 26,000 gallons of crude oil was discharged into the Chaudière River.

- On November 8, 2013, a train derailed in Aliceville, Alabama. The train was carrying 90 DOT-111 Legacy Tank Cars with Bakken crude oil from North Dakota to a refinery in the Gulf Coast. Approximately 12 of the tank cars released crude oil and caught fire. There were no reported injuries.
- On December 30, 2013, a train carrying 106 DOT-111 Legacy Tank Cars with Bakken crude oil collided with a grain train in Casselton, North Dakota. A total of 34 cars from both trains derailed, including 20 that were carrying Bakken crude oil. These cars released their contents, exploded and burned for over 24 hours. There were no reported injuries. Over 1,400 residents were evacuated from the scene.
- On April 30, 2014 in Lynchburg, Virginia, a train carrying crude oil tank cars derailed. Some of the cars that derailed were Legacy DOT-111 Tank Cars, while some were 1232 Tank Cars. One of the 1232 Tank Cars ruptured and released crude oil that ignited. In addition, over 33,000 gallons of Bakken crude oil was released into the James River. There were no reported injuries.
- February 16, 2015, a CSX train carrying Bakken crude derailed in the Mount Carbon area of Fayette County West Virginia. Twenty-six cars of a 109- car train derailed, and 19 of the cars were involved in the fire and explosion. Some of the spilled oil entered the Kanawha River. There were no reported injuries.
- March 5, 2015, a BNSF train carrying Bakken crude derailed near the town of Galena Illinois. Eight of the 105-car train derailed. Two of the cars were involved in a fire and explosion. There were no reported injuries.
- March 7, 2015, and Canadian National Railway train charring Alberta crude derailed in Northern Ontario. The train had about 94 cars and approximately 30 of them derailed. Some of the cars caught fire and oil entered the Mattagami River System. There were no reported injuries.

As a result of accidents a number of actions have been taken by the Federal government and the railroads to address the safety issues associated with moving crude oil by rail. These actions include the following:

- On August 2, 2013, FRA issued Emergency Order No. 28 establishing additional requirements for unattended trains. The requirements are designed to ensure that unattended trains, locomotives, and tenders on the mainline track or siding are properly secured against unintended movement. The Order was prompted by the Lac-Mégantic accident, which involved an unattended train.
- Also on August 2, 2013, PHMSA and FRA issued joint Safety Advisory 2013-06. The advisory recommended eight specific actions that railroads and shippers should take relating to unattended trains, procedures for securing trains, safety and security plans, and proper classification of hazardous materials for shipment.
- On September 6, 2013 PHMSA published an Advanced Notice of Proposed Rulemaking. This rulemaking will address, among other topics, the need to enhance the standards for

DOT-111 tank cars used to transport Packing Group I and II hazardous materials, including crude oil.

- On November 20, 2013, PHMSA and FRA issued joint Safety Advisory 2013-07 relating to the proper classification of crude oil for purposes of the packing group requirements. The Advisory expressed the concern that, based on its low flash point, the Bakken crude involved in the Lac-Mégantic incident should not have been classified as a Packing Group III material. The Advisory stressed the importance of proper classification based on flash point and other hazardous characteristics. The Advisory also announced a joint FRA/PHMSA compliance initiative called "Operation Classification." The initiative involves unannounced inspections at oil producing sites to ensure that crude oil has been properly tested and classified before it is loaded onto a tank car. The initiative has informally been referred to as the "Bakken Blitz."

- On January 2, 2014, PHMSA issued a Safety Alert reinforcing the need to properly characterize crude oil offered for shipment. The Alert specifically noted that, because of its low flash point and/or low boiling point, light sweet crude such as Bakken should typically be assigned to Packing Group I or II.

- On January 21, 2014, NTSB issued Safety Recommendations R-14-4, 14-5, and 14-6 to PHMSA relating to the Lac-Mégantic incident. NTSB reported its finding that, based on its flash point, the Bakken crude oil released in the Lac-Mégantic incident was improperly characterized as a Packing Group III material, and should have been assigned to Packing Group II. NTSB recommended, among other things, that PHMSA and FRA work together to require shippers to accurately characterize hazardous materials offered for shipment to ensure that they are assigned to the correct packing group.

- On January 23, 2014, NTSB issued Safety Recommendations R-14-1, 14-2, and 14-3 to FRA relating to the Lac-Mégantic incident. NTSB repeated its findings relating to mischaracterization of Bakken crude oil and recommended that FRA, among other things, audit shippers and railroads to ensure that they are using the correct shipping classifications.

- On February 21, 2014, DOT and AAR announced an agreement relating to the transport of crude oil by rail. AAR and its individual members (including Union Pacific Railroad) agreed to take the following eight specific actions designed to reduce the risk of transporting crude by rail:

  - **Increased Track Inspections** – Effective March 25, 2014, railroads will perform at least one additional internal-rail inspection each year above those required by new FRA regulations on main line routes over which trains moving 20 or more carloads of crude oil travel. Railroads will also conduct at least two high-tech track geometry inspections each year on main line routes over which trains with 20 or more loaded cars of crude oil are moving. Current federal regulations do not require comprehensive track geometry inspections.

  - **Braking Systems** – No later than April 1, 2014, railroads will equip all trains with 20 or more carloads of crude oil with either distributed power or two-way telemetry end-of-

train devices. These technologies allow train crews to apply emergency brakes from both ends of the train in order to stop the train faster.

- **Use of Rail Traffic Routing Technology** – No later than July 1, 2014 railroads will begin using the Rail Corridor Risk Management System (RCRMS) to aid in the determination of the safest and most secure rail routes for trains with 20 or more cars of crude oil. RCRMS is a sophisticated analytical tool, developed in coordination with the federal government, including the U.S. Department of Homeland Security (DHS), PHMSA and FRA. Railroads currently use RCRMS in the routing of security sensitive materials, but it currently does not apply to trains carrying crude oil. This tool takes into account 27 risk factors – including volume of commodity, trip length, population density along the route, local emergency response capability, track quality and signal systems – to assess the safety and security of rail routes.
- **Lower Speeds** – No later than July 1, 2014 railroads will operate trains with 20 or more tank cars carrying crude oil that include at least one older DOT-111 car no faster than 40 miles-per-hour in the federally designated high-threat-urban areas[1] (HTUA) as established by Federal regulations. In the meantime, railroads will continue to operate trains with 20 or more carloads of hazardous materials, including crude oil, at the industry self-imposed speed limit of 50 miles per hour.
- **Community Relations** – Railroads will continue to work with communities through which crude oil trains move to address location-specific concerns that communities may have.
- **Increased Trackside Safety Technology** – No later than July 1, 2014 railroads will begin installing additional wayside wheel bearing detectors[2] if they are not already in place every 40 miles along tracks with trains carrying 20 or more crude oil cars, as other safety factors allow.
- **Increased Emergency Response Training and Tuition Assistance** – Railroads have committed by July 1, 2014 to provide $5 million to develop specialized crude by rail training and tuition assistance program for local first responders. One part of the curriculum will be designed to be provided to local emergency responders in the field, as well as comprehensive training that will be designed to be conducted at the Transportation Technology Center, Inc. (TTCI) facility in Pueblo, Colo. The funding will provide program development as well as tuition assistance for an estimated 1,500 first responders in 2014.
- **Emergency Response Capability Planning** – Railroads will by July 1, 2014 develop an inventory of emergency response resources for responding to the release of large amounts of crude oil along routes over which trains with 20 or more cars of crude oil operate.

[1] High-Threat-Urban Areas are defined by the Federal Government as an area comprising one or more cities and surrounding areas including a 10-mile buffer zone. A list of the HTUA, as determined by the Federal Government, is provided in Appendix H.6.

[2] Wayside wheel bearing detectors are devices that are placed along railroad tracks that detect heat or acoustic signatures, which would indicate that a bearing may fail in the near future. This allows railroad operators to detect defects before they damage track or cause accidents.

This inventory will include locations for the staging of emergency response equipment and, where appropriate, contacts for the notification of communities. When the inventory is completed, railroads will provide DOT with information on the deployment of the resources and make the information available upon request to appropriate emergency responders.

- On March 6, 2014, USDOT issued Emergency Order DOT-OST-2014-0025. Among other things, the Order requires shippers to assign crude oil to Packing Groups I or II, thereby assuring that Bakken and other highly volatile crude oils cannot be mischaracterized and assigned to Packing Group III.

- On May 7, 2014, USDOT issued Emergency Order DOT-OST-2014-0067. The Order requires railroads to notify the State Emergency Response Commission for each state in which the railroad transports Bakken crude oil. The notice must contain certain prescribed information, including the number of trains, the train routes, and the characteristics of the crude oil. Absent the required notice, railroads are prohibited from transporting Bakken crude oil. The Order allows states to effectively plan emergency response procedures for an accident involving Bakken crude oil.

- On May 7, 2014, FRA and PHMSA issued a joint Safety Advisory relating to the transport of Bakken crude by rail. The Advisory recommended that shippers and railroads use the rail tank car designs with the "highest level of integrity reasonably available within their fleet" for the shipment of Bakken crude oil. The Advisory also specifically advised shippers and railroads to avoid the use of DOT-111 Legacy Tank Cars for shipping Bakken crude oil, to the extent reasonably practicable.

- On July 23, 2014 USDOT issued a Notice of Proposed Rulemaking (NPRM) covering enhanced tank car standards and operations controls for high-hazard flammable trains. PHMSA in coordination with the FRA, are proposing: (1) new operational requirements for certain trains transporting a large volume of Class 3 flammable liquids; (2) improvements in tank car standards; and (3) revision of the general requirements to ensure proper classification and characterization of mined gases and liquids. These proposed requirements are designed to lessen the frequency and consequences of train accidents/incidents involving certain trains transporting a large volume of flammable liquids, including trains carrying crude oil. This proposed rule is discussed further in the section below.

USDOT Proposed Rulemaking for High-Hazard Flammable Trains (HHFT)

USDOT regulates the design standards for rail cars. The rail car type for crude oil are DOT-111 non-pressurized tank cars (DOT 111A60W1). DOT-111 tank cars for crude oil service have a maximum capacity of 30,000 gallons. Following an accident in Illinois in 2009, the NTSB made a number of safety recommendations to both the American Association of Railroads (AAR) and the DOT Pipeline and Hazardous Materials Safety Administration (PHMSA) regarding DOT-111 tank cars. The NTSB recommended to PHMSA that it require modifications be made on all existing and new DOT-111s. PHMSA did not mandate a fleet retrofit, nor has it published new standard designs for crude and ethanol tank cars. The AAR-North American Tank Car Committee, independent of a federal mandate, implemented nearly all of the recommendations made to PHMSA in its design standards for new crude oil and ethanol tank cars ordered after

October 2011. Specifically, all new DOT-111 tank cars for ethanol and crude oil service beginning October 1, 2011 are required to have:

- Increased head and shell thickness;
- Normalized steel;
- ½-inch thick ½-height head shields; and
- Top fitting protection.

The NTSB also recommended the AAR review the design requirements for attaching center sills or draft sills for all tank cars. The AAR-North American Tank Car Committee has studied the stub sill issue and will revise those standards as recommended. Nearly 25 percent of the DOT-111 fleet carrying crude today meets the higher design standards, as outlined above.

On July 23, 2014 the DOT issued a notice of proposed rulemaking covering enhanced tank car standards and operational controls for high-hazard flammable trains, which include crude oil trains. As part of the proposed DOT rulemaking, the PHMSA, in coordination with the Federal Railroad Administration (FRA), is proposing: (1) new operational requirements for certain trains transporting a large volume of Class 3 flammable liquids[3]; (2) improvements in tank car standards; and (3) revision of the general requirements for offerors to ensure proper classification and characterization of mined gases and liquids. These proposed requirements are designed to lessen the frequency and consequences of train accidents/incidents (train accidents) involving certain trains transporting a large volume of flammable liquids. Table 4.7.5 provides a summary of the elements of the proposed rule.

Table 4.7.6 further summarizes the three options that DOT is considering for use with HHFT. As noted in Table 4.7.5, PHMSA proposes to require one of these options for new tank cars constructed after October 1, 2015, if those tank cars are used as part of HHFT.

In addition, for all three Options, PHMSA proposes the following timelines for tank cars used as part of HHFT: (1) for Packing Group I, DOT Specification 111 tank cars (pre and post October 2011 designs) are not authorized after October 1, 2017; (2) for Packing Group II, DOT Specification 111 tank cars are not authorized after October 1, 2018; and (3) for Packing Group III, DOT Specification 111 tank cars are not authorized after October 1, 2020. The crude transported to the SMR could be in Packing Group I.

On May 1, 2015 PHMSA issued the final rules for High-Hazard Flammable Trains (HHFT). The final rule is discussed below in Section 4.7.5.

Liquid Pipelines and Oil Facilities

Hazardous liquid pipelines are under the jurisdiction of the DOT and must follow the regulations in 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline, as authorized by the Hazardous Liquid Pipeline Safety Act of 1979 (49 USC 2004).

[3] A flammable liquid having a flash point of not more than 141°F, or any material in a liquid phase with a flash point at or above 100°F, and would include crude oil.

Table 4.7.5 Proposed Regulatory Requirements for HHFT (USDOT July 23, 2014)

Proposed Requirement	Effected Entity
Better classification and characterization of mined gases and liquids. • Written sampling and testing program for all mined gases and liquids, such as crude oil, to address: (1) frequency of sampling and testing; (2) sampling at various points along the supply chain; (3) sampling methods that ensure a representative sample of the entire mixture; (4) testing methods to enable complete analysis, classification, and characterization of material; (5) statistical justification for sample frequencies; and, (6) duplicate samples for quality assurance. • Require offerer to certify that program is in place, document the testing and sampling program, and make program information available to DOT personnel, upon request.	Offerors / Shippers of all mined gases and liquids
Rail routing risk assessment. • Requires carriers to perform a routing analysis that considers 27 safety and security factors. The carrier must select a route based on findings of the route analysis. These planning requirements are prescribed in 49 CFR 172.820 and would be expanded to apply to HHFTs. Notification to SERCs. • Require trains containing one million gallons of Bakken crude oil to notify State Emergency Response Commissions (SERCs) or other appropriate state delegated entity about the operation of these trains through their States. Reduced operating speeds. • Restrict all HHFTs to 50-mph in all areas • PHMSA is requesting comment on three speed restriction options for HHFTs that contain any tank cars not meeting the enhanced tank car standards proposed by this rule: (1) a 40-mph maximum speed restriction in all areas (2) a 40-mph speed restriction in high threat urban areas; and, (3) a 40-mph speed restriction in areas with a 100K+ population. • PHMSA is also requesting comment on a 30-mph speed restriction for HHFTs that do not comply with enhanced braking requirements. Enhanced braking. • Require all HHFTs be equipped with alternative brake signal propagation systems. Depending on the outcome of the tank car standard proposal and implementation timing, all HHFTs would be operated with either electronic controlled pneumatic brakes (ECP), a two-way end of train device (EOT), or distributed power (DP).	Rail Carriers, Emergency Responders
Enhanced standards for both new and existing tank cars. • Require new tank cars constructed after October 1, 2015 (that are used to transport flammable liquids as part of a HHFT) to meet criteria for a selected option, including specific design requirements or performance criteria (e.g., thermal, top fittings, and bottom outlet protection; tank head and shell puncture resistance). PHMSA is requesting comment on the following three options for the DOT Specification 117: 1. FRA and PHMSA Designed Car, or equivalent 2. AAR 2014 Tank Car, or equivalent 3. Jacketed CPC-1232, or equivalent • Require existing tank cars that are used to transport flammable liquids as part of a HHFT, to be retrofitted to meet the selected option for performance requirements, except for top fittings protection. Those not retrofitted would be retired, repurposed, or operated under speed restrictions for up to five years, based on packing group assignment of the lading.	Tank Car Manufacturers, Tank Car Owners, Shippers and Rail Carriers

HHFT-High-Hazard Flammable Trains
Source: USDOT, 2014.

Table 4.7.6 Proposed Safety Features by Tank Car Option (USDOT July 23, 2014)

Tank Car	Bottom Outlet Handle	GRL (lbs)	Head Shield Type	Pressure Relief Valve	Shell Thickness	Jacket	Tank Material	Top Fittings Protection	Thermal Protection System	Braking
Option 1: PHMSA and FRA Designed Tank Car	Bottom outlet handle removed or designed to prevent unintended actuation during a train accident	286k	Full- height, 1/2 inch thick Head shield	Reclosing pressure relief device	9/16 inch Minimum	Minimum 11-gauge jacket constructed from A1011 steel or equivalent. The jacket must be weather-tight	TC-128 Grade B, normalized steel	TIH Top fittings protection system and nozzle capable of sustaining, without failure, a rollover accident at a speed of 9 mph	Thermal protection system in accordance with §179.18	ECP brakes
Option 2: AAR 2014 Tank Car	Bottom outlet handle removed or designed to prevent unintended actuation during a train accident	286k	Full- height, 1/2 inch thick head shield	Reclosing pressure relief device	9/16 inch Minimum	Minimum 11-gauge jacket constructed from A1011 steel or equivalent. The jacket must be weather-tight	TC-128 Grade B, normalized steel	Equipped per AAR Specifications Tank Cars, appendix E paragraph 10.2.1	Thermal protection system in accordance with §179.18	In trains with DP or EOT devices
Option 3: Enhanced CPC 1232 Tank Car	Bottom outlet handle removed or designed to prevent unintended actuation during a train accident	286k	Full Height 1/2 inch thick head shield	Reclosing pressure relief device	7/16 inch-Minimum	Minimum 11-gauge jacket constructed from A1011 steel or equivalent. The jacket must be weather-tight	TC-128 Grade B, normalized steel	Equipped per AAR Specifications Tank Cars, appendix E paragraph 10.2.1	Thermal protection system in accordance with §179.18	In trains with DP or EOT devices
DOT 111A100 W1 Specification (Currently Authorized)[1]	Bottom Outlets are Optional	263K	Optional; Bare Tanks half height; Jacket Tanks full height	Reclosing pressure relief valve	7/16 inch-Minimum	Jackets are optional	TC-128 Grade B, normalized steel	Not required, but when Equipped per AAR Specifications Tank Cars, appendix E paragraph 10.2.1	Optional	Not required

1. A CPC-1232 tank car is with all of the options included in the design. This is referred to as a post October 1, 2011 tank car and is the tank car design proposed for use by the Applicant.

ECP-Electronically controlled pneumatic; DP-Distributed power; EOT-End of Train

Source: USDOT 2014.

Other applicable Federal requirements are contained in 40 CFR Parts 109, 110, 112, 113, and 114, pertaining to the need for Oil Spill Prevention Control & Countermeasures Plans; 40 CFR Parts 109–114 promulgated in response to the Oil Pollution Act of 1990.

Overview of the 49 CFR 195 Requirements.
Part 195.30 incorporates many of the applicable national safety standards of the:

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

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

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

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

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

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

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

- Correction of unsafe conditions within a reasonable time;
- Procedural manual for operations, maintenance, and emergencies;
- Training;
- Maps;
- Maximum operating pressure;
- Communication system;
- Cathodic protection system;
- External and internal corrosion control;
- Valve maintenance;

- Pipeline repairs;
- Overpressure safety devices;
- Firefighting equipment; and
- Public education program for hazardous liquid pipeline emergencies and reporting.

Overview of 40 CFR Parts 109, 110, 112, 113, and 114
The Spill Prevention, Control and Countermeasure Plans (SPCCs) covered in these regulatory programs apply to oil storage and transportation facilities and terminals, tank farms, bulk plants, oil refineries, and production facilities, as well as bulk oil consumers, such as apartment houses, office buildings, schools, hospitals, farms, and state and federal facilities as follows:

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

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

Emergency Planning and Community Right-to-Know Act
Under the Emergency Planning and Community Right-to-Know Act, or Title III of the Superfund Amendments and Reauthorization Act of 1986, the EPA requires local agencies to regulate the storage and handling of hazardous materials and requires development of a plan to mitigate the release of hazardous materials. Businesses that handle any of the specified hazardous materials must submit to government agencies (i.e., fire departments or Public Health Departments), an inventory of the hazardous materials, an emergency response plan, and an employee training program. The business plans must provide a description of the types of hazardous materials/waste onsite and the location of these materials. The information in the

business plan can then be used in the event of an emergency to determine the appropriate response action, the need for public notification, and the need for evacuation.

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

Hazardous Materials Management Planning

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

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

National Contingency Plan Requirements

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

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

Worker Health and Safety

Occupational Safety and Health Act, 29 CFR et seq.

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

<u>Hazard Communication, 29 CFR 1910.1200</u>

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

Process Safety Management, 29 CFR 1910.119
Under this section, facilities that use, store, manufacture, handle, process, or move hazardous materials are required to:

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

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

4.7.2.2 California Laws and Regulations

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

California Public Utilities Commission (CPUC)
CPUC is the State agency charged with ensuring the safety of freight railroads, inter-city and commuter railroads, and highway-railroad crossings in the State of California. CPUC performs these railroad safety responsibilities through the Railroad Operations and Safety Branch (ROSB) of the Safety & Enforcement Division.

ROSB's mission is to ensure that California communities and railroad employees are protected from unsafe practices on freight and passenger railroads by enforcing rail safety rules, regulations, and inspection efforts; and by carrying out proactive assessments of potential risks before they create dangerous conditions. ROSB personnel investigate rail accidents and safety related complaints, and recommend safety improvements to the Commission, railroads, and the federal government as appropriate. A more detailed listing of the CPUC regulations for railroad is provided in Appendix H.5.

The CPUC is responsible for enforcing federal and state railroad safety requirements, including those governing railroad tracks, facilities, bridges, rail crossings, motive power and equipment, operating practices, and hazardous material shipping requirements. The Rail Spur Project would require review and approval by the CPUC as it relates to the new track and operations that would occur at the SMR.

ROSB currently has 38 certified rail inspectors and has funding to hire seven more. Inspections are divided into five railroad disciplines:

1. Operating Practices – oversight of main, branch and yard train operations, including hours of service, carrier operating rules, employee qualification guidelines, and carrier training and testing programs to determine compliance with railroad occupational safety and health standards, accident and personal injury reporting requirements, and other requirements.
2. Track – oversight of track construction, maintenance and inspection activities.
3. Signal & Train Control – oversight of signal system construction, maintenance and inspection activities.
4. Motive Power & Equipment – oversight of locomotives, freight and passenger rail cars, air brakes, and other safety appliances maintenance and inspection activities.
5. Hazardous Materials – oversight of the rail movements of hazardous materials, such as petroleum and chemical products; and inspection of hazardous materials shippers.

At a minimum mainline track within California is inspected by ROSB inspectors on an annual basis. Any identified track deficiencies are reported to the FRA and the track operator, and repairs are required to be made. (Roger Clugston, CPUC ROSB Manager 2014).

Gas and Liquid Pipelines and Oil Facilities

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

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

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

California Pipeline Safety Act of 1981
The California Pipeline Safety Act gives regulatory jurisdiction for the safety of all intrastate hazardous liquid pipelines and all interstate pipelines used for the transportation of hazardous or highly volatile liquid substances to the CSFM. The law establishes the governing rules for interstate pipelines to be the Federal Hazardous Liquid Pipeline Safety Act and Federal pipeline safety regulations.

Oil Pipeline Environmental Responsibility Act (Assembly Bill 1868)
This Act requires every pipeline corporation qualifying as a public utility and transporting crude oil in a public utility oil pipeline system to be held strictly liable for any damages incurred by "any injured party which arise out of, or are caused by, the discharge or leaking of crude oil or any fraction thereof ..." The law applies only to public utility pipelines for which construction

would be completed after January 1, 1996, or that part of an existing utility pipeline that is being relocated after the above date and is more than three miles in length. The major features signed into law in October 1995 include:

- Each pipeline corporation that qualifies as a public utility that transports any crude oil in a public utility oil pipeline system shall be absolutely liable, without regard to fault, for any damages incurred by any injured party that arise out of, or are caused by, the discharge or leaking of crude oil.
- Damages for which a pipeline corporation is liable under this law are: all costs of response, containment, cleanup, removal, and treatment, including monitoring and administration cost; injury or economic losses resulting from destruction of, or injury to, real or personal property; injury to, destruction of, or loss of natural resources, including but not limited to, the reasonable cost of rehabilitating wildlife habitat, and other resources and the reasonable cost of assessing that injury, destruction, or loss, in any action brought by the State, County, city, or district; loss of taxes, royalties, rents, use, or profit shares caused by the injury, destruction, loss, or impairment of use of real property, personal property, or natural resources; and loss of use and enjoyment of natural resources and other public resources or facilities in any action brought by the State, County, city, or district;
- A pipeline corporation shall immediately clean up all crude oil that leaks or is discharged from a pipeline.
- No pipeline system subject to this law shall be permitted to operate unless the State Fire Marshal certifies that the pipeline corporation demonstrates sufficient financial responsibility to respond to the liability imposed by this section. The minimum financial responsibility required by the State Fire Marshal shall be seven hundred fifty dollars ($750) times the maximum capacity of the pipeline in the number of barrels per day up to a maximum of one hundred million dollars ($100,000,000) per pipeline system, or a maximum of two hundred million dollars ($200,000,000) per multiple pipeline system. For the Pacific Pipeline, the Bill specifically requires $100,000,000 for the financial responsibility (Section l.h.(l)).
- Financial responsibility shall be demonstrated by evidence that is substantially equivalent to that required by regulations issued under Section 8670.37.54 of the Government Code, including insurance, surety bond, letter of credit, guaranty, qualification as a self-insurer, or combination thereof or any other evidence of financial responsibility. The State Fire Marshal shall require that the documentation evidencing financial responsibility be placed on file with that office.
- The State Fire Marshal shall require evidence of financial responsibility to fund post-closure cleanup spots. The evidence of financial responsibility shall be 15 percent of the amount of financial responsibility stated above.

California Accident Release Prevention

The California Accident Release Prevention program mirrors the Federal Risk Management program, except that it adds external events and seismic analysis to the requirements and includes facilities with lower inventories of materials. A California Accident Release Prevention or Risk Management Plan, as administered by the Fire Departments and the EPA, if applicable,

is a document prepared by the owner or operator of a stationary source containing detailed information including:

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

Hazardous Materials and Hazardous Waste

Hazardous Waste Control Law

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

Hazardous Materials Management Planning

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

In January 2014, the Governor's Office convened a Rail Safety Working Group to examine safety concerns and recommend actions the State of California and others should take in response to the emerging risk posed by increased shipments of crude oil by rail into California.

The Working Group includes representatives from the California Public Utilities Commission, California Office of Emergency Services, California Environmental Protection Agency, Department of Toxic Substances Control, California Energy Commission, California Natural

Resources Agency, California Office of the State Fire Marshal, Department of Oil, Gas and Geothermal Resources, and Office of Spill Prevention and Response.

The Working Group published their report on June 10, 2014. The report provides preliminary findings and recommendations to improve emergency response for crude oil trains in California. Some of the key recommendations in the report covered increasing the number of CPUC rail inspectors, improve emergency preparedness and response programs at both the state and local level, require railroad to provide better information to emergency responders and affected communities about crude by rail shipments and accident/incident data.

Some of these recommendations were addressed with the passage of SB 861. More of the requirements of SB 861 can be found in the Biological Resources regulatory setting section (Section 4.2.2.2). Also, the most recent California budget allotted funds for additional CPUC rail inspectors, and the CPUC is currently in the process of hiring two railroad bridge inspectors.

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

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

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

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

County of San Luis Obispo Regulations
Energy Element and Conservation and Open Space Element
In 1995, the County of San Luis Obispo adopted the Energy Element as part of the County's General Plan, subsequently merged with the Conservation and Open Space Element. The

Conservation and Open Space Element contains a goal of protecting public health, safety, and environment and several policies that promote the stated goal. The applicable policies include:

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

4.7.2.3 Other Applicable Guidelines, National Codes, and Standards

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

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

- ASME & ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings;
- ASME & ANSI B16.9, Factory-Made Wrought Steel Butt Welding Fittings;
- ASME & ANSI B31.1a, Power Piping;
- ASME & ANSI B31.4a, addenda to ASME B31.4a, Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols;
- NACE Standard RP0190, Item No. 53071. Standard Recommended Practice External Protective Coatings for Joints, Fittings, and Valves on Metallic Underground or Submerged Pipelines and Piping Systems;
- NACE Standard RP0169, Item No. 53002. Standard Recommended Practice Control of External Corrosion on Underground or Submerged Metallic Piping Systems;

- API 510 Pressure Vessel inspection Code;
- API 570 Piping Inspection Code, applies to in-service metallic piping systems used for the transport of petroleum products;
- API 572 Inspection of Pressure Vessels;
- API 574 Inspection Practices for Pipe System Components;
- API 575 API Guidelines and Methods for Inspection of Existing Atmospheric and Low-pressure Storage Tanks;
- API 576 Inspection of Pressure Relieving Devices;
- API 650 Welded Steel Tanks for Oil Storage;
- API 651 Cathodic Protection of Aboveground Storage Tanks;
- API 653 Tank Inspection, Repair, Alteration, and Reconstruction;
- API 2610, Design, Construction, Operation, Maintenance, and Inspection of Terminal & Tank Facilities; and
- API Spec 12B - Bolted Tanks for Storage of Production Liquids.

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

- Tank suitability for service;
- Brittle fracture considerations;
- Inspections;
- Materials;
- Design considerations;
- Tank repair and alteration;
- Dismantling and reconstruction;
- Welding;
- Examination and testing;
- Marking and recordkeeping;
- Pertinent issues related to tank inspections in API 653;
- External inspections by an authorized inspector every 5 years;
- Ultrasonic inspections of shell thickness every 5 years (when corrosion rate not known); and
- Internal bottom inspection every 10 years, if corrosion rates not known.

Fire and Explosion Prevention and Control, National Fire Protection Agency

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

- NFPA 30 Flammable and Combustible Liquids Code and Handbook;
- NFPA 11 Foam Extinguishing Systems;
- NFPA 12 A&B Halogenated Extinguishing Agent Systems;

- NFPA 15 Water Spray Fixed Systems;
- NFPA 20 Centrifugal Fire Pumps; and
- NFPA 70 National Electrical Code.

4.7.3 Significance Criteria

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

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

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

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

Issues related to fire protection and emergency response are discussed in Section 4.11, Public Services.

The foregoing thresholds do not address risk of environmental damage. The threshold applied for risk of significant environmental impact due to accidental spills is as follows: an impact of spills would be potentially significant if operations would increase the probability or volume of oil spills into an environment that contained sensitive resources. The environmental impacts of a potential oil spill are discussed in other issue areas such as Biological Resources, Cultural Resources, Water Resources, and Agricultural Resources.

In addition, the thresholds do not apply to occupational safety. Occupational risk, which is governed by state and federal OSHAs is considered to be more voluntary and is generally judged according to more lenient standards of significance than those used for involuntary exposure.

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

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

4.7.4 Project Impacts and Mitigation Measures

The Rail Spur Project would result in the construction of new facilities that could lead to increased fire and explosion hazards at the refinery and along the railroad routes to the SMR. In assessing the level of public risk associated with these hazards a quantitative risk assessment (QRA) was conducted for both the facilities at the SMR as well as for the various mainline rail routes to the SMR.

A QRA involves evaluating risks presented to the public by a facility or transportation operation in the form of hazardous materials releases resulting in explosions, flammable vapors, or toxic material impacts. A QRA was used to evaluate the risks associated with the transport of crude by rail along the main rail lines between the SMR and Roseville and Colton, and for the rail operations that would occur at the SMR.

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

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

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

Figure 4.7-3 shows the steps in developing a QRA. A QRA computer model, developed by Marine Research Specialists, is used to calculate the risk profiles[4] and, in conjunction with Geographic Information System software, to manage the data in accordance with CCPS guidelines for hazard assessments (CCPS 1989). A detailed description of the QRA methodology is provided in Appendix H.1. This appendix describes each of the steps used in the QRA as well as the various consequence models and impact thresholds that were used in the QRA.

The spill modeling was done using a multi-component crude with the properties provided below in Table 4.7.7.

Table 4.7.7 Properties of Crude Oil Used for Consequence Modeling

Gravity (API)	25
Flash Point (F)	50
Vapor Pressure (psi)	11
Light Ends (C3-C10; Vol %)	24
Burn Rate (meters/second)	0.00025
Flame Temperature (K)	1,000
Flame Emissive Power (kw/m^2)	56.7

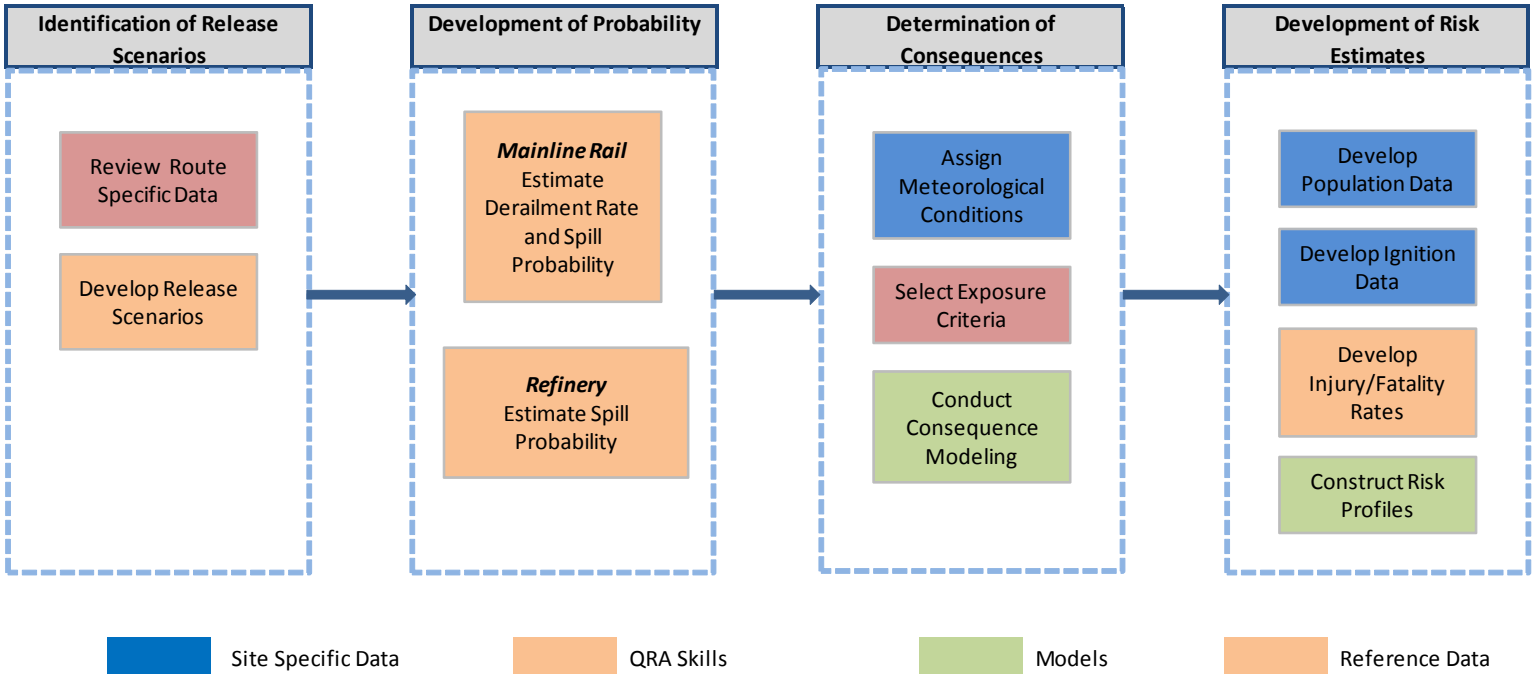
Combined, these values are extremely conservative, and represent a crude that is lighter than the crudes identified in Section 2.6 of the Project Description. Ultimately, the modeling is sensitive to the initial percent of light ends, flame temperature, and emissive power values, which for the modeling are very conservative for crude oil, regardless of type, and probably are more representative of very light synbit.

Impact #	Impact Description	Phase	Impact Classification
HM.1	The proposed rail spur unloading facility would increase the risk of an oil spill, fires and explosions at the refinery and on the project site that could impact the public.	Operation	Class III

The new unloading facility would include an access platform and a system of pumps and meters, suction lines from the railcars, carbon beds for vapor treatment, and a common pipeline leading to the refinery's existing tank farm. The unloading facility would be equipped with two 10-car unloading systems. This would allow 20 rail cars to be unloaded at one time.

[4] A risk profile is a plot of the frequency (i.e., probability) of various levels of fatalities or injuries that could result from a set of hazardous events.

Figure 4.7-3 Steps Involved in Developing a Quantitative Risk Assessment



The unloading rack would be configured to unload two 10-car strings simultaneously (one 10-car string on Track 1 and one 10-car string on Track 2). The system used to unload each car would consist of an adapter unit to connect the rail car to couplings, hoses, valves and piping connecting to a 400 gallon-per-minute (gpm) positive displacement pump. The system may employ unloading hoses for the connection to the rail cars. Each of the two unloading systems (one for Track 1 and one for Track 2) would be equipped with an air eliminator, flow meters, and carbon beds. Upon exiting the flow meters the crude oil from the two unloading systems would be comingled and transported via a new pipeline to the existing refinery crude oil storage tanks.

All of the rail track extensions built as part of the Rail Spur Project would have to comply with the applicable California Public Utilities Commission (CPUC) general orders including:

- GO 26-D: Clearances on railroads and street railroads as to side and overhead structures, parallel tracks and crossings,
- GO 72-B: Construction & Maintenance - Standard types of pavement construction at railroad grade crossings,
- GO 75-D: Warning Devices for at-grade railroad crossings, and
- GO 118: Construction, reconstruction and maintenance of walkways and control, of vegetation adjacent to railroad tracks.

Implementation of the project could result in spills at the Project Site due to mechanical failure, structural failure, corrosion, or human error during pipeline use and oil transportation to and from the Rail Spur. Given the low speed the trains would be moving at the site (3 mph) it is unlikely that a tank car could be impacted enough to result in a spill. The estimated shell and head puncture velocity of the tank car design proposed for use by the Applicant are 8.3 and 10.3 miles per hour respectively (USDOT 2014).

The most likely spill related event would be a release during the unloading process due to a loading line failure. The unloading racks are equipped with oil spill drain boxes which would feed below-grade 16-inch-diameter drain lines routed to three parallel 20,000 gallon rectangular storage tanks located in a vault for containment. The total capacity of the containment system would be about 273,000 gallons (this includes the drain boxes, curbed area, pipelines and storage tanks). The containment system has been designed to move any spilled oil away from the rail cars and into the 60,000 gallon storage tanks. The loss of a loading hose could result in a maximum spill of about 27,300 gallons of crude oil (the capacity of one rail car). This system would effectively control spills that would from the loading operations.

The loading area would also be equipped with a fire protection system that would consist of fire detection equipment hydrants, controls and piping. The unloading rack would be equipped with a foam sprinkler deluge system and firewater monitors with foam generators at the unloading rack periphery. In the event of a spill that led to a fire, the sprinkler deluge system would activate and douse the area with foam. Any spilled oil would be directed away from the unloading area to the spill containment tanks, which would serve to keep any fire away from the rail cars.

Downstream of the two unloading facility meter assemblies, a new 24-inch above ground pipeline would be routed along an existing internal dirt road on the Phillips 66 property between

the unloading facility and the refinery. This pipeline would connect with the existing refinery crude oil storage tanks. The route for this pipeline is shown in Project Description Figure 2-3. This dirt road accommodates periodic on-site traffic only associated with refinery personnel traveling at low-speeds.

The pipeline would be approximately 3,525 feet in length. The unloaded crude oil would be stored in the existing refinery storage tanks. Therefore, crude oil storage would not result in any increase in fire and explosion risk at the refinery.

The proposed unloading facility would have a maximum crude oil pumping rate of 8,000 gpm. The unloading facility and 24-inch pipeline would be monitored using multiple Programmable Logic Controllers (PLCs) and controlled using the existing refinery Supervisory Control and Data Acquisition (SCADA) system. The SCADA would detect a catastrophic failure of the 24-inch pipeline within one minute, thus limiting pumping losses. However, the drainage of the pipeline would occur, and potentially result in a worst-case spill of about 90,800 gallons of crude oil. This worst case spill would occur where the pipeline connects with unloading pumps since this is the lowest elevation of the pipeline. As one moves up the pipeline toward the storage tanks, the maximum spill volumes decrease, with the smallest spill volumes being near the storage tanks. In the event of a release from the pipeline the oil would drain into the area around the pipeline and unloading racks, which could result in a pool fire (see grading plans in Appendix A).

Several crude oil spill scenarios were modeled to evaluate worst-case thermal radiation hazards associated with a large crude oil fire. Modeled scenarios ranged from small releases from a tank car, full release of rail car contents, and full release of the pipeline volume. (see Appendix H.3 for consequence modeling input data and results). The worst-case thermal radiation hazard distance are provided in Table 4.7.8

Table 4.7.8 Worst Case Onsite Thermal Radiation Hazard Zones

Wind Speed (meters/second)	Distance in feet to	
	5 kw/m^2	10 kw/m^2
1	561	305
3	627	351
5	659	374
7	679	387
10	699	407
15	1,001	535
20	1,099	761

See Appendix H.3 for the detailed consequence modeling results.
See Appendix H.1 for a description of on the consequences associated with these hazards.

As shown in Figure 4.7-4, none of these flammable hazard zones have the potential for offsite impacts associated with the worst-case unloading facility crude oil spill and fire. The worst case spill occurs just north of the unloading facility where nearly the entire pipeline would drain onto the ground due to the slope of the area between the unloading facility and refinery storage tanks. Spills closer to the refinery storage tanks would be smaller, thus resulting in smaller hazard zones. Since the worst case hazard zones are within the SMR boundaries, no QRA was needed for the onsite impacts since no sensitive receptors would be impacted. Therefore, potential hazards associated with the unloading facility are considered less than significant since the worst case hazard zones do not extend outside of the boundaries of the SMR.

Mitigation Measures

No mitigation measures are required since the impacts are less than significant. However, implementation of mitigation measures PS-3a through PS-3i for fire protection and emergency response would serve to further reduce the onsite hazards associated with the Rail Spur Project.

Residual Impacts

Hazards associated with the onsite portion of the Rail Spur Project would be *less than significant (Class III)*.

Impact #	Impact Description	Phase	Impact Classification
HM.2	The potential for a crude oil unit train derailment would increase the risk to the public in the vicinity of the UPRR right-of-way.	Operations	Class I

It is unknown what route UPRR would use to deliver the trains to the SMR. Coming from the north the routes merge at the UPRR Roseville Rail Yard. From the south the routes merge at the Colton Rail Yard. Given that the route the trains would travel to get to these two UPRR yards is speculative, the EIR has evaluated in more detail the impacts of trains traveling from these two UPRR yards to the SMR.

Beyond the two UPRR Yards, trains could travel any number of routes (refer to Figure 2-8). Depending upon the source of the crude oil, crude oil trains could use any portion of the UPRR network between Roseville/Colton and the source location for the crude oil. The exact route that would be taken would depend upon a number of factors, that could include the source of the crude oil, weather conditions, train traffic conditions, etc. Since the routes past Roseville and Colton are somewhat speculative, a more qualitative assessment of public safety impacts associated with rail accidents beyond these two rail yards is provide at the end of this impact discussion.

The route distances were developed using a graphical information systems (GIS). The GIS estimated the route from Roseville via Oakland at 367.3 miles, which is almost identical to the 367.9 miles provide by UPPR for the length of this route. The other route distances were also close to the values provided by UPRR.

Figure 4.7-4 Worst Case Rail Unloading Facility Flammable Hazard Zones at the SMR

UPRR would be responsible for transporting the crude oil to the SMR if the project were approved. Federal law requires common carriers like UPRR, to transport hazardous materials, such as crude oil, ammonia, chlorine, for its customers. If a customer delivers the hazardous material in conformity with applicable DOT requirements, UPRR must transport the material. UPRR is required to transport all commodities in accordance with applicable federal laws.

To maximize safety and security when moving crude oil, UPRR has implemented additional measures that include:

- Using the Rail Corridor Risk Management System (RCRMS) routing protocol for trains carrying 20 or more crude oil cars to determine the safest and most secure routes. The RCRMS is an analytical tool developed in conjunction with the Department of Homeland Security (DHS) and the FRA. This tool takes into account 27 risk factors to assess rail route safety and security.
- Requiring trains carrying 20 or more crude oil cars that include at least one older DOT-111 tank car not to exceed 40 miles per hour in the 46[5] designated high-threat-urban areas (HTUA) established by Federal regulations. This reduces by 10 miles per hour Union Pacific's current self-imposed speed limit. This reduced train speed reduces the kinetic energy that contributes to tank car breeches in accident.
- Evaluating where the railroad may need to install additional advanced track-side detectors.
- Increased emergency response training and tuition assistance to include a specialized crude by rail curriculum at the industry's Transportation Technology Center, Inc. (TTCI) facility in Pueblo, Colorado.
- Creating a comprehensive emergency response resources inventory.
- Use of distributed power or two-way telemetry end-of-train devices for enhanced braking on trains that carry 20 or more carloads of crude oil (UPRR 2014a).

In addition, UPRR has a track inspection program for their rail lines in California that exceed the current Federal requirements. The UPRR inspection program includes the following:

- Tracks in California are visually inspected twice a week with "hi-rail pickup trucks to identify any broken rails or issues with track surface condition.
- Special inspections are performed during and after storm events and earthquakes.
- UPRR conducted track geometry tests of their mainline tracks at least twice per year. These tests provide information on the condition of the track, track alignment, curve wear, clearance in tunnels and bridges, track profile, etc. These inspections also include collecting video of the track, which can be used to further assess track conditions.

[5] A list of the HTUA is provided in Appendix H.6. Within California the crude oil trains could pass through three HTUA (the Bay Area, the Los Angeles Area, and Sacramento) depending upon the route taken to get to the SMR. Outside of California, a crude oil train could pass through a number of HTUA depending upon the route taken to get to California (i.e., Las Vegas, Denver, Seattle, etc.)

- UPRR also tests their main line rails in California every three to six months using a rail detector system, which uses ultrasonic sound waves to search the tracks for any internal issues. This is a key technology that helps to prevent broken rail derailments.

UPRR also has a capital track maintenance project in California that covers the replacement and upgrading of track. In the last five years UPRR has replaced over two million railroad ties and 452 miles of rail line in California (UPRR, 2014b).

UPRR also has a bridge inspection program that complies with 49 CFR Part 237-Bridge Safety Standards. This program is used to ensure the structural integrity of bridges, culverts, and tunnels. All bridges are inspected between one and three times per year. In the last five years, UPRR has upgraded 70 bridges in California (UPRR, 2014b).

As required by Federal law, UPRR has been installing Positive Train Control (PTC) on their main rail lines in California. The main line routes between Roseville/Colton and the SMR that would be used for the proposed project have been upgraded to include PTC. PTC is used to prevent train to train collisions, over-speed derailments, switch misalignment, and unauthorized entry into work zones (UPRR, 2014b).

The tracks along the mainline routes are also inspected by the FRA and CPUC rail inspectors. In discussions with the CPUC staff it was noted that the Coastal Line has very few deficiencies associated with the CPUC rail inspections (Roger Clugston CPUC ROSB Manager, 2014).

A QRA was prepared following the guidelines of the American Institute of Chemical Engineers, Center for Chemical Process Safety (CCPS, 1995). Appendix H.1 provides a detailed description of the QRA methodology and the parameters that were used for various QRA inputs. The three rail routes evaluated are shown in Figures 4.7-1 and 4.7-2. The QRA was used to determine the significance of an accident associated with crude oil transportation along each of the routes, assuming that all of the annual trains servicing the SMR used that specific route. Each of the major inputs to the QRA is discussed below.

Probability (e.g. Frequency) of a Derailment and Associated Crude Oil Spill
In order to identify the probability of an accident (i.e., accident rate or derailment rate) and oil spill (i.e., spill rate) from a crude oil train on each of the possible routes, Dr. Christopher Barkan was retained to conduct a quantitative assessment. Dr. Barkan is Professor and Executive Director of the Rail Transportation and Engineering Center at the Department of Civil and Environmental Engineering at the University of Illinois at Urbana- Champaign. He and his colleagues prepared a report (see Appendix H.2) that looked at route specific accident rates and spill rates based upon the tank car design proposed by the Applicant. The analysis took into account major risk factors, including route specific FRA track class, method of operation, tank car safety design, and the proposed volume of crude oil trains over the route.

In conducting the QRA the routes were divided into distinct segments based on rail characteristics and population density along the railroad. Segments are shown based on the population density adjacent to the railroad. Crude oil spill probabilities for each of routes and segments are shown in Tables 4.7.9 through 4.7.11.

Table 4.7.9 Summary of Unit Train Accident and Spill Rates by Segment for the Colton to SMR Route

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
1	Oso Flaco	2.8	4.30E-07	100	250	1.43E-06	8.42E-07	5.85E-07	1.43E-04	8.42E-05	5.85E-05
2	Nipomo	0.6	4.30E-07	1,000	250	3.28E-07	1.93E-07	1.34E-07	3.28E-05	1.93E-05	1.34E-05
3	Nipomo	1.5	4.30E-07	100	250	7.57E-07	4.47E-07	3.11E-07	7.57E-05	4.47E-05	3.11E-05
4	Guadalupe	1.3	4.30E-07	10,000	250	6.90E-07	4.07E-07	2.83E-07	6.90E-05	4.07E-05	2.83E-05
5	SMV	0.3	4.30E-07	100	250	1.57E-07	9.27E-08	6.44E-08	1.57E-05	9.27E-06	6.44E-06
6	Point Sal	13.8	4.30E-07	100	250	7.10E-06	4.19E-06	2.91E-06	7.10E-04	4.19E-04	2.91E-04
7	VAFB	13.5	4.30E-07	100	250	6.96E-06	4.11E-06	2.85E-06	6.96E-04	4.11E-04	2.85E-04
8	Rocky Point	14.7	4.30E-07	100	250	7.55E-06	4.45E-06	3.09E-06	7.55E-04	4.45E-04	3.09E-04
9	Hollister Ranch	13.0	4.30E-07	100	250	6.72E-06	3.96E-06	2.75E-06	6.72E-04	3.96E-04	2.75E-04
10	Gaviota Beach	0.5	4.30E-07	1,000	250	2.39E-07	1.41E-07	9.81E-08	2.39E-05	1.41E-05	9.81E-06
11	Gaviota	5.9	4.30E-07	100	250	3.01E-06	1.78E-06	1.24E-06	3.01E-04	1.78E-04	1.24E-04
12	Arroyo Quemado	0.3	4.30E-07	1,000	250	1.41E-07	8.33E-08	5.79E-08	1.41E-05	8.33E-06	5.79E-06
13	Tajiquas	2.9	4.30E-07	100	250	1.51E-06	8.93E-07	6.21E-07	1.51E-04	8.93E-05	6.21E-05
14	Refugio	0.2	4.30E-07	1,000	250	9.49E-08	5.60E-08	3.89E-08	9.49E-06	5.60E-06	3.89E-06
15	Canada del Corral	2.0	4.30E-07	100	250	1.02E-06	6.02E-07	4.18E-07	1.02E-04	6.02E-05	4.18E-05
16	El Capitan	0.8	4.30E-07	1,000	250	4.10E-07	2.42E-07	1.68E-07	4.10E-05	2.42E-05	1.68E-05
17	Naples	5.7	4.30E-07	100	250	2.92E-06	1.72E-06	1.20E-06	2.92E-04	1.72E-04	1.20E-04
18	Bacara	0.8	4.30E-07	1,000	250	3.88E-07	2.29E-07	1.59E-07	3.88E-05	2.29E-05	1.59E-05
19	Sandpiper	0.6	4.30E-07	100	250	2.98E-07	1.76E-07	1.22E-07	2.98E-05	1.76E-05	1.22E-05
20	Goleta	2.1	4.30E-07	3,000	250	1.08E-06	6.38E-07	4.43E-07	1.08E-04	6.38E-05	4.43E-05
21	Goleta	1.6	4.30E-07	1,000	250	8.40E-07	4.95E-07	3.44E-07	8.40E-05	4.95E-05	3.44E-05
22	Santa Barbara	9.5	4.30E-07	3,000	250	4.88E-06	2.88E-06	2.00E-06	4.88E-04	2.88E-04	2.00E-04
23	Santa Barbara	3.8	4.30E-07	10,000	250	1.96E-06	1.16E-06	8.05E-07	1.96E-04	1.16E-04	8.05E-05
24	Montecito	4.3	4.30E-07	3,000	250	2.19E-06	1.29E-06	9.00E-07	2.19E-04	1.29E-04	9.00E-05
25	Polo Grounds	0.9	4.30E-07	1,000	250	4.88E-07	2.88E-07	2.00E-07	4.88E-05	2.88E-05	2.00E-05
26	Padero Lane	0.5	4.30E-07	3,000	250	2.64E-07	1.56E-07	1.08E-07	2.64E-05	1.56E-05	1.08E-05
27	Carpinteria	2.8	4.30E-07	1,000	250	1.43E-06	8.45E-07	5.87E-07	1.43E-04	8.45E-05	5.87E-05
28	Carpinteria	1.3	4.30E-07	3,000	250	6.64E-07	3.92E-07	2.72E-07	6.64E-05	3.92E-05	2.72E-05
29	Carpinteria Bluffs	1.9	4.30E-07	1,000	250	9.58E-07	5.65E-07	3.93E-07	9.58E-05	5.65E-05	3.93E-05

Table 4.7.9 Summary of Unit Train Accident and Spill Rates by Segment for the Colton to SMR Route

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
30	Rincon	0.2	4.30E-07	3,000	250	1.21E-07	7.16E-08	4.98E-08	1.21E-05	7.16E-06	4.98E-06
31	La Concita Oil	1.7	4.30E-07	100	250	8.91E-07	5.26E-07	3.65E-07	8.91E-05	5.26E-05	3.65E-05
32	La Conchita	0.4	4.30E-07	3,000	250	2.13E-07	1.26E-07	8.75E-08	2.13E-05	1.26E-05	8.75E-06
33	Mussle Shoals	1.6	4.30E-07	1,000	250	8.19E-07	4.83E-07	3.36E-07	8.19E-05	4.83E-05	3.36E-05
34	Seacliff	0.9	4.30E-07	100	250	4.44E-07	2.62E-07	1.82E-07	4.44E-05	2.62E-05	1.82E-05
35	Faria/Solimar	4.5	4.30E-07	100	250	2.30E-06	1.36E-06	9.42E-07	2.30E-04	1.36E-04	9.42E-05
36	State Beaches	3.6	4.30E-07	100	250	1.86E-06	1.10E-06	7.62E-07	1.86E-04	1.10E-04	7.62E-05
37	Ventura	5.1	4.30E-07	3,000	250	2.62E-06	1.54E-06	1.07E-06	2.62E-04	1.54E-04	1.07E-04
38	Ventura Greenbelt	1.2	4.30E-07	1,000	250	5.92E-07	3.49E-07	2.43E-07	5.92E-05	3.49E-05	2.43E-05
39	Montalvo	1.0	4.30E-07	3,000	250	5.12E-07	3.02E-07	2.10E-07	5.12E-05	3.02E-05	2.10E-05
40	Santa Clara River	0.4	4.30E-07	100	250	2.02E-07	1.19E-07	8.27E-08	2.02E-05	1.19E-05	8.27E-06
41	Oxnard	4.1	4.30E-07	3,000	250	2.11E-06	1.24E-06	8.64E-07	2.11E-04	1.24E-04	8.64E-05
42	Oxnard Industrial	3.0	4.30E-07	1,000	250	1.55E-06	9.12E-07	6.33E-07	1.55E-04	9.12E-05	6.33E-05
43	Oxnard Ag	5.2	4.30E-07	100	250	2.66E-06	1.57E-06	1.09E-06	2.66E-04	1.57E-04	1.09E-04
44	Camarillo Comm	0.5	4.30E-07	1,000	250	2.79E-07	1.65E-07	1.14E-07	2.79E-05	1.65E-05	1.14E-05
45	Camarillo Ag	0.1	4.30E-07	100	250	4.28E-08	2.53E-08	1.76E-08	4.28E-06	2.53E-06	1.76E-06
46	Camarillo	2.5	4.30E-07	3,000	250	1.29E-06	7.63E-07	5.30E-07	1.29E-04	7.63E-05	5.30E-05
47	Somis	7.6	4.30E-07	100	250	3.89E-06	2.29E-06	1.59E-06	3.89E-04	2.29E-04	1.59E-04
48	Moorpark	1.1	4.30E-07	1,000	250	5.67E-07	3.34E-07	2.32E-07	5.67E-05	3.34E-05	2.32E-05
49	Moorpark	1.2	4.30E-07	3,000	250	5.92E-07	3.49E-07	2.43E-07	5.92E-05	3.49E-05	2.43E-05
50	Moorpark	2.1	4.30E-07	1,000	250	1.09E-06	6.44E-07	4.48E-07	1.09E-04	6.44E-05	4.48E-05
51	Los Alamos Cyn	0.8	4.30E-07	100	250	4.27E-07	2.52E-07	1.75E-07	4.27E-05	2.52E-05	1.75E-05
52	Simi Valley	1.1	4.30E-07	1,000	250	5.67E-07	3.34E-07	2.32E-07	5.67E-05	3.34E-05	2.32E-05
53	Simi Valley	6.8	4.30E-07	3,000	250	3.52E-06	2.08E-06	1.44E-06	3.52E-04	2.08E-04	1.44E-04
54	Santa Susana	1.6	4.30E-07	1,000	250	8.09E-07	4.77E-07	3.32E-07	8.09E-05	4.77E-05	3.32E-05
55	Santa Susana Pass	2.7	4.30E-07	100	250	1.38E-06	8.14E-07	5.66E-07	1.38E-04	8.14E-05	5.66E-05
56	Stoney Point	1.0	4.30E-07	1,000	250	4.99E-07	2.94E-07	2.05E-07	4.99E-05	2.94E-05	2.05E-05
57	Chatsworth	1.4	4.30E-07	3,000	250	7.16E-07	4.22E-07	2.94E-07	7.16E-05	4.22E-05	2.94E-05
58	Chatsworth	3.6	4.30E-07	10,000	250	1.84E-06	1.08E-06	7.54E-07	1.84E-04	1.08E-04	7.54E-05

Table 4.7.9 Summary of Unit Train Accident and Spill Rates by Segment for the Colton to SMR Route

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
59	Northridge	2.5	4.30E-07	10,000	250	1.31E-06	7.72E-07	5.36E-07	1.31E-04	7.72E-05	5.36E-05
60	Van Nyus AP	1.7	4.30E-07	3,000	250	8.91E-07	5.26E-07	3.65E-07	8.91E-05	5.26E-05	3.65E-05
61	North Hollywood	4.0	4.30E-07	10,000	250	2.08E-06	1.23E-06	8.53E-07	2.08E-04	1.23E-04	8.53E-05
62	Burbank	2.5	4.30E-07	10,000	250	1.31E-06	7.72E-07	5.36E-07	1.31E-04	7.72E-05	5.36E-05
63	Valhalla	0.7	4.30E-07	1,000	250	3.66E-07	2.16E-07	1.50E-07	3.66E-05	2.16E-05	1.50E-05
64	Burbank	1.8	4.30E-07	10,000	250	9.06E-07	5.35E-07	3.72E-07	9.06E-05	5.35E-05	3.72E-05
65	Burbank	0.4	4.30E-07	3,000	250	2.24E-07	1.32E-07	9.18E-08	2.24E-05	1.32E-05	9.18E-06
66	Glendale	2.9	4.30E-07	10,000	250	1.50E-06	8.87E-07	6.17E-07	1.50E-04	8.87E-05	6.17E-05
67	Atwater	3.3	4.30E-07	10,000	250	1.72E-06	1.01E-06	7.05E-07	1.72E-04	1.01E-04	7.05E-05
68	Elysian Park	5.8	4.30E-07	10,000	250	2.99E-06	1.77E-06	1.23E-06	2.99E-04	1.77E-04	1.23E-04
69	East Los Angeles	7.5	4.30E-07	10,000	250	3.87E-06	2.29E-06	1.59E-06	3.87E-04	2.29E-04	1.59E-04
70	San Gabriel Vly	6.0	4.30E-07	10,000	250	3.10E-06	1.83E-06	1.27E-06	3.10E-04	1.83E-04	1.27E-04
71	El Monte	0.4	4.30E-07	3,000	250	2.11E-07	1.24E-07	8.63E-08	2.11E-05	1.24E-05	8.63E-06
72	San Gabriel River	0.2	4.30E-07	1,000	250	1.21E-07	7.13E-08	4.96E-08	1.21E-05	7.13E-06	4.96E-06
73	La Puente	4.5	4.30E-07	3,000	250	2.32E-06	1.37E-06	9.50E-07	2.32E-04	1.37E-04	9.50E-05
74	La Puente-Walnut	7.9	4.30E-07	3,000	250	4.08E-06	2.41E-06	1.67E-06	4.08E-04	2.41E-04	1.67E-04
75	Walnut-Pomona	3.1	4.30E-07	3,000	250	1.62E-06	9.54E-07	6.63E-07	1.62E-04	9.54E-05	6.63E-05
76	Pomona	16.0	4.30E-07	3,000	250	8.23E-06	4.86E-06	3.37E-06	8.23E-04	4.86E-04	3.37E-04
77	Ontario	9.3	4.30E-07	3,000	250	4.81E-06	2.84E-06	1.97E-06	4.81E-04	2.84E-04	1.97E-04
78	Fontana	1.5	4.30E-07	1,000	250	7.83E-07	4.62E-07	3.21E-07	7.83E-05	4.62E-05	3.21E-05

Table 4.7.10 Summary of Unit Train Accident and Spill Rates by Segment for the Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
1	Arroyo Grande	1.6	3.90E-07	1,000	250	7.24E-07	4.27E-07	2.97E-07	2.97E-08	7.24E-05	4.27E-05
2	Arroyo Grande	0.8	3.90E-07	100	250	3.73E-07	2.20E-07	1.53E-07	1.53E-08	3.73E-05	2.20E-05
3	Arroyo Grande	0.9	3.90E-07	1,000	250	4.39E-07	2.59E-07	1.80E-07	1.80E-08	4.39E-05	2.59E-05
4	Arroyo Grande	1.4	3.90E-07	100	250	6.45E-07	3.81E-07	2.65E-07	2.65E-08	6.45E-05	3.81E-05
5	Oceano	0.4	3.90E-07	3,000	250	1.88E-07	1.11E-07	7.71E-08	7.71E-09	1.88E-05	1.11E-05
6	Oceano	0.6	3.90E-07	10,000	250	2.92E-07	1.72E-07	1.20E-07	1.20E-08	2.92E-05	1.72E-05
7	Oceano	0.2	3.90E-07	3,000	250	1.12E-07	6.59E-08	4.58E-08	4.58E-09	1.12E-05	6.59E-06
8	Pismo/Grover	2.1	3.90E-07	10,000	250	9.80E-07	5.78E-07	4.02E-07	4.02E-08	9.80E-05	5.78E-05
9	Pismo	0.3	3.90E-07	3,000	250	1.35E-07	7.96E-08	5.53E-08	5.53E-09	1.35E-05	7.96E-06
10	Pismo	0.4	3.90E-07	1,000	250	1.72E-07	1.02E-07	7.06E-08	7.06E-09	1.72E-05	1.02E-05
11	Price Canyon	5.2	3.90E-07	100	250	2.42E-06	1.43E-06	9.93E-07	9.93E-08	2.42E-04	1.43E-04
12	Edna	0.6	3.90E-07	1,000	250	2.81E-07	1.66E-07	1.15E-07	1.15E-08	2.81E-05	1.66E-05
13	Edna	1.6	3.90E-07	100	250	7.56E-07	4.46E-07	3.10E-07	3.10E-08	7.56E-05	4.46E-05
14	San Luis Obispo	4.7	3.90E-07	10,000	250	2.18E-06	1.29E-06	8.94E-07	8.94E-08	2.18E-04	1.29E-04
15	San Luis Obispo	0.6	3.90E-07	3,000	250	2.64E-07	1.56E-07	1.08E-07	1.08E-08	2.64E-05	1.56E-05
16	Chorro	0.4	3.90E-07	1,000	250	1.99E-07	1.17E-07	8.16E-08	8.16E-09	1.99E-05	1.17E-05
17	Chorro	1.6	3.90E-07	100	250	7.31E-07	4.31E-07	3.00E-07	3.00E-08	7.31E-05	4.31E-05
18	CMC	0.8	3.90E-07	3,000	250	3.56E-07	2.10E-07	1.46E-07	1.46E-08	3.56E-05	2.10E-05
19	Santa Lucia	11.2	3.90E-07	100	250	5.22E-06	3.08E-06	2.14E-06	2.14E-07	5.22E-04	3.08E-04
20	Santa Margarita	0.9	3.90E-07	3,000	250	4.12E-07	2.43E-07	1.69E-07	1.69E-08	4.12E-05	2.43E-05
21	Phillips PS	0.9	3.90E-07	100	250	3.97E-07	2.34E-07	1.63E-07	1.63E-08	3.97E-05	2.34E-05
22	Atascadero	7.4	3.90E-07	1,000	250	3.46E-06	2.04E-06	1.42E-06	1.42E-07	3.46E-04	2.04E-04
23	Atascadero	1.6	3.90E-07	3,000	250	7.47E-07	4.41E-07	3.06E-07	3.06E-08	7.47E-05	4.41E-05
24	Atascadero	1.3	3.90E-07	1,000	250	5.95E-07	3.51E-07	2.44E-07	2.44E-08	5.95E-05	3.51E-05
25	Atascadero	0.4	3.90E-07	3,000	250	2.01E-07	1.19E-07	8.24E-08	8.24E-09	2.01E-05	1.19E-05
26	101	0.4	3.90E-07	1,000	250	1.71E-07	1.01E-07	7.00E-08	7.00E-09	1.71E-05	1.01E-05
27	Templeton	2.1	3.90E-07	3,000	250	9.99E-07	5.90E-07	4.10E-07	4.10E-08	9.99E-05	5.90E-05
28	Paso Robles	0.5	3.90E-07	1,000	250	2.40E-07	1.41E-07	9.83E-08	9.83E-09	2.40E-05	1.41E-05
29	Paso Robles	0.8	3.90E-07	3,000	250	3.93E-07	2.32E-07	1.61E-07	1.61E-08	3.93E-05	2.32E-05

Table 4.7.10 Summary of Unit Train Accident and Spill Rates by Segment for the Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
30	Paso Robles	2.7	3.90E-07	1,000	250	1.28E-06	7.57E-07	5.26E-07	5.26E-08	1.28E-04	7.57E-05
31	Paso Robles	2.1	3.90E-07	3,000	250	9.99E-07	5.89E-07	4.10E-07	4.10E-08	9.99E-05	5.89E-05
32	Paso Robles	0.4	3.90E-07	10,000	250	2.03E-07	1.20E-07	8.32E-08	8.32E-09	2.03E-05	1.20E-05
33	Paso Robles	1.2	3.90E-07	3,000	250	5.43E-07	3.20E-07	2.23E-07	2.23E-08	5.43E-05	3.20E-05
34	101	2.1	3.90E-07	100	250	9.91E-07	5.84E-07	4.06E-07	4.06E-08	9.91E-05	5.84E-05
35	Wellsona	2.4	3.90E-07	1,000	250	1.14E-06	6.73E-07	4.68E-07	4.68E-08	1.14E-04	6.73E-05
36	101	1.9	3.90E-07	100	250	8.71E-07	5.14E-07	3.57E-07	3.57E-08	8.71E-05	5.14E-05
37	San Miguel	1.5	3.90E-07	3,000	250	6.86E-07	4.05E-07	2.81E-07	2.81E-08	6.86E-05	4.05E-05
38	101	2.7	3.90E-07	100	250	1.24E-06	7.31E-07	5.08E-07	5.08E-08	1.24E-04	7.31E-05
39	Camp Roberts	5.7	3.90E-07	100	250	2.67E-06	1.57E-06	1.09E-06	1.09E-07	2.67E-04	1.57E-04
40	Bradley	15.3	3.90E-07	100	250	7.15E-06	4.22E-06	2.93E-06	2.93E-07	7.15E-04	4.22E-04
41	San Lucas	18.5	3.90E-07	100	250	8.65E-06	5.10E-06	3.55E-06	3.55E-07	8.65E-04	5.10E-04
42	King City	1.5	3.90E-07	1,000	250	6.82E-07	4.02E-07	2.80E-07	2.80E-08	6.82E-05	4.02E-05
43	Clark Ranch	18.1	3.90E-07	100	250	8.45E-06	4.99E-06	3.46E-06	3.46E-07	8.45E-04	4.99E-04
44	Soledad	1.4	3.90E-07	1,000	250	6.63E-07	3.91E-07	2.72E-07	2.72E-08	6.63E-05	3.91E-05
45	Salinas Valley Ag	7.3	3.90E-07	100	250	3.43E-06	2.02E-06	1.41E-06	1.41E-07	3.43E-04	2.02E-04
46	Gonzales	1.2	3.90E-07	3,000	250	5.42E-07	3.20E-07	2.22E-07	2.22E-08	5.42E-05	3.20E-05
47	Salinas Valley Ag	5.0	3.90E-07	100	250	2.35E-06	1.39E-06	9.63E-07	9.63E-08	2.35E-04	1.39E-04
48	Chular	0.6	3.90E-07	1,000	250	2.98E-07	1.76E-07	1.22E-07	1.22E-08	2.98E-05	1.76E-05
49	Sprekles	7.8	3.90E-07	100	250	3.63E-06	2.14E-06	1.49E-06	1.49E-07	3.63E-04	2.14E-04
50	Salinas	3.9	3.90E-07	6,500	250	1.84E-06	1.08E-06	7.53E-07	7.53E-08	1.84E-04	1.08E-04
51	Salinas Valley Ag	6.2	3.90E-07	100	250	2.89E-06	1.70E-06	1.18E-06	1.18E-07	2.89E-04	1.70E-04
52	Castroville	1.1	3.90E-07	1,000	250	5.28E-07	3.11E-07	2.16E-07	2.16E-08	5.28E-05	3.11E-05
53	Las Lomas	15.4	3.90E-07	100	250	7.21E-06	4.26E-06	2.96E-06	2.96E-07	7.21E-04	4.26E-04
54	Aromas	12.1	3.90E-07	100	250	5.63E-06	3.32E-06	2.31E-06	2.31E-07	5.63E-04	3.32E-04
55	Gilroy	4.2	3.90E-07	3,000	250	1.95E-06	1.15E-06	8.01E-07	8.01E-08	1.95E-04	1.15E-04
56	San Martin	6.1	3.90E-07	100	250	2.83E-06	1.67E-06	1.16E-06	1.16E-07	2.83E-04	1.67E-04
57	Morgan Hill	3.8	3.90E-07	3,000	250	1.79E-06	1.06E-06	7.34E-07	7.34E-08	1.79E-04	1.06E-04
58	Coyote Valley	6.7	3.90E-07	100	250	3.12E-06	1.84E-06	1.28E-06	1.28E-07	3.12E-04	1.84E-04

Table 4.7.10 Summary of Unit Train Accident and Spill Rates by Segment for the Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
59	San Jose	6.3	3.90E-07	5,000	250	2.96E-06	1.75E-06	1.21E-06	1.21E-07	2.96E-04	1.75E-04
60	Seven Trees	1.9	3.90E-07	1,000	250	8.69E-07	5.13E-07	3.56E-07	3.56E-08	8.69E-05	5.13E-05
61	San Jose	5.0	3.90E-07	10,000	250	2.32E-06	1.37E-06	9.50E-07	9.50E-08	2.32E-04	1.37E-04
62	Santa Clara	5.1	3.90E-07	6,500	250	2.39E-06	1.41E-06	9.79E-07	9.79E-08	2.39E-04	1.41E-04
63	Alviso	1.7	3.90E-07	1,000	250	8.03E-07	4.74E-07	3.29E-07	3.29E-08	8.03E-05	4.74E-05
64	Drawbridge	5.7	3.90E-07	100	250	2.66E-06	1.57E-06	1.09E-06	1.09E-07	2.66E-04	1.57E-04
65	Newark	2.3	3.90E-07	1,000	250	1.05E-06	6.20E-07	4.31E-07	4.31E-08	1.05E-04	6.20E-05
66	Newark to Russell	11.3	3.90E-07	10,000	250	5.30E-06	3.13E-06	2.17E-06	2.17E-07	5.30E-04	3.13E-04
67	San Lorenzo	0.8	3.90E-07	3,000	250	3.73E-07	2.20E-07	1.53E-07	1.53E-08	3.73E-05	2.20E-05
68	San Leandro	1.3	3.90E-07	10,000	250	5.98E-07	3.53E-07	2.45E-07	2.45E-08	5.98E-05	3.53E-05
69	San Leandro	0.7	3.90E-07	3,000	250	3.37E-07	1.99E-07	1.38E-07	1.38E-08	3.37E-05	1.99E-05
70	Oakland	5.3	3.90E-07	10,000	250	2.46E-06	1.45E-06	1.01E-06	1.01E-07	2.46E-04	1.45E-04
71	Oakland	1.4	3.90E-07	3,000	250	6.40E-07	3.78E-07	2.62E-07	2.62E-08	6.40E-05	3.78E-05
72	Oakland	1.6	3.90E-07	10,000	250	7.57E-07	4.46E-07	3.10E-07	3.10E-08	7.57E-05	4.46E-05
73	Oakland	1.4	3.90E-07	3,000	250	6.31E-07	3.72E-07	2.59E-07	2.59E-08	6.31E-05	3.72E-05
74	Oakland	1.5	3.90E-07	10,000	250	7.19E-07	4.24E-07	2.95E-07	2.95E-08	7.19E-05	4.24E-05
75	Oakland	2.7	3.90E-07	3,000	250	1.25E-06	7.36E-07	5.11E-07	5.11E-08	1.25E-04	7.36E-05
76	Emeryville	1.5	3.90E-07	10,000	250	6.77E-07	4.00E-07	2.78E-07	2.78E-08	6.77E-05	4.00E-05
77	Berkeley	1.0	3.90E-07	3,000	250	4.72E-07	2.78E-07	1.93E-07	1.93E-08	4.72E-05	2.78E-05
78	Berkeley	1.8	3.90E-07	10,000	250	8.17E-07	4.82E-07	3.35E-07	3.35E-08	8.17E-05	4.82E-05
79	Richmond	1.5	3.90E-07	3,000	250	7.01E-07	4.13E-07	2.87E-07	2.87E-08	7.01E-05	4.13E-05
80	Richmond	3.8	3.90E-07	10,000	250	1.76E-06	1.04E-06	7.20E-07	7.20E-08	1.76E-04	1.04E-04
81	North Richmond	1.1	3.90E-07	3,000	250	4.90E-07	2.89E-07	2.01E-07	2.01E-08	4.90E-05	2.89E-05
82	San Pablo	2.5	3.90E-07	1,000	250	1.16E-06	6.86E-07	4.77E-07	4.77E-08	1.16E-04	6.86E-05
83	Sobranto	1.8	3.90E-07	100	250	8.17E-07	4.82E-07	3.35E-07	3.35E-08	8.17E-05	4.82E-05
84	Hercules	5.6	3.90E-07	1,000	250	2.62E-06	1.55E-06	1.07E-06	1.07E-07	2.62E-04	1.55E-04
85	Selby	1.7	3.90E-07	100	250	7.89E-07	4.66E-07	3.24E-07	3.24E-08	7.89E-05	4.66E-05
86	Crockett	1.6	3.90E-07	1,000	250	7.29E-07	4.30E-07	2.99E-07	2.99E-08	7.29E-05	4.30E-05
87	Port Costa	4.3	3.90E-07	100	250	2.01E-06	1.19E-06	8.25E-07	8.25E-08	2.01E-04	1.19E-04

Table 4.7.10 Summary of Unit Train Accident and Spill Rates by Segment for the Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
88	Martinez	0.5	3.90E-07	1,000	250	2.26E-07	1.34E-07	9.28E-08	9.28E-09	2.26E-05	1.34E-05
89	Suisun Pt Channel	2.6	3.90E-07	100	250	1.20E-06	7.08E-07	4.92E-07	4.92E-08	1.20E-04	7.08E-05
90	Benicia	3.5	3.90E-07	1,000	250	1.63E-06	9.65E-07	6.70E-07	6.70E-08	1.63E-04	9.65E-05
91	Grizzly Bay	10.6	3.90E-07	100	250	4.94E-06	2.92E-06	2.03E-06	2.03E-07	4.94E-04	2.92E-04
92	Fairfield	3.8	3.90E-07	3,000	250	1.78E-06	1.05E-06	7.32E-07	7.32E-08	1.78E-04	1.05E-04
93	Elmira	13.7	3.90E-07	100	250	6.40E-06	3.78E-06	2.62E-06	2.62E-07	6.40E-04	3.78E-04
94	Dixon	2.1	3.90E-07	1,000	250	1.00E-06	5.90E-07	4.10E-07	4.10E-08	1.00E-04	5.90E-05
95	Solano Co Ag	6.6	3.90E-07	100	250	3.09E-06	1.82E-06	1.27E-06	1.27E-07	3.09E-04	1.82E-04
96	Davis	3.5	3.90E-07	1,000	250	1.65E-06	9.73E-07	6.76E-07	6.76E-08	1.65E-04	9.73E-05
97	Yolo Co Ag	7.0	3.90E-07	100	250	3.27E-06	1.93E-06	1.34E-06	1.34E-07	3.27E-04	1.93E-04
98	Sacramento	3.3	3.90E-07	3,000	250	1.52E-06	8.96E-07	6.22E-07	6.22E-08	1.52E-04	8.96E-05
99	Sacramento River	0.4	3.90E-07	100	250	1.96E-07	1.16E-07	8.05E-08	8.05E-09	1.96E-05	1.16E-05
100	Sacramento	2.5	3.90E-07	10,000	250	1.15E-06	6.78E-07	4.71E-07	4.71E-08	1.15E-04	6.78E-05
101	Parkland	1.6	3.90E-07	100	250	7.57E-07	4.46E-07	3.10E-07	3.10E-08	7.57E-05	4.46E-05
102	Sacramento	3.1	3.90E-07	3,000	250	1.45E-06	8.54E-07	5.94E-07	5.94E-08	1.45E-04	8.54E-05
103	North Highlands	2.6	3.90E-07	1,000	250	1.21E-06	7.11E-07	4.94E-07	4.94E-08	1.21E-04	7.11E-05
104	North Highlands	4.4	3.90E-07	3,000	250	2.04E-06	1.20E-06	8.37E-07	8.37E-08	2.04E-04	1.20E-04
105	Roseville Yard	1.3	3.90E-07	100	250	5.89E-07	3.47E-07	2.41E-07	2.41E-08	5.89E-05	3.47E-05

Table 4.7.11 Summary of Unit Train Accident and Spill Rates by Segment for the Roseville to SMR via Altamont Pass

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
1	Arroyo Grande	1.6	5.10E-07	1,000	250	9.47E-07	5.59E-07	3.88E-07	3.88E-08	9.47E-05	5.59E-05
2	Arroyo Grande	0.8	5.10E-07	100	250	4.88E-07	2.88E-07	2.00E-07	2.00E-08	4.88E-05	2.88E-05
3	Arroyo Grande	0.9	5.10E-07	1,000	250	5.74E-07	3.39E-07	2.35E-07	2.35E-08	5.74E-05	3.39E-05
4	Arroyo Grande	1.4	5.10E-07	100	250	8.44E-07	4.98E-07	3.46E-07	3.46E-08	8.44E-05	4.98E-05
5	Oceano	0.4	5.10E-07	3,000	250	2.46E-07	1.45E-07	1.01E-07	1.01E-08	2.46E-05	1.45E-05
6	Oceano	0.6	5.10E-07	10,000	250	3.81E-07	2.25E-07	1.56E-07	1.56E-08	3.81E-05	2.25E-05
7	Oceano	0.2	5.10E-07	3,000	250	1.46E-07	8.61E-08	5.99E-08	5.99E-09	1.46E-05	8.61E-06
8	Pismo/Grover	2.1	5.10E-07	10,000	250	1.28E-06	7.56E-07	5.25E-07	5.25E-08	1.28E-04	7.56E-05
9	Pismo	0.3	5.10E-07	3,000	250	1.76E-07	1.04E-07	7.23E-08	7.23E-09	1.76E-05	1.04E-05
10	Pismo	0.4	5.10E-07	1,000	250	2.25E-07	1.33E-07	9.23E-08	9.23E-09	2.25E-05	1.33E-05
11	Price Canyon	5.2	5.10E-07	100	250	3.17E-06	1.87E-06	1.30E-06	1.30E-07	3.17E-04	1.87E-04
12	Edna	0.6	5.10E-07	1,000	250	3.67E-07	2.17E-07	1.51E-07	1.51E-08	3.67E-05	2.17E-05
13	Edna	1.6	5.10E-07	100	250	9.89E-07	5.83E-07	4.05E-07	4.05E-08	9.89E-05	5.83E-05
14	San Luis Obispo	4.7	5.10E-07	10,000	250	2.85E-06	1.68E-06	1.17E-06	1.17E-07	2.85E-04	1.68E-04
15	San Luis Obispo	0.6	5.10E-07	3,000	250	3.45E-07	2.04E-07	1.42E-07	1.42E-08	3.45E-05	2.04E-05
16	Chorro	0.4	5.10E-07	1,000	250	2.60E-07	1.54E-07	1.07E-07	1.07E-08	2.60E-05	1.54E-05
17	Chorro	1.6	5.10E-07	100	250	9.56E-07	5.64E-07	3.92E-07	3.92E-08	9.56E-05	5.64E-05
18	CMC	0.8	5.10E-07	3,000	250	4.66E-07	2.75E-07	1.91E-07	1.91E-08	4.66E-05	2.75E-05
19	Santa Lucia	11.2	5.10E-07	100	250	6.83E-06	4.03E-06	2.80E-06	2.80E-07	6.83E-04	4.03E-04
20	Santa Margarita	0.9	5.10E-07	3,000	250	5.39E-07	3.18E-07	2.21E-07	2.21E-08	5.39E-05	3.18E-05
21	Phillips PS	0.9	5.10E-07	100	250	5.19E-07	3.06E-07	2.13E-07	2.13E-08	5.19E-05	3.06E-05
22	Atascadero	7.4	5.10E-07	1,000	250	4.52E-06	2.67E-06	1.85E-06	1.85E-07	4.52E-04	2.67E-04
23	Atascadero	1.6	5.10E-07	3,000	250	9.77E-07	5.77E-07	4.01E-07	4.01E-08	9.77E-05	5.77E-05
24	Atascadero	1.3	5.10E-07	1,000	250	7.77E-07	4.59E-07	3.19E-07	3.19E-08	7.77E-05	4.59E-05
25	Atascadero	0.4	5.10E-07	3,000	250	2.63E-07	1.55E-07	1.08E-07	1.08E-08	2.63E-05	1.55E-05
26	101	0.4	5.10E-07	1,000	250	2.23E-07	1.32E-07	9.16E-08	9.16E-09	2.23E-05	1.32E-05
27	Templeton	2.1	5.10E-07	3,000	250	1.31E-06	7.71E-07	5.36E-07	5.36E-08	1.31E-04	7.71E-05
28	Paso Robles	0.5	5.10E-07	1,000	250	3.14E-07	1.85E-07	1.29E-07	1.29E-08	3.14E-05	1.85E-05
29	Paso Robles	0.8	5.10E-07	3,000	250	5.14E-07	3.03E-07	2.11E-07	2.11E-08	5.14E-05	3.03E-05

Table 4.7.11 Summary of Unit Train Accident and Spill Rates by Segment for the Roseville to SMR via Altamont Pass

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
30	Paso Robles	2.7	5.10E-07	1,000	250	1.68E-06	9.90E-07	6.88E-07	6.88E-08	1.68E-04	9.90E-05
31	Paso Robles	2.1	5.10E-07	3,000	250	1.31E-06	7.71E-07	5.36E-07	5.36E-08	1.31E-04	7.71E-05
32	Paso Robles	0.4	5.10E-07	10,000	250	2.65E-07	1.57E-07	1.09E-07	1.09E-08	2.65E-05	1.57E-05
33	Paso Robles	1.2	5.10E-07	3,000	250	7.10E-07	4.19E-07	2.91E-07	2.91E-08	7.10E-05	4.19E-05
34	101	2.1	5.10E-07	100	250	1.30E-06	7.64E-07	5.31E-07	5.31E-08	1.30E-04	7.64E-05
35	Wellsona	2.4	5.10E-07	1,000	250	1.49E-06	8.81E-07	6.12E-07	6.12E-08	1.49E-04	8.81E-05
36	101	1.9	5.10E-07	100	250	1.14E-06	6.72E-07	4.67E-07	4.67E-08	1.14E-04	6.72E-05
37	San Miguel	1.5	5.10E-07	3,000	250	8.97E-07	5.29E-07	3.68E-07	3.68E-08	8.97E-05	5.29E-05
38	101	2.7	5.10E-07	100	250	1.62E-06	9.55E-07	6.64E-07	6.64E-08	1.62E-04	9.55E-05
39	Camp Roberts	5.7	5.10E-07	100	250	3.49E-06	2.06E-06	1.43E-06	1.43E-07	3.49E-04	2.06E-04
40	Bradley	15.3	5.10E-07	100	250	9.35E-06	5.51E-06	3.83E-06	3.83E-07	9.35E-04	5.51E-04
41	San Lucas	18.5	5.10E-07	100	250	1.13E-05	6.67E-06	4.64E-06	4.64E-07	1.13E-03	6.67E-04
42	King City	1.5	5.10E-07	1,000	250	8.92E-07	5.26E-07	3.66E-07	3.66E-08	8.92E-05	5.26E-05
43	Clark Ranch	18.1	5.10E-07	100	250	1.11E-05	6.52E-06	4.53E-06	4.53E-07	1.11E-03	6.52E-04
44	Soledad	1.4	5.10E-07	1,000	250	8.67E-07	5.12E-07	3.56E-07	3.56E-08	8.67E-05	5.12E-05
45	Salinas Valley Ag	7.3	5.10E-07	100	250	4.48E-06	2.65E-06	1.84E-06	1.84E-07	4.48E-04	2.65E-04
46	Gonzales	1.2	5.10E-07	3,000	250	7.09E-07	4.18E-07	2.91E-07	2.91E-08	7.09E-05	4.18E-05
47	Salinas Valley Ag	5.0	5.10E-07	100	250	3.07E-06	1.81E-06	1.26E-06	1.26E-07	3.07E-04	1.81E-04
48	Chular	0.6	5.10E-07	1,000	250	3.89E-07	2.30E-07	1.60E-07	1.60E-08	3.89E-05	2.30E-05
49	Sprekles	7.8	5.10E-07	100	250	4.75E-06	2.80E-06	1.95E-06	1.95E-07	4.75E-04	2.80E-04
50	Salinas	3.9	5.10E-07	6,500	250	2.40E-06	1.42E-06	9.84E-07	9.84E-08	2.40E-04	1.42E-04
51	Salinas Valley Ag	6.2	5.10E-07	100	250	3.78E-06	2.23E-06	1.55E-06	1.55E-07	3.78E-04	2.23E-04
52	Castroville	1.1	5.10E-07	1,000	250	6.90E-07	4.07E-07	2.83E-07	2.83E-08	6.90E-05	4.07E-05
53	Las Lomas	15.4	5.10E-07	100	250	9.43E-06	5.56E-06	3.87E-06	3.87E-07	9.43E-04	5.56E-04
54	Aromas	12.1	5.10E-07	100	250	7.36E-06	4.34E-06	3.02E-06	3.02E-07	7.36E-04	4.34E-04
55	Gilroy	4.2	5.10E-07	3,000	250	2.55E-06	1.51E-06	1.05E-06	1.05E-07	2.55E-04	1.51E-04
56	San Martin	6.1	5.10E-07	100	250	3.70E-06	2.18E-06	1.52E-06	1.52E-07	3.70E-04	2.18E-04
57	Morgan Hill	3.8	5.10E-07	3,000	250	2.34E-06	1.38E-06	9.59E-07	9.59E-08	2.34E-04	1.38E-04
58	Coyote Valley	6.7	5.10E-07	100	250	4.07E-06	2.40E-06	1.67E-06	1.67E-07	4.07E-04	2.40E-04

Table 4.7.11 Summary of Unit Train Accident and Spill Rates by Segment for the Roseville to SMR via Altamont Pass

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
59	San Jose	6.3	5.10E-07	5,000	250	3.87E-06	2.28E-06	1.59E-06	1.59E-07	3.87E-04	2.28E-04
60	Seven Trees	1.9	5.10E-07	1,000	250	1.14E-06	6.70E-07	4.66E-07	4.66E-08	1.14E-04	6.70E-05
61	San Jose	5.0	5.10E-07	10,000	250	3.03E-06	1.79E-06	1.24E-06	1.24E-07	3.03E-04	1.79E-04
62	Santa Clara	5.1	5.10E-07	6,500	250	3.12E-06	1.84E-06	1.28E-06	1.28E-07	3.12E-04	1.84E-04
63	Alviso	1.7	5.10E-07	1,000	250	1.05E-06	6.20E-07	4.31E-07	4.31E-08	1.05E-04	6.20E-05
64	Drawbridge	5.7	5.10E-07	100	250	3.48E-06	2.05E-06	1.43E-06	1.43E-07	3.48E-04	2.05E-04
65	Newark	2.3	5.10E-07	1,000	250	1.37E-06	8.11E-07	5.64E-07	5.64E-08	1.37E-04	8.11E-05
107	Newark	3.1	5.10E-07	10,000	250	1.90E-06	1.12E-06	7.79E-07	7.79E-08	1.90E-04	1.12E-04
108	Fremont	3.2	5.10E-07	10,000	250	1.97E-06	1.16E-06	8.06E-07	8.06E-08	1.97E-04	1.16E-04
109	Sunol	6.8	5.10E-07	100	250	4.17E-06	2.46E-06	1.71E-06	1.71E-07	4.17E-04	2.46E-04
110	Pleasanton	1.8	5.10E-07	1,000	250	1.09E-06	6.42E-07	4.46E-07	4.46E-08	1.09E-04	6.42E-05
111	Pleasanton	2.5	5.10E-07	3,000	250	1.52E-06	8.97E-07	6.24E-07	6.24E-08	1.52E-04	8.97E-05
112	Pleasanton	3.0	5.10E-07	100	250	1.81E-06	1.07E-06	7.44E-07	7.44E-08	1.81E-04	1.07E-04
113	Livermore	5.0	5.10E-07	5,000	250	3.08E-06	1.82E-06	1.26E-06	1.26E-07	3.08E-04	1.82E-04
114	Livermore	2.5	5.10E-07	1,000	250	1.51E-06	8.90E-07	6.19E-07	6.19E-08	1.51E-04	8.90E-05
115	Altamont	14.2	5.10E-07	100	250	8.67E-06	5.12E-06	3.56E-06	3.56E-07	8.67E-04	5.12E-04
116	Tracy	3.9	5.10E-07	3,000	250	2.36E-06	1.39E-06	9.67E-07	9.67E-08	2.36E-04	1.39E-04
117	Lathrop	8.2	5.10E-07	100	250	5.01E-06	2.96E-06	2.05E-06	2.05E-07	5.01E-04	2.96E-04
118	French Camp	8.0	5.10E-07	1,000	250	4.89E-06	2.88E-06	2.00E-06	2.00E-07	4.89E-04	2.88E-04
119	Stockton	7.9	5.10E-07	10,000	250	4.83E-06	2.85E-06	1.98E-06	1.98E-07	4.83E-04	2.85E-04
120	Lodi	4.1	5.10E-07	100	250	2.47E-06	1.46E-06	1.01E-06	1.01E-07	2.47E-04	1.46E-04
121	Lodi	3.4	5.10E-07	5,000	250	2.07E-06	1.22E-06	8.49E-07	8.49E-08	2.07E-04	1.22E-04
122	Acampo	5.5	5.10E-07	100	250	3.36E-06	1.98E-06	1.38E-06	1.38E-07	3.36E-04	1.98E-04
123	Galt	1.6	5.10E-07	4,000	250	9.53E-07	5.62E-07	3.91E-07	3.91E-08	9.53E-05	5.62E-05
124	Hicksville	8.6	5.10E-07	100	250	5.24E-06	3.09E-06	2.15E-06	2.15E-07	5.24E-04	3.09E-04
125	Elk Grove	1.0	5.10E-07	100	250	5.83E-07	3.44E-07	2.39E-07	2.39E-08	5.83E-05	3.44E-05
126	Elk Grove	5.8	5.10E-07	5,000	250	3.52E-06	2.08E-06	1.44E-06	1.44E-07	3.52E-04	2.08E-04
127	Sacramento	4.2	5.10E-07	1,000	250	2.57E-06	1.51E-06	1.05E-06	1.05E-07	2.57E-04	1.51E-04
128	Sacramento	4.6	5.10E-07	10,000	250	2.78E-06	1.64E-06	1.14E-06	1.14E-07	2.78E-04	1.64E-04

Table 4.7.11 Summary of Unit Train Accident and Spill Rates by Segment for the Roseville to SMR via Altamont Pass

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
101	Parkland	0.8	5.10E-07	100	250	4.94E-07	2.91E-07	2.02E-07	2.02E-08	4.94E-05	2.91E-05
102	Sacramento	3.1	5.10E-07	3,000	250	1.89E-06	1.11E-06	7.74E-07	7.74E-08	1.89E-04	1.11E-04
103	North Highlands	2.6	5.10E-07	1,000	250	1.56E-06	9.23E-07	6.41E-07	6.41E-08	1.56E-04	9.23E-05
104	North Highlands	4.4	5.10E-07	3,000	250	2.67E-06	1.57E-06	1.09E-06	1.09E-07	2.67E-04	1.57E-04
105	Roseville Yard	1.3	5.10E-07	100	250	7.70E-07	4.54E-07	3.16E-07	3.16E-08	7.70E-05	4.54E-05

The results of this analysis showed that the probability of a crude oil release incident exceeding 100 gallons or more would range between one every 46 years to once every 76 years depending upon the rail route used to get to the SMR. These probabilities of a release are only for the portion of the routes between Roseville/Colton and the SMR. As discussed below, the probability of a release of crude oil would be greater for the entire route in California and for the full length of the train route (crude source location to SMR).

Consequence Modeling Results

As with the refinery spill analysis, several crude oil spill scenarios were modeled to evaluate worst-case thermal radiation hazards associated with a large crude oil fire. Modeled scenarios ranged from small releases from a tank car, to the complete loss of multiple tank cars. The worst case spill was assumed to be 180,000 gallons (about six tanker cars). An explosion of tank cars, simulated as a Boiling Liquid Expanding Vapor Explosion (BLEVE), was also evaluated. The worst-case thermal radiation and explosion hazard distance are provided in Table 4.7.12. The modeling input data and results for these hazards are provided in Appendix H.3. A 100-gallon spill was used as the cut off from the hazards analysis since below that level the hazard zones would likely be contained to the railroad right-of-way, and explosions would be unlikely since 100-gallon spill fire would not generate enough thermal radiation for a long enough period of time to produce a BLEVE.

Table 4.7.12 Worst Case Mainline Rail Hazard Zones

Thermal Radiation Hazard Zones (feet)		
Wind Speed (meters/second)	**5 kw/m^2**	**10 kw/m^2**
1	745	407
3	856	436
5	938	495
7	1,063	495
10	1,204	541
15	1,335	728
20	1,404	958
BLEVE Hazard Zones (feet)		
40 kj/m^2	1,690	
150 kj/m^2	860	
196 kj/m^2	643	

See Appendix H.3 for the detailed consequence modeling results.
See Appendix H.1 for a description of on the consequences associated with these hazards.

These modeling results, known as consequence modeling, were then used along with the spill probability and population densities to estimate the overall risk of injury and fatality for each of the routes. These hazard zones would be the same for the entire rail route within California and all the way back to the source of the crude oil.

Quantitative Risk Assessment Results

The results of the QRA are presented in Figure 4.7-5 as risk profiles. The risk profiles for each route assume that all 250 trains per year use route. The level of risk for the Rail Spur Project along the three potential mainline rail routes is represented by the solid green, red and blue lines in Figure 4.7-5. The graph on the left shows the risk for potential injuries, while the graph on the right shows the risk for potential fatalities. Because maximum risks from proposed transport of crude oil are above the significant risk threshold (dashed green line), impacts would be considered potentially significant. These risk profiles represent the cumulative risk along the entire route. The risk within any individual City or County would be considerably less. The risk is primarily driven by the HTUA (Los Angeles Area, Bay Area, and Sacramento) since these are the locations where fairly long stretches of track are in close proximity to heavily populated areas.

The diagonal dashed green and red lines in Figure 4.7-5 represent the significant risk threshold for insignificant (green) and significant and unavoidable (red) risk. If the risk falls between the dashed green and red lines, the impact remains significant, but risk may be viewed as acceptable if all feasible mitigation has been identified and implemented.

Public Safety Impacts beyond Roseville and Colton Yards

Beyond the two UPRR Yards, trains could travel any number of routes (refer to Figure 2-8). Also, crude oil delivered to California by UPRR would generally pass through either of these two rail yards in route to the SMR.

Depending upon the source of the crude oil, crude oil trains could use any portion of the UPRR network between Roseville/Colton and the source location for the crude oil. The exact route that would be taken would depend upon a number of factors, that could include the source of the crude oil, weather conditions, train traffic conditions, etc.

While the exact route the trains would take to get to these two rail yards is somewhat speculative, all of the routes within and outside of California would traverse populated areas that could be impacted in the event of a release that resulted in a fire or explosion. Train accident rates are typically determined based upon “accidents per million miles traveled”. As the miles a train travels increase the probability of an accident increases. Therefore, when the miles traveled beyond Roseville or Colton is included the overall probability of an accident would increase.

This EIR has evaluated several routes between the Colton or Roseville rail yards to the state line to determine the route specific accident rates for areas beyond Roseville and Colton. For the routes past these two rail yards the train would have to use track that the CPUC has determined are LSHS. From Roseville, rail traffic would likely follow two different routes; one following the UPRR following the I-80 corridor to Reno, Nevada, with the other heading north along the I-5 corridor to Oregon. A third route through the Feather River Canyon was not considered for further analysis. From Colton, the rail route would traverse north and east through the Cajon Pass, Barstow, the Mojave Desert, and enter Nevada southwest of Las Vegas. In conducting the QRA the routes were divided into distinct segments based on rail characteristics and population density along the railroad. Segments are shown based on the population density adjacent to the railroad. Crude oil spill probabilities for each of routes and segments are shown in Figure 4.7-6 and Tables 4.7.13 through 4.7.17.

Figure 4.7-5 Risk Associated with Mainline Rail Crude Oil Unit Train Transportation

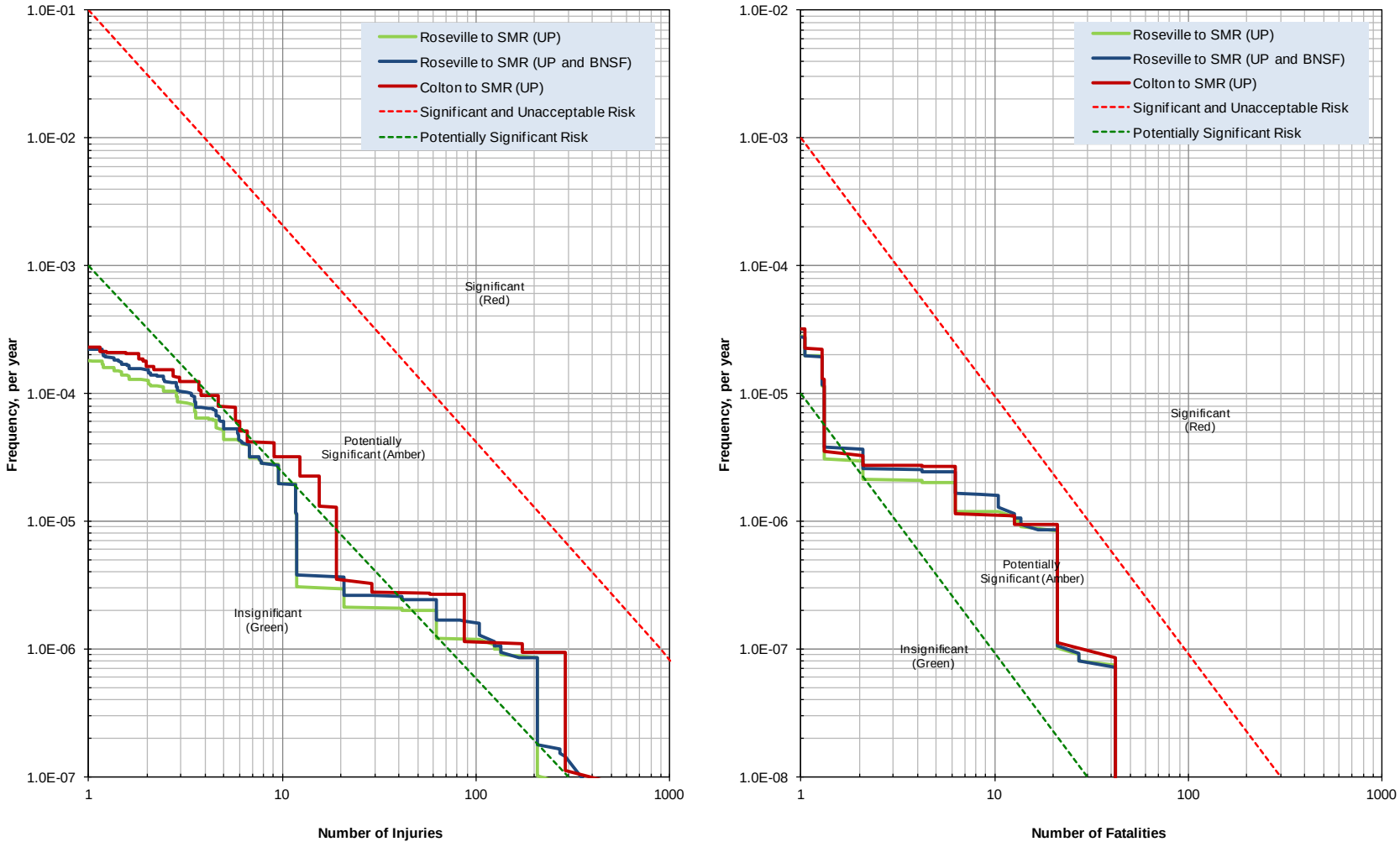


Figure 4.7-6 UPRR Route and Population Densities (SMR Nevada and Oregon Routes)

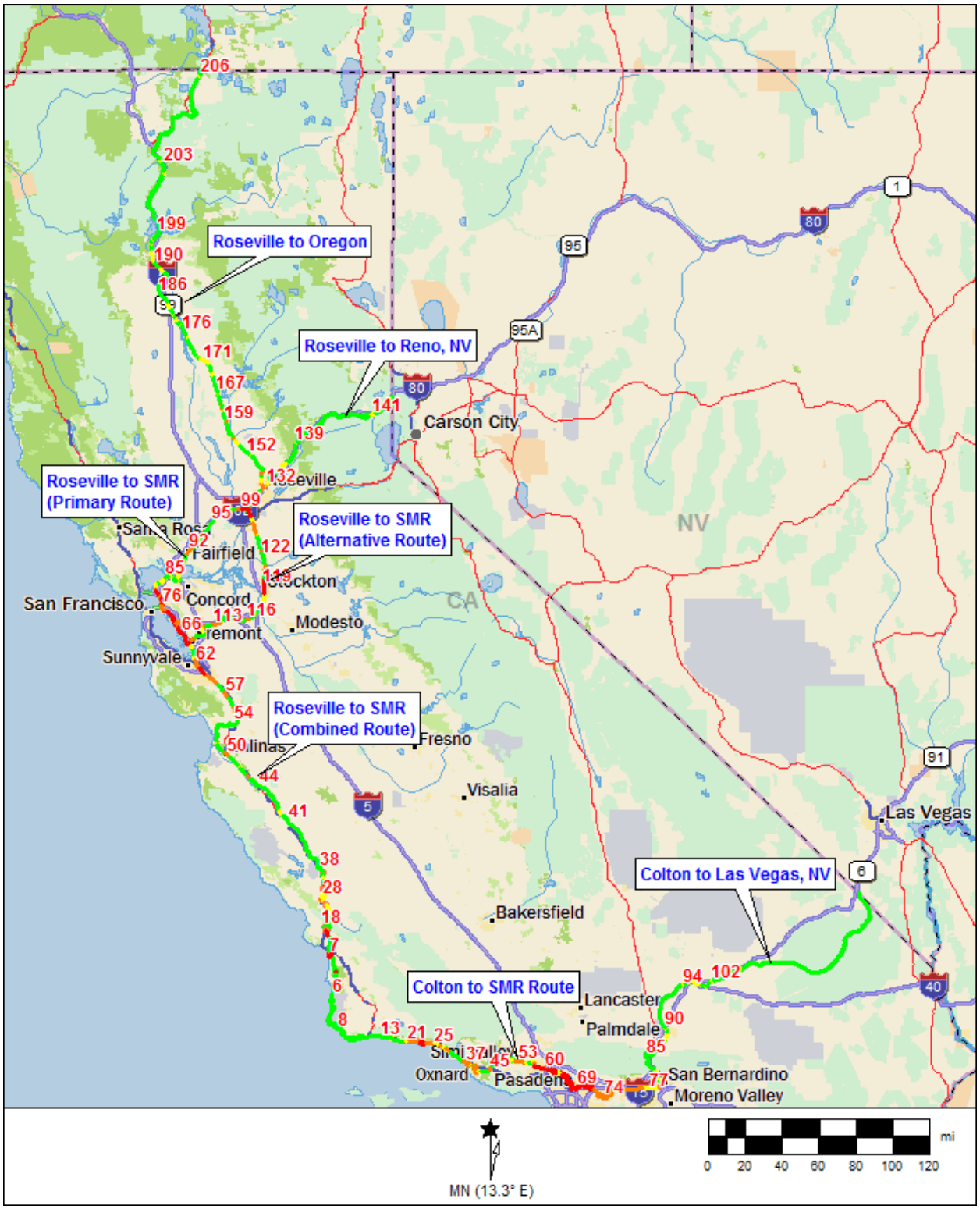


Table 4.7.13 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Colton to SMR Route

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
1	Oso Flaco	2.8	4.30E-07	100	250	1.43E-06	8.42E-07	5.85E-07	5.26E-08	1.43E-04	8.42E-05
2	Nipomo	0.6	4.30E-07	1,000	250	3.28E-07	1.93E-07	1.34E-07	1.21E-08	3.28E-05	1.93E-05
3	Nipomo	1.5	4.30E-07	100	250	7.57E-07	4.47E-07	3.11E-07	2.79E-08	7.57E-05	4.47E-05
4	Guadalupe	1.3	4.30E-07	10,000	250	6.90E-07	4.07E-07	2.83E-07	2.55E-08	6.90E-05	4.07E-05
5	SMV	0.3	4.30E-07	100	250	1.57E-07	9.27E-08	6.44E-08	5.79E-09	1.57E-05	9.27E-06
6	Point Sal	13.8	4.30E-07	100	250	7.10E-06	4.19E-06	2.91E-06	2.62E-07	7.10E-04	4.19E-04
7	VAFB	13.5	4.30E-07	100	250	6.96E-06	4.11E-06	2.85E-06	2.57E-07	6.96E-04	4.11E-04
8	Rocky Point	14.7	4.30E-07	100	250	7.55E-06	4.45E-06	3.09E-06	2.78E-07	7.55E-04	4.45E-04
9	Bixby/Hollister	13.0	4.30E-07	100	250	6.72E-06	3.96E-06	2.75E-06	2.48E-07	6.72E-04	3.96E-04
10	Gaviota Beach	0.5	4.30E-07	1,000	250	2.39E-07	1.41E-07	9.81E-08	8.83E-09	2.39E-05	1.41E-05
11	Gaviota	5.9	4.30E-07	100	250	3.01E-06	1.78E-06	1.24E-06	1.11E-07	3.01E-04	1.78E-04
12	Arroyo Quemado	0.3	4.30E-07	1,000	250	1.41E-07	8.33E-08	5.79E-08	5.21E-09	1.41E-05	8.33E-06
13	Tajiquas	2.9	4.30E-07	100	250	1.51E-06	8.93E-07	6.21E-07	5.59E-08	1.51E-04	8.93E-05
14	Refugio	0.2	4.30E-07	1,000	250	9.49E-08	5.60E-08	3.89E-08	3.50E-09	9.49E-06	5.60E-06
15	Canada del Corral	2.0	4.30E-07	100	250	1.02E-06	6.02E-07	4.18E-07	3.76E-08	1.02E-04	6.02E-05
16	El Capitan	0.8	4.30E-07	1,000	250	4.10E-07	2.42E-07	1.68E-07	1.51E-08	4.10E-05	2.42E-05
17	Naples	5.7	4.30E-07	100	250	2.92E-06	1.72E-06	1.20E-06	1.08E-07	2.92E-04	1.72E-04
18	Bacara	0.8	4.30E-07	1,000	250	3.88E-07	2.29E-07	1.59E-07	1.43E-08	3.88E-05	2.29E-05
19	Sandpiper	0.6	4.30E-07	100	250	2.98E-07	1.76E-07	1.22E-07	1.10E-08	2.98E-05	1.76E-05
20	Goleta	2.1	4.30E-07	3,000	250	1.08E-06	6.38E-07	4.43E-07	3.99E-08	1.08E-04	6.38E-05
21	Goleta	1.6	4.30E-07	1,000	250	8.40E-07	4.95E-07	3.44E-07	3.10E-08	8.40E-05	4.95E-05
22	Santa Barbara	9.5	4.30E-07	3,000	250	4.88E-06	2.88E-06	2.00E-06	1.80E-07	4.88E-04	2.88E-04
23	Santa Barbara	3.8	4.30E-07	10,000	250	1.96E-06	1.16E-06	8.05E-07	7.24E-08	1.96E-04	1.16E-04
24	Montecito	4.3	4.30E-07	3,000	250	2.19E-06	1.29E-06	9.00E-07	8.10E-08	2.19E-04	1.29E-04
25	Polo Grounds	0.9	4.30E-07	1,000	250	4.88E-07	2.88E-07	2.00E-07	1.80E-08	4.88E-05	2.88E-05
26	Padero Lane	0.5	4.30E-07	3,000	250	2.64E-07	1.56E-07	1.08E-07	9.75E-09	2.64E-05	1.56E-05
27	Carpinteria	2.8	4.30E-07	1,000	250	1.43E-06	8.45E-07	5.87E-07	5.28E-08	1.43E-04	8.45E-05
28	Carpinteria	1.3	4.30E-07	3,000	250	6.64E-07	3.92E-07	2.72E-07	2.45E-08	6.64E-05	3.92E-05
29	Carpinteria Bluffs	1.9	4.30E-07	1,000	250	9.58E-07	5.65E-07	3.93E-07	3.53E-08	9.58E-05	5.65E-05

Table 4.7.13 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Colton to SMR Route

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
30	Rincon	0.2	4.30E-07	3,000	250	1.21E-07	7.16E-08	4.98E-08	4.48E-09	1.21E-05	7.16E-06
31	La Concita Oil	1.7	4.30E-07	100	250	8.91E-07	5.26E-07	3.65E-07	3.29E-08	8.91E-05	5.26E-05
32	La Conchita	0.4	4.30E-07	3,000	250	2.13E-07	1.26E-07	8.75E-08	7.88E-09	2.13E-05	1.26E-05
33	Mussle Shoals	1.6	4.30E-07	1,000	250	8.19E-07	4.83E-07	3.36E-07	3.02E-08	8.19E-05	4.83E-05
34	Seacliff	0.9	4.30E-07	100	250	4.44E-07	2.62E-07	1.82E-07	1.64E-08	4.44E-05	2.62E-05
35	Faria/Solimar	4.5	4.30E-07	100	250	2.30E-06	1.36E-06	9.42E-07	8.48E-08	2.30E-04	1.36E-04
36	State Beaches	3.6	4.30E-07	100	250	1.86E-06	1.10E-06	7.62E-07	6.86E-08	1.86E-04	1.10E-04
37	Ventura	5.1	4.30E-07	3,000	250	2.62E-06	1.54E-06	1.07E-06	9.65E-08	2.62E-04	1.54E-04
38	Ventura Greenbelt	1.2	4.30E-07	1,000	250	5.92E-07	3.49E-07	2.43E-07	2.19E-08	5.92E-05	3.49E-05
39	Montalvo	1.0	4.30E-07	3,000	250	5.12E-07	3.02E-07	2.10E-07	1.89E-08	5.12E-05	3.02E-05
40	Santa Clara River	0.4	4.30E-07	100	250	2.02E-07	1.19E-07	8.27E-08	7.45E-09	2.02E-05	1.19E-05
41	Oxnard	4.1	4.30E-07	3,000	250	2.11E-06	1.24E-06	8.64E-07	7.77E-08	2.11E-04	1.24E-04
42	Oxnard Indust/Ag	3.0	4.30E-07	1,000	250	1.55E-06	9.12E-07	6.33E-07	5.70E-08	1.55E-04	9.12E-05
43	Oxnard Ag	5.2	4.30E-07	100	250	2.66E-06	1.57E-06	1.09E-06	9.81E-08	2.66E-04	1.57E-04
44	Camarillo Comm	0.5	4.30E-07	1,000	250	2.79E-07	1.65E-07	1.14E-07	1.03E-08	2.79E-05	1.65E-05
45	Camarillo Ag	0.1	4.30E-07	100	250	4.28E-08	2.53E-08	1.76E-08	1.58E-09	4.28E-06	2.53E-06
46	Camarillo	2.5	4.30E-07	3,000	250	1.29E-06	7.63E-07	5.30E-07	4.77E-08	1.29E-04	7.63E-05
47	Somis	7.6	4.30E-07	100	250	3.89E-06	2.29E-06	1.59E-06	1.43E-07	3.89E-04	2.29E-04
48	Moorpark	1.1	4.30E-07	1,000	250	5.67E-07	3.34E-07	2.32E-07	2.09E-08	5.67E-05	3.34E-05
49	Moorpark	1.2	4.30E-07	3,000	250	5.92E-07	3.49E-07	2.43E-07	2.19E-08	5.92E-05	3.49E-05
50	Moorpark	2.1	4.30E-07	1,000	250	1.09E-06	6.44E-07	4.48E-07	4.03E-08	1.09E-04	6.44E-05
51	Los Alamos Cyn	0.8	4.30E-07	100	250	4.27E-07	2.52E-07	1.75E-07	1.58E-08	4.27E-05	2.52E-05
52	Simi Valley	1.1	4.30E-07	1,000	250	5.67E-07	3.34E-07	2.32E-07	2.09E-08	5.67E-05	3.34E-05
53	Simi Valley	6.8	4.30E-07	3,000	250	3.52E-06	2.08E-06	1.44E-06	1.30E-07	3.52E-04	2.08E-04
54	Santa Susana Knl	1.6	4.30E-07	1,000	250	8.09E-07	4.77E-07	3.32E-07	2.98E-08	8.09E-05	4.77E-05
55	Santa Susana Pass	2.7	4.30E-07	100	250	1.38E-06	8.14E-07	5.66E-07	5.09E-08	1.38E-04	8.14E-05
56	Stoney Point	1.0	4.30E-07	1,000	250	4.99E-07	2.94E-07	2.05E-07	1.84E-08	4.99E-05	2.94E-05
57	Chatsworth	1.4	4.30E-07	3,000	250	7.16E-07	4.22E-07	2.94E-07	2.64E-08	7.16E-05	4.22E-05
58	Chatsworth	3.6	4.30E-07	10,000	250	1.84E-06	1.08E-06	7.54E-07	6.78E-08	1.84E-04	1.08E-04

Table 4.7.13 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Colton to SMR Route

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
59	Northridge	2.5	4.30E-07	10,000	250	1.31E-06	7.72E-07	5.36E-07	4.83E-08	1.31E-04	7.72E-05
60	Van Nyus AP	1.7	4.30E-07	3,000	250	8.91E-07	5.26E-07	3.65E-07	3.29E-08	8.91E-05	5.26E-05
61	North Hollywood	4.0	4.30E-07	10,000	250	2.08E-06	1.23E-06	8.53E-07	7.68E-08	2.08E-04	1.23E-04
62	Burbank	2.5	4.30E-07	10,000	250	1.31E-06	7.72E-07	5.36E-07	4.83E-08	1.31E-04	7.72E-05
63	Valhalla	0.7	4.30E-07	1,000	250	3.66E-07	2.16E-07	1.50E-07	1.35E-08	3.66E-05	2.16E-05
64	Burbank	1.8	4.30E-07	10,000	250	9.06E-07	5.35E-07	3.72E-07	3.34E-08	9.06E-05	5.35E-05
65	Burbank	0.4	4.30E-07	3,000	250	2.24E-07	1.32E-07	9.18E-08	8.26E-09	2.24E-05	1.32E-05
66	Glendale	2.9	4.30E-07	10,000	250	1.50E-06	8.87E-07	6.17E-07	5.55E-08	1.50E-04	8.87E-05
67	Atwater	3.3	4.30E-07	10,000	250	1.72E-06	1.01E-06	7.05E-07	6.35E-08	1.72E-04	1.01E-04
68	Elysian Park	5.8	4.30E-07	10,000	250	2.99E-06	1.77E-06	1.23E-06	1.10E-07	2.99E-04	1.77E-04
69	East Los Angeles	7.5	4.30E-07	10,000	250	3.87E-06	2.29E-06	1.59E-06	1.43E-07	3.87E-04	2.29E-04
70	San Gabriel Val	6.0	4.30E-07	10,000	250	3.10E-06	1.83E-06	1.27E-06	1.14E-07	3.10E-04	1.83E-04
71	El monte	0.4	4.30E-07	3,000	250	2.11E-07	1.24E-07	8.63E-08	7.77E-09	2.11E-05	1.24E-05
72	San Gabriel River	0.2	4.30E-07	1,000	250	1.21E-07	7.13E-08	4.96E-08	4.46E-09	1.21E-05	7.13E-06
73	La Puente	4.5	4.30E-07	3,000	250	2.32E-06	1.37E-06	9.50E-07	8.55E-08	2.32E-04	1.37E-04
74	La Puente-Walnut	7.9	4.30E-07	3,000	250	4.08E-06	2.41E-06	1.67E-06	1.51E-07	4.08E-04	2.41E-04
75	Walnut-Pomona	3.1	4.30E-07	3,000	250	1.62E-06	9.54E-07	6.63E-07	5.97E-08	1.62E-04	9.54E-05
76	Pomona	16.0	4.30E-07	3,000	250	8.23E-06	4.86E-06	3.37E-06	3.04E-07	8.23E-04	4.86E-04
77	Ontario	9.3	4.30E-07	3,000	250	4.81E-06	2.84E-06	1.97E-06	1.77E-07	4.81E-04	2.84E-04
78	Fontana	1.2	4.30E-07	1,000	250	6.27E-07	3.70E-07	2.57E-07	2.31E-08	6.27E-05	3.70E-05
79	Colton	2.1	2.60E-07	3,000	250	6.39E-07	3.77E-07	2.62E-07	2.36E-08	6.39E-05	3.77E-05
80	Rialto	1.9	2.60E-07	1,000	250	5.79E-07	3.41E-07	2.37E-07	2.13E-08	5.79E-05	3.41E-05
81	Rialto	1.1	2.60E-07	100	250	3.44E-07	2.03E-07	1.41E-07	1.27E-08	3.44E-05	2.03E-05
82	San Bernardino	1.9	2.60E-07	1,000	250	5.86E-07	3.46E-07	2.40E-07	2.16E-08	5.86E-05	3.46E-05
83	S. Bernardino Co	3.2	2.60E-07	100	250	1.01E-06	5.96E-07	4.14E-07	3.73E-08	1.01E-04	5.96E-05
84	Devore	1.6	2.60E-07	1,000	250	5.09E-07	3.00E-07	2.09E-07	1.88E-08	5.09E-05	3.00E-05
85	Cajon Pass	19.5	2.60E-07	100	250	6.08E-06	3.58E-06	2.49E-06	2.24E-07	6.08E-04	3.58E-04
86	Hesperia	4.5	2.60E-07	1,000	250	1.41E-06	8.32E-07	5.78E-07	5.21E-08	1.41E-04	8.32E-05
87	Hesperia	1.0	2.60E-07	100	250	3.23E-07	1.91E-07	1.32E-07	1.19E-08	3.23E-05	1.91E-05

Table 4.7.13 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Colton to SMR Route

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
88	Victorville	4.3	2.60E-07	1,000	250	1.35E-06	7.97E-07	5.54E-07	4.98E-08	1.35E-04	7.97E-05
89	Victorville	2.1	2.60E-07	100	250	6.40E-07	3.78E-07	2.63E-07	2.36E-08	6.40E-05	3.78E-05
90	Victorville	0.7	2.60E-07	1,000	250	2.30E-07	1.36E-07	9.44E-08	8.50E-09	2.30E-05	1.36E-05
91	Victorville	4.5	2.60E-07	100	250	1.39E-06	8.19E-07	5.69E-07	5.12E-08	1.39E-04	8.19E-05
92	Oro Grande	0.5	2.60E-07	1,000	250	1.60E-07	9.46E-08	6.57E-08	5.91E-09	1.60E-05	9.46E-06
93	Helendale	25.4	2.60E-07	100	250	7.90E-06	4.66E-06	3.24E-06	2.91E-07	7.90E-04	4.66E-04
94	Lenwood	1.1	2.60E-07	1,000	250	3.48E-07	2.05E-07	1.43E-07	1.29E-08	3.48E-05	2.05E-05
95	Barstow	1.8	2.60E-07	100	250	5.65E-07	3.33E-07	2.32E-07	2.08E-08	5.65E-05	3.33E-05
96	Barstow	1.7	2.60E-07	1,000	250	5.34E-07	3.15E-07	2.19E-07	1.97E-08	5.34E-05	3.15E-05
97	Barstow	0.7	2.60E-07	100	250	2.28E-07	1.35E-07	9.36E-08	8.43E-09	2.28E-05	1.35E-05
98	Barstow	6.2	2.60E-07	1,000	250	1.93E-06	1.14E-06	7.89E-07	7.10E-08	1.93E-04	1.14E-04
99	Daggett	2.4	2.60E-07	100	250	7.57E-07	4.46E-07	3.10E-07	2.79E-08	7.57E-05	4.46E-05
100	Daggett	0.8	2.60E-07	1,000	250	2.36E-07	1.39E-07	9.68E-08	8.71E-09	2.36E-05	1.39E-05
101	MCSC	4.3	2.60E-07	100	250	1.35E-06	7.98E-07	5.55E-07	4.99E-08	1.35E-04	7.98E-05
102	Yermo	1.3	2.60E-07	1,000	250	3.97E-07	2.34E-07	1.63E-07	1.46E-08	3.97E-05	2.34E-05
103	Mojave Desert	123.5	2.60E-07	100	250	3.85E-05	2.27E-05	1.58E-05	1.42E-06	3.85E-03	2.27E-03

Table 4.7.14 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
1	Arroyo Grande	1.6	3.90E-07	1,000	250	7.24E-07	4.27E-07	2.97E-07	2.67E-08	7.24E-05	4.27E-05
2	Arroyo Grande	0.8	3.90E-07	100	250	3.73E-07	2.20E-07	1.53E-07	1.38E-08	3.73E-05	2.20E-05
3	Arroyo Grande	0.9	3.90E-07	1,000	250	4.39E-07	2.59E-07	1.80E-07	1.62E-08	4.39E-05	2.59E-05
4	Arroyo Grande	1.4	3.90E-07	100	250	6.45E-07	3.81E-07	2.65E-07	2.38E-08	6.45E-05	3.81E-05
5	Oceano	0.4	3.90E-07	3,000	250	1.88E-07	1.11E-07	7.71E-08	6.94E-09	1.88E-05	1.11E-05
6	Oceano	0.6	3.90E-07	10,000	250	2.92E-07	1.72E-07	1.20E-07	1.08E-08	2.92E-05	1.72E-05
7	Oceano	0.2	3.90E-07	3,000	250	1.12E-07	6.59E-08	4.58E-08	4.12E-09	1.12E-05	6.59E-06
8	Pismo/Grover	2.1	3.90E-07	10,000	250	9.80E-07	5.78E-07	4.02E-07	3.62E-08	9.80E-05	5.78E-05
9	Pismo	0.3	3.90E-07	3,000	250	1.35E-07	7.96E-08	5.53E-08	4.98E-09	1.35E-05	7.96E-06
10	Pismo	0.4	3.90E-07	1,000	250	1.72E-07	1.02E-07	7.06E-08	6.35E-09	1.72E-05	1.02E-05
11	Price Canyon	5.2	3.90E-07	100	250	2.42E-06	1.43E-06	9.93E-07	8.94E-08	2.42E-04	1.43E-04
12	Edna	0.6	3.90E-07	1,000	250	2.81E-07	1.66E-07	1.15E-07	1.04E-08	2.81E-05	1.66E-05
13	Edna	1.6	3.90E-07	100	250	7.56E-07	4.46E-07	3.10E-07	2.79E-08	7.56E-05	4.46E-05
14	San Luis Obispo	4.7	3.90E-07	10,000	250	2.18E-06	1.29E-06	8.94E-07	8.05E-08	2.18E-04	1.29E-04
15	San Luis Obispo	0.6	3.90E-07	3,000	250	2.64E-07	1.56E-07	1.08E-07	9.74E-09	2.64E-05	1.56E-05
16	Chorro	0.4	3.90E-07	1,000	250	1.99E-07	1.17E-07	8.16E-08	7.35E-09	1.99E-05	1.17E-05
17	Chorro	1.6	3.90E-07	100	250	7.31E-07	4.31E-07	3.00E-07	2.70E-08	7.31E-05	4.31E-05
18	CMC	0.8	3.90E-07	3,000	250	3.56E-07	2.10E-07	1.46E-07	1.31E-08	3.56E-05	2.10E-05
19	Santa Lucia	11.2	3.90E-07	100	250	5.22E-06	3.08E-06	2.14E-06	1.93E-07	5.22E-04	3.08E-04
20	Santa Margarita	0.9	3.90E-07	3,000	250	4.12E-07	2.43E-07	1.69E-07	1.52E-08	4.12E-05	2.43E-05
21	Phillips PS	0.9	3.90E-07	100	250	3.97E-07	2.34E-07	1.63E-07	1.47E-08	3.97E-05	2.34E-05
22	Atascadero	7.4	3.90E-07	1,000	250	3.46E-06	2.04E-06	1.42E-06	1.28E-07	3.46E-04	2.04E-04
23	Atascadero	1.6	3.90E-07	3,000	250	7.47E-07	4.41E-07	3.06E-07	2.76E-08	7.47E-05	4.41E-05
24	Atascadero	1.3	3.90E-07	1,000	250	5.95E-07	3.51E-07	2.44E-07	2.19E-08	5.95E-05	3.51E-05
25	Atascadero	0.4	3.90E-07	3,000	250	2.01E-07	1.19E-07	8.24E-08	7.42E-09	2.01E-05	1.19E-05
26	101	0.4	3.90E-07	1,000	250	1.71E-07	1.01E-07	7.00E-08	6.30E-09	1.71E-05	1.01E-05
27	Templeton	2.1	3.90E-07	3,000	250	9.99E-07	5.90E-07	4.10E-07	3.69E-08	9.99E-05	5.90E-05
28	Paso Robles	0.5	3.90E-07	1,000	250	2.40E-07	1.41E-07	9.83E-08	8.85E-09	2.40E-05	1.41E-05
29	Paso Robles	0.8	3.90E-07	3,000	250	3.93E-07	2.32E-07	1.61E-07	1.45E-08	3.93E-05	2.32E-05

Table 4.7.14 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
30	Paso Robles	2.7	3.90E-07	1,000	250	1.28E-06	7.57E-07	5.26E-07	4.74E-08	1.28E-04	7.57E-05
31	Paso Robles	2.1	3.90E-07	3,000	250	9.99E-07	5.89E-07	4.10E-07	3.69E-08	9.99E-05	5.89E-05
32	Paso Robles	0.4	3.90E-07	10,000	250	2.03E-07	1.20E-07	8.32E-08	7.49E-09	2.03E-05	1.20E-05
33	Paso Robles	1.2	3.90E-07	3,000	250	5.43E-07	3.20E-07	2.23E-07	2.00E-08	5.43E-05	3.20E-05
34	101	2.1	3.90E-07	100	250	9.91E-07	5.84E-07	4.06E-07	3.66E-08	9.91E-05	5.84E-05
35	Wellsona	2.4	3.90E-07	1,000	250	1.14E-06	6.73E-07	4.68E-07	4.21E-08	1.14E-04	6.73E-05
36	101	1.9	3.90E-07	100	250	8.71E-07	5.14E-07	3.57E-07	3.22E-08	8.71E-05	5.14E-05
37	San Miguel	1.5	3.90E-07	3,000	250	6.86E-07	4.05E-07	2.81E-07	2.53E-08	6.86E-05	4.05E-05
38	101	2.7	3.90E-07	100	250	1.24E-06	7.31E-07	5.08E-07	4.57E-08	1.24E-04	7.31E-05
39	Camp Roberts	5.7	3.90E-07	100	250	2.67E-06	1.57E-06	1.09E-06	9.84E-08	2.67E-04	1.57E-04
40	Bradley	15.3	3.90E-07	100	250	7.15E-06	4.22E-06	2.93E-06	2.64E-07	7.15E-04	4.22E-04
41	San Lucas	18.5	3.90E-07	100	250	8.65E-06	5.10E-06	3.55E-06	3.19E-07	8.65E-04	5.10E-04
42	King City	1.5	3.90E-07	1,000	250	6.82E-07	4.02E-07	2.80E-07	2.52E-08	6.82E-05	4.02E-05
43	Clark Ranch	18.1	3.90E-07	100	250	8.45E-06	4.99E-06	3.46E-06	3.12E-07	8.45E-04	4.99E-04
44	Soledad	1.4	3.90E-07	1,000	250	6.63E-07	3.91E-07	2.72E-07	2.45E-08	6.63E-05	3.91E-05
45	Salinas Vly Ag	7.3	3.90E-07	100	250	3.43E-06	2.02E-06	1.41E-06	1.27E-07	3.43E-04	2.02E-04
46	Gonzales	1.2	3.90E-07	3,000	250	5.42E-07	3.20E-07	2.22E-07	2.00E-08	5.42E-05	3.20E-05
47	Salinas Vly Ag	5.0	3.90E-07	100	250	2.35E-06	1.39E-06	9.63E-07	8.67E-08	2.35E-04	1.39E-04
48	Chular	0.6	3.90E-07	1,000	250	2.98E-07	1.76E-07	1.22E-07	1.10E-08	2.98E-05	1.76E-05
49	Sprekles	7.8	3.90E-07	100	250	3.63E-06	2.14E-06	1.49E-06	1.34E-07	3.63E-04	2.14E-04
50	Salinas	3.9	3.90E-07	6,500	250	1.84E-06	1.08E-06	7.53E-07	6.77E-08	1.84E-04	1.08E-04
51	Salinas Vly Ag	6.2	3.90E-07	100	250	2.89E-06	1.70E-06	1.18E-06	1.07E-07	2.89E-04	1.70E-04
52	Castroville	1.1	3.90E-07	1,000	250	5.28E-07	3.11E-07	2.16E-07	1.95E-08	5.28E-05	3.11E-05
53	Las Lomas	15.4	3.90E-07	100	250	7.21E-06	4.26E-06	2.96E-06	2.66E-07	7.21E-04	4.26E-04
54	Aromas	12.1	3.90E-07	100	250	5.63E-06	3.32E-06	2.31E-06	2.08E-07	5.63E-04	3.32E-04
55	Gilroy	4.2	3.90E-07	3,000	250	1.95E-06	1.15E-06	8.01E-07	7.20E-08	1.95E-04	1.15E-04
56	San Martin	6.1	3.90E-07	100	250	2.83E-06	1.67E-06	1.16E-06	1.04E-07	2.83E-04	1.67E-04
57	Morgan Hill	3.8	3.90E-07	3,000	250	1.79E-06	1.06E-06	7.34E-07	6.60E-08	1.79E-04	1.06E-04
58	Coyote Valley	6.7	3.90E-07	100	250	3.12E-06	1.84E-06	1.28E-06	1.15E-07	3.12E-04	1.84E-04

Table 4.7.14 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
59	San Jose	6.3	3.90E-07	5,000	250	2.96E-06	1.75E-06	1.21E-06	1.09E-07	2.96E-04	1.75E-04
60	Seven Trees	1.9	3.90E-07	1,000	250	8.69E-07	5.13E-07	3.56E-07	3.21E-08	8.69E-05	5.13E-05
61	San Jose	5.0	3.90E-07	10,000	250	2.32E-06	1.37E-06	9.50E-07	8.55E-08	2.32E-04	1.37E-04
62	Santa Clara	5.1	3.90E-07	6,500	250	2.39E-06	1.41E-06	9.79E-07	8.81E-08	2.39E-04	1.41E-04
63	Alviso	1.7	3.90E-07	1,000	250	8.03E-07	4.74E-07	3.29E-07	2.96E-08	8.03E-05	4.74E-05
64	Drawbridge	5.7	3.90E-07	100	250	2.66E-06	1.57E-06	1.09E-06	9.82E-08	2.66E-04	1.57E-04
65	Newark	2.3	3.90E-07	1,000	250	1.05E-06	6.20E-07	4.31E-07	3.88E-08	1.05E-04	6.20E-05
66	Newark/Russell	11.3	3.90E-07	10,000	250	5.30E-06	3.13E-06	2.17E-06	1.95E-07	5.30E-04	3.13E-04
67	San Lorenzo	0.8	3.90E-07	3,000	250	3.73E-07	2.20E-07	1.53E-07	1.38E-08	3.73E-05	2.20E-05
68	San Leandro	1.3	3.90E-07	10,000	250	5.98E-07	3.53E-07	2.45E-07	2.21E-08	5.98E-05	3.53E-05
69	San Leandro	0.7	3.90E-07	3,000	250	3.37E-07	1.99E-07	1.38E-07	1.24E-08	3.37E-05	1.99E-05
70	Oakland	5.3	3.90E-07	10,000	250	2.46E-06	1.45E-06	1.01E-06	9.07E-08	2.46E-04	1.45E-04
71	Oakland	1.4	3.90E-07	3,000	250	6.40E-07	3.78E-07	2.62E-07	2.36E-08	6.40E-05	3.78E-05
72	Oakland	1.6	3.90E-07	10,000	250	7.57E-07	4.46E-07	3.10E-07	2.79E-08	7.57E-05	4.46E-05
73	Oakland	1.4	3.90E-07	3,000	250	6.31E-07	3.72E-07	2.59E-07	2.33E-08	6.31E-05	3.72E-05
74	Oakland	1.5	3.90E-07	10,000	250	7.19E-07	4.24E-07	2.95E-07	2.65E-08	7.19E-05	4.24E-05
75	Oakland	2.7	3.90E-07	3,000	250	1.25E-06	7.36E-07	5.11E-07	4.60E-08	1.25E-04	7.36E-05
76	Emeryville	1.5	3.90E-07	10,000	250	6.77E-07	4.00E-07	2.78E-07	2.50E-08	6.77E-05	4.00E-05
77	Berkeley	1.0	3.90E-07	3,000	250	4.72E-07	2.78E-07	1.93E-07	1.74E-08	4.72E-05	2.78E-05
78	Berkeley	1.8	3.90E-07	10,000	250	8.17E-07	4.82E-07	3.35E-07	3.02E-08	8.17E-05	4.82E-05
79	Richmond	1.5	3.90E-07	3,000	250	7.01E-07	4.13E-07	2.87E-07	2.59E-08	7.01E-05	4.13E-05
80	Richmond	3.8	3.90E-07	10,000	250	1.76E-06	1.04E-06	7.20E-07	6.48E-08	1.76E-04	1.04E-04
81	North Richmond	1.1	3.90E-07	3,000	250	4.90E-07	2.89E-07	2.01E-07	1.81E-08	4.90E-05	2.89E-05
82	San Pablo	2.5	3.90E-07	1,000	250	1.16E-06	6.86E-07	4.77E-07	4.29E-08	1.16E-04	6.86E-05
83	Sobranto	1.8	3.90E-07	100	250	8.17E-07	4.82E-07	3.35E-07	3.02E-08	8.17E-05	4.82E-05
84	Hercules	5.6	3.90E-07	1,000	250	2.62E-06	1.55E-06	1.07E-06	9.67E-08	2.62E-04	1.55E-04
85	Selby	1.7	3.90E-07	100	250	7.89E-07	4.66E-07	3.24E-07	2.91E-08	7.89E-05	4.66E-05
86	Crockett	1.6	3.90E-07	1,000	250	7.29E-07	4.30E-07	2.99E-07	2.69E-08	7.29E-05	4.30E-05
87	Port Costa	4.3	3.90E-07	100	250	2.01E-06	1.19E-06	8.25E-07	7.43E-08	2.01E-04	1.19E-04

Table 4.7.14 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
88	Martinez	0.5	3.90E-07	1,000	250	2.26E-07	1.34E-07	9.28E-08	8.35E-09	2.26E-05	1.34E-05
89	Suisun Pt Chnl	2.6	3.90E-07	100	250	1.20E-06	7.08E-07	4.92E-07	4.43E-08	1.20E-04	7.08E-05
90	Benicia	3.5	3.90E-07	1,000	250	1.63E-06	9.65E-07	6.70E-07	6.03E-08	1.63E-04	9.65E-05
91	Grizzly Bay	10.6	3.90E-07	100	250	4.94E-06	2.92E-06	2.03E-06	1.82E-07	4.94E-04	2.92E-04
92	Fairfield	3.8	3.90E-07	3,000	250	1.78E-06	1.05E-06	7.32E-07	6.58E-08	1.78E-04	1.05E-04
93	Elmira	13.7	3.90E-07	100	250	6.40E-06	3.78E-06	2.62E-06	2.36E-07	6.40E-04	3.78E-04
94	Dixon	2.1	3.90E-07	1,000	250	1.00E-06	5.90E-07	4.10E-07	3.69E-08	1.00E-04	5.90E-05
95	Solano Co Ag	6.6	3.90E-07	100	250	3.09E-06	1.82E-06	1.27E-06	1.14E-07	3.09E-04	1.82E-04
96	Davis	3.5	3.90E-07	1,000	250	1.65E-06	9.73E-07	6.76E-07	6.08E-08	1.65E-04	9.73E-05
97	Yolo Co Ag	7.0	3.90E-07	100	250	3.27E-06	1.93E-06	1.34E-06	1.20E-07	3.27E-04	1.93E-04
98	Sacramento	3.3	3.90E-07	3,000	250	1.52E-06	8.96E-07	6.22E-07	5.60E-08	1.52E-04	8.96E-05
99	Sacramento Rvr	0.4	3.90E-07	100	250	1.96E-07	1.16E-07	8.05E-08	7.24E-09	1.96E-05	1.16E-05
100	Sacramento	2.5	3.90E-07	10,000	250	1.15E-06	6.78E-07	4.71E-07	4.24E-08	1.15E-04	6.78E-05
101	Parkland	1.6	3.90E-07	100	250	7.57E-07	4.46E-07	3.10E-07	2.79E-08	7.57E-05	4.46E-05
102	Sacramento	3.1	3.90E-07	3,000	250	1.45E-06	8.54E-07	5.94E-07	5.34E-08	1.45E-04	8.54E-05
103	North Highlands	2.6	3.90E-07	1,000	250	1.21E-06	7.11E-07	4.94E-07	4.45E-08	1.21E-04	7.11E-05
104	North Highlands	4.4	3.90E-07	3,000	250	2.04E-06	1.20E-06	8.37E-07	7.53E-08	2.04E-04	1.20E-04
105	Roseville Yard	1.3	3.90E-07	100	250	5.89E-07	3.47E-07	2.41E-07	2.17E-08	5.89E-05	3.47E-05
145	Roseville	2.3	2.70E-07	3,000	250	7.37E-07	4.35E-07	3.02E-07	2.72E-08	7.37E-05	4.35E-05
146	Roseville	1.3	2.70E-07	1,000	250	4.13E-07	2.43E-07	1.69E-07	1.52E-08	4.13E-05	2.43E-05
147	Roseville	0.1	2.70E-07	100	250	4.79E-08	2.83E-08	1.96E-08	1.77E-09	4.79E-06	2.83E-06
148	Placer Co	2.9	2.70E-07	1,000	250	9.45E-07	5.58E-07	3.88E-07	3.49E-08	9.45E-05	5.58E-05
149	Lincoln	1.2	2.70E-07	100	250	3.86E-07	2.28E-07	1.58E-07	1.42E-08	3.86E-05	2.28E-05
150	Lincoln	2.9	2.70E-07	3,000	250	9.27E-07	5.47E-07	3.80E-07	3.42E-08	9.27E-05	5.47E-05
151	Sheridan	10.7	2.70E-07	100	250	3.45E-06	2.03E-06	1.41E-06	1.27E-07	3.45E-04	2.03E-04
152	Wheatland	0.9	2.70E-07	1,000	250	3.01E-07	1.78E-07	1.23E-07	1.11E-08	3.01E-05	1.78E-05
153	Yuba County	9.2	2.70E-07	100	250	2.99E-06	1.76E-06	1.22E-06	1.10E-07	2.99E-04	1.76E-04
154	Olivehurst	4.3	2.70E-07	1,000	250	1.38E-06	8.13E-07	5.65E-07	5.08E-08	1.38E-04	8.13E-05
155	Marysville	1.3	2.70E-07	3,000	250	4.29E-07	2.53E-07	1.76E-07	1.58E-08	4.29E-05	2.53E-05

Table 4.7.14 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
156	Marysville	2.3	2.70E-07	100	250	7.51E-07	4.43E-07	3.08E-07	2.77E-08	7.51E-05	4.43E-05
157	Live Oak	0.3	2.70E-07	1,000	250	1.06E-07	6.27E-08	4.36E-08	3.92E-09	1.06E-05	6.27E-06
158	Live Oak	6.4	2.70E-07	100	250	2.08E-06	1.23E-06	8.51E-07	7.66E-08	2.08E-04	1.23E-04
159	Live Oak	0.4	2.70E-07	1,000	250	1.18E-07	6.99E-08	4.86E-08	4.37E-09	1.18E-05	6.99E-06
160	Live Oak	1.0	2.70E-07	3,000	250	3.28E-07	1.93E-07	1.34E-07	1.21E-08	3.28E-05	1.93E-05
161	Butte Co	5.2	2.70E-07	100	250	1.69E-06	9.97E-07	6.93E-07	6.23E-08	1.69E-04	9.97E-05
162	Gridley	0.5	2.70E-07	1,000	250	1.47E-07	8.68E-08	6.03E-08	5.43E-09	1.47E-05	8.68E-06
163	Gridley	0.8	2.70E-07	3,000	250	2.68E-07	1.58E-07	1.10E-07	9.89E-09	2.68E-05	1.58E-05
164	Gridley	2.5	2.70E-07	100	250	8.11E-07	4.79E-07	3.33E-07	2.99E-08	8.11E-05	4.79E-05
165	Biggs	0.6	2.70E-07	3,000	250	1.85E-07	1.09E-07	7.59E-08	6.83E-09	1.85E-05	1.09E-05
166	Butte Co	5.1	2.70E-07	100	250	1.66E-06	9.79E-07	6.80E-07	6.12E-08	1.66E-04	9.79E-05
167	Richvale	0.8	2.70E-07	1,000	250	2.70E-07	1.59E-07	1.11E-07	9.97E-09	2.70E-05	1.59E-05
168	Nelson	9.3	2.70E-07	100	250	3.00E-06	1.77E-06	1.23E-06	1.11E-07	3.00E-04	1.77E-04
169	Durham	2.4	2.70E-07	1,000	250	7.88E-07	4.65E-07	3.23E-07	2.91E-08	7.88E-05	4.65E-05
170	Chico	4.3	2.70E-07	100	250	1.40E-06	8.25E-07	5.73E-07	5.16E-08	1.40E-04	8.25E-05
171	Chico	4.5	2.70E-07	1,000	250	1.46E-06	8.61E-07	5.98E-07	5.39E-08	1.46E-04	8.61E-05
172	Chico	2.8	2.70E-07	100	250	9.06E-07	5.35E-07	3.71E-07	3.34E-08	9.06E-05	5.35E-05
173	Nord	0.6	2.70E-07	1,000	250	1.89E-07	1.11E-07	7.73E-08	6.96E-09	1.89E-05	1.11E-05
174	Butte Co	11.3	2.70E-07	100	250	3.67E-06	2.16E-06	1.50E-06	1.35E-07	3.67E-04	2.16E-04
175	Vina	0.4	2.70E-07	1,000	250	1.44E-07	8.51E-08	5.91E-08	5.32E-09	1.44E-05	8.51E-06
176	Copeland	6.3	2.70E-07	100	250	2.04E-06	1.20E-06	8.37E-07	7.53E-08	2.04E-04	1.20E-04
177	Los Molinos	0.5	2.70E-07	1,000	250	1.68E-07	9.91E-08	6.89E-08	6.20E-09	1.68E-05	9.91E-06
178	Los Molinos	1.0	2.70E-07	100	250	3.21E-07	1.89E-07	1.32E-07	1.19E-08	3.21E-05	1.89E-05
179	Tehema	0.3	2.70E-07	1,000	250	1.08E-07	6.34E-08	4.41E-08	3.97E-09	1.08E-05	6.34E-06
180	Tehema	2.2	2.70E-07	100	250	7.23E-07	4.27E-07	2.97E-07	2.67E-08	7.23E-05	4.27E-05
181	Gerber	2.3	2.70E-07	1,000	250	7.49E-07	4.42E-07	3.07E-07	2.76E-08	7.49E-05	4.42E-05
182	Tehema Co	1.8	2.70E-07	100	250	5.78E-07	3.41E-07	2.37E-07	2.13E-08	5.78E-05	3.41E-05
183	Red Bluff	0.8	2.70E-07	1,000	250	2.49E-07	1.47E-07	1.02E-07	9.21E-09	2.49E-05	1.47E-05
184	Red Bluff	4.6	2.70E-07	100	250	1.50E-06	8.83E-07	6.14E-07	5.52E-08	1.50E-04	8.83E-05

Table 4.7.14 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
185	Red Bluff	3.3	2.70E-07	1,000	250	1.06E-06	6.26E-07	4.35E-07	3.92E-08	1.06E-04	6.26E-05
186	Tehema Co	15.3	2.70E-07	100	250	4.94E-06	2.92E-06	2.03E-06	1.82E-07	4.94E-04	2.92E-04
187	Cottonwood	0.6	2.70E-07	1,000	250	1.97E-07	1.16E-07	8.08E-08	7.27E-09	1.97E-05	1.16E-05
188	Anderson	5.4	2.70E-07	100	250	1.73E-06	1.02E-06	7.10E-07	6.39E-08	1.73E-04	1.02E-04
189	Anderson	3.5	2.70E-07	1,000	250	1.15E-06	6.77E-07	4.70E-07	4.23E-08	1.15E-04	6.77E-05
190	Anderson	4.1	2.70E-07	100	250	1.32E-06	7.79E-07	5.42E-07	4.87E-08	1.32E-04	7.79E-05
191	Redding	6.0	2.70E-07	1,000	250	1.95E-06	1.15E-06	8.01E-07	7.21E-08	1.95E-04	1.15E-04
192	Redding	0.8	2.70E-07	1,000	250	2.46E-07	1.45E-07	1.01E-07	9.09E-09	2.46E-05	1.45E-05
193	Redding	1.1	2.70E-07	100	250	3.65E-07	2.16E-07	1.50E-07	1.35E-08	3.65E-05	2.16E-05
194	Redding	0.4	2.70E-07	1,000	250	1.26E-07	7.45E-08	5.18E-08	4.66E-09	1.26E-05	7.45E-06
195	Redding	2.6	2.70E-07	100	250	8.35E-07	4.92E-07	3.42E-07	3.08E-08	8.35E-05	4.92E-05
196	Shasta Co	0.5	2.70E-07	1,000	250	1.69E-07	9.98E-08	6.93E-08	6.24E-09	1.69E-05	9.98E-06
197	Shasta Lake	1.7	2.70E-07	100	250	5.34E-07	3.15E-07	2.19E-07	1.97E-08	5.34E-05	3.15E-05
198	Shasta Lake	0.8	2.70E-07	1,000	250	2.43E-07	1.43E-07	9.96E-08	8.96E-09	2.43E-05	1.43E-05
199	Shasta Co	16.4	2.70E-07	100	250	5.32E-06	3.14E-06	2.18E-06	1.96E-07	5.32E-04	3.14E-04
200	Lakeshore	0.6	2.70E-07	1,000	250	1.96E-07	1.16E-07	8.05E-08	7.24E-09	1.96E-05	1.16E-05
201	Shasta Co	30.4	2.70E-07	100	250	9.82E-06	5.79E-06	4.03E-06	3.62E-07	9.82E-04	5.79E-04
202	Dunsmuir	1.3	2.70E-07	1,000	250	4.21E-07	2.49E-07	1.73E-07	1.56E-08	4.21E-05	2.49E-05
203	Siskiyou Co	12.8	2.70E-07	100	250	4.13E-06	2.44E-06	1.69E-06	1.52E-07	4.13E-04	2.44E-04
204	Mount Shasta	1.1	2.70E-07	1,000	250	3.66E-07	2.16E-07	1.50E-07	1.35E-08	3.66E-05	2.16E-05
205	Siskiyou Co	69.5	2.70E-07	100	250	2.25E-05	1.33E-05	9.21E-06	8.29E-07	2.25E-03	1.33E-03
206	Dorris	0.9	2.70E-07	100	250	2.85E-07	1.68E-07	1.17E-07	1.05E-08	2.85E-05	1.68E-05
207	Siskiyou Co	3.4	2.70E-07	1,000	250	1.10E-06	6.51E-07	4.52E-07	4.07E-08	1.10E-04	6.51E-05

Table 4.7.15 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
1	Arroyo Grande	1.6	3.90E-07	1,000	250	7.24E-07	4.27E-07	2.97E-07	2.67E-08	7.24E-05	4.27E-05
2	Arroyo Grande	0.8	3.90E-07	100	250	3.73E-07	2.20E-07	1.53E-07	1.38E-08	3.73E-05	2.20E-05
3	Arroyo Grande	0.9	3.90E-07	1,000	250	4.39E-07	2.59E-07	1.80E-07	1.62E-08	4.39E-05	2.59E-05
4	Arroyo Grande	1.4	3.90E-07	100	250	6.45E-07	3.81E-07	2.65E-07	2.38E-08	6.45E-05	3.81E-05
5	Oceano	0.4	3.90E-07	3,000	250	1.88E-07	1.11E-07	7.71E-08	6.94E-09	1.88E-05	1.11E-05
6	Oceano	0.6	3.90E-07	10,000	250	2.92E-07	1.72E-07	1.20E-07	1.08E-08	2.92E-05	1.72E-05
7	Oceano	0.2	3.90E-07	3,000	250	1.12E-07	6.59E-08	4.58E-08	4.12E-09	1.12E-05	6.59E-06
8	Pismo/Grover	2.1	3.90E-07	10,000	250	9.80E-07	5.78E-07	4.02E-07	3.62E-08	9.80E-05	5.78E-05
9	Pismo	0.3	3.90E-07	3,000	250	1.35E-07	7.96E-08	5.53E-08	4.98E-09	1.35E-05	7.96E-06
10	Pismo	0.4	3.90E-07	1,000	250	1.72E-07	1.02E-07	7.06E-08	6.35E-09	1.72E-05	1.02E-05
11	Price Canyon	5.2	3.90E-07	100	250	2.42E-06	1.43E-06	9.93E-07	8.94E-08	2.42E-04	1.43E-04
12	Edna	0.6	3.90E-07	1,000	250	2.81E-07	1.66E-07	1.15E-07	1.04E-08	2.81E-05	1.66E-05
13	Edna	1.6	3.90E-07	100	250	7.56E-07	4.46E-07	3.10E-07	2.79E-08	7.56E-05	4.46E-05
14	San Luis Obispo	4.7	3.90E-07	10,000	250	2.18E-06	1.29E-06	8.94E-07	8.05E-08	2.18E-04	1.29E-04
15	San Luis Obispo	0.6	3.90E-07	3,000	250	2.64E-07	1.56E-07	1.08E-07	9.74E-09	2.64E-05	1.56E-05
16	Chorro	0.4	3.90E-07	1,000	250	1.99E-07	1.17E-07	8.16E-08	7.35E-09	1.99E-05	1.17E-05
17	Chorro	1.6	3.90E-07	100	250	7.31E-07	4.31E-07	3.00E-07	2.70E-08	7.31E-05	4.31E-05
18	CMC	0.8	3.90E-07	3,000	250	3.56E-07	2.10E-07	1.46E-07	1.31E-08	3.56E-05	2.10E-05
19	Santa Lucia	11.2	3.90E-07	100	250	5.22E-06	3.08E-06	2.14E-06	1.93E-07	5.22E-04	3.08E-04
20	Santa Margarita	0.9	3.90E-07	3,000	250	4.12E-07	2.43E-07	1.69E-07	1.52E-08	4.12E-05	2.43E-05
21	Phillips PS	0.9	3.90E-07	100	250	3.97E-07	2.34E-07	1.63E-07	1.47E-08	3.97E-05	2.34E-05
22	Atascadero	7.4	3.90E-07	1,000	250	3.46E-06	2.04E-06	1.42E-06	1.28E-07	3.46E-04	2.04E-04
23	Atascadero	1.6	3.90E-07	3,000	250	7.47E-07	4.41E-07	3.06E-07	2.76E-08	7.47E-05	4.41E-05
24	Atascadero	1.3	3.90E-07	1,000	250	5.95E-07	3.51E-07	2.44E-07	2.19E-08	5.95E-05	3.51E-05
25	Atascadero	0.4	3.90E-07	3,000	250	2.01E-07	1.19E-07	8.24E-08	7.42E-09	2.01E-05	1.19E-05
26	101	0.4	3.90E-07	1,000	250	1.71E-07	1.01E-07	7.00E-08	6.30E-09	1.71E-05	1.01E-05
27	Templeton	2.1	3.90E-07	3,000	250	9.99E-07	5.90E-07	4.10E-07	3.69E-08	9.99E-05	5.90E-05
28	Paso Robles	0.5	3.90E-07	1,000	250	2.40E-07	1.41E-07	9.83E-08	8.85E-09	2.40E-05	1.41E-05
29	Paso Robles	0.8	3.90E-07	3,000	250	3.93E-07	2.32E-07	1.61E-07	1.45E-08	3.93E-05	2.32E-05

Table 4.7.15 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Oakland

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
30	Paso Robles	2.7	3.90E-07	1,000	250	1.28E-06	7.57E-07	5.26E-07	4.74E-08	1.28E-04	7.57E-05
31	Paso Robles	2.1	3.90E-07	3,000	250	9.99E-07	5.89E-07	4.10E-07	3.69E-08	9.99E-05	5.89E-05
32	Paso Robles	0.4	3.90E-07	10,000	250	2.03E-07	1.20E-07	8.32E-08	7.49E-09	2.03E-05	1.20E-05
33	Paso Robles	1.2	3.90E-07	3,000	250	5.43E-07	3.20E-07	2.23E-07	2.00E-08	5.43E-05	3.20E-05
34	101	2.1	3.90E-07	100	250	9.91E-07	5.84E-07	4.06E-07	3.66E-08	9.91E-05	5.84E-05
35	Wellsona	2.4	3.90E-07	1,000	250	1.14E-06	6.73E-07	4.68E-07	4.21E-08	1.14E-04	6.73E-05
36	101	1.9	3.90E-07	100	250	8.71E-07	5.14E-07	3.57E-07	3.22E-08	8.71E-05	5.14E-05
37	San Miguel	1.5	3.90E-07	3,000	250	6.86E-07	4.05E-07	2.81E-07	2.53E-08	6.86E-05	4.05E-05
38	101	2.7	3.90E-07	100	250	1.24E-06	7.31E-07	5.08E-07	4.57E-08	1.24E-04	7.31E-05
39	Camp Roberts	5.7	3.90E-07	100	250	2.67E-06	1.57E-06	1.09E-06	9.84E-08	2.67E-04	1.57E-04
40	Bradley	15.3	3.90E-07	100	250	7.15E-06	4.22E-06	2.93E-06	2.64E-07	7.15E-04	4.22E-04
41	San Lucas	18.5	3.90E-07	100	250	8.65E-06	5.10E-06	3.55E-06	3.19E-07	8.65E-04	5.10E-04
42	King City	1.5	3.90E-07	1,000	250	6.82E-07	4.02E-07	2.80E-07	2.52E-08	6.82E-05	4.02E-05
43	Clark Ranch	18.1	3.90E-07	100	250	8.45E-06	4.99E-06	3.46E-06	3.12E-07	8.45E-04	4.99E-04
44	Soledad	1.4	3.90E-07	1,000	250	6.63E-07	3.91E-07	2.72E-07	2.45E-08	6.63E-05	3.91E-05
45	Salinas Valley Ag	7.3	3.90E-07	100	250	3.43E-06	2.02E-06	1.41E-06	1.27E-07	3.43E-04	2.02E-04
46	Gonzales	1.2	3.90E-07	3,000	250	5.42E-07	3.20E-07	2.22E-07	2.00E-08	5.42E-05	3.20E-05
47	Salinas Valley Ag	5.0	3.90E-07	100	250	2.35E-06	1.39E-06	9.63E-07	8.67E-08	2.35E-04	1.39E-04
48	Chular	0.6	3.90E-07	1,000	250	2.98E-07	1.76E-07	1.22E-07	1.10E-08	2.98E-05	1.76E-05
49	Sprekles	7.8	3.90E-07	100	250	3.63E-06	2.14E-06	1.49E-06	1.34E-07	3.63E-04	2.14E-04
50	Salinas	3.9	3.90E-07	6,500	250	1.84E-06	1.08E-06	7.53E-07	6.77E-08	1.84E-04	1.08E-04
51	Salinas Valley Ag	6.2	3.90E-07	100	250	2.89E-06	1.70E-06	1.18E-06	1.07E-07	2.89E-04	1.70E-04
52	Castroville	1.1	3.90E-07	1,000	250	5.28E-07	3.11E-07	2.16E-07	1.95E-08	5.28E-05	3.11E-05
53	Las Lomas	15.4	3.90E-07	100	250	7.21E-06	4.26E-06	2.96E-06	2.66E-07	7.21E-04	4.26E-04
54	Aromas	12.1	3.90E-07	100	250	5.63E-06	3.32E-06	2.31E-06	2.08E-07	5.63E-04	3.32E-04
55	Gilroy	4.2	3.90E-07	3,000	250	1.95E-06	1.15E-06	8.01E-07	7.20E-08	1.95E-04	1.15E-04
56	San Martin	6.1	3.90E-07	100	250	2.83E-06	1.67E-06	1.16E-06	1.04E-07	2.83E-04	1.67E-04
57	Morgan Hill	3.8	3.90E-07	3,000	250	1.79E-06	1.06E-06	7.34E-07	6.60E-08	1.79E-04	1.06E-04
58	Coyote Valley	6.7	3.90E-07	100	250	3.12E-06	1.84E-06	1.28E-06	1.15E-07	3.12E-04	1.84E-04

Table 4.7.15 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Oakland

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
59	San Jose	6.3	3.90E-07	5,000	250	2.96E-06	1.75E-06	1.21E-06	1.09E-07	2.96E-04	1.75E-04
60	Seven Trees	1.9	3.90E-07	1,000	250	8.69E-07	5.13E-07	3.56E-07	3.21E-08	8.69E-05	5.13E-05
61	San Jose	5.0	3.90E-07	10,000	250	2.32E-06	1.37E-06	9.50E-07	8.55E-08	2.32E-04	1.37E-04
62	Santa Clara	5.1	3.90E-07	6,500	250	2.39E-06	1.41E-06	9.79E-07	8.81E-08	2.39E-04	1.41E-04
63	Alviso	1.7	3.90E-07	1,000	250	8.03E-07	4.74E-07	3.29E-07	2.96E-08	8.03E-05	4.74E-05
64	Drawbridge	5.7	3.90E-07	100	250	2.66E-06	1.57E-06	1.09E-06	9.82E-08	2.66E-04	1.57E-04
65	Newark	2.3	3.90E-07	1,000	250	1.05E-06	6.20E-07	4.31E-07	3.88E-08	1.05E-04	6.20E-05
66	Newark to Russell	11.3	3.90E-07	10,000	250	5.30E-06	3.13E-06	2.17E-06	1.95E-07	5.30E-04	3.13E-04
67	San Lorenzo	0.8	3.90E-07	3,000	250	3.73E-07	2.20E-07	1.53E-07	1.38E-08	3.73E-05	2.20E-05
68	San Leandro	1.3	3.90E-07	10,000	250	5.98E-07	3.53E-07	2.45E-07	2.21E-08	5.98E-05	3.53E-05
69	San Leandro	0.7	3.90E-07	3,000	250	3.37E-07	1.99E-07	1.38E-07	1.24E-08	3.37E-05	1.99E-05
70	Oakland	5.3	3.90E-07	10,000	250	2.46E-06	1.45E-06	1.01E-06	9.07E-08	2.46E-04	1.45E-04
71	Oakland	1.4	3.90E-07	3,000	250	6.40E-07	3.78E-07	2.62E-07	2.36E-08	6.40E-05	3.78E-05
72	Oakland	1.6	3.90E-07	10,000	250	7.57E-07	4.46E-07	3.10E-07	2.79E-08	7.57E-05	4.46E-05
73	Oakland	1.4	3.90E-07	3,000	250	6.31E-07	3.72E-07	2.59E-07	2.33E-08	6.31E-05	3.72E-05
74	Oakland	1.5	3.90E-07	10,000	250	7.19E-07	4.24E-07	2.95E-07	2.65E-08	7.19E-05	4.24E-05
75	Oakland	2.7	3.90E-07	3,000	250	1.25E-06	7.36E-07	5.11E-07	4.60E-08	1.25E-04	7.36E-05
76	Emeryville	1.5	3.90E-07	10,000	250	6.77E-07	4.00E-07	2.78E-07	2.50E-08	6.77E-05	4.00E-05
77	Berkeley	1.0	3.90E-07	3,000	250	4.72E-07	2.78E-07	1.93E-07	1.74E-08	4.72E-05	2.78E-05
78	Berkeley	1.8	3.90E-07	10,000	250	8.17E-07	4.82E-07	3.35E-07	3.02E-08	8.17E-05	4.82E-05
79	Richmond	1.5	3.90E-07	3,000	250	7.01E-07	4.13E-07	2.87E-07	2.59E-08	7.01E-05	4.13E-05
80	Richmond	3.8	3.90E-07	10,000	250	1.76E-06	1.04E-06	7.20E-07	6.48E-08	1.76E-04	1.04E-04
81	North Richmond	1.1	3.90E-07	3,000	250	4.90E-07	2.89E-07	2.01E-07	1.81E-08	4.90E-05	2.89E-05
82	San Pablo	2.5	3.90E-07	1,000	250	1.16E-06	6.86E-07	4.77E-07	4.29E-08	1.16E-04	6.86E-05
83	Sobranto	1.8	3.90E-07	100	250	8.17E-07	4.82E-07	3.35E-07	3.02E-08	8.17E-05	4.82E-05
84	Hercules	5.6	3.90E-07	1,000	250	2.62E-06	1.55E-06	1.07E-06	9.67E-08	2.62E-04	1.55E-04
85	Selby	1.7	3.90E-07	100	250	7.89E-07	4.66E-07	3.24E-07	2.91E-08	7.89E-05	4.66E-05
86	Crockett	1.6	3.90E-07	1,000	250	7.29E-07	4.30E-07	2.99E-07	2.69E-08	7.29E-05	4.30E-05
87	Port Costa	4.3	3.90E-07	100	250	2.01E-06	1.19E-06	8.25E-07	7.43E-08	2.01E-04	1.19E-04

Table 4.7.15 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Oakland

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
88	Martinez	0.5	3.90E-07	1,000	250	2.26E-07	1.34E-07	9.28E-08	8.35E-09	2.26E-05	1.34E-05
89	Suisun Pt Channel	2.6	3.90E-07	100	250	1.20E-06	7.08E-07	4.92E-07	4.43E-08	1.20E-04	7.08E-05
90	Benicia	3.5	3.90E-07	1,000	250	1.63E-06	9.65E-07	6.70E-07	6.03E-08	1.63E-04	9.65E-05
91	Grizzly Bay	10.6	3.90E-07	100	250	4.94E-06	2.92E-06	2.03E-06	1.82E-07	4.94E-04	2.92E-04
92	Fairfield	3.8	3.90E-07	3,000	250	1.78E-06	1.05E-06	7.32E-07	6.58E-08	1.78E-04	1.05E-04
93	Elmira	13.7	3.90E-07	100	250	6.40E-06	3.78E-06	2.62E-06	2.36E-07	6.40E-04	3.78E-04
94	Dixon	2.1	3.90E-07	1,000	250	1.00E-06	5.90E-07	4.10E-07	3.69E-08	1.00E-04	5.90E-05
95	Solano Co Ag	6.6	3.90E-07	100	250	3.09E-06	1.82E-06	1.27E-06	1.14E-07	3.09E-04	1.82E-04
96	Davis	3.5	3.90E-07	1,000	250	1.65E-06	9.73E-07	6.76E-07	6.08E-08	1.65E-04	9.73E-05
97	Yolo Co Ag	7.0	3.90E-07	100	250	3.27E-06	1.93E-06	1.34E-06	1.20E-07	3.27E-04	1.93E-04
98	Sacramento	3.3	3.90E-07	3,000	250	1.52E-06	8.96E-07	6.22E-07	5.60E-08	1.52E-04	8.96E-05
99	Sacramento River	0.4	3.90E-07	100	250	1.96E-07	1.16E-07	8.05E-08	7.24E-09	1.96E-05	1.16E-05
100	Sacramento	2.5	3.90E-07	10,000	250	1.15E-06	6.78E-07	4.71E-07	4.24E-08	1.15E-04	6.78E-05
101	Parkland	1.6	3.90E-07	100	250	7.57E-07	4.46E-07	3.10E-07	2.79E-08	7.57E-05	4.46E-05
102	Sacramento	3.1	3.90E-07	3,000	250	1.45E-06	8.54E-07	5.94E-07	5.34E-08	1.45E-04	8.54E-05
103	North Highlands	2.6	3.90E-07	1,000	250	1.21E-06	7.11E-07	4.94E-07	4.45E-08	1.21E-04	7.11E-05
104	North Highlands	4.4	3.90E-07	3,000	250	2.04E-06	1.20E-06	8.37E-07	7.53E-08	2.04E-04	1.20E-04
105	Roseville Yard	1.3	3.90E-07	100	250	5.89E-07	3.47E-07	2.41E-07	2.17E-08	5.89E-05	3.47E-05
129	Roseville	1.4	8.20E-07	3,000	250	1.38E-06	8.16E-07	5.67E-07	5.10E-08	1.38E-04	8.16E-05
130	Roseville	1.1	8.20E-07	3,000	250	1.08E-06	6.37E-07	4.43E-07	3.98E-08	1.08E-04	6.37E-05
131	Roseville	2.1	8.20E-07	1,000	250	2.08E-06	1.23E-06	8.52E-07	7.66E-08	2.08E-04	1.23E-04
132	Roseville	0.5	8.20E-07	3,000	250	4.44E-07	2.62E-07	1.82E-07	1.64E-08	4.44E-05	2.62E-05
133	Rocklin	2.5	8.20E-07	1,000	250	2.47E-06	1.46E-06	1.01E-06	9.11E-08	2.47E-04	1.46E-04
134	Placer Co	8.0	8.20E-07	100	250	7.83E-06	4.62E-06	3.21E-06	2.89E-07	7.83E-04	4.62E-04
135	Newcastle	0.5	8.20E-07	1,000	250	4.43E-07	2.61E-07	1.82E-07	1.63E-08	4.43E-05	2.61E-05
136	Placer Co	2.5	8.20E-07	100	250	2.46E-06	1.45E-06	1.01E-06	9.08E-08	2.46E-04	1.45E-04
137	Auburn	5.3	8.20E-07	1,000	250	5.24E-06	3.09E-06	2.15E-06	1.93E-07	5.24E-04	3.09E-04
138	Placer Co	13.6	8.20E-07	100	250	1.34E-05	7.88E-06	5.47E-06	4.93E-07	1.34E-03	7.88E-04
139	Colfax	0.7	8.20E-07	1,000	250	6.62E-07	3.91E-07	2.71E-07	2.44E-08	6.62E-05	3.91E-05

Table 4.7.15 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Oakland

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	***Segment Description***	***Length (miles)***	***Accident Probability (per mile)***	***Population Density (per sq.mi.)***	***# of Trains (per year)***	***All Spill Probability (per year)***	***Small Spill Probability (per year)***	***Large Spill Probability (per year)***	***All Spill Probability (per year)***	***Small Spill Probability (per year)***	***Large Spill Probability (per year)***
140	Placer Co	61.6	8.20E-07	100	250	6.05E-05	3.57E-05	2.48E-05	2.23E-06	6.05E-03	3.57E-03
141	Truckee	2.1	8.20E-07	1,000	250	2.08E-06	1.23E-06	8.54E-07	7.69E-08	2.08E-04	1.23E-04
142	Nevada Co	13.9	8.20E-07	100	250	1.36E-05	8.04E-06	5.59E-06	5.03E-07	1.36E-03	8.04E-04
143	Floriston	0.2	8.20E-07	1,000	250	2.27E-07	1.34E-07	9.32E-08	8.39E-09	2.27E-05	1.34E-05
144	Sierra Co	5.8	8.20E-07	100	250	5.69E-06	3.36E-06	2.33E-06	2.10E-07	5.69E-04	3.36E-04

Table 4.7.16 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon to Roseville to SMR via Altamont Pass

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
1	Arroyo Grande	1.6	5.10E-07	1,000	250	9.47E-07	5.59E-07	3.88E-07	3.49E-08	9.47E-05	5.59E-05
2	Arroyo Grande	0.8	5.10E-07	100	250	4.88E-07	2.88E-07	2.00E-07	1.80E-08	4.88E-05	2.88E-05
3	Arroyo Grande	0.9	5.10E-07	1,000	250	5.74E-07	3.39E-07	2.35E-07	2.12E-08	5.74E-05	3.39E-05
4	Arroyo Grande	1.4	5.10E-07	100	250	8.44E-07	4.98E-07	3.46E-07	3.11E-08	8.44E-05	4.98E-05
5	Oceano	0.4	5.10E-07	3,000	250	2.46E-07	1.45E-07	1.01E-07	9.07E-09	2.46E-05	1.45E-05
6	Oceano	0.6	5.10E-07	10,000	250	3.81E-07	2.25E-07	1.56E-07	1.41E-08	3.81E-05	2.25E-05
7	Oceano	0.2	5.10E-07	3,000	250	1.46E-07	8.61E-08	5.99E-08	5.39E-09	1.46E-05	8.61E-06
8	Pismo/Grover	2.1	5.10E-07	10,000	250	1.28E-06	7.56E-07	5.25E-07	4.73E-08	1.28E-04	7.56E-05
9	Pismo	0.3	5.10E-07	3,000	250	1.76E-07	1.04E-07	7.23E-08	6.51E-09	1.76E-05	1.04E-05
10	Pismo	0.4	5.10E-07	1,000	250	2.25E-07	1.33E-07	9.23E-08	8.31E-09	2.25E-05	1.33E-05
11	Price Canyon	5.2	5.10E-07	100	250	3.17E-06	1.87E-06	1.30E-06	1.17E-07	3.17E-04	1.87E-04
12	Edna	0.6	5.10E-07	1,000	250	3.67E-07	2.17E-07	1.51E-07	1.35E-08	3.67E-05	2.17E-05
13	Edna	1.6	5.10E-07	100	250	9.89E-07	5.83E-07	4.05E-07	3.65E-08	9.89E-05	5.83E-05
14	San Luis Obispo	4.7	5.10E-07	10,000	250	2.85E-06	1.68E-06	1.17E-06	1.05E-07	2.85E-04	1.68E-04
15	San Luis Obispo	0.6	5.10E-07	3,000	250	3.45E-07	2.04E-07	1.42E-07	1.27E-08	3.45E-05	2.04E-05
16	Chorro	0.4	5.10E-07	1,000	250	2.60E-07	1.54E-07	1.07E-07	9.61E-09	2.60E-05	1.54E-05
17	Chorro	1.6	5.10E-07	100	250	9.56E-07	5.64E-07	3.92E-07	3.53E-08	9.56E-05	5.64E-05
18	CMC	0.8	5.10E-07	3,000	250	4.66E-07	2.75E-07	1.91E-07	1.72E-08	4.66E-05	2.75E-05
19	Santa Lucia	11.2	5.10E-07	100	250	6.83E-06	4.03E-06	2.80E-06	2.52E-07	6.83E-04	4.03E-04
20	Santa Margarita	0.9	5.10E-07	3,000	250	5.39E-07	3.18E-07	2.21E-07	1.99E-08	5.39E-05	3.18E-05
21	Phillips PS	0.9	5.10E-07	100	250	5.19E-07	3.06E-07	2.13E-07	1.92E-08	5.19E-05	3.06E-05
22	Atascadero	7.4	5.10E-07	1,000	250	4.52E-06	2.67E-06	1.85E-06	1.67E-07	4.52E-04	2.67E-04
23	Atascadero	1.6	5.10E-07	3,000	250	9.77E-07	5.77E-07	4.01E-07	3.61E-08	9.77E-05	5.77E-05
24	Atascadero	1.3	5.10E-07	1,000	250	7.77E-07	4.59E-07	3.19E-07	2.87E-08	7.77E-05	4.59E-05
25	Atascadero	0.4	5.10E-07	3,000	250	2.63E-07	1.55E-07	1.08E-07	9.70E-09	2.63E-05	1.55E-05
26	101	0.4	5.10E-07	1,000	250	2.23E-07	1.32E-07	9.16E-08	8.24E-09	2.23E-05	1.32E-05
27	Templeton	2.1	5.10E-07	3,000	250	1.31E-06	7.71E-07	5.36E-07	4.82E-08	1.31E-04	7.71E-05
28	Paso Robles	0.5	5.10E-07	1,000	250	3.14E-07	1.85E-07	1.29E-07	1.16E-08	3.14E-05	1.85E-05
29	Paso Robles	0.8	5.10E-07	3,000	250	5.14E-07	3.03E-07	2.11E-07	1.90E-08	5.14E-05	3.03E-05

Table 4.7.16 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon to Roseville to SMR via Altamont Pass

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
30	Paso Robles	2.7	5.10E-07	1,000	250	1.68E-06	9.90E-07	6.88E-07	6.19E-08	1.68E-04	9.90E-05
31	Paso Robles	2.1	5.10E-07	3,000	250	1.31E-06	7.71E-07	5.36E-07	4.82E-08	1.31E-04	7.71E-05
32	Paso Robles	0.4	5.10E-07	10,000	250	2.65E-07	1.57E-07	1.09E-07	9.79E-09	2.65E-05	1.57E-05
33	Paso Robles	1.2	5.10E-07	3,000	250	7.10E-07	4.19E-07	2.91E-07	2.62E-08	7.10E-05	4.19E-05
34	101	2.1	5.10E-07	100	250	1.30E-06	7.64E-07	5.31E-07	4.78E-08	1.30E-04	7.64E-05
35	Wellsona	2.4	5.10E-07	1,000	250	1.49E-06	8.81E-07	6.12E-07	5.51E-08	1.49E-04	8.81E-05
36	101	1.9	5.10E-07	100	250	1.14E-06	6.72E-07	4.67E-07	4.20E-08	1.14E-04	6.72E-05
37	San Miguel	1.5	5.10E-07	3,000	250	8.97E-07	5.29E-07	3.68E-07	3.31E-08	8.97E-05	5.29E-05
38	101	2.7	5.10E-07	100	250	1.62E-06	9.55E-07	6.64E-07	5.97E-08	1.62E-04	9.55E-05
39	Camp Roberts	5.7	5.10E-07	100	250	3.49E-06	2.06E-06	1.43E-06	1.29E-07	3.49E-04	2.06E-04
40	Bradley	15.3	5.10E-07	100	250	9.35E-06	5.51E-06	3.83E-06	3.45E-07	9.35E-04	5.51E-04
41	San Lucas	18.5	5.10E-07	100	250	1.13E-05	6.67E-06	4.64E-06	4.17E-07	1.13E-03	6.67E-04
42	King City	1.5	5.10E-07	1,000	250	8.92E-07	5.26E-07	3.66E-07	3.29E-08	8.92E-05	5.26E-05
43	Clark Ranch	18.1	5.10E-07	100	250	1.11E-05	6.52E-06	4.53E-06	4.08E-07	1.11E-03	6.52E-04
44	Soledad	1.4	5.10E-07	1,000	250	8.67E-07	5.12E-07	3.56E-07	3.20E-08	8.67E-05	5.12E-05
45	Salinas Valley Ag	7.3	5.10E-07	100	250	4.48E-06	2.65E-06	1.84E-06	1.65E-07	4.48E-04	2.65E-04
46	Gonzales	1.2	5.10E-07	3,000	250	7.09E-07	4.18E-07	2.91E-07	2.61E-08	7.09E-05	4.18E-05
47	Salinas Valley Ag	5.0	5.10E-07	100	250	3.07E-06	1.81E-06	1.26E-06	1.13E-07	3.07E-04	1.81E-04
48	Chular	0.6	5.10E-07	1,000	250	3.89E-07	2.30E-07	1.60E-07	1.44E-08	3.89E-05	2.30E-05
49	Sprekles	7.8	5.10E-07	100	250	4.75E-06	2.80E-06	1.95E-06	1.75E-07	4.75E-04	2.80E-04
50	Salinas	3.9	5.10E-07	6,500	250	2.40E-06	1.42E-06	9.84E-07	8.86E-08	2.40E-04	1.42E-04
51	Salinas Valley Ag	6.2	5.10E-07	100	250	3.78E-06	2.23E-06	1.55E-06	1.39E-07	3.78E-04	2.23E-04
52	Castroville	1.1	5.10E-07	1,000	250	6.90E-07	4.07E-07	2.83E-07	2.55E-08	6.90E-05	4.07E-05
53	Las Lomas	15.4	5.10E-07	100	250	9.43E-06	5.56E-06	3.87E-06	3.48E-07	9.43E-04	5.56E-04
54	Aromas	12.1	5.10E-07	100	250	7.36E-06	4.34E-06	3.02E-06	2.72E-07	7.36E-04	4.34E-04
55	Gilroy	4.2	5.10E-07	3,000	250	2.55E-06	1.51E-06	1.05E-06	9.42E-08	2.55E-04	1.51E-04
56	San Martin	6.1	5.10E-07	100	250	3.70E-06	2.18E-06	1.52E-06	1.36E-07	3.70E-04	2.18E-04
57	Morgan Hill	3.8	5.10E-07	3,000	250	2.34E-06	1.38E-06	9.59E-07	8.63E-08	2.34E-04	1.38E-04
58	Coyote Valley	6.7	5.10E-07	100	250	4.07E-06	2.40E-06	1.67E-06	1.50E-07	4.07E-04	2.40E-04

Table 4.7.16 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon to Roseville to SMR via Altamont Pass

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
59	San Jose	6.3	5.10E-07	5,000	250	3.87E-06	2.28E-06	1.59E-06	1.43E-07	3.87E-04	2.28E-04
60	Seven Trees	1.9	5.10E-07	1,000	250	1.14E-06	6.70E-07	4.66E-07	4.19E-08	1.14E-04	6.70E-05
61	San Jose	5.0	5.10E-07	10,000	250	3.03E-06	1.79E-06	1.24E-06	1.12E-07	3.03E-04	1.79E-04
62	Santa Clara	5.1	5.10E-07	6,500	250	3.12E-06	1.84E-06	1.28E-06	1.15E-07	3.12E-04	1.84E-04
63	Alviso	1.7	5.10E-07	1,000	250	1.05E-06	6.20E-07	4.31E-07	3.88E-08	1.05E-04	6.20E-05
64	Drawbridge	5.7	5.10E-07	100	250	3.48E-06	2.05E-06	1.43E-06	1.28E-07	3.48E-04	2.05E-04
65	Newark	2.3	5.10E-07	1,000	250	1.37E-06	8.11E-07	5.64E-07	5.07E-08	1.37E-04	8.11E-05
107	Newark	3.1	5.10E-07	10,000	250	1.90E-06	1.12E-06	7.79E-07	7.01E-08	1.90E-04	1.12E-04
108	Fremont	3.2	5.10E-07	10,000	250	1.97E-06	1.16E-06	8.06E-07	7.26E-08	1.97E-04	1.16E-04
109	Sunol	6.8	5.10E-07	100	250	4.17E-06	2.46E-06	1.71E-06	1.54E-07	4.17E-04	2.46E-04
110	Pleasanton	1.8	5.10E-07	1,000	250	1.09E-06	6.42E-07	4.46E-07	4.01E-08	1.09E-04	6.42E-05
111	Pleasanton	2.5	5.10E-07	3,000	250	1.52E-06	8.97E-07	6.24E-07	5.61E-08	1.52E-04	8.97E-05
112	Pleasanton	3.0	5.10E-07	100	250	1.81E-06	1.07E-06	7.44E-07	6.69E-08	1.81E-04	1.07E-04
113	Livermore	5.0	5.10E-07	5,000	250	3.08E-06	1.82E-06	1.26E-06	1.14E-07	3.08E-04	1.82E-04
114	Livermore	2.5	5.10E-07	1,000	250	1.51E-06	8.90E-07	6.19E-07	5.57E-08	1.51E-04	8.90E-05
115	Altamont	14.2	5.10E-07	100	250	8.67E-06	5.12E-06	3.56E-06	3.20E-07	8.67E-04	5.12E-04
116	Tracy	3.9	5.10E-07	3,000	250	2.36E-06	1.39E-06	9.67E-07	8.70E-08	2.36E-04	1.39E-04
117	Lathrop	8.2	5.10E-07	100	250	5.01E-06	2.96E-06	2.05E-06	1.85E-07	5.01E-04	2.96E-04
118	French Camp	8.0	5.10E-07	1,000	250	4.89E-06	2.88E-06	2.00E-06	1.80E-07	4.89E-04	2.88E-04
119	Stockton	7.9	5.10E-07	10,000	250	4.83E-06	2.85E-06	1.98E-06	1.78E-07	4.83E-04	2.85E-04
120	Lodi	4.1	5.10E-07	100	250	2.47E-06	1.46E-06	1.01E-06	9.13E-08	2.47E-04	1.46E-04
121	Lodi	3.4	5.10E-07	5,000	250	2.07E-06	1.22E-06	8.49E-07	7.64E-08	2.07E-04	1.22E-04
122	Acampo	5.5	5.10E-07	100	250	3.36E-06	1.98E-06	1.38E-06	1.24E-07	3.36E-04	1.98E-04
123	Galt	1.6	5.10E-07	4,000	250	9.53E-07	5.62E-07	3.91E-07	3.52E-08	9.53E-05	5.62E-05
124	Hicksville	8.6	5.10E-07	100	250	5.24E-06	3.09E-06	2.15E-06	1.93E-07	5.24E-04	3.09E-04
125	Elk Grove	1.0	5.10E-07	100	250	5.83E-07	3.44E-07	2.39E-07	2.15E-08	5.83E-05	3.44E-05
126	Elk Grove	5.8	5.10E-07	5,000	250	3.52E-06	2.08E-06	1.44E-06	1.30E-07	3.52E-04	2.08E-04
127	Sacramento	4.2	5.10E-07	1,000	250	2.57E-06	1.51E-06	1.05E-06	9.47E-08	2.57E-04	1.51E-04
128	Sacramento	4.6	5.10E-07	10,000	250	2.78E-06	1.64E-06	1.14E-06	1.03E-07	2.78E-04	1.64E-04

Table 4.7.16 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon to Roseville to SMR via Altamont Pass

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
101	Parkland	0.8	5.10E-07	100	250	4.94E-07	2.91E-07	2.02E-07	1.82E-08	4.94E-05	2.91E-05
102	Sacramento	3.1	5.10E-07	3,000	250	1.89E-06	1.11E-06	7.74E-07	6.97E-08	1.89E-04	1.11E-04
103	North Highlands	2.6	5.10E-07	1,000	250	1.56E-06	9.23E-07	6.41E-07	5.77E-08	1.56E-04	9.23E-05
104	North Highlands	4.4	5.10E-07	3,000	250	2.67E-06	1.57E-06	1.09E-06	9.85E-08	2.67E-04	1.57E-04
105	Roseville Yard	1.3	5.10E-07	100	250	7.70E-07	4.54E-07	3.16E-07	2.84E-08	7.70E-05	4.54E-05
145	Roseville	2.3	2.70E-07	3,000	250	7.37E-07	4.35E-07	3.02E-07	2.72E-08	7.37E-05	4.35E-05
146	Roseville	1.3	2.70E-07	1,000	250	4.13E-07	2.43E-07	1.69E-07	1.52E-08	4.13E-05	2.43E-05
147	Roseville	0.1	2.70E-07	100	250	4.79E-08	2.83E-08	1.96E-08	1.77E-09	4.79E-06	2.83E-06
148	Placer Co	2.9	2.70E-07	1,000	250	9.45E-07	5.58E-07	3.88E-07	3.49E-08	9.45E-05	5.58E-05
149	Lincoln	1.2	2.70E-07	100	250	3.86E-07	2.28E-07	1.58E-07	1.42E-08	3.86E-05	2.28E-05
150	Lincoln	2.9	2.70E-07	3,000	250	9.27E-07	5.47E-07	3.80E-07	3.42E-08	9.27E-05	5.47E-05
151	Sheridan	10.7	2.70E-07	100	250	3.45E-06	2.03E-06	1.41E-06	1.27E-07	3.45E-04	2.03E-04
152	Wheatland	0.9	2.70E-07	1,000	250	3.01E-07	1.78E-07	1.23E-07	1.11E-08	3.01E-05	1.78E-05
153	Yuba County	9.2	2.70E-07	100	250	2.99E-06	1.76E-06	1.22E-06	1.10E-07	2.99E-04	1.76E-04
154	Olivehurst	4.3	2.70E-07	1,000	250	1.38E-06	8.13E-07	5.65E-07	5.08E-08	1.38E-04	8.13E-05
155	Marysville	1.3	2.70E-07	3,000	250	4.29E-07	2.53E-07	1.76E-07	1.58E-08	4.29E-05	2.53E-05
156	Marysville	2.3	2.70E-07	100	250	7.51E-07	4.43E-07	3.08E-07	2.77E-08	7.51E-05	4.43E-05
157	Live Oak	0.3	2.70E-07	1,000	250	1.06E-07	6.27E-08	4.36E-08	3.92E-09	1.06E-05	6.27E-06
158	Live Oak	6.4	2.70E-07	100	250	2.08E-06	1.23E-06	8.51E-07	7.66E-08	2.08E-04	1.23E-04
159	Live Oak	0.4	2.70E-07	1,000	250	1.18E-07	6.99E-08	4.86E-08	4.37E-09	1.18E-05	6.99E-06
160	Live Oak	1.0	2.70E-07	3,000	250	3.28E-07	1.93E-07	1.34E-07	1.21E-08	3.28E-05	1.93E-05
161	Butte Co	5.2	2.70E-07	100	250	1.69E-06	9.97E-07	6.93E-07	6.23E-08	1.69E-04	9.97E-05
162	Gridley	0.5	2.70E-07	1,000	250	1.47E-07	8.68E-08	6.03E-08	5.43E-09	1.47E-05	8.68E-06
163	Gridley	0.8	2.70E-07	3,000	250	2.68E-07	1.58E-07	1.10E-07	9.89E-09	2.68E-05	1.58E-05
164	Gridley	2.5	2.70E-07	100	250	8.11E-07	4.79E-07	3.33E-07	2.99E-08	8.11E-05	4.79E-05
165	Biggs	0.6	2.70E-07	3,000	250	1.85E-07	1.09E-07	7.59E-08	6.83E-09	1.85E-05	1.09E-05
166	Butte Co	5.1	2.70E-07	100	250	1.66E-06	9.79E-07	6.80E-07	6.12E-08	1.66E-04	9.79E-05
167	Richvale	0.8	2.70E-07	1,000	250	2.70E-07	1.59E-07	1.11E-07	9.97E-09	2.70E-05	1.59E-05
168	Nelson	9.3	2.70E-07	100	250	3.00E-06	1.77E-06	1.23E-06	1.11E-07	3.00E-04	1.77E-04

Table 4.7.16 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon to Roseville to SMR via Altamont Pass

Segment	Segment Description	Length (miles)	Accident Probability (per mile)	Population Density (per sq.mi.)	# of Trains (per year)	Project Oil Spill with Ignition			Project Oil Spill with no Ignition		
						All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)	All Spill Probability (per year)	Small Spill Probability (per year)	Large Spill Probability (per year)
169	Durham	2.4	2.70E-07	1,000	250	7.88E-07	4.65E-07	3.23E-07	2.91E-08	7.88E-05	4.65E-05
170	Chico	4.3	2.70E-07	100	250	1.40E-06	8.25E-07	5.73E-07	5.16E-08	1.40E-04	8.25E-05
171	Chico	4.5	2.70E-07	1,000	250	1.46E-06	8.61E-07	5.98E-07	5.39E-08	1.46E-04	8.61E-05
172	Chico	2.8	2.70E-07	100	250	9.06E-07	5.35E-07	3.71E-07	3.34E-08	9.06E-05	5.35E-05
173	Nord	0.6	2.70E-07	1,000	250	1.89E-07	1.11E-07	7.73E-08	6.96E-09	1.89E-05	1.11E-05
174	Butte Co	11.3	2.70E-07	100	250	3.67E-06	2.16E-06	1.50E-06	1.35E-07	3.67E-04	2.16E-04
175	Vina	0.4	2.70E-07	1,000	250	1.44E-07	8.51E-08	5.91E-08	5.32E-09	1.44E-05	8.51E-06
176	Copeland	6.3	2.70E-07	100	250	2.04E-06	1.20E-06	8.37E-07	7.53E-08	2.04E-04	1.20E-04
177	Los Molinos	0.5	2.70E-07	1,000	250	1.68E-07	9.91E-08	6.89E-08	6.20E-09	1.68E-05	9.91E-06
178	Los Molinos	1.0	2.70E-07	100	250	3.21E-07	1.89E-07	1.32E-07	1.19E-08	3.21E-05	1.89E-05
179	Tehema	0.3	2.70E-07	1,000	250	1.08E-07	6.34E-08	4.41E-08	3.97E-09	1.08E-05	6.34E-06
180	Tehema	2.2	2.70E-07	100	250	7.23E-07	4.27E-07	2.97E-07	2.67E-08	7.23E-05	4.27E-05
181	Gerber	2.3	2.70E-07	1,000	250	7.49E-07	4.42E-07	3.07E-07	2.76E-08	7.49E-05	4.42E-05
182	Tehema Co	1.8	2.70E-07	100	250	5.78E-07	3.41E-07	2.37E-07	2.13E-08	5.78E-05	3.41E-05
183	Red Bluff	0.8	2.70E-07	1,000	250	2.49E-07	1.47E-07	1.02E-07	9.21E-09	2.49E-05	1.47E-05
184	Red Bluff	4.6	2.70E-07	100	250	1.50E-06	8.83E-07	6.14E-07	5.52E-08	1.50E-04	8.83E-05
185	Red Bluff	3.3	2.70E-07	1,000	250	1.06E-06	6.26E-07	4.35E-07	3.92E-08	1.06E-04	6.26E-05
186	Tehema Co	15.3	2.70E-07	100	250	4.94E-06	2.92E-06	2.03E-06	1.82E-07	4.94E-04	2.92E-04
187	Cottonwood	0.6	2.70E-07	1,000	250	1.97E-07	1.16E-07	8.08E-08	7.27E-09	1.97E-05	1.16E-05
188	Anderson	5.4	2.70E-07	100	250	1.73E-06	1.02E-06	7.10E-07	6.39E-08	1.73E-04	1.02E-04
189	Anderson	3.5	2.70E-07	1,000	250	1.15E-06	6.77E-07	4.70E-07	4.23E-08	1.15E-04	6.77E-05
190	Anderson	4.1	2.70E-07	100	250	1.32E-06	7.79E-07	5.42E-07	4.87E-08	1.32E-04	7.79E-05
191	Redding	6.0	2.70E-07	1,000	250	1.95E-06	1.15E-06	8.01E-07	7.21E-08	1.95E-04	1.15E-04
192	Redding	0.8	2.70E-07	1,000	250	2.46E-07	1.45E-07	1.01E-07	9.09E-09	2.46E-05	1.45E-05
193	Redding	1.1	2.70E-07	100	250	3.65E-07	2.16E-07	1.50E-07	1.35E-08	3.65E-05	2.16E-05
194	Redding	0.4	2.70E-07	1,000	250	1.26E-07	7.45E-08	5.18E-08	4.66E-09	1.26E-05	7.45E-06
195	Redding	2.6	2.70E-07	100	250	8.35E-07	4.92E-07	3.42E-07	3.08E-08	8.35E-05	4.92E-05
196	Shasta Co	0.5	2.70E-07	1,000	250	1.69E-07	9.98E-08	6.93E-08	6.24E-09	1.69E-05	9.98E-06
197	Shasta Lake	1.7	2.70E-07	100	250	5.34E-07	3.15E-07	2.19E-07	1.97E-08	5.34E-05	3.15E-05

Table 4.7.16 Summary of Unit Train Accident and Spill Rates by Segment for the Oregon to Roseville to SMR via Altamont Pass

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
198	Shasta Lake	0.8	2.70E-07	1,000	250	2.43E-07	1.43E-07	9.96E-08	8.96E-09	2.43E-05	1.43E-05
199	Shasta Co	16.4	2.70E-07	100	250	5.32E-06	3.14E-06	2.18E-06	1.96E-07	5.32E-04	3.14E-04
200	Lakeshore	0.6	2.70E-07	1,000	250	1.96E-07	1.16E-07	8.05E-08	7.24E-09	1.96E-05	1.16E-05
201	Shasta Co	30.4	2.70E-07	100	250	9.82E-06	5.79E-06	4.03E-06	3.62E-07	9.82E-04	5.79E-04
202	Dunsmuir	1.3	2.70E-07	1,000	250	4.21E-07	2.49E-07	1.73E-07	1.56E-08	4.21E-05	2.49E-05
203	Siskiyou Co	12.8	2.70E-07	100	250	4.13E-06	2.44E-06	1.69E-06	1.52E-07	4.13E-04	2.44E-04
204	Mount Shasta	1.1	2.70E-07	1,000	250	3.66E-07	2.16E-07	1.50E-07	1.35E-08	3.66E-05	2.16E-05
205	Siskiyou Co	69.5	2.70E-07	100	250	2.25E-05	1.33E-05	9.21E-06	8.29E-07	2.25E-03	1.33E-03
206	Dorris	0.9	2.70E-07	100	250	2.85E-07	1.68E-07	1.17E-07	1.05E-08	2.85E-05	1.68E-05
207	Siskiyou Co	3.4	2.70E-07	1,000	250	1.10E-06	6.51E-07	4.52E-07	4.07E-08	1.10E-04	6.51E-05

Table 4.7.17 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Altamont Pass

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
1	Arroyo Grande	1.6	5.10E-07	1,000	250	9.47E-07	5.59E-07	3.88E-07	3.49E-08	9.47E-05	5.59E-05
2	Arroyo Grande	0.8	5.10E-07	100	250	4.88E-07	2.88E-07	2.00E-07	1.80E-08	4.88E-05	2.88E-05
3	Arroyo Grande	0.9	5.10E-07	1,000	250	5.74E-07	3.39E-07	2.35E-07	2.12E-08	5.74E-05	3.39E-05
4	Arroyo Grande	1.4	5.10E-07	100	250	8.44E-07	4.98E-07	3.46E-07	3.11E-08	8.44E-05	4.98E-05
5	Oceano	0.4	5.10E-07	3,000	250	2.46E-07	1.45E-07	1.01E-07	9.07E-09	2.46E-05	1.45E-05
6	Oceano	0.6	5.10E-07	10,000	250	3.81E-07	2.25E-07	1.56E-07	1.41E-08	3.81E-05	2.25E-05
7	Oceano	0.2	5.10E-07	3,000	250	1.46E-07	8.61E-08	5.99E-08	5.39E-09	1.46E-05	8.61E-06
8	Pismo/Grover	2.1	5.10E-07	10,000	250	1.28E-06	7.56E-07	5.25E-07	4.73E-08	1.28E-04	7.56E-05
9	Pismo	0.3	5.10E-07	3,000	250	1.76E-07	1.04E-07	7.23E-08	6.51E-09	1.76E-05	1.04E-05
10	Pismo	0.4	5.10E-07	1,000	250	2.25E-07	1.33E-07	9.23E-08	8.31E-09	2.25E-05	1.33E-05
11	Price Canyon	5.2	5.10E-07	100	250	3.17E-06	1.87E-06	1.30E-06	1.17E-07	3.17E-04	1.87E-04
12	Edna	0.6	5.10E-07	1,000	250	3.67E-07	2.17E-07	1.51E-07	1.35E-08	3.67E-05	2.17E-05
13	Edna	1.6	5.10E-07	100	250	9.89E-07	5.83E-07	4.05E-07	3.65E-08	9.89E-05	5.83E-05
14	San Luis Obispo	4.7	5.10E-07	10,000	250	2.85E-06	1.68E-06	1.17E-06	1.05E-07	2.85E-04	1.68E-04
15	San Luis Obispo	0.6	5.10E-07	3,000	250	3.45E-07	2.04E-07	1.42E-07	1.27E-08	3.45E-05	2.04E-05
16	Chorro	0.4	5.10E-07	1,000	250	2.60E-07	1.54E-07	1.07E-07	9.61E-09	2.60E-05	1.54E-05
17	Chorro	1.6	5.10E-07	100	250	9.56E-07	5.64E-07	3.92E-07	3.53E-08	9.56E-05	5.64E-05
18	CMC	0.8	5.10E-07	3,000	250	4.66E-07	2.75E-07	1.91E-07	1.72E-08	4.66E-05	2.75E-05
19	Santa Lucia	11.2	5.10E-07	100	250	6.83E-06	4.03E-06	2.80E-06	2.52E-07	6.83E-04	4.03E-04
20	Santa Margarita	0.9	5.10E-07	3,000	250	5.39E-07	3.18E-07	2.21E-07	1.99E-08	5.39E-05	3.18E-05
21	Phillips PS	0.9	5.10E-07	100	250	5.19E-07	3.06E-07	2.13E-07	1.92E-08	5.19E-05	3.06E-05
22	Atascadero	7.4	5.10E-07	1,000	250	4.52E-06	2.67E-06	1.85E-06	1.67E-07	4.52E-04	2.67E-04
23	Atascadero	1.6	5.10E-07	3,000	250	9.77E-07	5.77E-07	4.01E-07	3.61E-08	9.77E-05	5.77E-05
24	Atascadero	1.3	5.10E-07	1,000	250	7.77E-07	4.59E-07	3.19E-07	2.87E-08	7.77E-05	4.59E-05
25	Atascadero	0.4	5.10E-07	3,000	250	2.63E-07	1.55E-07	1.08E-07	9.70E-09	2.63E-05	1.55E-05
26	101	0.4	5.10E-07	1,000	250	2.23E-07	1.32E-07	9.16E-08	8.24E-09	2.23E-05	1.32E-05
27	Templeton	2.1	5.10E-07	3,000	250	1.31E-06	7.71E-07	5.36E-07	4.82E-08	1.31E-04	7.71E-05
28	Paso Robles	0.5	5.10E-07	1,000	250	3.14E-07	1.85E-07	1.29E-07	1.16E-08	3.14E-05	1.85E-05
29	Paso Robles	0.8	5.10E-07	3,000	250	5.14E-07	3.03E-07	2.11E-07	1.90E-08	5.14E-05	3.03E-05

Table 4.7.17 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Altamont Pass

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
30	Paso Robles	2.7	5.10E-07	1,000	250	1.68E-06	9.90E-07	6.88E-07	6.19E-08	1.68E-04	9.90E-05
31	Paso Robles	2.1	5.10E-07	3,000	250	1.31E-06	7.71E-07	5.36E-07	4.82E-08	1.31E-04	7.71E-05
32	Paso Robles	0.4	5.10E-07	10,000	250	2.65E-07	1.57E-07	1.09E-07	9.79E-09	2.65E-05	1.57E-05
33	Paso Robles	1.2	5.10E-07	3,000	250	7.10E-07	4.19E-07	2.91E-07	2.62E-08	7.10E-05	4.19E-05
34	101	2.1	5.10E-07	100	250	1.30E-06	7.64E-07	5.31E-07	4.78E-08	1.30E-04	7.64E-05
35	Wellsona	2.4	5.10E-07	1,000	250	1.49E-06	8.81E-07	6.12E-07	5.51E-08	1.49E-04	8.81E-05
36	101	1.9	5.10E-07	100	250	1.14E-06	6.72E-07	4.67E-07	4.20E-08	1.14E-04	6.72E-05
37	San Miguel	1.5	5.10E-07	3,000	250	8.97E-07	5.29E-07	3.68E-07	3.31E-08	8.97E-05	5.29E-05
38	101	2.7	5.10E-07	100	250	1.62E-06	9.55E-07	6.64E-07	5.97E-08	1.62E-04	9.55E-05
39	Camp Roberts	5.7	5.10E-07	100	250	3.49E-06	2.06E-06	1.43E-06	1.29E-07	3.49E-04	2.06E-04
40	Bradley	15.3	5.10E-07	100	250	9.35E-06	5.51E-06	3.83E-06	3.45E-07	9.35E-04	5.51E-04
41	San Lucas	18.5	5.10E-07	100	250	1.13E-05	6.67E-06	4.64E-06	4.17E-07	1.13E-03	6.67E-04
42	King City	1.5	5.10E-07	1,000	250	8.92E-07	5.26E-07	3.66E-07	3.29E-08	8.92E-05	5.26E-05
43	Clark Ranch	18.1	5.10E-07	100	250	1.11E-05	6.52E-06	4.53E-06	4.08E-07	1.11E-03	6.52E-04
44	Soledad	1.4	5.10E-07	1,000	250	8.67E-07	5.12E-07	3.56E-07	3.20E-08	8.67E-05	5.12E-05
45	Salinas Valley Ag	7.3	5.10E-07	100	250	4.48E-06	2.65E-06	1.84E-06	1.65E-07	4.48E-04	2.65E-04
46	Gonzales	1.2	5.10E-07	3,000	250	7.09E-07	4.18E-07	2.91E-07	2.61E-08	7.09E-05	4.18E-05
47	Salinas Valley Ag	5.0	5.10E-07	100	250	3.07E-06	1.81E-06	1.26E-06	1.13E-07	3.07E-04	1.81E-04
48	Chular	0.6	5.10E-07	1,000	250	3.89E-07	2.30E-07	1.60E-07	1.44E-08	3.89E-05	2.30E-05
49	Sprekles	7.8	5.10E-07	100	250	4.75E-06	2.80E-06	1.95E-06	1.75E-07	4.75E-04	2.80E-04
50	Salinas	3.9	5.10E-07	6,500	250	2.40E-06	1.42E-06	9.84E-07	8.86E-08	2.40E-04	1.42E-04
51	Salinas Valley Ag	6.2	5.10E-07	100	250	3.78E-06	2.23E-06	1.55E-06	1.39E-07	3.78E-04	2.23E-04
52	Castroville	1.1	5.10E-07	1,000	250	6.90E-07	4.07E-07	2.83E-07	2.55E-08	6.90E-05	4.07E-05
53	Las Lomas	15.4	5.10E-07	100	250	9.43E-06	5.56E-06	3.87E-06	3.48E-07	9.43E-04	5.56E-04
54	Aromas	12.1	5.10E-07	100	250	7.36E-06	4.34E-06	3.02E-06	2.72E-07	7.36E-04	4.34E-04
55	Gilroy	4.2	5.10E-07	3,000	250	2.55E-06	1.51E-06	1.05E-06	9.42E-08	2.55E-04	1.51E-04
56	San Martin	6.1	5.10E-07	100	250	3.70E-06	2.18E-06	1.52E-06	1.36E-07	3.70E-04	2.18E-04
57	Morgan Hill	3.8	5.10E-07	3,000	250	2.34E-06	1.38E-06	9.59E-07	8.63E-08	2.34E-04	1.38E-04
58	Coyote Valley	6.7	5.10E-07	100	250	4.07E-06	2.40E-06	1.67E-06	1.50E-07	4.07E-04	2.40E-04

Table 4.7.17 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Altamont Pass

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
59	San Jose	6.3	5.10E-07	5,000	250	3.87E-06	2.28E-06	1.59E-06	1.43E-07	3.87E-04	2.28E-04
60	Seven Trees	1.9	5.10E-07	1,000	250	1.14E-06	6.70E-07	4.66E-07	4.19E-08	1.14E-04	6.70E-05
61	San Jose	5.0	5.10E-07	10,000	250	3.03E-06	1.79E-06	1.24E-06	1.12E-07	3.03E-04	1.79E-04
62	Santa Clara	5.1	5.10E-07	6,500	250	3.12E-06	1.84E-06	1.28E-06	1.15E-07	3.12E-04	1.84E-04
63	Alviso	1.7	5.10E-07	1,000	250	1.05E-06	6.20E-07	4.31E-07	3.88E-08	1.05E-04	6.20E-05
64	Drawbridge	5.7	5.10E-07	100	250	3.48E-06	2.05E-06	1.43E-06	1.28E-07	3.48E-04	2.05E-04
65	Newark	2.3	5.10E-07	1,000	250	1.37E-06	8.11E-07	5.64E-07	5.07E-08	1.37E-04	8.11E-05
107	Newark	3.1	5.10E-07	10,000	250	1.90E-06	1.12E-06	7.79E-07	7.01E-08	1.90E-04	1.12E-04
108	Fremont	3.2	5.10E-07	10,000	250	1.97E-06	1.16E-06	8.06E-07	7.26E-08	1.97E-04	1.16E-04
109	Sunol	6.8	5.10E-07	100	250	4.17E-06	2.46E-06	1.71E-06	1.54E-07	4.17E-04	2.46E-04
110	Pleasanton	1.8	5.10E-07	1,000	250	1.09E-06	6.42E-07	4.46E-07	4.01E-08	1.09E-04	6.42E-05
111	Pleasanton	2.5	5.10E-07	3,000	250	1.52E-06	8.97E-07	6.24E-07	5.61E-08	1.52E-04	8.97E-05
112	Pleasanton	3.0	5.10E-07	100	250	1.81E-06	1.07E-06	7.44E-07	6.69E-08	1.81E-04	1.07E-04
113	Livermore	5.0	5.10E-07	5,000	250	3.08E-06	1.82E-06	1.26E-06	1.14E-07	3.08E-04	1.82E-04
114	Livermore	2.5	5.10E-07	1,000	250	1.51E-06	8.90E-07	6.19E-07	5.57E-08	1.51E-04	8.90E-05
115	Altamont	14.2	5.10E-07	100	250	8.67E-06	5.12E-06	3.56E-06	3.20E-07	8.67E-04	5.12E-04
116	Tracy	3.9	5.10E-07	3,000	250	2.36E-06	1.39E-06	9.67E-07	8.70E-08	2.36E-04	1.39E-04
117	Lathrop	8.2	5.10E-07	100	250	5.01E-06	2.96E-06	2.05E-06	1.85E-07	5.01E-04	2.96E-04
118	French Camp	8.0	5.10E-07	1,000	250	4.89E-06	2.88E-06	2.00E-06	1.80E-07	4.89E-04	2.88E-04
119	Stockton	7.9	5.10E-07	10,000	250	4.83E-06	2.85E-06	1.98E-06	1.78E-07	4.83E-04	2.85E-04
120	Lodi	4.1	5.10E-07	100	250	2.47E-06	1.46E-06	1.01E-06	9.13E-08	2.47E-04	1.46E-04
121	Lodi	3.4	5.10E-07	5,000	250	2.07E-06	1.22E-06	8.49E-07	7.64E-08	2.07E-04	1.22E-04
122	Acampo	5.5	5.10E-07	100	250	3.36E-06	1.98E-06	1.38E-06	1.24E-07	3.36E-04	1.98E-04
123	Galt	1.6	5.10E-07	4,000	250	9.53E-07	5.62E-07	3.91E-07	3.52E-08	9.53E-05	5.62E-05
124	Hicksville	8.6	5.10E-07	100	250	5.24E-06	3.09E-06	2.15E-06	1.93E-07	5.24E-04	3.09E-04
125	Elk Grove	1.0	5.10E-07	100	250	5.83E-07	3.44E-07	2.39E-07	2.15E-08	5.83E-05	3.44E-05
126	Elk Grove	5.8	5.10E-07	5,000	250	3.52E-06	2.08E-06	1.44E-06	1.30E-07	3.52E-04	2.08E-04
127	Sacramento	4.2	5.10E-07	1,000	250	2.57E-06	1.51E-06	1.05E-06	9.47E-08	2.57E-04	1.51E-04
128	Sacramento	4.6	5.10E-07	10,000	250	2.78E-06	1.64E-06	1.14E-06	1.03E-07	2.78E-04	1.64E-04

Table 4.7.17 Summary of Unit Train Accident and Spill Rates by Segment for the Nevada to Roseville to SMR via Altamont Pass

						Project Oil Spill with Ignition			*Project Oil Spill with no Ignition*		
Segment	*Segment Description*	*Length (miles)*	*Accident Probability (per mile)*	*Population Density (per sq.mi.)*	*# of Trains (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*	*All Spill Probability (per year)*	*Small Spill Probability (per year)*	*Large Spill Probability (per year)*
101	Parkland	0.8	5.10E-07	100	250	4.94E-07	2.91E-07	2.02E-07	1.82E-08	4.94E-05	2.91E-05
102	Sacramento	3.1	5.10E-07	3,000	250	1.89E-06	1.11E-06	7.74E-07	6.97E-08	1.89E-04	1.11E-04
103	North Highlands	2.6	5.10E-07	1,000	250	1.56E-06	9.23E-07	6.41E-07	5.77E-08	1.56E-04	9.23E-05
104	North Highlands	4.4	5.10E-07	3,000	250	2.67E-06	1.57E-06	1.09E-06	9.85E-08	2.67E-04	1.57E-04
105	Roseville Yard	1.3	5.10E-07	100	250	7.70E-07	4.54E-07	3.16E-07	2.84E-08	7.70E-05	4.54E-05
129	Roseville	1.4	8.20E-07	3,000	250	1.38E-06	8.16E-07	5.67E-07	5.10E-08	1.38E-04	8.16E-05
130	Roseville	1.1	8.20E-07	3,000	250	1.08E-06	6.37E-07	4.43E-07	3.98E-08	1.08E-04	6.37E-05
131	Roseville	2.1	8.20E-07	1,000	250	2.08E-06	1.23E-06	8.52E-07	7.66E-08	2.08E-04	1.23E-04
132	Roseville	0.5	8.20E-07	3,000	250	4.44E-07	2.62E-07	1.82E-07	1.64E-08	4.44E-05	2.62E-05
133	Rocklin	2.5	8.20E-07	1,000	250	2.47E-06	1.46E-06	1.01E-06	9.11E-08	2.47E-04	1.46E-04
134	Placer Co	8.0	8.20E-07	100	250	7.83E-06	4.62E-06	3.21E-06	2.89E-07	7.83E-04	4.62E-04
135	Newcastle	0.5	8.20E-07	1,000	250	4.43E-07	2.61E-07	1.82E-07	1.63E-08	4.43E-05	2.61E-05
136	Placer Co	2.5	8.20E-07	100	250	2.46E-06	1.45E-06	1.01E-06	9.08E-08	2.46E-04	1.45E-04
137	Auburn	5.3	8.20E-07	1,000	250	5.24E-06	3.09E-06	2.15E-06	1.93E-07	5.24E-04	3.09E-04
138	Placer Co	13.6	8.20E-07	100	250	1.34E-05	7.88E-06	5.47E-06	4.93E-07	1.34E-03	7.88E-04
139	Colfax	0.7	8.20E-07	1,000	250	6.62E-07	3.91E-07	2.71E-07	2.44E-08	6.62E-05	3.91E-05
140	Placer Co	61.6	8.20E-07	100	250	6.05E-05	3.57E-05	2.48E-05	2.23E-06	6.05E-03	3.57E-03
141	Truckee	2.1	8.20E-07	1,000	250	2.08E-06	1.23E-06	8.54E-07	7.69E-08	2.08E-04	1.23E-04
142	Nevada Co	13.9	8.20E-07	100	250	1.36E-05	8.04E-06	5.59E-06	5.03E-07	1.36E-03	8.04E-04
143	Floriston	0.2	8.20E-07	1,000	250	2.27E-07	1.34E-07	9.32E-08	8.39E-09	2.27E-05	1.34E-05
144	Sierra Co	5.8	8.20E-07	100	250	5.69E-06	3.36E-06	2.33E-06	2.10E-07	5.69E-04	3.36E-04

The public safety risk, which is shown in the risk profiles (Figure 4.7-5) covers only the portion of the routes between the SMR and Roseville/Colton. Figure 4.7-7 shows the risk profiles for several routes between the SMR, Nevada and Oregon. The cumulative societal risk of injuries and fatalities) associated with the additional route segments in California is not substantially different than the risks shown in Figure 4.7-5 since the segments between Roseville/Colton and Nevada/Oregon would not pass through any additional HTUA. These are areas with high population densities in close proximity to long stretches of track, which increase the risk of larger numbers of injuries and facilities. With the additional track in California the impact to public safety in the event of a derailment that leads to a fire or explosion would remain significant.

If the track outside of California was included the public safety risk would increase and would remain significant. Depending upon the route taken, the crude oil train could pass though a number of HTUA such as Las Vegas, Denver, Phoenix, Seattle, etc.

Mitigation Measures

HM-2a *Only rail cars designed to FRA, July 23, 2014 Proposed Rulemaking Option 1: PHMSA and FRA Designed Tank Car as listed in Table 4.7.6, shall be allowed to unload crude oil at the Santa Maria Refinery.*

HM-2b *For crude oil shipments via rail to the SMR a rail transportation route analysis shall be conducted annually. The rail transportation route analysis shall be prepared following the requirements in 49 CFR 172.820. The route with the lowest level of safety and security risk shall be used to transport the crude oil to the Santa Maria Refinery.*

HM-2c *The Applicant's contract with UPRR, shall include a provision to require that Positive Train Control (PTC) be in place for all mainline rail routes in California that could be used for transporting crude oil to the SMR.*

HM-2d *The refinery shall not accept or unload at the rail unloading facility any crude oil or petroleum product with an API Gravity of 30° or greater.*

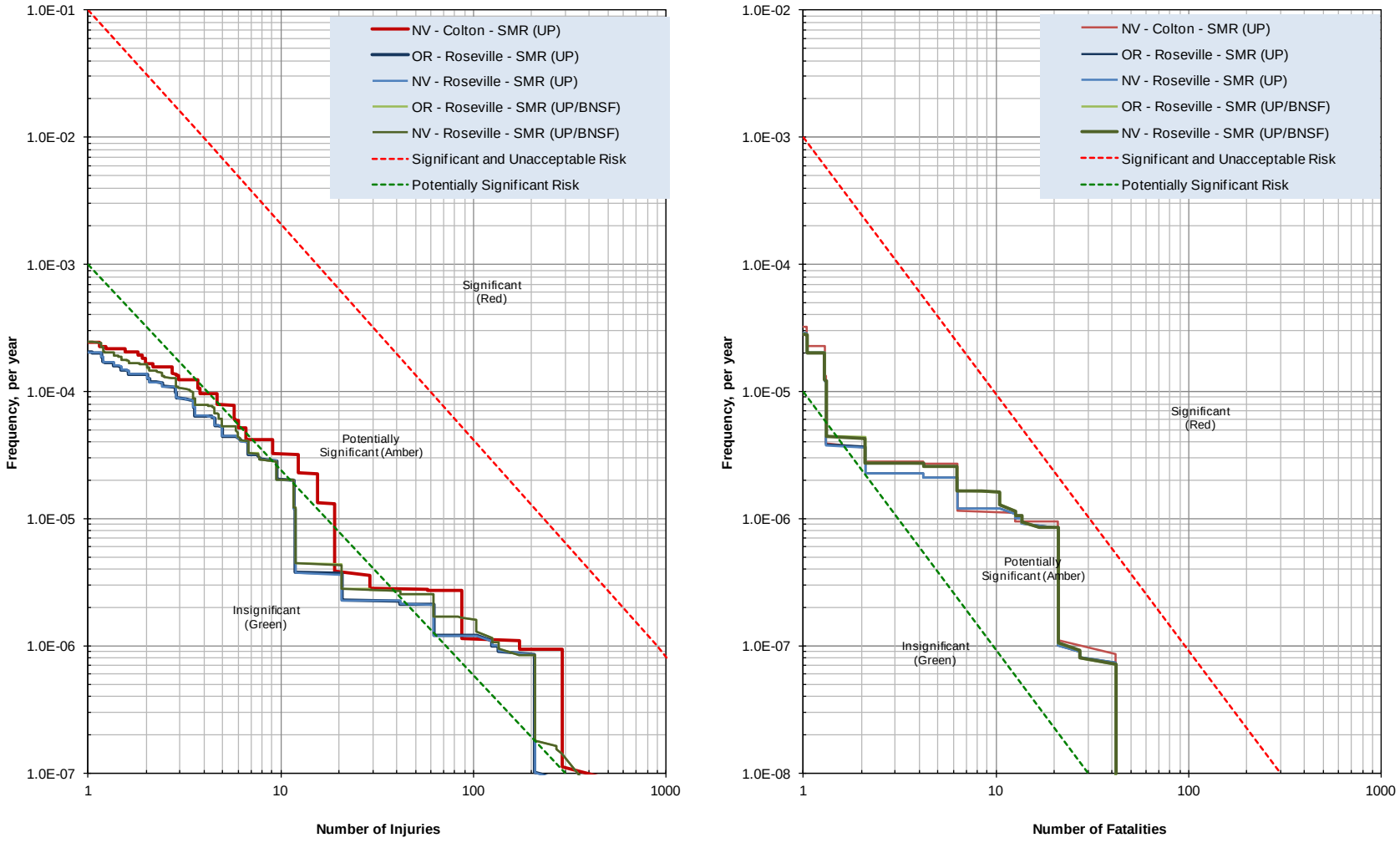
Implement mitigation measures PS-4a through PS4e.

Residual Impacts

Mitigation measures HM-2a through HM-2d would reduce the potential for a potential rail accident and loss of containment, and would also improve emergency response in the event of an accident. Implementation of HM-2a would reduce the probability of a release from a rail car by about 74 percent over the rail car design that is currently proposed by the Applicant. Figure 4.7-8 shows the risk for the mainline rail transport between the SMR and Colton/Roseville rail yards with implementation of the proposed mitigation measures. Figure 4.7-9 shows the risk for the mainline rail transport between the SMR and state line with implementation of the proposed mitigation measures.

Even with this reduction in release probability, the hazards associated with the Rail Spur Project risk along the UPRR right-of-way would still be potentially *significant (Class I)* in the event of a release of crude oil that resulted in a fire or explosion.

Figure 4.7-7 Risk Associated with Mainline Rail Crude Oil Unit Train Transportation – SMR to the California State Line



Note: Some lines overlap and may not be visible.

Figure 4.7-8 Risk Associated with Mainline Rail Crude Oil Unit Train Transportation-With Mitigation

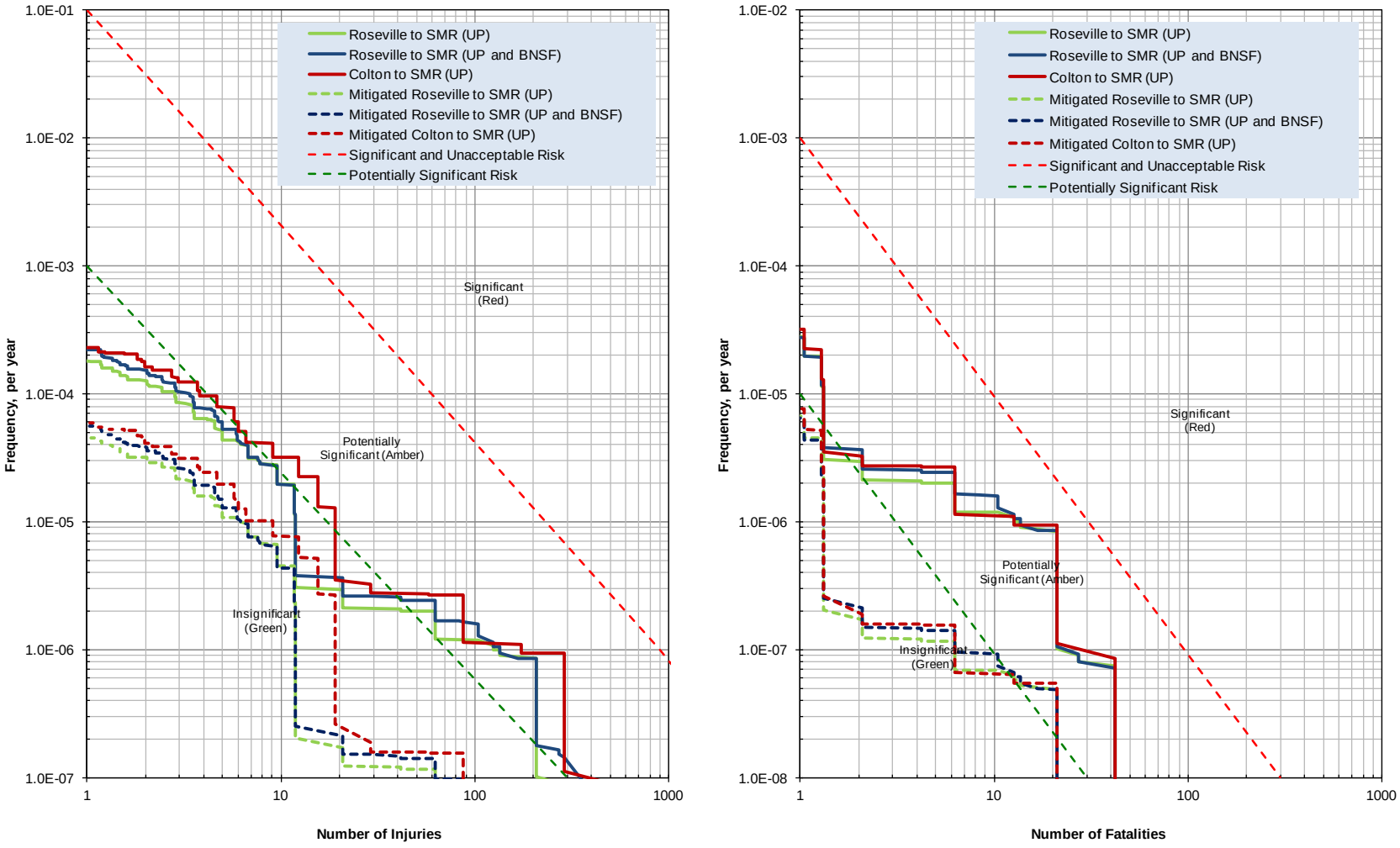
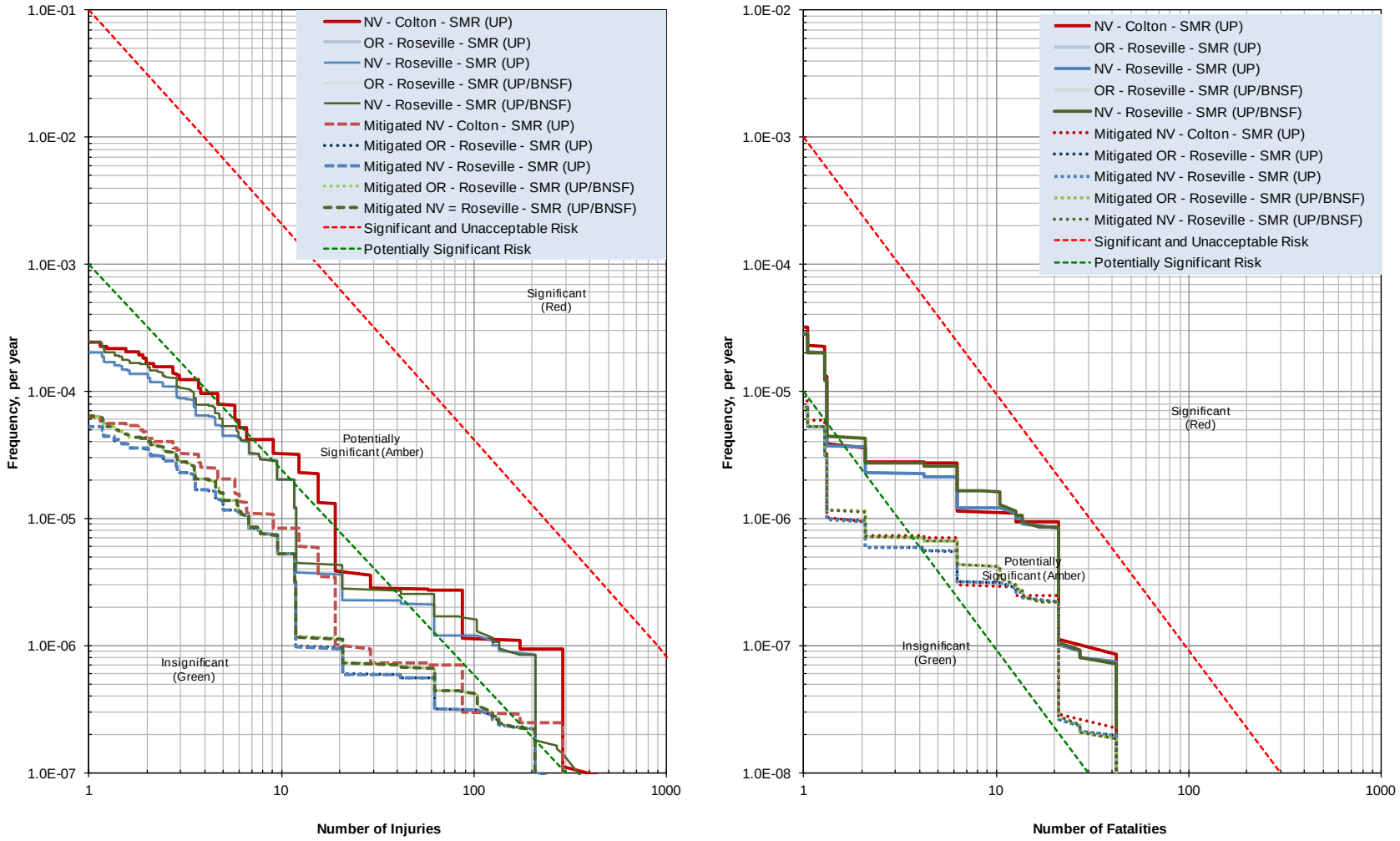


Figure 4.7-9 Risk Associated with Mainline Rail Crude Oil Unit Train Transportation-With Mitigation – SMR to California State Line



Note: Some lines overlap and may not be visible.

The County may be preempted by federal law from implementing these measures as they require particular contractual provisions that might be determined to improperly impact interstate commerce or conflict with the Interstate Commerce Commission Termination Act (ICCTA), which preempts state and local laws with respect to rail transportation.

As discussed above, the USDOT was proposing to implement new rules that would result in stricter regulation of crude by rail transportation. The rules were final on May 1, 2015. The impact of final rule is discussed below in Section 4.7.5.

With or without preemption, the hazards associated with the Rail Spur Project risk along the UPRR right-of-way would still be potentially *significant (Class I)* in the event of a release of crude oil that resulted in a fire or explosion. However, if the County is preempted, the potential severity of the Class I impact would be greater.

Impact #	Impact Description	Phase	Impact Classification
HM.3	A change in crude slate from rail deliveries could increase hazards at the refinery that would impact the public.	Operations	Class III

The SMR is designed to handle heavy sour crude, to only partially refine crude oil to extract intermediates and gases, and uses the heavier crude oil components to produce petroleum coke.

The SMR, as with all refineries, is similar to other manufacturing facilities that regularly evaluate their principal manufacturing feedstocks in terms of availability, suitability, and economics. This is certainly true of the crude oil feedstock used at the SMR. The refinery processes a range of crude oils from different sources, and the crudes have varied over time. In addition, the refinery often blends crudes from multiple sources prior to processing to assure the crude is within the processing design limits of the refinery.

For the SMR, key crude slate parameters that could impact hazards and potential releases at the refinery have to do with the corrosivity of the crude oil. Table 4.7.18 provides the key corrosivity driving properties (sulfur and total acid number (TAN)) of the typical crude blend and range of major crudes processed at the SMR as well as a range of typical crudes that could be delivered by rail.

Naphthenic acids are natural constituents in many petroleum sources, including bitumen from oil sands. Naphthenic acids can create corrosion problems. This type of corrosion is referred to as naphthenic acid corrosion (NAC). Because of the lack of available naphthenic acid concentration data for crude oil, the petroleum industry uses a measurement known as the total acid number (TAN) to qualitatively measure the potential for an oil to produce such corrosion problems. High sulfur levels can lead to sulfide related corrosion.

Table 4.7.18 Key Corrosivity Properties of Current and Potential Future Crude Oils at the Santa Maria Refinery

Property	Unit of Measure	Current SMR Operations		Potential Crude by Rail Sources	
		Typical Crude Blend	Range of Major Crude Sources	Access Western Blend	Peace River Heavy
Sulfur Concentration	Weight %	4.2	2.1-5.2	4.0	5.0
Total Acid Number (TAN)	mgKOH/g	1.0	0.4-4.0	1.7	2.5

1. Typical blend properties based upon 3-year average.
2. Range of major crudes represent the major sources of current crudes to the refinery and include a number of OCS and local onshore sources.

Source: Data provided by Phillips 66, 2014.

SMR currently processes sour, heavy crudes with elevated levels of sulfur and organic acids. The SMR follow the guidelines laid out in the American Petroleum Institute Recommended Practice "Guidelines for Avoiding Sulfidation Corrosion Failures in Oil Refineries". Phillips 66 also has a required standard for their refineries (M-42-RS-03 "Sulfidation Service Equipment."), which the SMR is in compliance with. Both these documents provide rules and guidelines to monitor, mitigate and prevent sulfidation corrosion of process equipment.

With respect to organic acid corrosion, SMR follows generally accepted industry practices and the Phillips 66 Consensus Best Practice for "Naphthenic Acid Service Equipment." This document provides guidelines and recommendations for appropriate metallurgy and wide-spread risk based inspection including inspection frequency and methods, use of corrosion inhibitors and suggestions for possible equipment locations, material types, fluid velocities and temperature ranges where naphthenic acid corrosion may be expected to occur. SMR has a comprehensive inspection and monitoring program for naphthenic acid corrosion and has made numerous metallurgical upgrades of piping and equipment in response to program findings. Phillips 66 has approved capital projects planned between now and 2015 to further upgrade piping and equipment and improve organic acid corrosion resistance at SMR.

Phillips 66 has a number of existing process safety policies and procedures that would apply to the SMR rail project, including the equipment and operating procedures. These programs are designed to prevent releases of hazardous materials, minimize risk, and ensure the refinery's ability to process crude without increasing risk of releases. For example, the Mechanical Integrity Program covers equipment used to process, control, and store hazardous chemicals and assigns responsibility for equipment inspection and testing as well as maintenance. This program meets the requirements of CCR Title 8 Sec 5189, "Process Safety Management of Acutely Hazardous Materials" (f), (j) and 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals" (j).

The refinery uses a Positive Material Identification (PMI) program to ensure the integrity of all mechanical and pressurized systems. This program is overseen by the refinery's Inspection Supervisor.

Any new feedstock coming to the refinery undergoes a complete Management of Change (MOC) analysis to ensure that all hazards, as well as the refinery's systems are safe and operable. The

MOC program is part of the refinery's Process Safety Management program and tracks equipment modification, addition of new systems and process changes. MOC covers all changes that involve specific chemicals at or above threshold limits as defined in California Code of Regulation, Section 5189, Appendix A or flammable liquids or gasses as defined by California Code of Regulations, Section 5194(c) including new construction, modifications, changes in chemicals or materials, changes in feedstock, and changes in concentrations, temperatures, pressures, or flow rates outside of established Safe Process Limits.

A review of the data in Table 4.7.14 shows that the expected range of sulfur and TAN would be within the range of the crudes that are currently being processed at the SMR. Therefore, the change in crude slate would not be expected to change the sulfur or TAN levels compared to the crude sources that are currently being processed at the SMR. It is possible that the TAN could increase when compared to the typical crude blend. However, with the programs and management systems, discussed above, in place, this potential increase would not be expected to increase the hazards or likelihood of a release at the SMR. Therefore, the impact would be less than significant.

Mitigation Measures

No mitigation measures are required since the impacts are less than significant.

Residual Impacts

Hazards associated with crude slate changes would be *less than significant (Class III)*.

4.7.5 USDOT Final for High-Hazard Flammable Trains (HHFT)

On May 1, 2015, the DOT issued their final rule covering enhanced tank car standards and operational controls for high-hazard flammable trains. The final rule defines certain trains transporting large volumes of flammable liquids as "high-hazard flammable trains" (HHFT) and regulates their operation in terms of speed restrictions, braking systems, and routing. The final rule also adopts safety improvements in tank car design standards, a sampling and classification program for unrefined petroleum-based products, and notification requirements. Table 4.7.19 provides a summary of the elements of the final rule. Table 4.7.20 further summarizes the design specifications for tank cars allowed under the final rule. New tank cars built after October 1, 2015 would be required to meet the new DOT-117 standard. All existing Non-Jacketed CPC-1232 tank cars in Packing Group I service (tank cars proposed for use by Applicant) would have to meet the DOT-117R standard by April 1, 2020.

Table 4.7.19 Final Regulatory Requirements for HHFT (USDOT May 1, 2015)

Proposed Requirement	Effected Entity
Enhanced Standards for Both New and Existing Tank Cars Used in HHFTs • New tank cars constructed after October 1, 2015 are required to meet enhanced DOT Specification 117 design or performance criteria. • Existing tank cars must be retrofitted in accordance with the DOT-prescribed retrofit design or performance standard. • Retrofits must be completed based on a prescriptive retrofit schedule and a retrofit reporting requirement is triggered if initial milestone is not achieved.	Tank Car Manufacturers, Tank Car Owners, Shippers / Offerors and Rail Carriers

Table 4.7.19 Final Regulatory Requirements for HHFT (USDOT May 1, 2015)

Proposed Requirement	Effected Entity
More Accurate Classification of Unrefined Petroleum-Based Products • Develop and carry out sampling and testing program for all unrefined petroleum-based products, such as crude oil, to address: (1) Frequency of sampling and testing that accounts for any appreciable variability of the material (2) Sampling prior to the initial offering of the material for transportation and when changes that may affect the properties of the material occur; (3) Sampling methods that ensures a representative sample of the entire mixture, as offered, is collected; (4) Testing methods that enable classification of the material under the HMR; (5) Quality control measures for sample frequencies; (6) Duplicate samples or equivalent measures for quality assurance; (7) Criteria for modifying the sampling and testing program; (8) Testing or other appropriate methods used to identify properties of the mixture relevant to packaging requirements • Certify that program is in place, document the testing and sampling program outcomes, and make information available to DOT personnel upon request.	Offerors / Shippers of unrefined petroleum-based products
Rail routing - Risk Assessment • Perform a routing analysis that considers, at a minimum, 27 safety and security factors and select a route based on its findings. These planning requirements are prescribed in 49 CFR § 172.820. ***Rail routing - Notification*** • Ensures that railroads notify State and/or regional fusion centers and State, local, and tribal officials who contact a railroad to discuss routing decisions are provided appropriate contact information for the railroad in order to request information related to the routing of hazardous materials through their jurisdictions. This replaces the proposed requirements to notify State Emergency Response Commissions (SERCs) or other appropriate state delegated entity about the operation of these trains through their States. ***Reduced Operating Speeds*** • Restrict all HHFTs to 50-mph in all areas. • Require HHFTs that contain any tank cars not meeting the enhanced tank car standards required by this rule operate at a 40-mph speed restriction in high-threat urban areas.	Rail Carriers
Enhanced Braking • Require HHFTs to have in place a functioning two-way end-of-train (EOT) device or a distributed power (DP) braking system. • Require trains meeting the definition of a "high-hazard flammable unit train" (HHFUT) be operated with an electronically controlled pneumatic (ECP) braking system by January 1, 2021, when transporting one or more tank cars loaded with a Packing Group I flammable liquid. • Require trains meeting the definition of a HHFUT be operated with an ECP braking system by May 1, 2023, when transporting one or more tank cars loaded with a Packing Group II or III flammable liquid.	Rail Carriers

HHFT-High-Hazard Flammable Trains (A train comprised of 20 or more loaded tank cars of a Class 3 flammable liquid in a continuous block or 35 or more loaded tank cars of a Class 3 flammable liquid across the entire train.
HHFUT-High-Hazard Flammable Unit Train (a train comprised of 70 or more loaded tank cars containing Class 3 flammable liquids traveling at speeds greater than 30 mph.)
Source: USDOT, 2015a.

Table 4.7.20 Final Safety Features by Tank Car Option (USDOT May 1, 2015)

Tank Car	Bottom Outlet Handle	GRL (lbs)	Head Shield Type	Pressure Relief Valve	Shell Thickness	Jacket	Tank Material	Top Fittings Protection	Thermal Protection System	Braking
DOT-117	Bottom outlet handle removed or designed to prevent unintended actuation during a train accident	286k	Full- height, 1/2 inch thick head shield	Reclosing pressure relief device	9/16 inch Minimum	Minimum 11-gauge jacket constructed from A1011 steel or equivalent. The jacket must be weather-tight	TC-128 Grade B, normalized steel	Equipped per AAR Specifications Tank Cars, appendix E paragraph 10.2.1	Thermal protection system in accordance with §179.18	In trains with DP or EOT devices
DOT-117R for Unjacketed CPC-1232	Bottom outlet handle removed or designed to prevent unintended actuation during a train accident	286k	Full Height 1/2 inch thick head shield	Reclosing pressure relief device	7/16 inch-Minimum	Minimum 11-gauge jacket constructed from A1011 steel or equivalent. The jacket must be weather-tight	TC-128 Grade B, normalized steel	Equipped per AAR Specifications Tank Cars, appendix E paragraph 10.2.1	Thermal protection system in accordance with §179.18	In trains with DP or EOT devices
CPC-1232[1]	Bottom Outlets are Optional	263K	Optional; Bare Tanks half height; Jacket Tanks full height	Reclosing pressure relief valve	7/16 inch-Minimum	Jackets are optional	TC-128 Grade B, normalized steel	Not required, but when Equipped per AAR Specifications Tank Cars, appendix E paragraph 10.2.1	Optional	Not required

2. This is referred to as a post October 1, 2011 tank car and is the tank car design proposed for use by Valero.
ECP-Electronically controlled pneumatic; DP-Distributed power; EOT-End of Train
HHFUTs transporting at least one car of Packing Group I flammable liquid to operate with ECP breaking system by January 1, 2021. Requires all other HHFUTs to operate with ECP braking system by May 1, 2013 or operate at a maximum speed of 30 miles per hour.
Non –Jacketed CPC-1232 tank cars in Packing Group I (Applicant proposed tank cars) must meet DOT-117R standard by April 1, 2020.
Source: Adapted from USDOT 2015a.

Use of DOT-117 tanker cars would reduce the probability of a release from a rail car by about 73.9% percent over the rail car design that is currently proposed by the Applicant. Use of the DOT-117R tanker cars would reduce the probability of a release from a rail car by about 65.9% percent over the rail car design that is currently proposed by the Applicant. Figure 4.7-10 shows the risk for the mainline rail transport between the SMR and state line assuming the use of either DOT-117 or DOT-117R tanker cars.

4.7.6 Cumulative Analysis

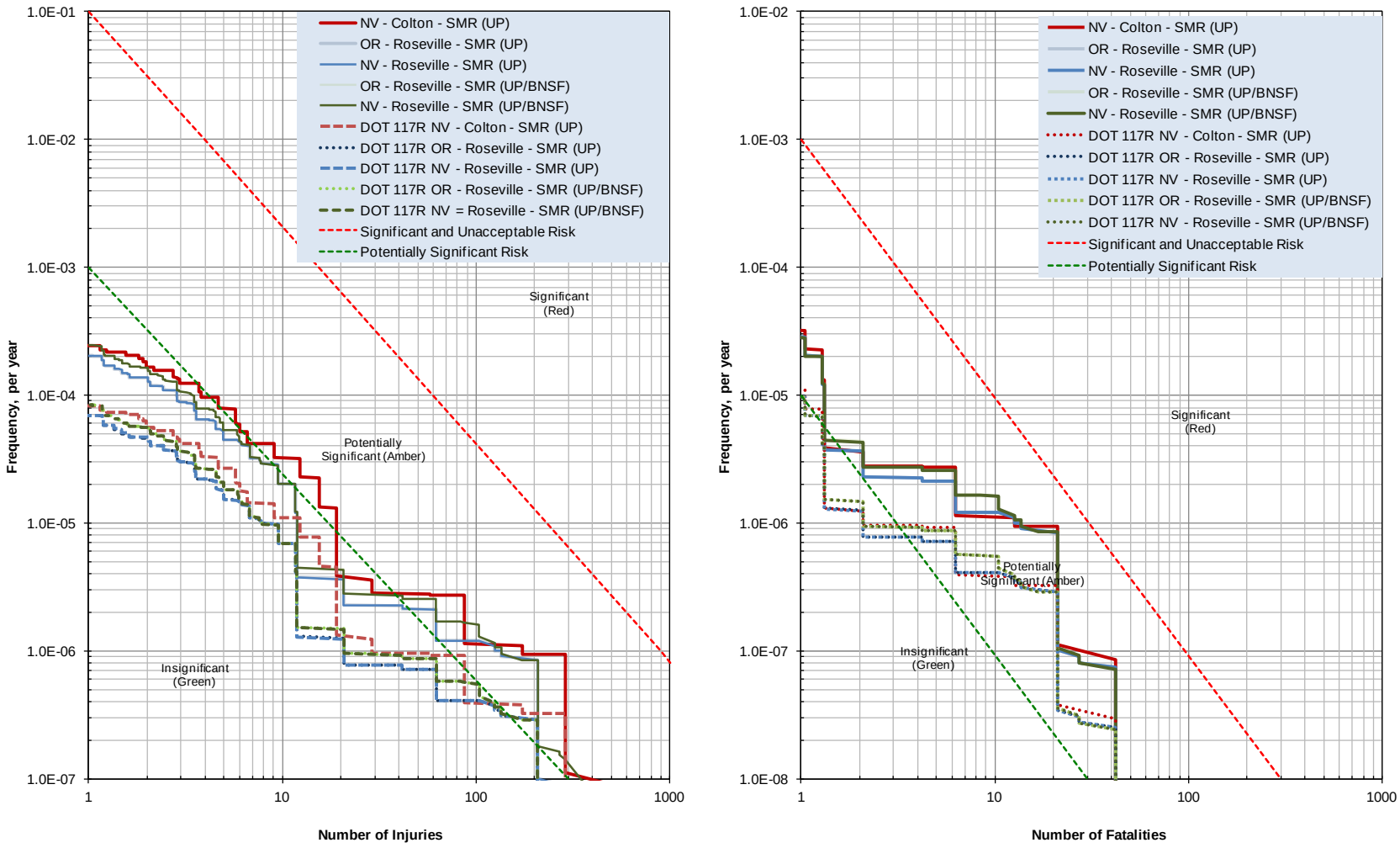
The Rail Spur Project would not significantly contribute to the risk associated with any of the proposed development projects at or in the vicinity of the SMR found under the cumulative projects list (see Chapter 3.0, Cumulative Scenario and Methodology). A brief description of potential cumulative hazards for relevant projects is provided below:

SMR Throughput Increase Project. As noted in the Refinery Throughput Increase FEIR releases of hazardous materials from the project site would not acutely impact nearby residences, agriculture, or industrial facilities due to the distance for offsite receptors. The closest population to the crude oil tanks at the SMR is an industrial area 425 feet northeast of the crude oil storage facilities. The closest residence to the crude oil tanks, which is located within the industrial area, is 1,200 feet northeast of the tank storage area. The gas processing equipment and piping are approximately 1,700 feet from the fence line and the closest receptor on industrial property. Given the limited population and significant distance between these receptors and the SMR, there would not be a significant risk level. The same is the case for the proposed rail spur unloading facilities, where worst-case hazards would not extend beyond the SMF property. Therefore, there is no increase in cumulative risk associated with the proposed Rail Spur Project and Refinery Throughput Increase Project.

Phillips 66 Pipeline Project/Freeport-McMoRan Oil & Gas Oil Field Expansion. The proposed Phillips pipeline route would be located relatively close to the UPRR railroad in Price Canyon. There is the potential for some overlap in hazards associated with a pipeline crude oil spill and a unit train derailment. The probability of a train derailment and oil spill on the Price Canyon segment of the UPRR route is approximately 5.2 in a million, with the probability of a spill and crude oil fire being less than one in a million for this segment. Given the low probability of a train derailment, oil spill and fire in the vicinity of the proposed Phillips 66 Pipeline and Freeport-McMoRan Oil & Gas Oil Field Expansion Projects, the Rail Spur Project would not significantly contribute to the potential cumulative risk in Price Canyon. Therefore, potential cumulative risks are considered less than significant.

Crude by Rail Projects. There is the potential for cumulative impacts associated with the crude by rail project discussed in Chapter 3.

Figure 4.7-10 Risk Associated with Mainline Rail Crude Oil Unit Train Transportation Using DOT-117 or DOT-177R Tanker Cars – SMR to California State Line



Note: Some lines overlap and may not be visible.

In conducting the cumulative analysis for crude by rail it has been assumed that the cumulative projects listed in Table 3.1 would use the same rail car tank design as the SMR Rail Spur Project, and that the cumulative crude by rail projects, with the exception of the Phillips Rail Spur Project, would transport a Bakken type crude, which is a worst case assumption.[6] It has also been assumed that all of the Rail Spur Project crude oil trains would use routes discussed below.

From Sacramento the crude oil trains servicing the Valero Benicia and Kinder Morgan projects could use the same UPRR tracks as the Rail Spur Project from Sacramento to the Bay Area a distance of about 53 miles. This portion of track could have up to four crude oil trains per day (two for Valero, one for Kinder Morgan, and one for the SMR).

From Sacramento the crude oil trains servicing the Alon, Targa, and Plains All American projects could use the same tracks as the Rail Spur Project from Sacramento to Stockton a distance of about 46 miles. This portion of track could have up to five crude oil trains per day (two for Alon, one for Targa, one for Plains All American, and one for the SMR).

If all of the crude by rail projects travel via the Roseville area, then up to eight crude oil trains per day could travel on the stretch of track between Sacramento and the California boarder (two for Valero, one for Kinder Morgan, two for Alon, one for Targa, one for Plains All American, and one for the SMR). From Roseville, rail traffic would likely follow two different routes; one following the I-80 corridor to Reno, Nevada, with the other heading north along the I-5 corridor to Oregon. A third route through the Feather River Canyon was not considered for further analysis.

None of the other cumulative crude by rail projects would use the mainline tracks along the southern route thorough the Los Angeles Basin since the crude oil trains going to Bakersfield would use Tehachapi Pass via Barstow and would not travel has far west as Colton. However, up to four unit trains per day could share the route between Nevada and Barstow (two for Alon, one for Plains All American, and one for the SMR). Given the sparse population densities along the Union Pacific mainline between the Nevada state line and Barstow, the societal risk is very low.

Along this route, there are potential cumulative impacts on the mainline stretch beginning at Barstow. However, it is unlikely that crude oil trains from Alon and Plains All American terminals would use the UPRR mainline east of Barstow since trains coming from Bakersfield would be utilizing the BNSF mainline. In this case, eastbound Alon and Plains All American crude oil trains would likely continue on the BNSF mainline to Arizona via Needles and crossing the Colorado River at Topock.

Using the QRA conducted for the Rail Spur Project a cumulative risk profile was developed for two stretches of mainline track (Roseville to Valero and Roseville to Stockton). Figure 4.7-11 shows the cumulative risk profiles for these two stretches of track. This figure shows that the cumulative risk would be significant. Risk profiles were also prepared for the continuation of these routes to the Nevada and Oregon state lines, as well as the southern route between Barstow and Nevada. Figure 4.7-12 shows the cumulative risk profiles for these five stretches of track.

[6] Canadian Crude, as specified in the Project Description, was assumed for the Phillips Rail Spur Project as part of the project and cumulative analysis.

Figure 4.7-11 Cumulative Risk Associated with Mainline Rail Crude Oil Unit Train Transportation – Rail Yards to Terminals

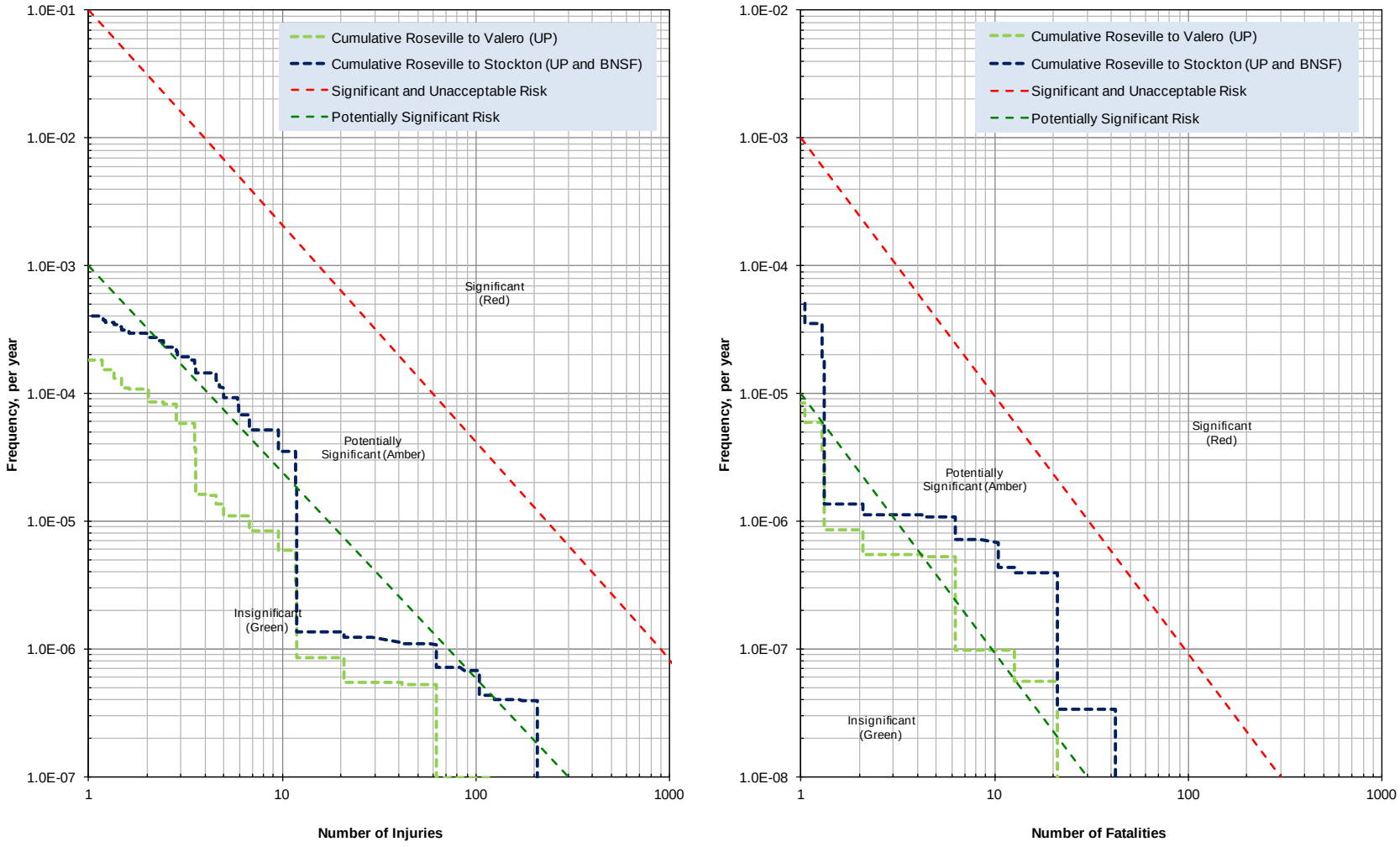
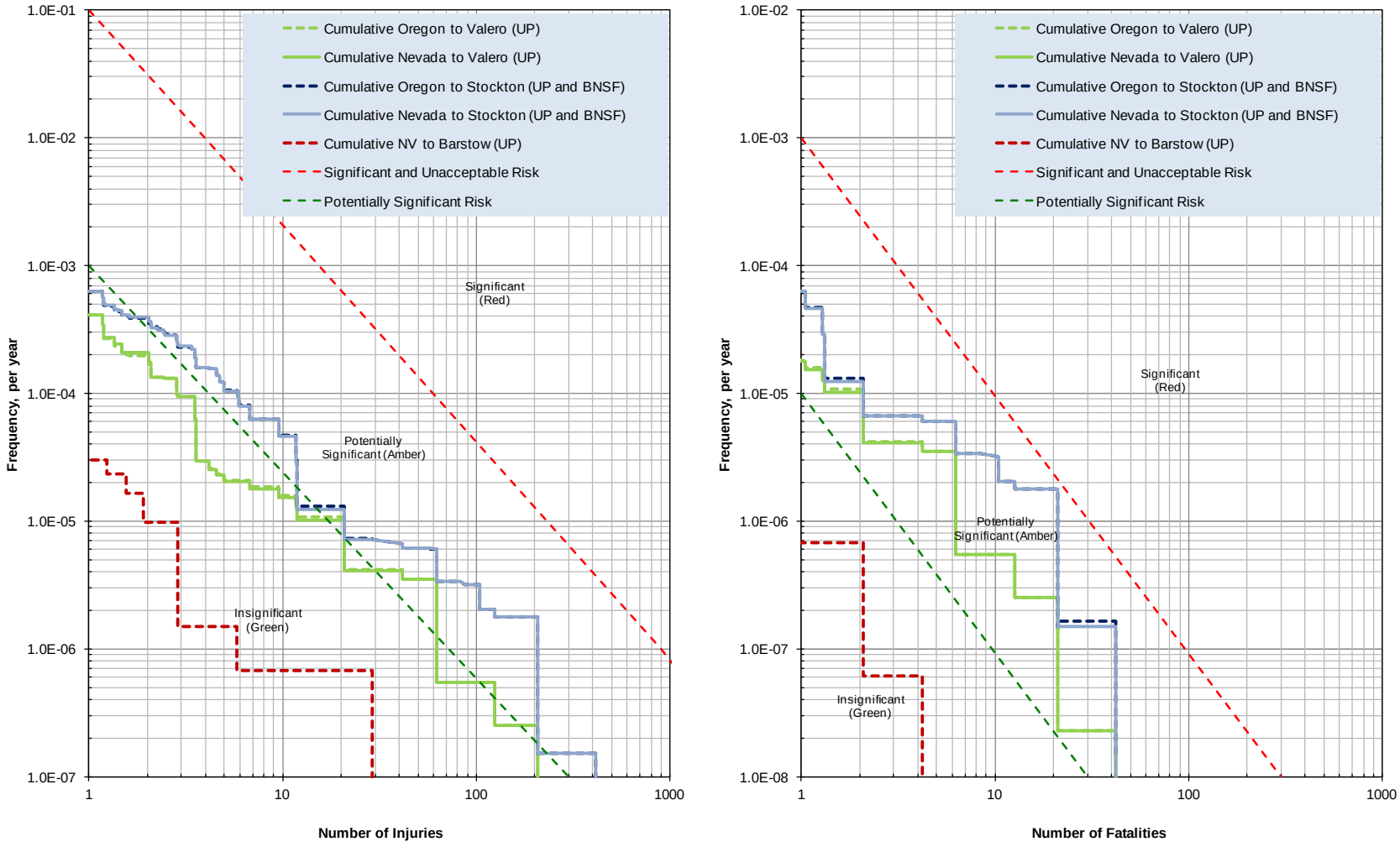


Figure 4.7-12 Cumulative Risk Associated with Mainline Rail Crude Oil Unit Train Transportation – California State Line to Terminals



Depending upon what tank car design USDOT adopts, the risk along this section of mainline track could be reduced to less than significant. However, since these are proposed regulations at this time, the cumulative risk would remain significant and unavoidable along this stretch of track.

Northern Santa Barbara County Oil Projects

The main hazards associated with the cumulative Northern Santa Barbara County oil development projects would involve the of flammable gas and oil spills. The release of flammable gases would be associated with production equipment and wells. Releases of flammable gases can produce flame jets, fires and explosions, or toxic impacts due to the presence of H_2S. Distances that these types of scenarios could impact would generally be less than 1,000 feet. Since the SMR is located over 20 miles from these Northern Santa Barbara County oil development projects, the hazards would not impact the same areas. This would also be true for the mainline rail routes through Northern Santa Barbara County which are located about 10 miles for the cumulative oil development projects.

As these cumulative oil development projects produce and transport crude oil, a failure in the tanks or pipelines could cause a release of crude oil into the environment. Spill volumes from tanks and processing equipment could produce spills as large as the largest tank. However, as all tanks and processing equipment are typically located within bermed areas, the frequency of spills that would impact areas outside the berms is very low.

Spill volumes from a pipeline rupture are based on the pipeline diameter and the terrain profile, which would limit the amount of oil that could drain out of the pipeline, given a rupture. In addition, the pumping rate also affects the size of a release as oil pumped into the pipeline would contribute to the release size until the pumps are shut down. None of the cumulative oil projects in Northern Santa Barbara County would have pipelines in the vicinity of the SMR or the mainline UPRR routes. Therefore, there would be no overlap in the spill hazard areas, and as such, no cumulative spill impacts.

Future oil development projects in the Santa Maria Valley and Sisquoc surrounding areas may involve the use of some amount of hazardous materials during construction and/or operation and may generate hazardous wastes. The potential use and transport of hazardous materials in the project vicinity would potentially expose persons and/or the environment to hazardous materials. Cumulative impacts could result from an increase in the frequency and/or magnitude of public safety risks to those populations exposed, however, there would be no overlap in hazard areas between the Rail Spur Project and these oil development project due to the distance between the projects. Therefore, the Rail Spur Project's contribution to cumulative hazard impacts with the Northern Santa Barbara County oil development projects would be less than significant. All cumulative oil development project in Northern Santa Barbara would be required to comply with regulatory agency requirements to implement appropriate measures that reduce the risk associated with the use and transport of hazardous materials.

4.7.7 Mitigation Monitoring Plan

Mitigation Measure	Plan Requirements and Timing	Compliance Verification		
		Method	Timing	Responsible Party
HM-2a	Only rail cars designed to Option 1: PHMSA and FRA Designed Tank Car as listed in Table 4.7.6, shall be allowed to unload crude oil at the Santa Maria Refinery.	Review of tank car specification sheets Site Inspection	Prior to Notice to Proceed During Operations	County Planning and Building
HM-2b	For crude oil shipments via rail to the SMR a rail transportation route analysis shall be conducted annually. The rail transportation route analysis shall be prepared following the requirements in 49 CFR 172.820. The route with the lowest level of safety and security risk shall be used to transport the crude oil to the Santa Maria Refinery.	Review of transportation route analysis	Annually	USDOT
HM-2c	The Applicant's contract with UPRR, shall include a provision to require that Positive Train Control (PTC) be in place for all mainline rail routes in California that could be used for transporting crude oil to the SMR.	Review of Agreement with UPPR and CTC documentation	Prior to trains arriving at the SMR	County Planning and Building
HM-2d	The refinery shall not accept or unload at the rail unloading facility any crude oil or petroleum product with an API Gravity of 30° or greater.	Review of shipping papers Site Inspection	On-going during operations	County Planning and Building

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