ATTACHMENT C.1

SYU LFC INTERIM TRUCKING

AIR QUALITY ANALYSIS

ExxonMobil Production Company, a division of Exxon Mobil Corporation (ExxonMobil or "Applicant") is requesting approval from the Santa Barbara County Planning and Development Department and the Santa Barbara County Air Pollution Control District (APCD) for the construction and operation of a crude truck loading facility at Las Flores Canyon to allow transfer of product from LFC to crude transport trucks for delivery to local markets. The emissions from the LFC interim trucking include both stationary source emissions from the operation of the truck loading facilities at LFC and the mobile source emissions from operation of the crude transport trucks delivering the product to markets.

Stationary Source

At LFC, the LFC interim trucking operation will result in additional air emissions of Reactive Organic Compounds (ROCs) and respective greenhouse emissions expressed in carbon dioxide equivalents (CO_2e). Emission sources include piping components necessary to transfer product, emissions occurring during the loading operations, and emissions from the transfer of truck vapors to the facility's vapor recovery system. In addition, since the Bureau of Safety and Environmental Enforcement (BSEE) requires Lease Automatic Custody Transfer (LACT) units be installed for royalty measurement determination, the fugitive component category includes the emissions from these components based on preliminary engineering information.

The emissions from the proposed loading operation are required to be controlled in accordance with the Best Available Control Technology (BACT) requirements defined in the APCD's rules pertaining to New Source Review. ExxonMobil will comply with this requirement by including a number of features during the truck loading operation to reduce or eliminate the release of hydrocarbons to the environment to the maximum extent practical as summarized below:

- Control truck vapors generated during loading operations via the facility's existing vapor recovery system
- Automatically inject fuel gas into loading vapor recovery line as necessary to reduce oxygen content to safe levels
- Process collected truck loading vapors in existing LFC facilities and utilized as plant fuel gas
- Weld interconnecting piping sections and utilize low leak valves wherever practical
- Conduct annual inspection of truck transport trailers to verify all ports are sealing properly; Repair any leaking ports prior to use
- Inspect truck transport trailers and connections prior to and after each loading to verify proper operation and no leaks

Should it have a mitigating impact (i.e., increase efficiency) on vapor recovery efficiency, the system will maintain a 1-3" water column vacuum on the trucks during loading to mitigate losses to the environment. From the compressors, the vapors will be treated and then utilized as fuel gas in the facility.

Additionally, as the SYU stationary source has previously triggered the requirement to provide emission offsets under the APCD's New Source Review regulation, all future projects must provide emission offsets. ExxonMobil will provide offsets in the form of emission reduction credits (ERCs) for the stationary source emissions associated with the LFC interim trucking. Greenhouse gas emissions are not required to be offset.

The estimated stationary source emissions from the LFC interim trucking are summarized below, assuming a minimum of 95% vapor recovery efficiency during truck loading:

	ROC (TPY)	ROC (lb/day)	CO_2e (MT/yr)
Fugitive Hydrocarbon Components	10.65	58.38	44.8

Mobile Source

The LFC interim trucking will result in additional air emissions of Nitrogen Oxides (NOx), Particulate Matter (PM), ROCs, and associated greenhouse gas emissions expressed in CO_2e. Mobile emission sources include the exhaust gases from the operation of the crude transport truck engines.

Mobile source emissions are determined using the following factors: number of trucks per day transporting product to market, distance each truck takes to unloading facility, and truck engine emission factors. The calculations assume that each truck returns to LFC after unloading at the designated facility.

In order to reduce emissions, ExxonMobil will require the trucking contractor to restrict trucks to only those that have a 2014 or newer engine. All of the trucks will be classified as Heavy-Heavy Duty Diesel Trucks. The engine emission factors will be based on the Santa Barbara County EMFAC2014 On-road Heavy-Heavy Duty Diesel Truck Emission Factors supplemented with US EPA factors for on-road vehicle paved road dust entrainment.

Two truck transport scenarios are provided to cover the various possible operating situations. In Scenario 1, all of the trucks (70 per day) will load product at LFC and travel to the P66 Santa Maria Terminal for unloading. All of the trucks are assumed to return to LFC for re-loading. In Scenario 2, 68 trucks per day will load product at LFC and travel to the Plains Pentland Terminal for unloading. All of the trucks are

assumed to return to LFC for re-loading. These two scenarios are not presumed to limit actual daily deliveries.[1] On any particular day some portion of the total trucks may go to P66 Santa Maria Terminal with the remainder going to Plains Pentland Terminal.

The estimated mobile source emissions from the LFC Interim Trucking are summarized below:

Criteria Pollutants	ROC	NOx	PM 10	CO	SO2		CO2e
Scenario 1							MT/Yr
Total Trips Emissions (Lb/Day)	1.17	24.23	6.64	20.82	0.23		
Total Trip Emissions (Tons/Yr)	0.21	4.42	1.21	3.80	0.04		4.6k
SBC Trip Emissions (Lb/Day)	1.17	24.23	6.64	20.82	0.23		
Scenario 2							
Total Trips Emissions (Lb/Day)	2.93	60.59	16.60	52.06	0.58		
Total Trip Emissions (Tons/Yr)	0.53	11.06	3.03	9.50	0.11		11.5k
SBC Trip Emissions (Lb/Day)	1.20	24.85	6.81	21.35	0.24		

Note: Emissions based on 70 trucks per day for Scenario 1and 68 trucks per day for Scenario 2

[1] The APCD ATC/PTO will be for 70 trucks/day to account for the maximum potential amount of emissions. If all trucks go to Plains Pentland Terminal during one day they will limited to 68 trucks to remain within the significance threshold for NOx.

Stationary and Mobile Sources Combined

Combined, stationary and mobile emissions for ROCs are calculated to be 59.55 lbs/day (Scenario 1) and 59.58 lbs/day (Scenario 2), which is above the CEQA significance threshold of 55 lbs/day. However, these emissions would be mitigated down to at most 1.17 lbs/day and 1.20 lbs/day, respectively, after emission reduction credit offsets.

ExxonMobil will work with the agencies with jurisdiction to mitigate the emissions associated with the LFC Interim Trucking to satisfy the annual compliance obligations as required by CEQA. The only component that exceeds the SBC significance threshold (after known mitigations) is the annual metric tons/yr GHG CO_2e level.

ATTACHMENT C.2
INTERIM TRUCKING QUANTITATIVE RISK ANALYSIS

ExxonMobil SYU LFC Interim Trucking

Quantitative Risk Analysis

Application to County of Santa Barbara

Planning & Development Department

Energy & Minerals Division

September 2017

Prepared by:

InterAct

260 Maple Court, Suite 210
Ventura, CA 93003
805-658-5600
www.interactprojects.com

Prepared for:

ExxonMobil

12000 Calle Real Road
Goleta, CA 93117

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APPENDICES

Appendix 1 Truck Route Maps

Appendix 2 Combustion Products Dispersion Modeling Details

Appendix 3 Santa Barbara County Public Risk Thresholds

Appendix 4 Risk Calculation Details

Appendix 5 Proposed Product Trucking Public Injury and Fatality F-N Curves

1.0 Introduction

ExxonMobil is proposing interim trucking to transport Santa Ynez Unit (SYU) crude from the Las Flores Canyon (LFC) facility located at 12000 Calle Real Road in Goleta to one or more destinations: (1) Phillips 66 Santa Maria station, and (2) Plains All American Pipeline Pentland (PAAPL) station. This report evaluates the public risk from a truck accident associated with the transportation of crude oil from LFC to these destinations via truck.

Santa Barbara County thresholds were used to evaluate trucking risk. The public safety risks were calculated to be below the thresholds, and therefore the impacts to public risk from the proposed Interim Trucking are considered less than significant (Class III).

Product trucking is proposed as described in Table 1 below.

Table 1 Product Trucking Details

Parameter	Value
Maximum number of trucks	70 trucks per day
Maximum volume of product per truck	160 barrels (bbls) (worst case scenario for a single truck incident, which is the maximum volume of oil potentially spilled from a single truck)
Annual number of truck trips	70 x 365 = 25,550
Maximum duration of Interim Trucking	From the approval of the Interim Trucking Permit until a pipeline alternative becomes available
Annual volume of oil transported	Approximately 4 million barrels (MM BBL)

This quantitative risk assessment (QRA) was prepared in accordance with the requirements of the Santa Barbara County Planning and Development Department Environmental Thresholds and Guidelines Manual [Ref. 1], which specifies thresholds for significant impacts to public safety (Section 15). These thresholds focus on involuntary public exposure to acute risks that stem from certain types of activities with significant quantities of hazardous materials. In this case, the hazardous material of concern is crude oil (product) transported by trucks on public roads. In general, a QRA goal is to address worst case scenarios such that the maximum consequence can be evaluated.

This QRA estimates the potential public safety risks associated with the proposed crude oil (product) trucking activities. Risks were estimated using a transportation risk model which includes volume data, accident rates, population data, and probabilities of release and ignition. The public risk is presented on an F-N plot. An F-N curve is a plot of cumulative frequency vs consequence (expressed as a number of injuries or fatalities). The estimated public risks were compared to the Santa Barbara collective risk thresholds, the two straight lines in the F-N plot, to determine the significance of an adverse impact to public safety.

Public safety risks stem from a potential for a transportation-related incident involving trucks transporting LFC product. Under a worst-case scenario, an incident could lead to a product spill that, if ignited, could result in a pool fire that could cause significant injury or fatality. Members of the public that could be exposed are those living or working in the areas that could be affected by a potential fire.

2.0 Description of the Proposed Interim Trucking

Trucking of product from LFC was evaluated under two scenarios. In Scenario 1 all seventy (70) trucks per day would deliver product to Phillips 66 Station in Santa Maria

consistent with the project. In Scenario 2 all seventy (70) trucks per day would deliver product to PAAPL Pentland Station in Maricopa, though a maximum of 68 are proposed for the project itself. In actual operation, trucks could deliver product to one or the other or both of the two facilities on a given day. The details of the routes and facilities descriptions are provided in Table 2. The maps of the trucking routes are provided in Appendix 1.

Table 2 Trucking Routes Details

Parameter	Unloading Facility 1: Phillips 66 Santa Maria Station	Unloading Facility 2: PAAPL Pentland Station
Address	1580 East Battles Road Santa Maria, CA 93454	2311 Basic School Road, Maricopa, CA
Distance from LFC	55 miles	139 miles
County	Santa Barbara	Kern
Route Details from LFC to the Unloading Facility	• South on internal LFC/SYU Road • Right onto Calle Real - 1.5 mi • Left onto Refugio Rd. - 197 ft • Right onto US-101 N ramp - 0.3 mi • Merge onto US-101 N - 49.2 mi • Exit 169, Betteravia Rd. - 0.2 mi • Left onto Rosemary Rd - 0.5 mi • Left onto E Battles Rd - 0.3 mi • Left into facility	• South on internal LFC/SYU Road • Right onto Calle Real - 1.5 mi • Left onto Refugio Rd. - 197 ft • Right onto US-101 N ramp - 0.3 mi • Merge onto US-101 N - 54.4 mi • Exit 175, CA-166 E to Maricopa - 0.2 mi • Right onto CA-166 E/Cuyama Hwy - 80.7 mi • Right onto Basic School Rd - 0.3 mi • Right into facility

Methodology

The QRA evaluated risks using the following steps:

1. Potential hazards identification
2. Probability analysis
3. Consequence analysis
4. Public safety risk estimates

3.1 Hazards Identification

A typical hazard scenario that arises from crude oil trucking is a release of flammable hydrocarbons due to a truck incident (e.g., collision, overturning, or a truck mechanical failure). More severe hazards would involve an accident that leads to a spill and thermal radiation or toxic concentrations from a subsequent pool fire (crude oil is a Class 1 flammable liquid). An explosion or Boiling Liquid Expanding Vapor Explosion (BLEVE) is not expected from a truck accident because the product transported has relatively low vapor pressure, thus formation of appreciable volume of flammable gas that can lead to an explosion is not expected.

A truck incident can result in two spill scenarios. The first spill scenario is a full rupture of the tanker (large spill) and pool fire. The second spill scenario is a hole that leads to a 10% spill volume and pool fire. Table 3 summarizes the trucking hazard scenarios examined in this study.

Table 3 Trucking Hazard scenarios

No.	Equipment	Potential Hazard Scenario	Hazards
1	DOT 407 Tanker Truck	Truck accident, large spill and pool fire	Thermal radiation, toxic combustion products release
2	DOT 407 Tanker Truck	Truck accident, small spill and pool fire	Thermal radiation, toxic combustion products release

3.2 Probability Analysis

3.2.1 Truck Accident Probability

Accident rates were obtained from available studies related to truck collision rates and conditional probabilities. The probability a truck road collision or accident is 0.528 per million miles for California rural freeway and 1.720 per million miles for rural two-lane roads (based on a study by Harwood, 1993 [Ref. 2]). Accident probabilities can be reduced by using control factors which have been documented and statistically proven to reduce the risk of an accident. In this case, the accident probability was reduced using the following control factors:

- Implementation of safety programs reduces accidents by 41%
- Speed control reduces accidents by 26% as listed by MRS, 2004 [Ref. 3].

ExxonMobil's Final Development Plan Permit with Santa Barbara County requires the implementation of a Crude Oil Transportation Risk Management and Prevention Program (CO-TRMPP) as provided in Attachment C.4. Implementation of this program will further reduce risk by requiring trucks transporting LFC product to have those controls through driver safety training and equipment installation. All trucks transporting the LFC product, regardless of the route and mileage, will have a speed control.

Additionally, non-collision, in-transit accident rates were assumed to occur at a base rate of 20% of the collision accident rate [Ref. 3]. The non-collision rate was reduced by 37.5% due to a regular maintenance program for trucks utilized by ExxonMobil, and a reduction of 45% due to pre-trip truck inspection, as listed by MRS, 2004 [Ref. 3]

The resulting adjusted truck accident rates (AR) were estimated to be as follows:

AR = [0.528/million miles x (1-(0.41+0.26))] + [0.2 x 0.528/million miles x (1-(0.375+0.45))]

AR = 0.193 accidents per million truck-miles travelled (rural freeway)

AR = [1.720/million miles x (1-(0.41+0.26))] + [0.2 x 1.720/million miles x (1-(0.375+0.45))]

AR = 0.628 accidents per million truck-miles travelled (rural two-lane roads)

3.2.2 Spill and Pool Fire Probability

To estimate the probability of a pool fire, given that an accident has happened, the following conditional probabilities should be considered: probability of a spill, probability of a large or small spill, and probability of ignition (e.g., a spark or static electricity).

The 1993 Harwood study [Ref. 2] estimated the probability of a hazardous material release, once an accident occurred, to be 9%. A chance of ignition of a pool fire was estimated at 2% based on the Golder, 2007 [Ref. 4]. It was assumed that large spills occurred 25% of the time, and leaks occurred 75% of the time, as a worst case scenario. Thus, the likelihood of a pool fire (pool fire rate or PFR) is estimated as follows:

PFR Large (rural freeway) = (0.193/million miles) x 0.09 x 0.02 x 0.25 = 8.7×10^{-11} per mile

PFR Small (rural freeway) = (0.193/million miles) x 0.09 x 0.02 x 0.75 = 2.6×10^{-10} per mile

PFR Large (rural two-lane) = (0.628/million miles) x 0.09 x 0.02 x 0.25 = 2.8×10^{-10} per mile

PFR Small (rural two-lane) = (0.628/million miles) x 0.09 x 0.02 x 0.75 = 8.5×10^{-10} per mile

To define the incident outcome for these scenarios, two event trees have been constructed (Figures 1 and 2).

Figure 1 Trucking Hazards Event Tree (rural freeway)

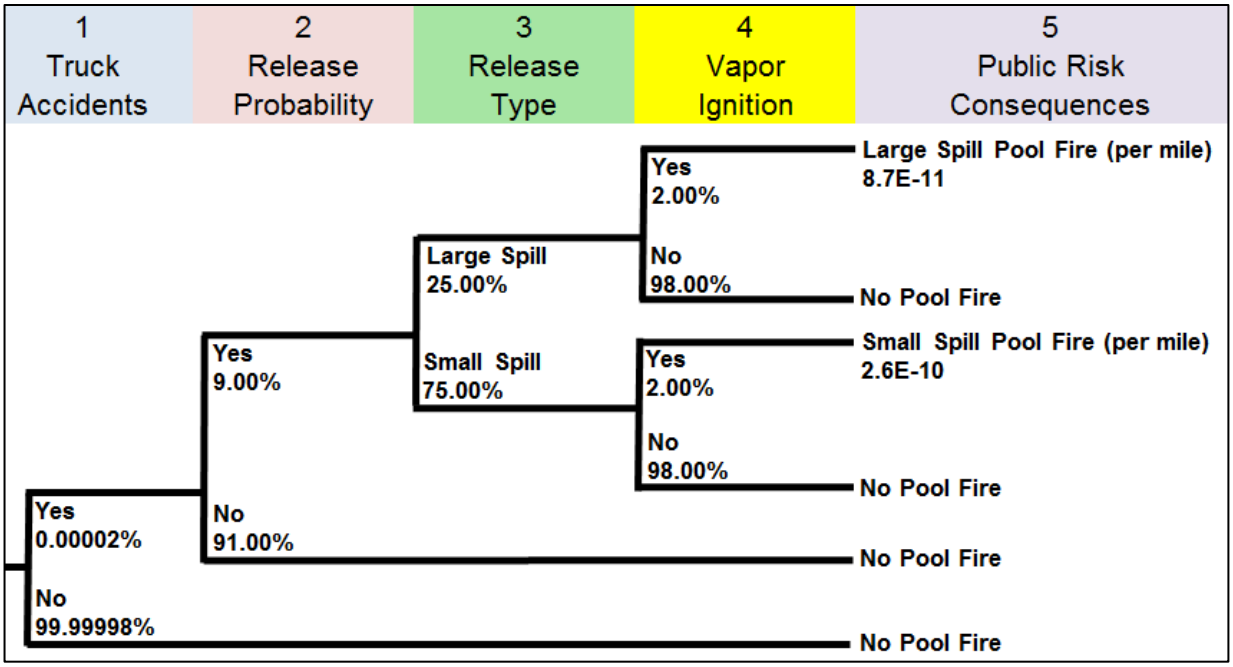
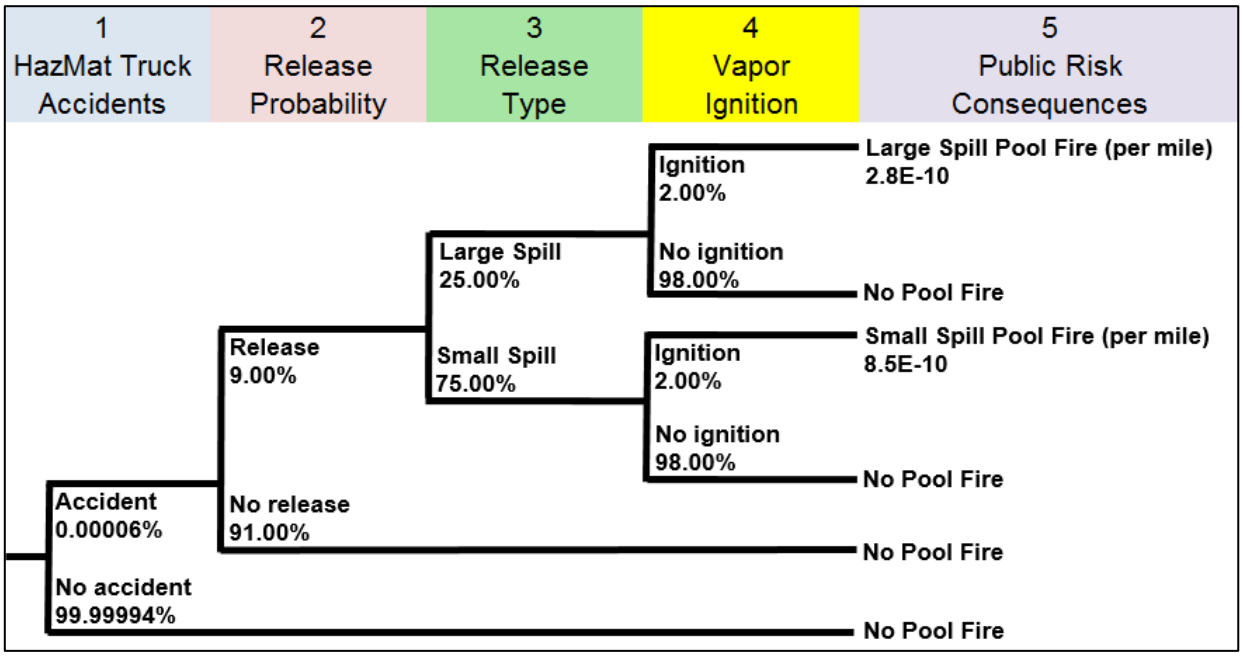


Figure 2 Trucking Hazards Event Tree (rural two-lane)



3.3 Consequence Analysis

Consequences from traffic accidents without a spill and a fire were used as identified in the Harwood 1993 study [Ref. 2]. Consequences from a pool fire were identified as follows for a small and large spill:

1. Volumes of potential spills were estimated
2. Spill area and radius were calculated
3. Thermal radiation distances for injury and fatality were calculated
4. Population affected by the respective thermal radiation levels was estimated

Toxic impacts from hydrogen sulfide (H_2S) are not expected because the product prepared for sales has a negligible H_2S content, and combustion does not create appreciable amounts of H_2S. However, the LFC product has 5.2% of sulfur by weight, thus formation of sulfur dioxide (SO_2), which is a toxic gas, as a combustion product in a pool fire could occur. Potential consequences of SO_2 formation are discussed further below (also see Appendix 2).

3.3.1 Spill Volume

Two types of oil spills were considered:

- A full truck rupture releasing the entire 160 bbls (6,720 gallons); and
- A leak resulting in a 10% loss, or 16 bbls (672 gallons).

The spill of 160 bbls from a single largest truck was used as a worst case scenario, although some trucks may be transporting smaller volumes.

3.3.2 Spill Pool Area and Radius

Spill areas were estimated assuming 1 inch deep circular pool with the truck as a center of the circle.

$$R = \sqrt{(Spill\ Area/\pi)}$$

3.3.3 Thermal Radiation Impact Areas

For thermal exposure to fires or flames, the fatality exposure level was estimated to be 10 kilowatts per square meter (kw/m^2) and the injury level to be 5 kw/m^2 [Ref. 3]. These levels are based on the time it takes to develop second degree burns.

The thermal radiation to injury and fatality levels are calculated per the methodology presented by Department of Transportation (DOT) and Environmental Protection Agency (EPA) [Ref. 5]:

$$X_{10} = 0.30 \times R \times EP^{0.57}$$

$$X_{05} = 0.43 \times R \times EP^{0.57}$$

Where R is the product spill pool radius determined in Section 3.3.2 above, EP is emissive power equal to 20 kW/m^2, X_{10} is a radius where thermal radiation is 10 kW/m^2 or higher, and X_5 is a radius where thermal radiation is 5 kW/m^2 or higher.

Thermal impact areas A_{10} and A_{05} are assumed to be uniform circular areas assuming static meteorological conditions.

$$A_{10} = \Pi \times (X_{10})^2$$

$$A_{05} = \Pi \times (X_{05})^2$$

Where A_{10} is area for ≥ 10 kW/m^2 (fatality outcome), and A_{05} is area for ≥ 5 kW/m^2 (injury outcome). Therefore in a full tank spill pool fire, the fatality zone has a radius of 97 feet from the center of the pool. The potential injury zone has a radius of 139 feet.

Table 4 below provides the details of the calculations.

Table 4 Product Release Volume, Area and Thermal Hazard Details

Truck Release Scenario	Spill Volume			Pool Area 1 inch deep pool		Spill Radius	Thermal Hazard	
							Radius	Area
	bbls	gal.	cu. inch	sq. inch	sq. ft.	ft	ft	sq. ft.
Rupture (100%)	160	6,720	1,552,320	1,552,320	10,780	59	**X_{05}:** 139 (injury zone)	**A_{05}:** 60,636
							X_{10}: 97 (fatality zone)	**A_{10}:** 29,515
Leak (10%)	16	672	155,232	155,232	1,078	19	**X_{05}:** 44 (injury zone)	**A_{05}:** 6,064
							X_{10}: 31 (fatality zone)	**A_{10}:** 2,952

3.3.4 Toxic Emissions Impact Areas

Immediate Dangerous to Life or Health Concentration (IDLH) of SO_2 is 100 parts per million (ppm) for one-hour exposures, and 1241 ppm (any fatality at 5 minute exposure) to 3764 ppm (50% fatality at 5 minute exposure) for shorter exposure times [Refs 6, 7]. The evaluation below shows that the ground level concentrations of SO_2 would not reach hazardous levels outside of the fatality zone identified for pool fire above.

Burning rate of crude in a pool fire is 3 to 4 millimeters per minute (mm/min) according to both D. Evans and H. Koseki [Refs 8, 9], 3.6 mm/min is assumed here

for heavier crudes. Rate of SO_2 formation is estimated from the crude combustion rate.

According to the references: "due to high-temperature buoyancy effects, the plume first rises, then the plume becomes heavier than air by cooling leading to plume subsidence" [Refs 10, 11]. Therefore to model hot combustion products dispersion, a pool fire is approximated as a tilted cylinder with the base as the spill pool circle area; dispersion of combustion products (e.g., SO_2) is modeled as originating at the top of the fire cylinder according to Witlox and Ufuah [Refs 10, 11, 12]. Height of the fire cylinder is obtained from hydrocarbon fires studies [Ref 12, 13].

SO_2 formation is assumed to occur across the whole volume of the "fire cylinder". SO_2 starting concentration for dispersion modeling determined from the SO_2 formation rate and "fire cylinder" volume. See Appendix 2 for the details of the combustion products dispersion modeling.

It was assumed that in the fire all sulfur is converted to SO_2 (5.2 wt. %) stoichiometrically:

$$S + O_2 \rightarrow SO_2$$

Downwind concentrations of SO_2 are found using the Gaussian dispersion model [Ref 14] with the parameters listed in Table 5.

$$C_x = \frac{Q}{\pi \sigma_y \sigma_z u} e^{-1/2 [\frac{H}{\sigma_z}]^2}$$

Where Q = SO_2 release rate, g/sec; u = wind speed, 4 m/s;

X = distance downwind, m; H = height of fire, m;

Atmospheric stability "D" has been chosen as a neutral stability.

σ_y = sigma y for "D" stability = $0.08 * X * (1+0.0001 * X)^{-0.5}$ [Ref 14]

σ_z = sigma z for "D" stability = $0.06 * X (1+0.0015 * X)^{-0.5}$ [Ref 14]

Cx = downwind concentration of SO_2 within the fatal zone of temperature radiation (at 10 kW/m^2): 97 feet radius zone for a full tank spill, and 31 feet radius zone for a 10% leak scenario. This zone is selected to show that SO_2 concentrations are below lethal levels within the zone of fatality from fire, therefore there are no additional impacts from SO_2 beyond those from the fire heat.

Table 5 Determination of SO_2 Concentration in the Fire Fatality Zone

Scenario	Spill Area	Spill Radius	Fatality Zone Radius 10 kW/m^2	Volume of Spill	Oil Burn Rate	Oil com-busted	SO_2 release rate, Q
	sq ft	ft	ft	ft^3	ft3/min	kg oil/min	g/sec
Rupture	10,780	59	97	898	127	3412	5909.0
Leak	1,078	19	31	90	13	341	590.9

Scenario	Pool Fire Diameter		Down-wind Distance from fire	Height of Fire (Release)	Sigma y for "D" stability	Sigma z for "D" Stability	SO_2 Concentration
	ft	m	X	H	σ_y	σ_z	ppm
Rupture	117.2	35.5	29.4	15	2.35	1.72	2.0
Leak	37.0	11.2	9.3	15	0.74	0.55	19.5

Table 5 shows that ground level SO_2 concentrations at the distance from a spill that would cause heat fatalities (within the zone with 10 kW/m^2 heat), at 97 feet for a full tank spill and 31 feet for a leak, are 2 ppm and 19.5 ppm, respectively. These concentrations are below 400 ppm (injury level for a short exposure), and therefore are below the level of an injury or a fatality for short exposures (with the burn rate of 3.6 mm/min, the entire spilled pool of oil will be combusted in 7 minutes). This

means that toxicity from the formed SO_2 does not create additional injuries or fatalities than those from the fire heat.

Thus the potential consequence from transporting the LFC product by truck is not greater than the consequence of transporting any other similar material by trucks of the same volume that are currently on the roads.

3.3.5 Impacted Population

Exposure to high heat levels can produce severe injury or fatality to exposed population within the specified area. Per Muhlbauer, 2004 ([Ref. 15], heat of 10 kW/m^2 would result in a fatality in approximately 40% of exposed population; heat of 5 kW/m^2 would result in injury after 15-20 seconds of exposure. Thus the number of fatalities and injuries for each pool and fire scenario were estimated as follows:

No. of Fatalities = $(40\% \times A_{10}) \times PD$

No. of Injuries = $(60\% A_{10} + A_{05}) \times PD$

Where PD is population density as number of people per square foot.

3.3.6 Population Densities

Population densities were estimated for accident scenarios along the trucking routes. The trucking route was subdivided into segments based on the different population density category along the roads. The population density was assumed to be constant over the entire length of a particular segment. If one side of the road was of a different population category than the opposite side of the road population category, an average of the two categories was used. This population data also assumes presence of people immediately upon the accident. In reality, once the accident has occurred, emergency personnel would move people away from the accident site therefore reducing the likelihood of injury.

Population densities were estimated based on aerial imagery, local zoning and field reconnaissance. Table 6 summarizes the population densities used in this study, per the data published by Arthur D. Little, 1990 [Ref. 16].

Table 6 Population Densities Categories

Category	Population Density (No. of People / Sq. Mile)
Commercial High	10,000
Commercial Medium	5,000
Commercial Low	1,000
Residential High	10,000
Residential Medium	3,000
Residential Low	1,000
Mixed Use High	10,000
Mixed Use Medium	3,000
Mixed Use Low	1,000
Industrial	2,000
Rural/Farm	20
Recreational	100
Unpopulated/Open Space	5
Onsite / Private	0

Population categories and related population densities specific to the segments of each transportation route are contained in the tables in Appendix 4.

3.4 Public Safety Risks Analysis

Public safety risks are based on the estimated probabilities (chance of occurrence) and consequences (serious injury or fatality) of the evaluated accident scenarios. The

estimated annual accident risks were compared to the Santa Barbara County's thresholds to determine if adverse impacts from the proposed Interim Trucking are potentially significant. The two figures in Appendix 3 show the County's thresholds for Fatalities and Injuries respectively [Ref. 1]. Per the County, the plotted risk results should be interpreted as follows:

Class I – Adverse significant unavoidable impacts that cannot be mitigated: risks that fall into the Red and Amber Zones on the F-N curve.

Class II – Adverse significant impacts that can be potentially mitigated: risks that fall into the Red and Amber Zones, but that move into the Green zone with application of available mitigation measures.

Class III – Adverse impacts that are considered insignificant. For example, severe consequences that are unlikely or high likelihood hazardous events that do not have severe consequences are considered less than significant.

3.0 Probability and Consequence Analysis

Proposed product trucking probability and consequence analysis was conducted according to the methodology presented in Section 3.2 and 3.3, respectively. The details of the calculations conducted per the methodology outlined in Section 3 above, are presented in Appendix 4.

4.0 Public Safety Risks

Fatality and Injury F-N curves were constructed to show public safety risks from the proposed Interim Trucking, see Figures in Appendix 5. The calculated public risk was found to be less than 10^{-5} (frequency/year) of 1 or more fatalities and less than 10^{-3}

(frequency/year) of 1 or more injuries for both trucking scenarios. Therefore, the risk curves for both scenarios fall inside the low risk criteria (green zone).

5.0 Conclusions

Public safety risks were calculated to be below the Santa Barbara County thresholds. The resulting F-N curves are entirely in the "Green" zone of the constructed F-N curves for injuries and fatalities, for both transportation scenarios. Therefore, the impacts to public risk from the proposed Interim Trucking are considered less than significant in the context of CEQA (Class III).

6.0 References

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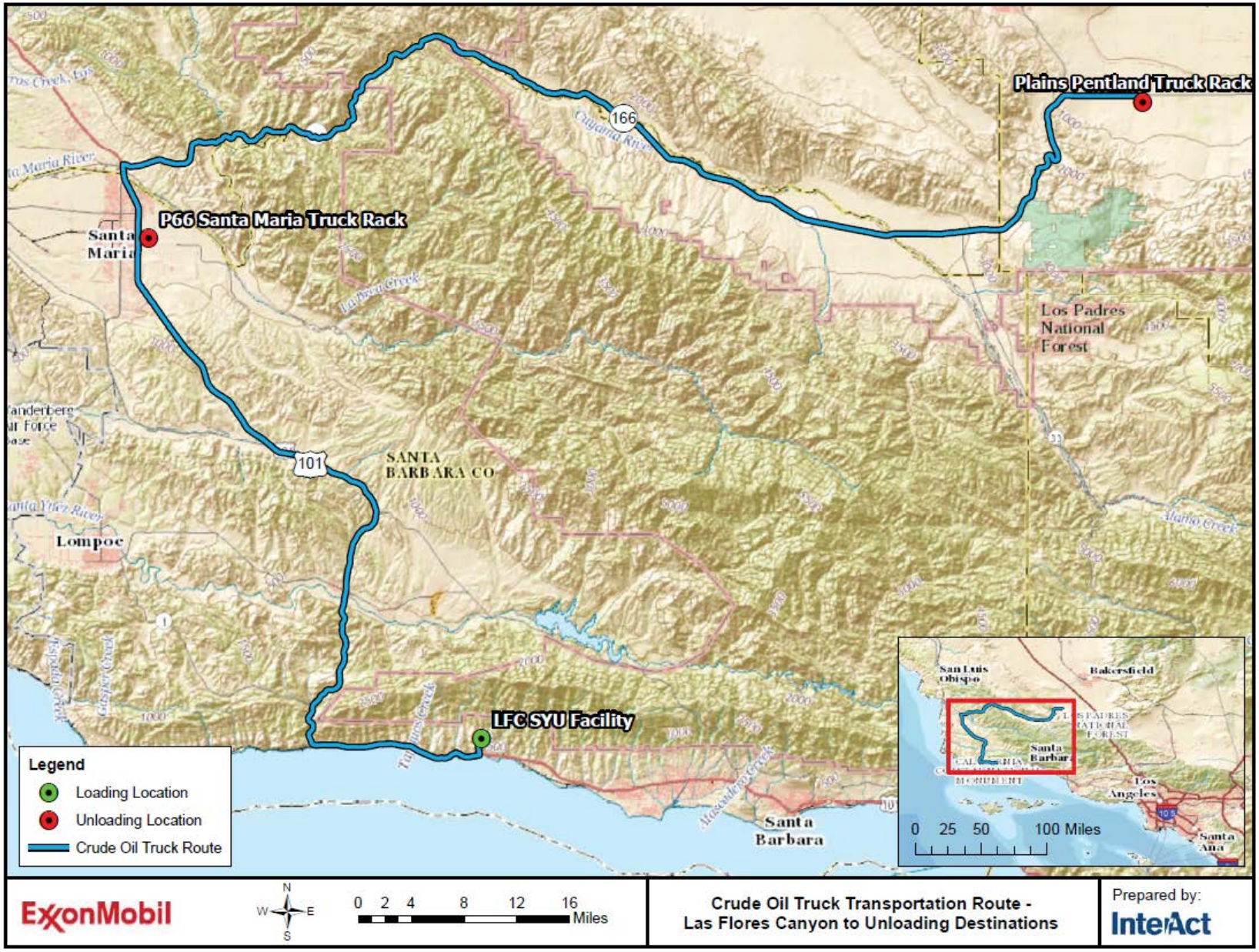
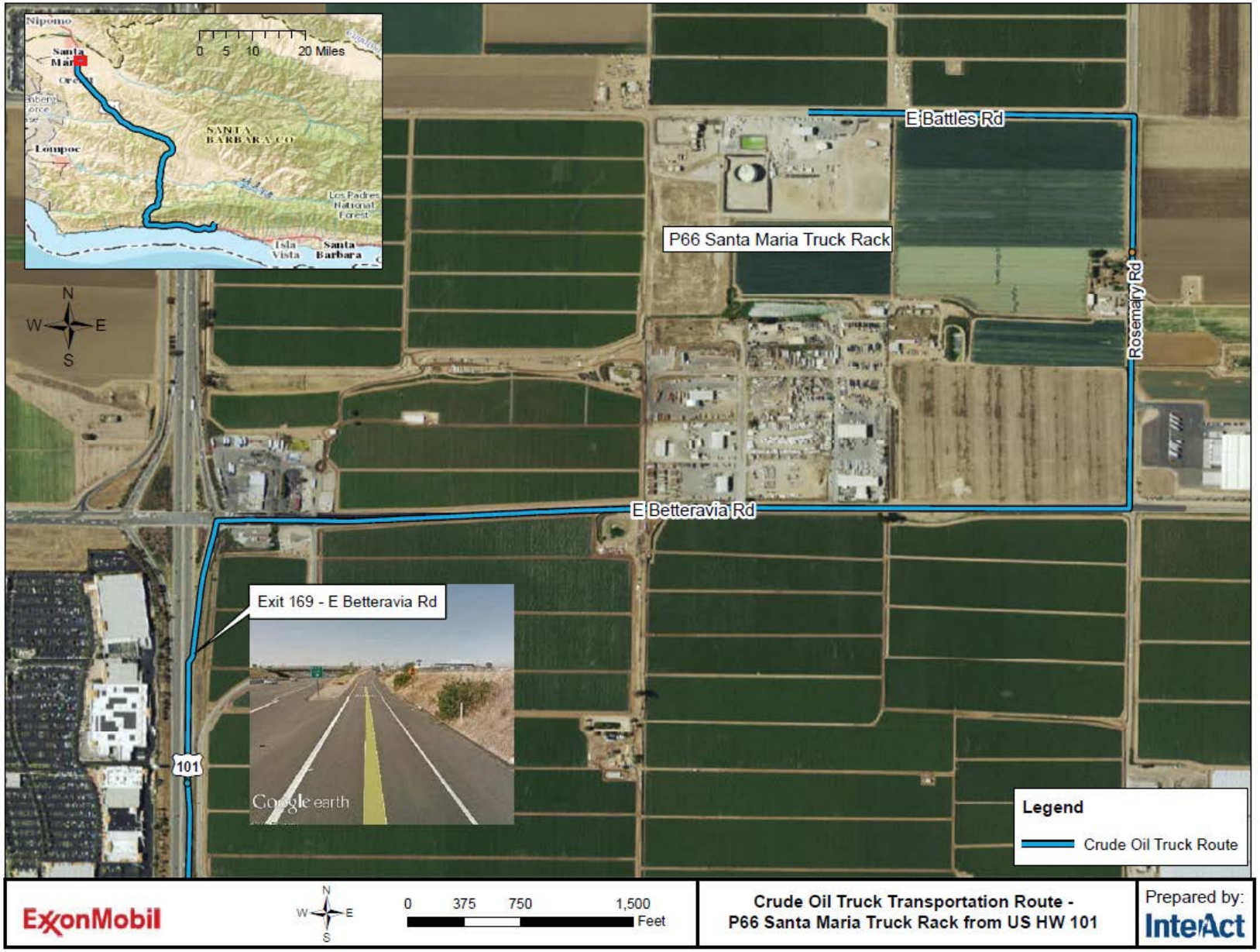
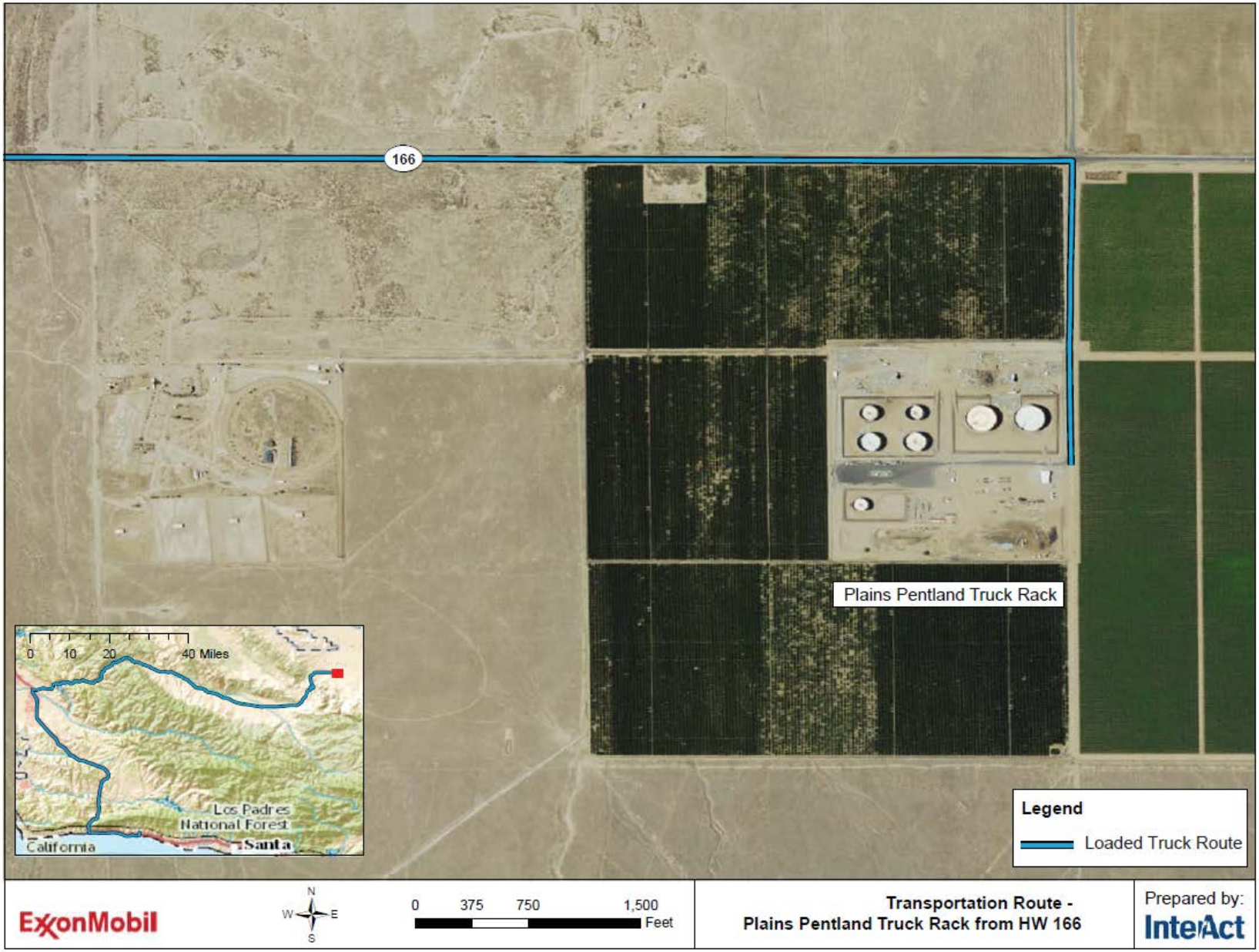
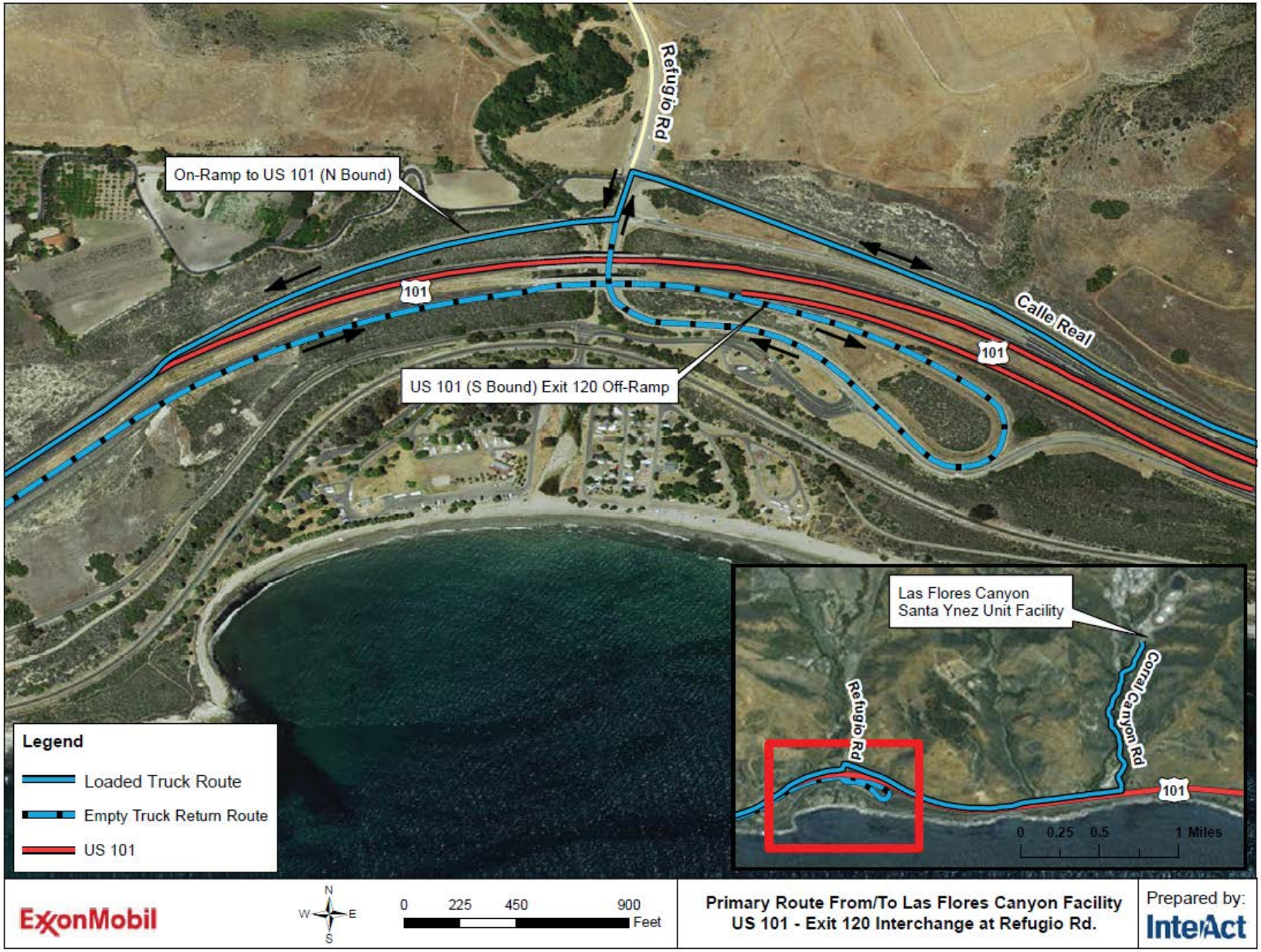
APPENDIX 1

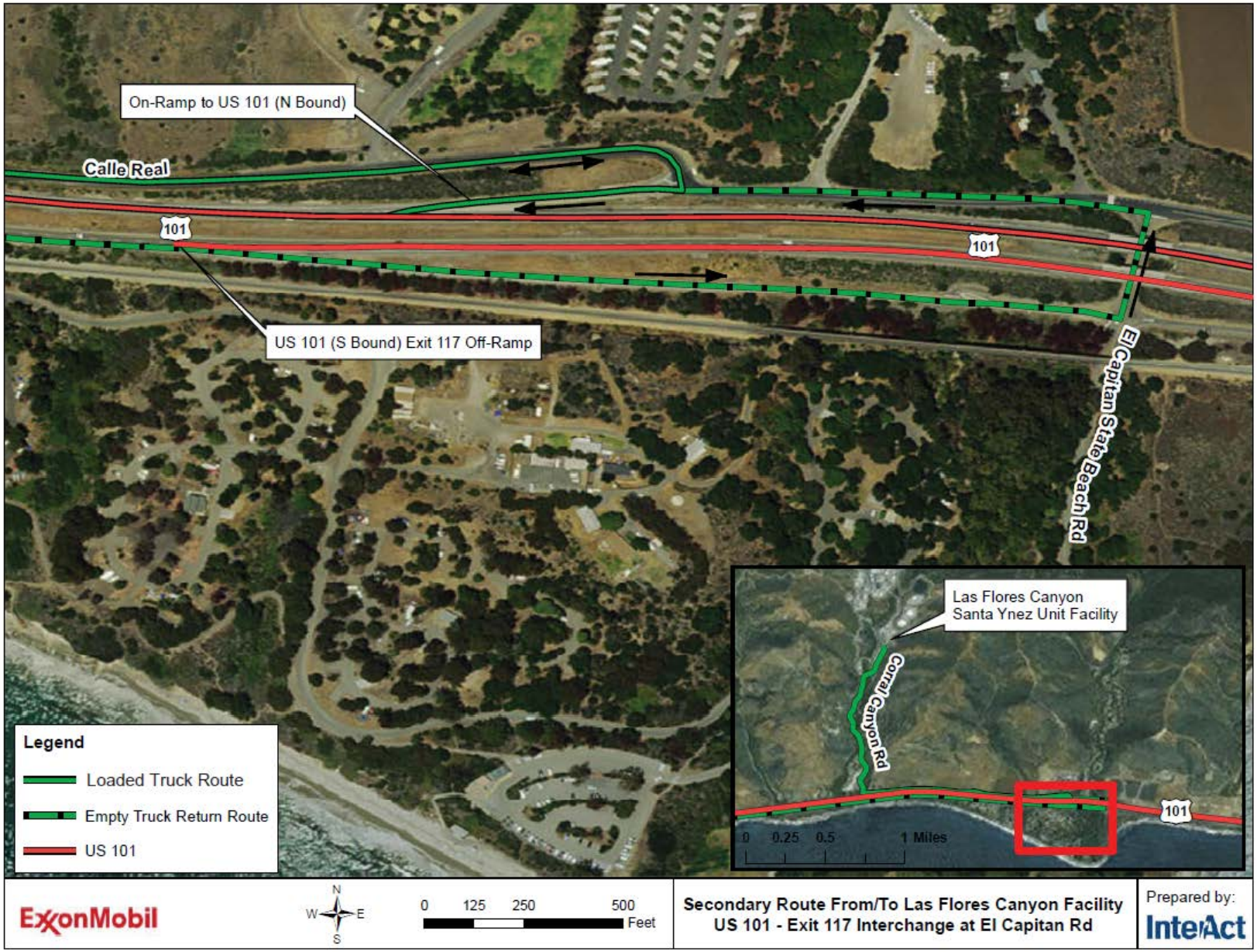
TRUCK ROUTES MAPS


Plains Pentland Truck Rack
P66 Santa Maria Truck Rack
LFC SYU Facility
166
101
Santa Maria
Lompoc
SANTA BARBARA CO
Los Padres National Forest
Santa Barbara
Legend
Loading Location
Unloading Location
Crude Oil Truck Route
San Luis Obispo
Bakersfield
Los Angeles
Santa Ana
0 25 50 100 Miles
ExxonMobil
N
W
E
S
0 2 4 8 12 16 Miles
Crude Oil Truck Transportation Route -
Las Flores Canyon to Unloading Destinations
Prepared by:
InterAct


Nipomo
Santa Maria
0 5 10 20 Miles
SANTA BARBARA CO
Lompoc
Los Padres National Forest
Isla Vista
Santa Barbara
N
W
E
S
E Battles Rd
P66 Santa Maria Truck Rack
Rosemary Rd
E Betteravia Rd
Exit 169 - E Betteravia Rd
Google earth
101
Legend
Crude Oil Truck Route
ExxonMobil
0 375 750 1,500
Feet
Crude Oil Truck Transportation Route -
P66 Santa Maria Truck Rack from US HW 101
Prepared by:
InterAct


166
Plains Pentland Truck Rack
0 10 20 40 Miles
Los Padres
National Forest
California
Santa
Legend
Loaded Truck Route
ExxonMobil
N
W
E
S
0 375 750 1,500
Feet
Transportation Route -
Plains Pentland Truck Rack from HW 166
Prepared by:
InterAct


Refugio Rd
On-Ramp to US 101 (N Bound)
101
Calle Real
101
US 101 (S Bound) Exit 120 Off-Ramp
Las Flores Canyon
Santa Ynez Unit Facility
Refugio Rd
Coral Canyon Rd
101
0 0.25 0.5 1 Miles
Legend
Loaded Truck Route
Empty Truck Return Route
US 101
ExxonMobil
N
W
E
S
0 225 450 900
Feet
Primary Route From/To Las Flores Canyon Facility
US 101 - Exit 120 Interchange at Refugio Rd.
Prepared by:
InterAct

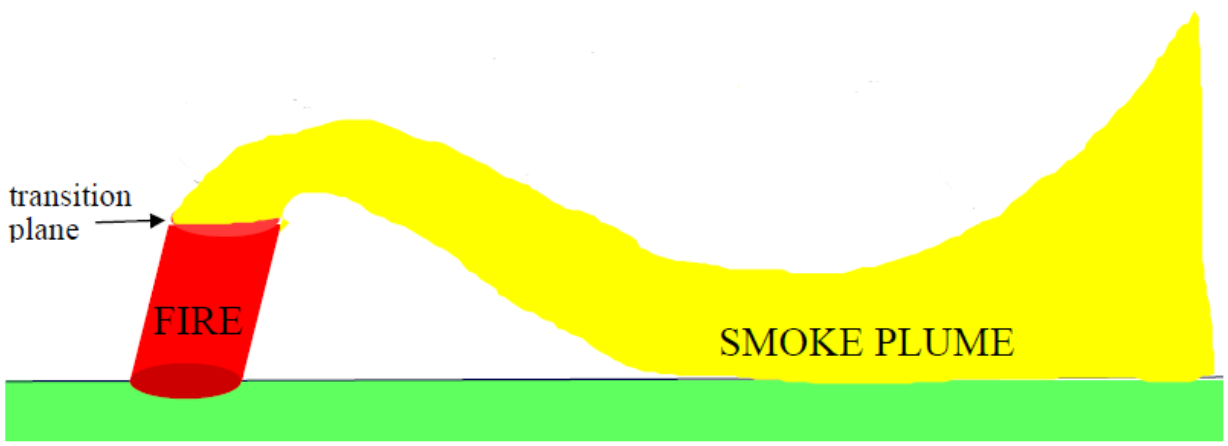

On-Ramp to US 101 (N Bound)
Calle Real
101
101
US 101 (S Bound) Exit 117 Off-Ramp
El Capitan State Beach Rd
Las Flores Canyon
Santa Ynez Unit Facility
Corral Canyon Rd
101
0 0.25 0.5 1 Miles
Legend
Loaded Truck Route
Empty Truck Return Route
US 101
ExxonMobil
N
W
E
S
0 125 250 500
Feet
Secondary Route From/To Las Flores Canyon Facility
US 101 - Exit 117 Interchange at El Capitan Rd
Prepared by:
InterAct

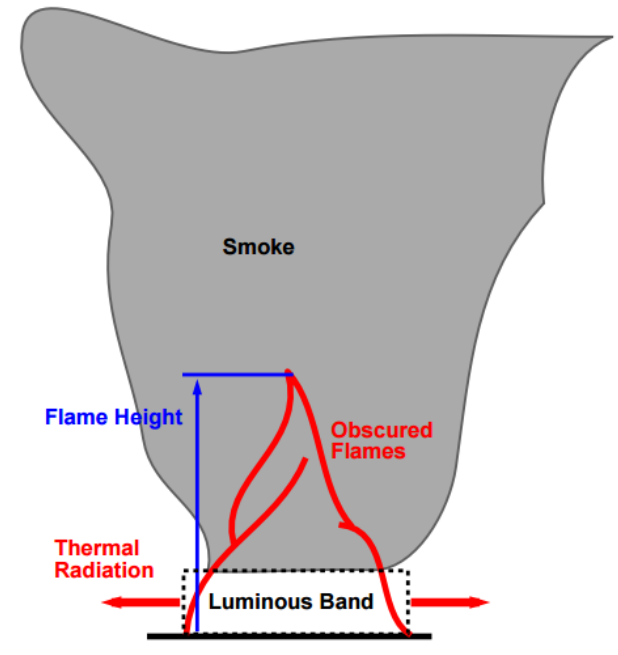
APPENDIX 2

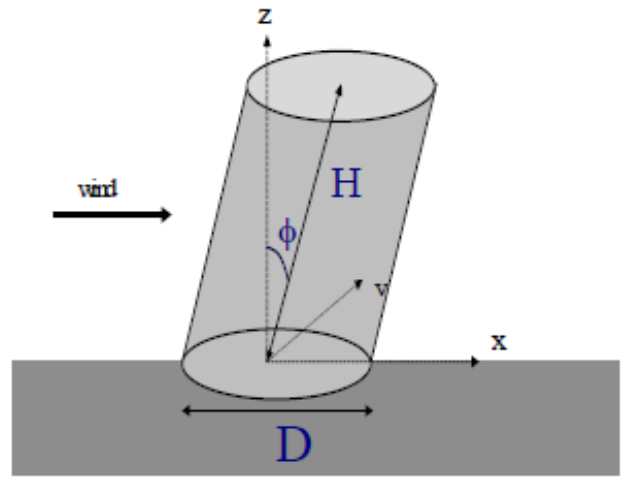
COMBUSTION PRODUCTS DISPERSION MODELING DETAILS

Combustion products typically rise over the spill pool area first and then disperse with the wind; thus modeling of fire and combustion products dispersion typically is approximated with two shapes: a tilted cylinder and a smoke plume [Refs 12, 13]. Dispersion of combustion materials is assumed to start at the top of the fire cylinder and follow the cone shape distribution in the down wind direction.

Even though SO_2 is heavier than air, the mixture of hot combustion gases (where SO_2 represents is only a small percentage of the total gas mixture) rising from the fire has neutral buoyancy because it is mixed with air [Risk Assessment in Chemical Process Industries, Advanced Techniques. F. I. Khan, S. I. Abbasi. 1998. Chapter: Analysis of a Chloralkali Industry, p 213].

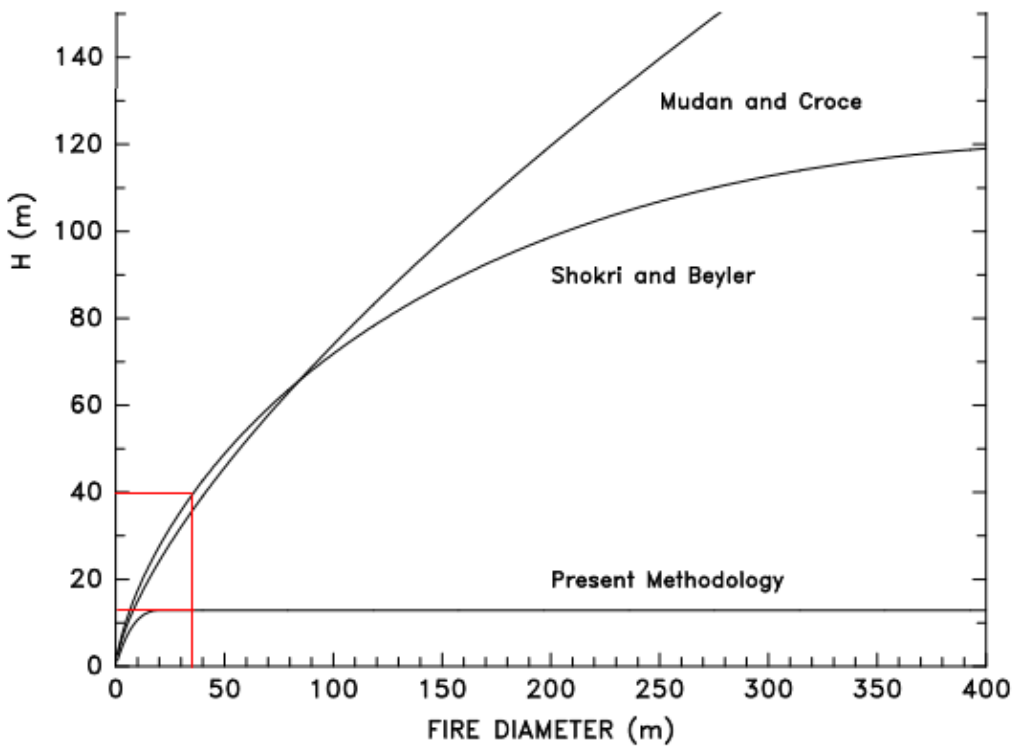




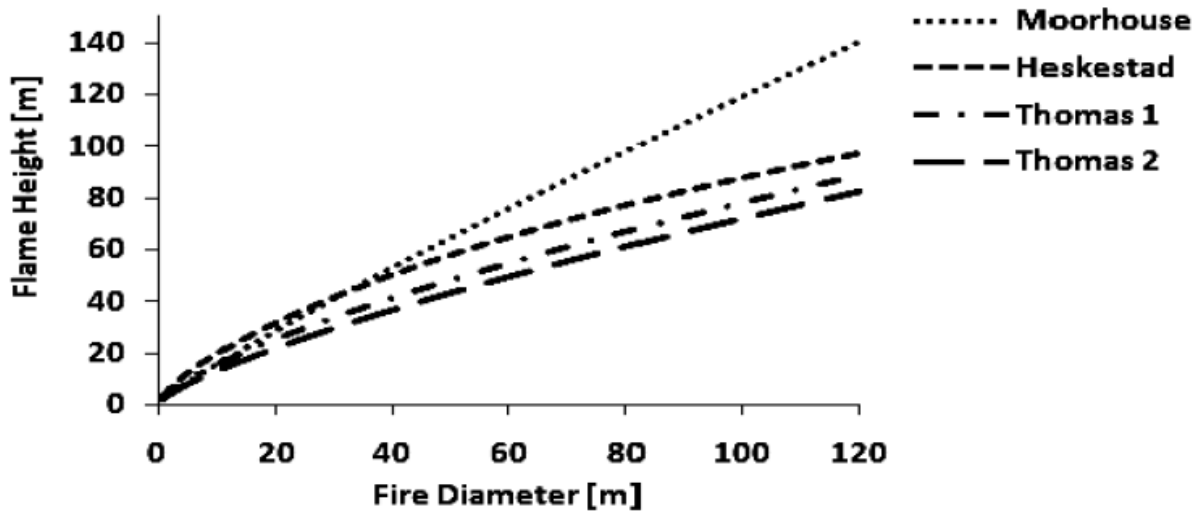


Schematic diagram of a large liquid fuel fire [Ref 13]

Pool fire Model [12]



Fire height depending on the fire diameter [Ref 13, McGrattan]



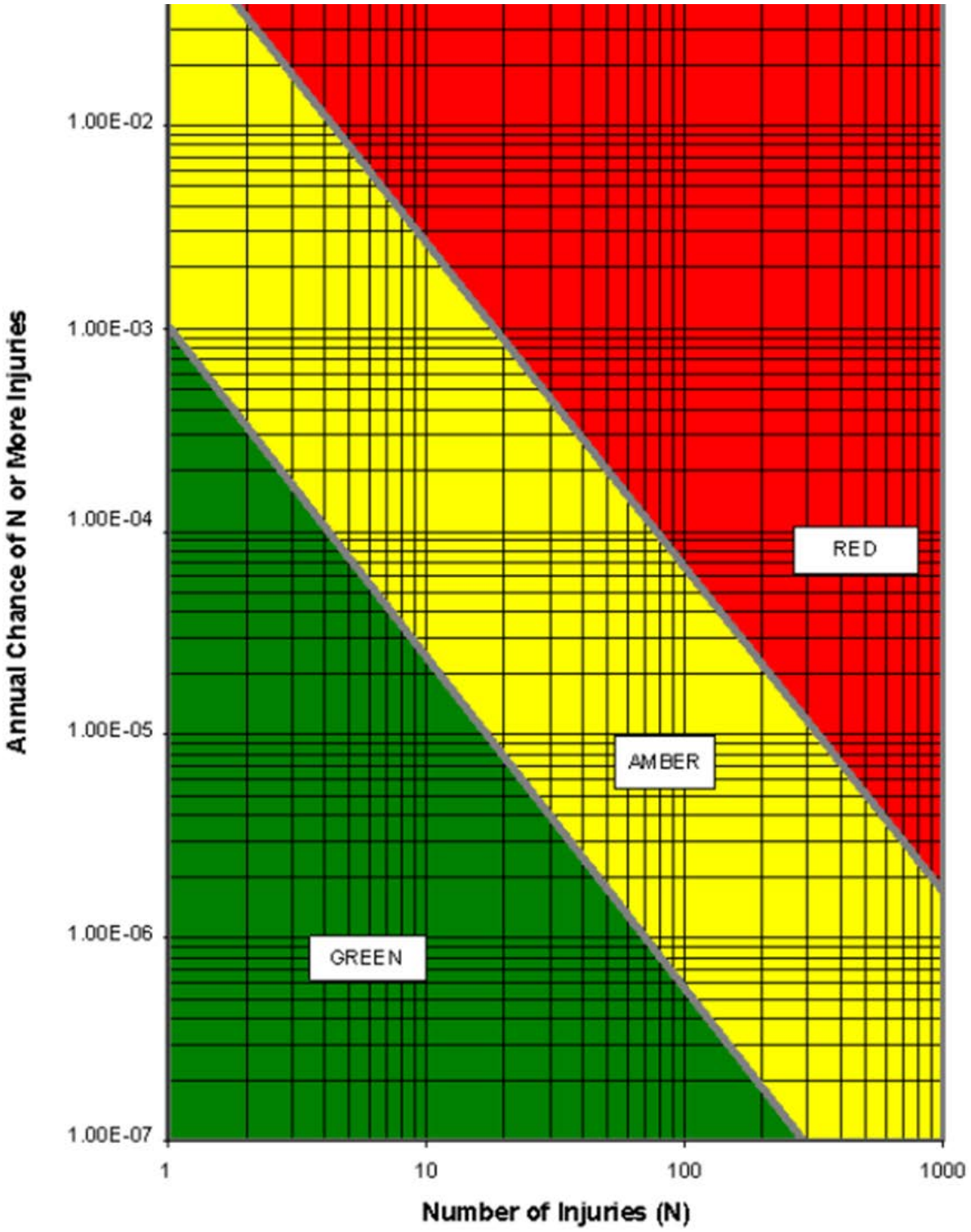
Flame height correlations for gasoline pool fire [Ref 11, Ufuah]

Fire height is modeled by a cylinder with the height approximated depending on the pool fire diameter [Refs 11, 13], at 35 meters in diameter (58.9 feet in radius pool fire), the fire height would be 10 to 40 meters. A height of 15 feet was selected as a conservative value.

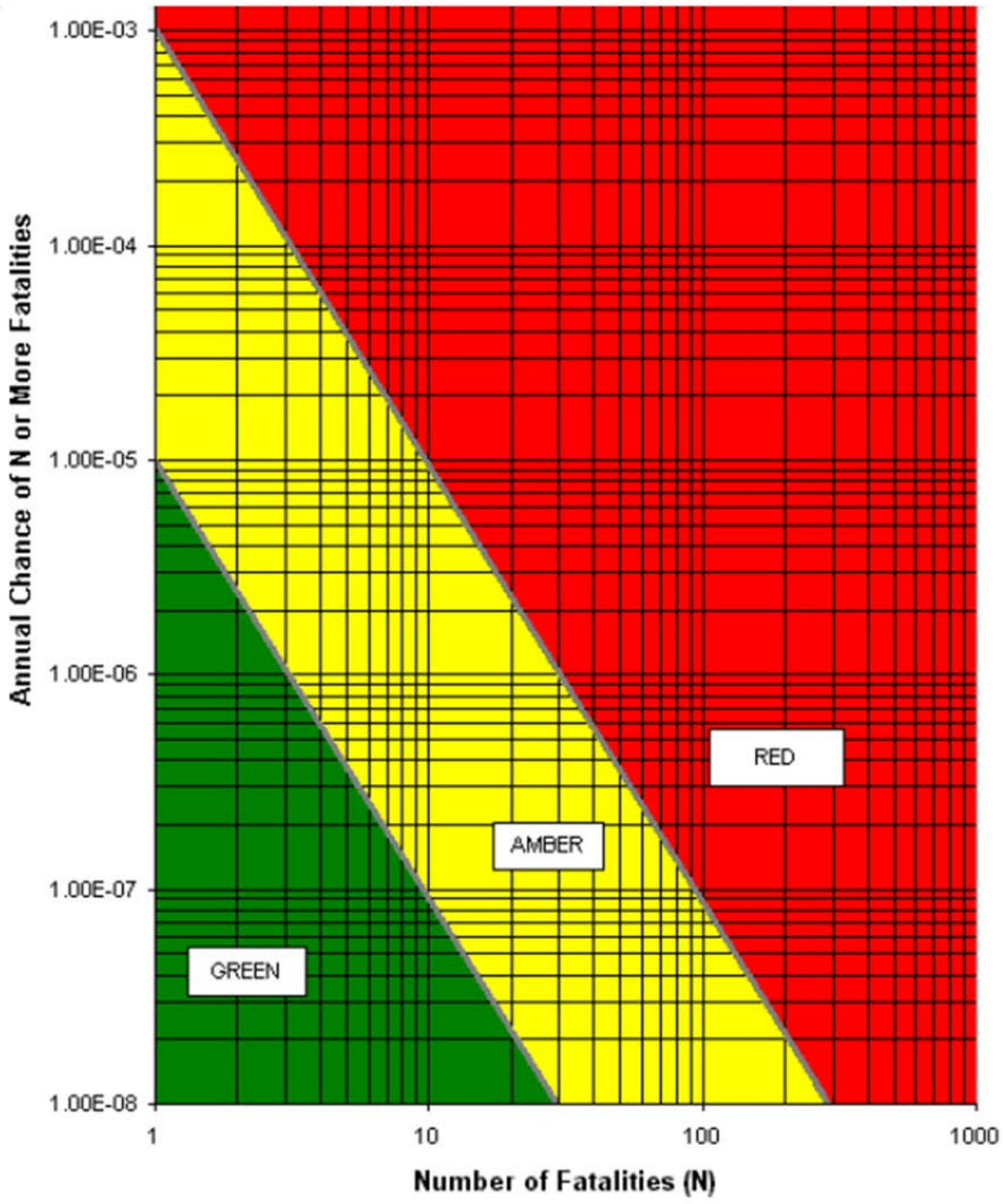
APPENDIX 3

SANTA BARBARA COUNTY PUBLIC RISK THRESHOLDS

Santa Barbara County Public Injury Risk Spectrum



Santa Barbara County Public Fatality Risk Spectrum



APPENDIX 4

RISK CALCULATION DETAILS

ROUTE FROM LFC to PHILLIPS 66 STATION in SANTA MARIA

F-N CURVE DATA

Santa Barbara County Fatality Criteria

Red	/yr	Amber	/yr
1	1.00E-03	1	1.00E-05
300	1.00E-08	30	1.00E-08

Santa Barbara County Injury Criteria

Red	/yr	Amber	/yr
1	1.00E-01	1	1.00E-03
900	2.00E-06	300	1.00E-07

1	sq foot =	3.59E-08	sq mile
1	sq mile =	27,878,399	sq feet

Probabilities

Base case of truck accidents: **0.528** per million miles (Rural highways in California, per Harwood 1993)

Collision accident reduction factors - (accident with collisions)

41.0 % reduction factor, due to safety programs

26.0 % reduction factor, due to speed control

Non-collision Accident reduction factors (non-collision accidents - 20% that of accidents w/ collision)

37.5 % reduction factor, due to maintenance programs

45.0 % reduction factor, due to pre-trip-inspection

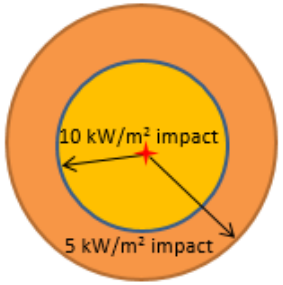
Formula for Adjusted Probability of a truck accident per million miles

0.528 x [0.8 x (1-0.41-0.26) + 0.2 x (1-0.375-0.45)]

Adjusted rate of truck accidents: **0.193** per million miles

40% of people in 10 kW/m2 area will have Fatality

60% of people in 10 kW/m2 area + all people in 5 kW/m2 area will have Injury



Scenario, Volume and Impact Area Calculations

Scenario	Spilled	Volume Spilled			Area		Radius	10 kW/m² Radius	5 kW/m² Radius	10 kW/m² Area	5 kW/m² Area*	Probability of Accident, Release & Ignition
	% of truck	bbls	gallons	cu. inch	sq. inch	sq ft	ft	ft	ft	sq ft	sq ft	per mile
Rupture	100%	160	6,720	1,552,320	1,552,320	10,780	58.58	96.93	138.93	29,515	31,121	8.7E-11
Leak	10%	16	672	155,232	155,232	1,078	18.52	30.65	43.93	2,951	3,112	2.6E-10

Note: * the area with the 5 kW/m2 heat is a ring with the inside radius eqal to the 10 kW/m2 heat impact, and outside radius equal to the 5 kW/m2 heat impact

Trucks/day to P66	Truck trips per year	Total Miles per year	Accident Rate per mile	Probability of Release	Probability of Large Spill	Probability of small Spill	Probability of Ignition
70	25,550	1.38E+06	1.93E-07	0.09	0.25	0.75	0.02

Total Volume trucked, bbl
4,088,000

ROUTE FROM LFC to PHILLIPS 66 STATION in SANTA MARIA

Probability Data by Route Segment								Consequence Data by Route Segment					
Segmt. No.	Area on Segment	Segment Population category	Population		Mileage of Segment	Mileage of Segment	Total Trucking	Large Pool Fire Frequency (per year)	Small Pool Fire Frequency (per year)	Large Spill		Small Spill	
			ppl/sq mile	ppl/sq ft	feet	miles	miles			Injuries	Fatalities	Injuries	Fatalities
1	LFC to Camino R.	Private/Open Sp.	5	1.79E-07	5,750	1.09	27,824.3	2.41E-06	7.24E-06	0.01	0.00	0.00	0.00
2	from LFC to Camp	Rural	20	7.17E-07	5,790	1.10	28,017.9	2.43E-06	7.29E-06	0.04	0.01	0.00	0.00
3	Refugio camp	Recreation	100	3.59E-06	4,960	0.94	24,001.5	2.08E-06	6.24E-06	0.18	0.04	0.02	0.00
4	Rural Residence**	Rural	20	7.17E-07	3,750	0.71	18,146.3	1.57E-06	4.72E-06	0.04	0.01	0.00	0.00
5	Beach	Recreation	100	3.59E-06	834	0.16	4,035.7	3.50E-07	1.05E-06	0.18	0.04	0.02	0.00
6	Rural area	Rural	20	7.17E-07	3,110	0.59	15,049.3	1.31E-06	3.92E-06	0.04	0.01	0.00	0.00
7	Rural residential	Rural	20	7.17E-07	12,350	2.34	59,761.8	5.18E-06	1.55E-05	0.04	0.01	0.00	0.00
8	Beach, camps	Recreation	100	3.59E-06	16,400	3.11	79,359.8	6.88E-06	2.06E-05	0.18	0.04	0.02	0.00
9	Gaviota plant**	Recreation	100	3.59E-06	3,340	0.63	16,162.3	1.40E-06	4.20E-06	0.18	0.04	0.02	0.00
10	Beach, camps	Recreation	100	3.59E-06	1,187	0.22	5,743.9	4.98E-07	1.49E-06	0.18	0.04	0.02	0.00
11	Rural w/ Fire Sta.	Rural	20	7.17E-07	1,196	0.23	5,787.5	5.02E-07	1.51E-06	0.04	0.01	0.00	0.00
12	Motel or Rest Stop	Recreation	100	3.59E-06	17,800	3.37	86,134.5	7.47E-06	2.24E-05	0.18	0.04	0.02	0.00
13	Rural Recreation	Recreation	100	3.59E-06	1,012	0.19	4,897.1	4.25E-07	1.27E-06	0.18	0.04	0.02	0.00
14	Grazing/Open*	Unpopulated	5	1.79E-07	40,600	7.69	196,464.0	1.70E-05	5.11E-05	0.01	0.00	0.00	0.00
15	Shops (Rte 240)	Commercial Low	1000	3.59E-05	8,319	1.58	40,255.8	3.49E-06	1.05E-05	1.75	0.42	0.18	0.04
16	Grazing	Rural	20	7.17E-07	1,446	0.27	6,997.2	6.07E-07	1.82E-06	0.04	0.01	0.00	0.00
17	Rural residence	Resid. very low	200	7.17E-06	1,004	0.19	4,858.4	4.21E-07	1.26E-06	0.35	0.08	0.04	0.01
18	Shops	Commercial Low	1000	3.59E-05	342	0.06	1,654.9	1.44E-07	4.31E-07	1.75	0.42	0.18	0.04
19	Open space	Unpopulated	5	1.79E-07	60,400	11.44	292,276.5	2.53E-05	7.60E-05	0.01	0.00	0.00	0.00
20	Rural	Rural	20	7.17E-07	1,217	0.23	5,889.1	5.11E-07	1.53E-06	0.04	0.01	0.00	0.00
21	Shops at Rte 135	Commercial Low	1000	3.59E-05	1,378	0.26	6,668.2	5.78E-07	1.73E-06	1.75	0.42	0.18	0.04
22	Rte 135	Residential Low	1000	3.59E-05	548	0.10	2,651.8	2.30E-07	6.90E-07	1.75	0.42	0.18	0.04
23	Shops at Rte 135	Commercial Low	1000	3.59E-05	916	0.17	4,432.5	3.84E-07	1.15E-06	1.75	0.42	0.18	0.04
24	at Pepertree Ln.	Residential Low	1000	3.59E-05	3,175	0.60	15,363.9	1.33E-06	4.00E-06	1.75	0.42	0.18	0.04
25	South of S. Maria	Open Space	5	1.79E-07	48,780	9.24	236,047.2	2.05E-05	6.14E-05	0.01	0.00	0.00	0.00
26	Approach S. Maria	Residential Low	1000	3.59E-05	5,680	1.08	27,485.6	2.38E-06	7.15E-06	1.75	0.42	0.18	0.04
27	S. Maria	Commercial Low	1000	3.59E-05	3,500	0.66	16,936.6	1.47E-06	4.41E-06	1.75	0.42	0.18	0.04
28	S. Maria	Residential Med	3000	1.08E-04	6,975	1.32	33,752.1	2.93E-06	8.78E-06	5.25	1.27	0.53	0.13
29	S. Maria	Residential Med	3000	1.08E-04	1,695	0.32	8,202.1	7.11E-07	2.13E-06	5.25	1.27	0.53	0.13
30	S. Maria	Residential Low	1000	3.59E-05	9,430	1.79	45,631.9	3.96E-06	1.19E-05	1.75	0.42	0.18	0.04
31	Betteravia Exit	Comm. Med+Rural	2510	9.00E-05	2,580	0.49	12,484.7	1.08E-06	3.25E-06	4.40	1.06	0.44	0.11
32	from 101 to Station	Rural	20	7.17E-07	8,976	1.70	43,435.0	3.77E-06	1.13E-05	0.04	0.01	0.00	0.00

ROUTE FROM LFC to PHILLIPS 66 STATION in SANTA MARIA

Injury Data for the FN Curve

Injuries	Pool Fire Frequency (per year)	Cumulative Frequency (per year)
5.25	2.93E-06	2.93E-06
5.25	7.11E-07	3.64E-06
4.40	1.08E-06	4.72E-06
1.75	3.49E-06	8.21E-06
1.75	1.44E-07	8.36E-06
1.75	5.78E-07	8.93E-06
1.75	2.30E-07	9.16E-06
1.75	3.84E-07	9.55E-06
1.75	1.33E-06	1.09E-05
1.75	2.38E-06	1.33E-05
1.75	1.47E-06	1.47E-05
1.75	3.96E-06	1.87E-05
0.53	8.78E-06	2.75E-05
0.53	2.13E-06	2.96E-05
0.44	3.25E-06	3.29E-05
0.35	4.21E-07	3.33E-05
0.18	2.08E-06	3.54E-05
0.18	3.50E-07	3.57E-05
0.18	6.88E-06	4.26E-05
0.18	1.40E-06	4.40E-05
0.18	4.98E-07	4.45E-05
0.18	7.47E-06	5.20E-05
0.18	4.25E-07	5.24E-05
0.18	1.05E-05	6.29E-05
0.18	4.31E-07	6.33E-05
0.18	1.73E-06	6.50E-05
0.18	6.90E-07	6.57E-05
0.18	1.15E-06	6.69E-05
0.18	4.00E-06	7.09E-05
0.18	7.15E-06	7.80E-05
0.18	4.41E-06	8.24E-05
0.18	1.19E-05	9.43E-05
0.04	2.43E-06	9.67E-05

Fatality Data for the FN Curve

Fatalities	Pool Fire Frequency (per year)t	Cumulative Frequency (per year)
1.27	2.93E-06	2.93E-06
1.27	7.11E-07	3.64E-06
1.06	1.08E-06	4.72E-06
0.42	3.49E-06	8.21E-06
0.42	1.44E-07	8.36E-06
0.42	5.78E-07	8.93E-06
0.42	2.30E-07	9.16E-06
0.42	3.84E-07	9.55E-06
0.42	1.33E-06	1.09E-05
0.42	2.38E-06	1.33E-05
0.42	1.47E-06	1.47E-05
0.42	3.96E-06	1.87E-05
0.13	8.78E-06	2.75E-05
0.13	2.13E-06	2.96E-05
0.11	3.25E-06	3.29E-05
0.08	4.21E-07	3.33E-05
0.04	2.08E-06	3.54E-05
0.04	3.50E-07	3.57E-05
0.04	6.88E-06	4.26E-05
0.04	1.40E-06	4.40E-05
0.04	4.98E-07	4.45E-05
0.04	7.47E-06	5.20E-05
0.04	4.25E-07	5.24E-05
0.04	1.05E-05	6.29E-05
0.04	4.31E-07	6.33E-05
0.04	1.73E-06	6.50E-05
0.04	6.90E-07	6.57E-05
0.04	1.15E-06	6.69E-05
0.04	4.00E-06	7.09E-05
0.04	7.15E-06	7.80E-05
0.04	4.41E-06	8.24E-05
0.04	1.19E-05	9.43E-05
0.01	2.43E-06	9.67E-05

Injury Data for the FN Curve

Injuries	Pool Fire Frequency (per year)	Cumulative Frequency (per year)
0.04	1.57E-06	9.83E-05
0.04	1.31E-06	9.96E-05
0.04	5.18E-06	1.05E-04
0.04	5.02E-07	1.05E-04
0.04	6.07E-07	1.06E-04
0.04	5.11E-07	1.06E-04
0.04	3.77E-06	1.10E-04
0.04	1.26E-06	1.11E-04
0.02	6.24E-06	1.18E-04
0.02	1.05E-06	1.19E-04
0.02	2.06E-05	1.39E-04
0.02	4.20E-06	1.44E-04
0.02	1.49E-06	1.45E-04
0.02	2.24E-05	1.67E-04
0.02	1.27E-06	1.69E-04
0.01	2.41E-06	1.71E-04
0.01	1.70E-05	1.88E-04
0.01	2.53E-05	2.14E-04
0.01	2.05E-05	2.34E-04
0.00	7.29E-06	2.41E-04
0.00	4.72E-06	2.46E-04
0.00	3.92E-06	2.50E-04
0.00	1.55E-05	2.66E-04
0.00	1.51E-06	2.67E-04
0.00	1.82E-06	2.69E-04
0.00	1.53E-06	2.70E-04
0.00	1.13E-05	2.82E-04
0.00	7.24E-06	2.89E-04
0.00	5.11E-05	3.40E-04
0.00	7.60E-05	4.16E-04
0.00	6.14E-05	4.77E-04

Fatality Data for the FN Curve

Fatalities	Pool Fire Frequency (per year)t	Cumulative Frequency (per year)
0.01	1.57E-06	9.83E-05
0.01	1.31E-06	9.96E-05
0.01	5.18E-06	1.05E-04
0.01	5.02E-07	1.05E-04
0.01	6.07E-07	1.06E-04
0.01	5.11E-07	1.06E-04
0.01	3.77E-06	1.10E-04
0.01	1.26E-06	1.11E-04
0.00	6.24E-06	1.18E-04
0.00	1.05E-06	1.19E-04
0.00	2.06E-05	1.39E-04
0.00	4.20E-06	1.44E-04
0.00	1.49E-06	1.45E-04
0.00	2.24E-05	1.67E-04
0.00	1.27E-06	1.69E-04
0.00	2.41E-06	1.71E-04
0.00	1.70E-05	1.88E-04
0.00	2.53E-05	2.14E-04
0.00	2.05E-05	2.34E-04
0.00	7.29E-06	2.41E-04
0.00	4.72E-06	2.46E-04
0.00	3.92E-06	2.50E-04
0.00	1.55E-05	2.66E-04
0.00	1.51E-06	2.67E-04
0.00	1.82E-06	2.69E-04
0.00	1.53E-06	2.70E-04
0.00	1.13E-05	2.82E-04
0.00	7.24E-06	2.89E-04
0.00	5.11E-05	3.40E-04
0.00	7.60E-05	4.16E-04
0.00	6.14E-05	4.77E-04

ROUTE FROM LFC to PENTLAND STATION in MARICOPA

F-N CURVE DATA

Santa Barbara County Fatality Criteria

Red	/yr	Amber	/yr
1	1.00E-03	1	1.00E-05
300	1.00E-08	30	1.00E-08

Santa Barbara County Injury Criteria

Red	/yr	Amber	/yr
1	1.00E-01	1	1.00E-03
900	2.00E-06	300	1.00E-07

1	sq foot =	3.59E-08	sq mile
1	sq mile =	27,878,399	sq feet

Probabilities

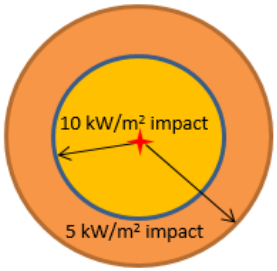
Base case of truck accidents (1): **0.528** per million miles (Rural freeway in California, per Harwood 1993)
Base case of truck accidents (2): **1.720** per million miles (Rural two-lane in California, per Harwood 1993)
Collision accident reduction factors - (accident with collisions)
41.0 % reduction factor, due to safety programs
26.0 % reduction factor, due to speed control
Non-collision Accident reduction factors (non-collision accidents = 20% that of accidents w/ collision)
37.5 % reduction factor, due to maintenance programs
45.0 % reduction factor, due to pre-trip-inspection

Formula for Adjusted Probability of a truck accident per million miles
0.528 x [0.8 x (1-0.41-0.26) + 0.2 x (1-0.375-0.45)]

Adjusted truck accident rate (1): **0.193** per million miles (Rural freeway)
Adjusted truck accident rate (2): **0.628** per million miles (Rural two-lane)

40% of people in 10 kW/m2 area will have Fatality

60% of people in 10 kW/m2 area + all people in 5 kW/m2 area will have Injury



Scenario, Volume and Impact Area Calculations

Scenario	Spilled	Volume Spilled			Area		Radius	10 kW/m² Radius	5 kW/m² Radius	10 kW/m² Area	5 kW/m² Area*	Probability of Accident, Release & Ignition	Probability of Accident, Release & Ignition
	% of truck	bbls	gallons	cu. inch	sq. inch	sq ft	ft	ft	ft	sq ft	sq ft	per mile	per mile
Rupture	100%	160	6,720	1,552,320	1,552,320	10,780	58.58	96.93	138.93	29,515	31,121	8.7E-11	2.8E-10
Leak	10%	16	672	155,232	155,232	1,078	18.52	30.65	43.93	2,951	3,112	2.6E-10	8.5E-10

Note: * the area with the 5 kW/m2 heat is a ring with the inside radius equal to the 10 kW/m2 heat impact, and outside radius equal to the 5 kW/m2 heat impact

Trucks/day to Pentland	Truck trips per year	Total Miles per year	Accident Rate 1 per mile	Accident Rate 2 per mile	Probability of Release	Probability of Large Spill	Probability of small Spill	Probability of Ignition
70	25,550	9730	1.93E-07	6.28E-07	0.09	0.25	0.75	0.02

Total Volume trucked, bbl
4,088,000

ROUTE FROM LFC to PENTLAND STATION in MARICOPA

Probability Data by Route Segment								Consequence Data by Route Segment						
Segmt. No.	Area on Segment	Segment Population category	Population		Mileage of Segment	Mileage of Segment	Total Trucking	Large Pool Fire Frequency (per year)	Small Pool Fire Frequency (per year)	Large Spill		Small Spill		
			ppl/sq mile	ppl/sq ft	feet	miles	mile/yr			Injuries	Fatalities	Injuries	Fatalities	
1	LFC to Camino R.**	Private/Open Sp.	5	1.79E-07	5,750	1.09	27,824.3	2.41E-06	7.24E-06	0.01	0.00	0.00	0.00	Portion of Route common to both Stations: Phillips 66 & Pentland Station
2	LFC to Refugio C.**	Rural	20	7.17E-07	5,790	1.10	28,017.9	2.43E-06	7.29E-06	0.04	0.01	0.00	0.00	
3	Refugio camp	Recreation	100	3.59E-06	4,960	0.94	24,001.5	2.08E-06	6.24E-06	0.18	0.04	0.02	0.00	
4	Rural Residence**	Rural	20	7.17E-07	3,750	0.71	18,146.3	1.57E-06	4.72E-06	0.04	0.01	0.00	0.00	
5	Beach	Recreation	100	3.59E-06	834	0.16	4,035.7	3.50E-07	1.05E-06	0.18	0.04	0.02	0.00	
6	Rural area	Rural	20	7.17E-07	3,110	0.59	15,049.3	1.31E-06	3.92E-06	0.04	0.01	0.00	0.00	
7	Rural residential	Rural	20	7.17E-07	12,350	2.34	59,761.8	5.18E-06	1.55E-05	0.04	0.01	0.00	0.00	
8	Beach, camps	Recreation	100	3.59E-06	16,400	3.11	79,359.8	6.88E-06	2.06E-05	0.18	0.04	0.02	0.00	
9	Gaviota plant**	Recreation	100	3.59E-06	3,340	0.63	16,162.3	1.40E-06	4.20E-06	0.18	0.04	0.02	0.00	
10	Beach, camps	Recreation	100	3.59E-06	1,187	0.22	5,743.9	4.98E-07	1.49E-06	0.18	0.04	0.02	0.00	
11	Rural w/ Fire Sta.**	Rural	20	7.17E-07	1,196	0.23	5,787.5	5.02E-07	1.51E-06	0.04	0.01	0.00	0.00	
12	Motel or Rest Stop	Recreation	100	3.59E-06	17,800	3.37	86,134.5	7.47E-06	2.24E-05	0.18	0.04	0.02	0.00	
13	Rural Recreation	Recreation	100	3.59E-06	1,012	0.19	4,897.1	4.25E-07	1.27E-06	0.18	0.04	0.02	0.00	
14	Grazing/Open**	Unpopulated	5	1.79E-07	40,600	7.69	196,464.0	1.70E-05	5.11E-05	0.01	0.00	0.00	0.00	
15	Shops (Rte 240)	Commercial Low	1000	3.59E-05	8,319	1.58	40,255.8	3.49E-06	1.05E-05	1.75	0.42	0.18	0.04	
16	Grazing	Rural	20	7.17E-07	1,446	0.27	6,997.2	6.07E-07	1.82E-06	0.04	0.01	0.00	0.00	
17	Rural residence**	Resid. very low	200	7.17E-06	1,004	0.19	4,858.4	4.21E-07	1.26E-06	0.35	0.08	0.04	0.01	
18	Shops	Commercial Low	1000	3.59E-05	342	0.06	1,654.9	1.44E-07	4.31E-07	1.75	0.42	0.18	0.04	
19	Open space**	Unpopulated	5	1.79E-07	60,400	11.44	292,276.5	2.53E-05	7.60E-05	0.01	0.00	0.00	0.00	
20	Rural**	Rural	20	7.17E-07	1,217	0.23	5,889.1	5.11E-07	1.53E-06	0.04	0.01	0.00	0.00	
21	Shops at Rte 135	Commercial Low	1000	3.59E-05	1,378	0.26	6,668.2	5.78E-07	1.73E-06	1.75	0.42	0.18	0.04	
22	Rte 135	Residential Low	1000	3.59E-05	548	0.10	2,651.8	2.30E-07	6.90E-07	1.75	0.42	0.18	0.04	
23	Shops at Rte 135	Commercial Low	1000	3.59E-05	916	0.17	4,432.5	3.84E-07	1.15E-06	1.75	0.42	0.18	0.04	
24	at Pepertree Ln.	Residential Low	1000	3.59E-05	3,175	0.60	15,363.9	1.33E-06	4.00E-06	1.75	0.42	0.18	0.04	
25	South of S. Maria**	Open Space	5	1.79E-07	48,780	9.24	236,047.2	2.05E-05	6.14E-05	0.01	0.00	0.00	0.00	
26	Approach S. Maria	Residential Low	1000	3.59E-05	5,680	1.08	27,485.6	2.38E-06	7.15E-06	1.75	0.42	0.18	0.04	
27	S. Maria**	Commercial Low	1000	3.59E-05	3,500	0.66	16,936.6	1.47E-06	4.41E-06	1.75	0.42	0.18	0.04	
28	S. Maria**	Residential Med	3000	1.08E-04	6,975	1.32	33,752.1	2.93E-06	8.78E-06	5.25	1.27	0.53	0.13	
29	S. Maria**	Residential Med	3000	1.08E-04	1,695	0.32	8,202.1	7.11E-07	2.13E-06	5.25	1.27	0.53	0.13	
30	S. Maria**	Residential Low	1000	3.59E-05	9,430	1.79	45,631.9	3.96E-06	1.19E-05	1.75	0.42	0.18	0.04	
31	Betteravia Exit	Comm. Med+Rura	2510	9.00E-05	2,580	0.49	12,484.7	1.08E-06	3.25E-06	4.40	1.06	0.44	0.11	
32	Betteravia - Station	Rural	20	7.17E-07	8,976	1.70	43,435.0	3.77E-06	1.13E-05	0.04	0.01	0.00	0.00	

ROUTE FROM LFC to PENTLAND STATION in MARICOPA

Probability Data by Route Segment | **Consequence Data by Route Segment**

Segmt. No.	Area on Segment	Segment Population category	Population		Mileage of Segment	Mileage of Segment	Total Trucking	Large Pool Fire Frequency (per year)	Small Pool Fire Frequency (per year)	Large Spill		Small Spill		
			ppl/sq mile	ppl/sq ft	feet	miles	mile/yr			Injuries	Fatalities	Injuries	Fatalities	
33	Mid of S. Maria	Comm Med+Rural	2510	9.00E-05	5,285	1.00	25,574.2	2.22E-06	6.65E-06	4.40	1.06	0.44	0.11	Portion of the Route only to Pentland Station
34	Mid of S. Maria**	Residential Low	1000	3.59E-05	11,445	2.17	55,382.5	4.80E-06	1.44E-05	1.75	0.42	0.18	0.04	
35	Mid of S. Maria	Commercial Low	1000	3.59E-05	3,250	0.62	15,726.8	1.36E-06	4.09E-06	1.75	0.42	0.18	0.04	
36	Mid of S. Maria	Residential Med	3000	1.08E-04	1,010	0.19	4,887.4	4.24E-07	1.27E-06	5.25	1.27	0.53	0.13	
37	River Bridge	Unpopulated	5	1.79E-07	2,521	0.48	12,199.2	1.06E-06	3.17E-06	0.01	0.00	0.00	0.00	
38	N of S. Maria	Commercial Low	1000	3.59E-05	1,145	0.22	5,540.7	4.81E-07	1.44E-06	1.75	0.42	0.18	0.04	
39	Sparse population	Rural	20	7.17E-07	85,350	16.16	413,009.9	1.17E-04	3.50E-04	0.04	0.01	0.00	0.00	
40	Hills on Rte 166	Unpopulated	5	1.79E-07	48,300	9.15	233,724.4	6.60E-05	1.98E-04	0.01	0.00	0.00	0.00	
41	Brown Cyn	Rural	20	7.17E-07	3,700	0.70	17,904.4	5.06E-06	1.52E-05	0.04	0.01	0.00	0.00	
42	To Green Cyn.	Unpopulated	5	1.79E-07	94,100	17.82	455,351.3	1.29E-04	3.86E-04	0.01	0.00	0.00	0.00	
43	Green Cyn.	Rural	20	7.17E-07	8,450	1.60	40,889.7	1.16E-05	3.47E-05	0.04	0.01	0.00	0.00	
44	East of Green Cyn.	Unpopulated	5	1.79E-07	11,600	2.20	56,132.6	1.59E-05	4.76E-05	0.01	0.00	0.00	0.00	
45	Small shop area	Commercial Low	1000	3.59E-05	528	0.10	2,555.0	7.22E-07	2.17E-06	1.75	0.42	0.18	0.04	
46	West of N Cuyama	Unpopulated	5	1.79E-07	4,224	0.80	20,440.0	5.77E-06	1.73E-05	0.01	0.00	0.00	0.00	
47	to New Cuyama	Rural	20	7.17E-07	17,980	3.41	87,005.5	2.46E-05	7.37E-05	0.04	0.01	0.00	0.00	
48	New Cuyama	Residential Low	1000	3.59E-05	6,340	1.20	30,679.4	8.67E-06	2.60E-05	1.75	0.42	0.18	0.04	
49	to Cuyama	Rural	20	7.17E-07	14,800	2.80	71,617.4	2.02E-05	6.07E-05	0.04	0.01	0.00	0.00	
50	Cuyama	Residential Low	1000	3.59E-05	5,280	1.00	25,550.0	7.22E-06	2.17E-05	1.75	0.42	0.18	0.04	
51	east of Cuyama	Rural	20	7.17E-07	37,650	7.13	182,188.9	5.15E-05	1.54E-04	0.04	0.01	0.00	0.00	
52	to Maricopa	Unpopulated	5	1.79E-07	59,400	11.25	287,437.5	8.12E-05	2.44E-04	0.01	0.00	0.00	0.00	
53	Maricopa	Residential Low	1000	3.59E-05	5,290	1.00	25,598.4	7.23E-06	2.17E-05	1.75	0.42	0.18	0.04	
54	east of Maricopa	Rural	20	7.17E-07	30,800	5.83	149,041.7	4.21E-05	1.26E-04	0.04	0.01	0.00	0.00	
					TOTAL	139.00	3,594,846							

ROUTE FROM LFC to PENTLAND STATION in MARICOPA

Injury Data for the FN Curve

Injuries	Pool Fire Frequency (per year)	Cumulative Frequency (per year)
5.2546	2.93E-06	2.93E-06
5.2546	7.11E-07	3.64E-06
5.2546	4.24E-07	4.06E-06
4.3964	1.08E-06	5.15E-06
4.3964	2.22E-06	7.36E-06
1.7515	3.49E-06	1.09E-05
1.7515	1.44E-07	1.10E-05
1.7515	5.78E-07	1.16E-05
1.7515	2.30E-07	1.18E-05
1.7515	3.84E-07	1.22E-05
1.7515	1.33E-06	1.35E-05
1.7515	2.38E-06	1.59E-05
1.7515	1.47E-06	1.74E-05
1.7515	3.96E-06	2.13E-05
1.7515	4.80E-06	2.61E-05
1.7515	1.36E-06	2.75E-05
1.7515	4.81E-07	2.80E-05
1.7515	7.22E-07	2.87E-05
1.7515	8.67E-06	3.74E-05
1.7515	7.22E-06	4.46E-05
1.7515	7.23E-06	5.18E-05
0.5255	8.78E-06	6.06E-05
0.5255	2.13E-06	6.27E-05
0.5255	1.27E-06	6.40E-05
0.4396	3.25E-06	6.73E-05
0.4396	6.65E-06	7.39E-05
0.3503	4.21E-07	7.43E-05
0.1752	2.08E-06	7.64E-05
0.1752	3.50E-07	7.68E-05
0.1752	6.88E-06	8.36E-05
0.1752	1.40E-06	8.50E-05
0.1752	4.98E-07	8.55E-05
0.1752	7.47E-06	9.30E-05
0.1752	4.25E-07	9.34E-05
0.1752	1.05E-05	1.04E-04
0.1752	4.31E-07	1.04E-04
0.1752	1.73E-06	1.06E-04

Fatality Data for the FN Curve

Fatalities	Pool Fire Frequency (per year)	Cumulative Frequency (per year)
1.2704	2.93E-06	2.93E-06
1.2704	7.11E-07	3.64E-06
1.2704	4.24E-07	4.06E-06
1.0629	1.08E-06	5.15E-06
1.0629	2.22E-06	7.36E-06
0.4235	3.49E-06	1.09E-05
0.4235	1.44E-07	1.10E-05
0.4235	5.78E-07	1.16E-05
0.4235	2.30E-07	1.18E-05
0.4235	3.84E-07	1.22E-05
0.4235	1.33E-06	1.35E-05
0.4235	2.38E-06	1.59E-05
0.4235	1.47E-06	1.74E-05
0.4235	3.96E-06	2.13E-05
0.4235	4.80E-06	2.61E-05
0.4235	1.36E-06	2.75E-05
0.4235	4.81E-07	2.80E-05
0.4235	7.22E-07	2.87E-05
0.4235	8.67E-06	3.74E-05
0.4235	7.22E-06	4.46E-05
0.4235	7.23E-06	5.18E-05
0.1270	8.78E-06	6.06E-05
0.1270	2.13E-06	6.27E-05
0.1270	1.27E-06	6.40E-05
0.1063	3.25E-06	6.73E-05
0.1063	6.65E-06	7.39E-05
0.0847	4.21E-07	7.43E-05
0.0423	2.08E-06	7.64E-05
0.0423	3.50E-07	7.68E-05
0.0423	6.88E-06	8.36E-05
0.0423	1.40E-06	8.50E-05
0.0423	4.98E-07	8.55E-05
0.0423	7.47E-06	9.30E-05
0.0423	4.25E-07	9.34E-05
0.0423	1.05E-05	1.04E-04
0.0423	4.31E-07	1.04E-04
0.0423	1.73E-06	1.06E-04

ROUTE FROM LFC to PENTLAND STATION in MARICOPA

Injury Data for the FN Curve

Injuries	Pool Fire Frequency (per year)	Cumulative Frequency (per year)
0.1752	6.90E-07	1.07E-04
0.1752	1.15E-06	1.08E-04
0.1752	4.00E-06	1.12E-04
0.1752	7.15E-06	1.19E-04
0.1752	4.41E-06	1.23E-04
0.1752	1.19E-05	1.35E-04
0.1752	1.44E-05	1.50E-04
0.1752	4.09E-06	1.54E-04
0.1752	1.44E-06	1.55E-04
0.1752	2.17E-06	1.57E-04
0.1752	2.60E-05	1.83E-04
0.1752	2.17E-05	2.05E-04
0.1752	2.17E-05	2.27E-04
0.0350	2.43E-06	2.29E-04
0.0350	1.57E-06	2.31E-04
0.0350	1.31E-06	2.32E-04
0.0350	5.18E-06	2.37E-04
0.0350	5.02E-07	2.38E-04
0.0350	6.07E-07	2.38E-04
0.0350	5.11E-07	2.39E-04
0.0350	3.77E-06	2.43E-04
0.0350	1.17E-04	3.59E-04
0.0350	5.06E-06	3.64E-04
0.0350	1.16E-05	3.76E-04
0.0350	2.46E-05	4.01E-04
0.0350	2.02E-05	4.21E-04
0.0350	5.15E-05	4.72E-04
0.0350	4.21E-05	5.14E-04
0.0350	1.26E-06	5.16E-04
0.0175	6.24E-06	5.22E-04
0.0175	1.05E-06	5.23E-04
0.0175	2.06E-05	5.44E-04
0.0175	4.20E-06	5.48E-04
0.0175	1.49E-06	5.49E-04
0.0175	2.24E-05	5.72E-04
0.0175	1.27E-06	5.73E-04
0.0088	2.41E-06	5.75E-04

Fatality Data for the FN Curve

Fatalities	Pool Fire Frequency (per year)	Cumulative Frequency (per year)
0.0423	6.90E-07	1.07E-04
0.0423	1.15E-06	1.08E-04
0.0423	4.00E-06	1.12E-04
0.0423	7.15E-06	1.19E-04
0.0423	4.41E-06	1.23E-04
0.0423	1.19E-05	1.35E-04
0.0423	1.44E-05	1.50E-04
0.0423	4.09E-06	1.54E-04
0.0423	1.44E-06	1.55E-04
0.0423	2.17E-06	1.57E-04
0.0423	2.60E-05	1.83E-04
0.0423	2.17E-05	2.05E-04
0.0423	2.17E-05	2.27E-04
0.0085	2.43E-06	2.29E-04
0.0085	1.57E-06	2.31E-04
0.0085	1.31E-06	2.32E-04
0.0085	5.18E-06	2.37E-04
0.0085	5.02E-07	2.38E-04
0.0085	6.07E-07	2.38E-04
0.0085	5.11E-07	2.39E-04
0.0085	3.77E-06	2.43E-04
0.0085	1.17E-04	3.59E-04
0.0085	5.06E-06	3.64E-04
0.0085	1.16E-05	3.76E-04
0.0085	2.46E-05	4.01E-04
0.0085	2.02E-05	4.21E-04
0.0085	5.15E-05	4.72E-04
0.0085	4.21E-05	5.14E-04
0.0085	1.26E-06	5.16E-04
0.0042	6.24E-06	5.22E-04
0.0042	1.05E-06	5.23E-04
0.0042	2.06E-05	5.44E-04
0.0042	4.20E-06	5.48E-04
0.0042	1.49E-06	5.49E-04
0.0042	2.24E-05	5.72E-04
0.0042	1.27E-06	5.73E-04
0.0021	2.41E-06	5.75E-04

ROUTE FROM LFC to PENTLAND STATION in MARICOPA

Injury Data for the FN Curve

Injuries	Pool Fire Frequency (per year)	Cumulative Frequency (per year)
0.0088	1.70E-05	5.92E-04
0.0088	2.53E-05	6.18E-04
0.0088	2.05E-05	6.38E-04
0.0088	1.06E-06	6.39E-04
0.0088	6.60E-05	7.05E-04
0.0088	1.29E-04	8.34E-04
0.0088	1.59E-05	8.50E-04
0.0088	5.77E-06	8.56E-04
0.0088	8.12E-05	9.37E-04
0.0035	7.29E-06	9.44E-04
0.0035	4.72E-06	9.49E-04
0.0035	3.92E-06	9.53E-04
0.0035	1.55E-05	9.68E-04
0.0035	1.51E-06	9.70E-04
0.0035	1.82E-06	9.72E-04
0.0035	1.53E-06	9.73E-04
0.0035	1.13E-05	9.84E-04
0.0035	3.50E-04	1.33E-03
0.0035	1.52E-05	1.35E-03
0.0035	3.47E-05	1.38E-03
0.0035	7.37E-05	1.46E-03
0.0035	6.07E-05	1.52E-03
0.0035	1.54E-04	1.67E-03
0.0035	1.26E-04	1.80E-03
0.0009	7.24E-06	1.81E-03
0.0009	5.11E-05	1.86E-03
0.0009	7.60E-05	1.93E-03
0.0009	6.14E-05	2.00E-03
0.0009	3.17E-06	2.00E-03
0.0009	1.98E-04	2.20E-03
0.0009	3.86E-04	2.58E-03
0.0009	4.76E-05	2.63E-03
0.0009	1.73E-05	2.65E-03
0.0009	2.44E-04	2.89E-03

Fatality Data for the FN Curve

Fatalities	Pool Fire Frequency (per year)	Cumulative Frequency (per year)
0.0021	1.70E-05	5.92E-04
0.0021	2.53E-05	6.18E-04
0.0021	2.05E-05	6.38E-04
0.0021	1.06E-06	6.39E-04
0.0021	6.60E-05	7.05E-04
0.0021	1.29E-04	8.34E-04
0.0021	1.59E-05	8.50E-04
0.0021	5.77E-06	8.56E-04
0.0021	8.12E-05	9.37E-04
0.0008	7.29E-06	9.44E-04
0.0008	4.72E-06	9.49E-04
0.0008	3.92E-06	9.53E-04
0.0008	1.55E-05	9.68E-04
0.0008	1.51E-06	9.70E-04
0.0008	1.82E-06	9.72E-04
0.0008	1.53E-06	9.73E-04
0.0008	1.13E-05	9.84E-04
0.0008	3.50E-04	1.33E-03
0.0008	1.52E-05	1.35E-03
0.0008	3.47E-05	1.38E-03
0.0008	7.37E-05	1.46E-03
0.0008	6.07E-05	1.52E-03
0.0008	1.54E-04	1.67E-03
0.0008	1.26E-04	1.80E-03
0.0002	7.24E-06	1.81E-03
0.0002	5.11E-05	1.86E-03
0.0002	7.60E-05	1.93E-03
0.0002	6.14E-05	2.00E-03
0.0002	3.17E-06	2.00E-03
0.0002	1.98E-04	2.20E-03
0.0002	3.86E-04	2.58E-03
0.0002	4.76E-05	2.63E-03
0.0002	1.73E-05	2.65E-03
0.0002	2.44E-04	2.89E-03

APPENDIX 5

PROPOSED PRODUCT TRUCKING PUBLIC INJURY AND FATALITY F-N CURVES

Injury Curve, Scenario 1: 70 Trucks to Phillips 66 Station

Fatality Curve, Scenario 1: 70 Trucks to Phillips 66 Station

Injury Curve, Scenario 2: 70 Trucks to PAAPL Pentland Station

Fatality Curve, Scenario 2: 70 Trucks to PAAPL Pentland Station

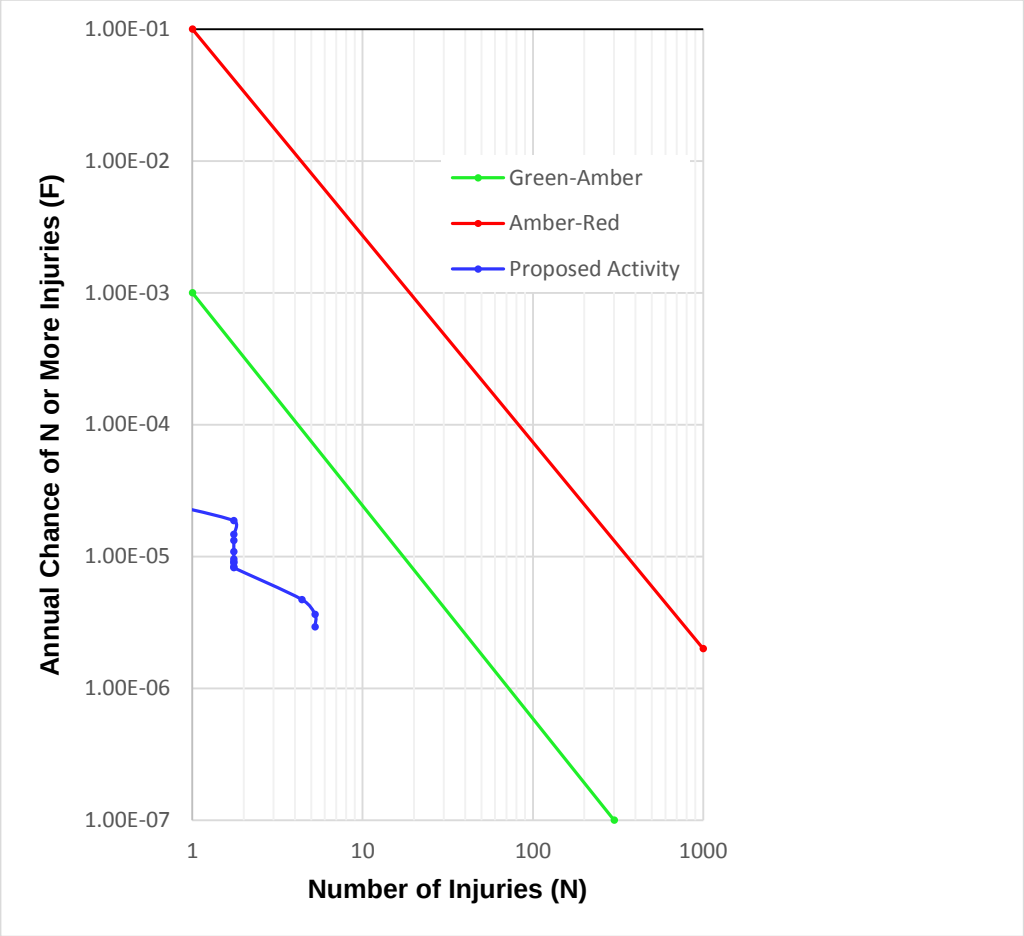


Figure 1 LFC product trucking public injury F-N curve 70 trucks per day to Phillips 66 Station

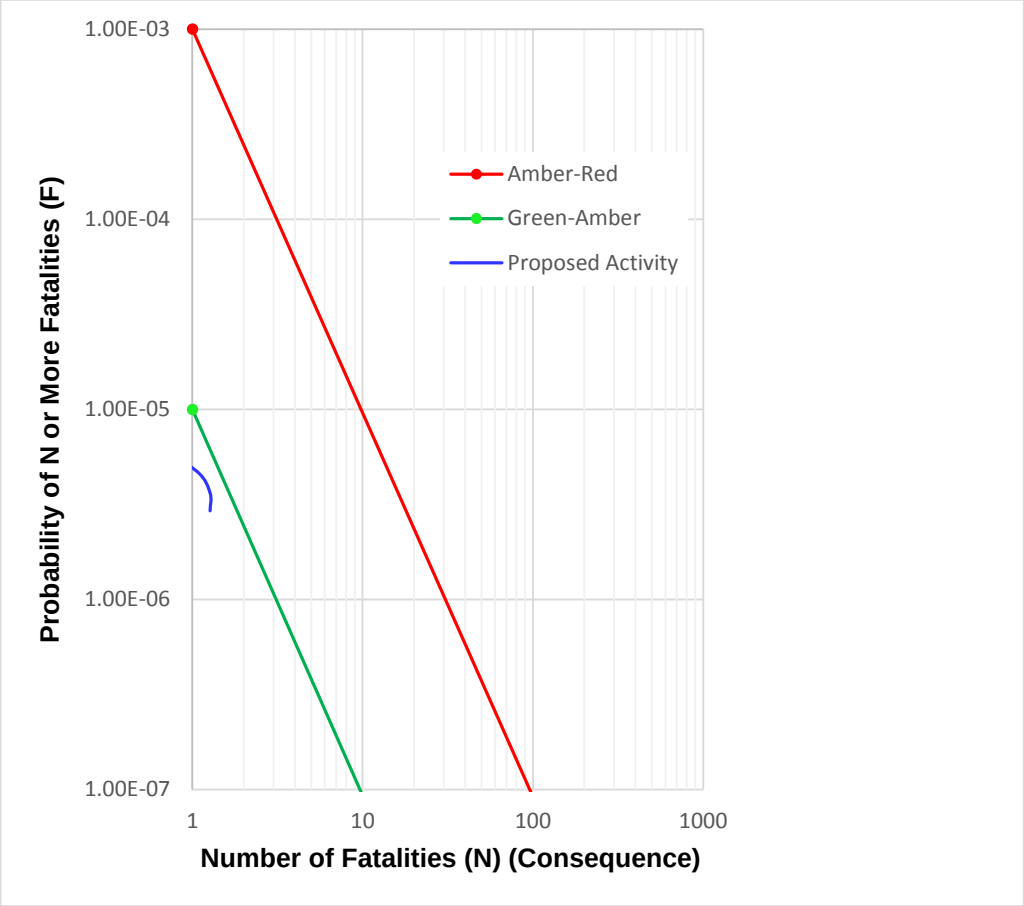


Figure 2 LFC product trucking public fatality F-N curve 70 trucks per day to Phillips 66 Station

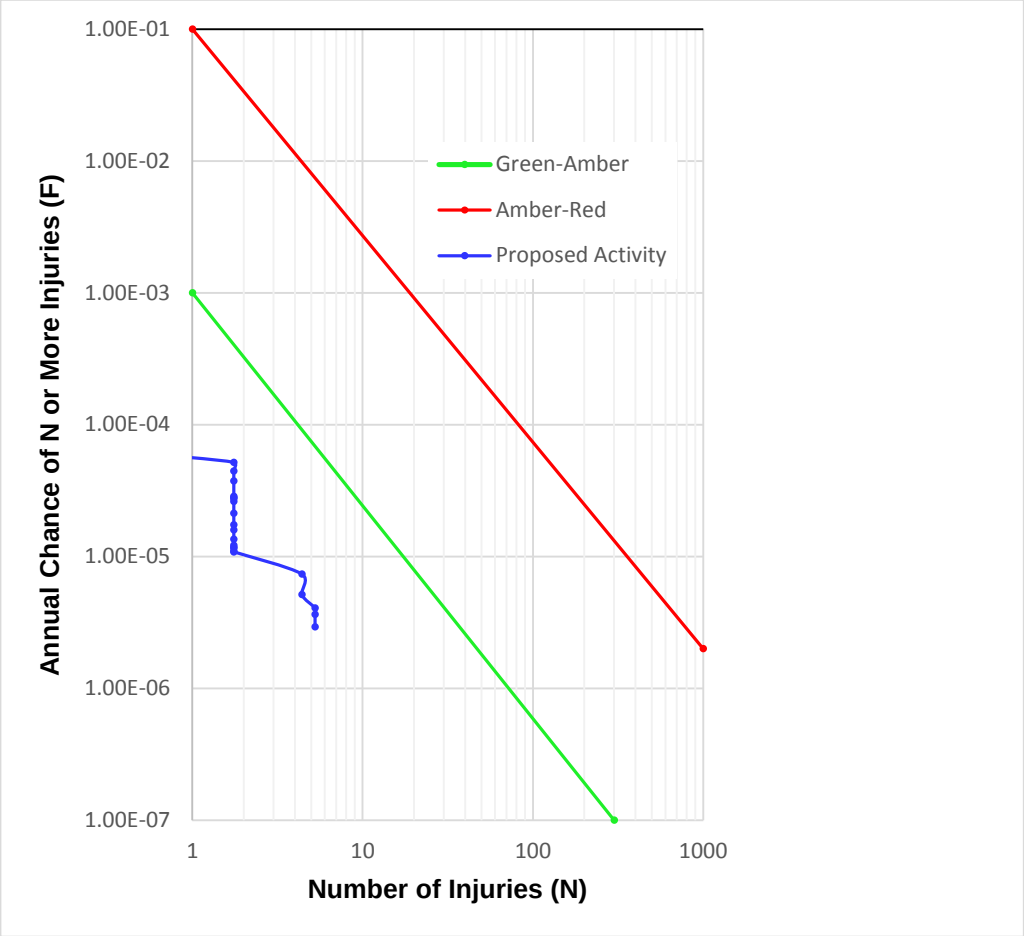


Figure 3 LFC product trucking public injury F-N curve 70 trucks per day to PAAPL Pentland Station

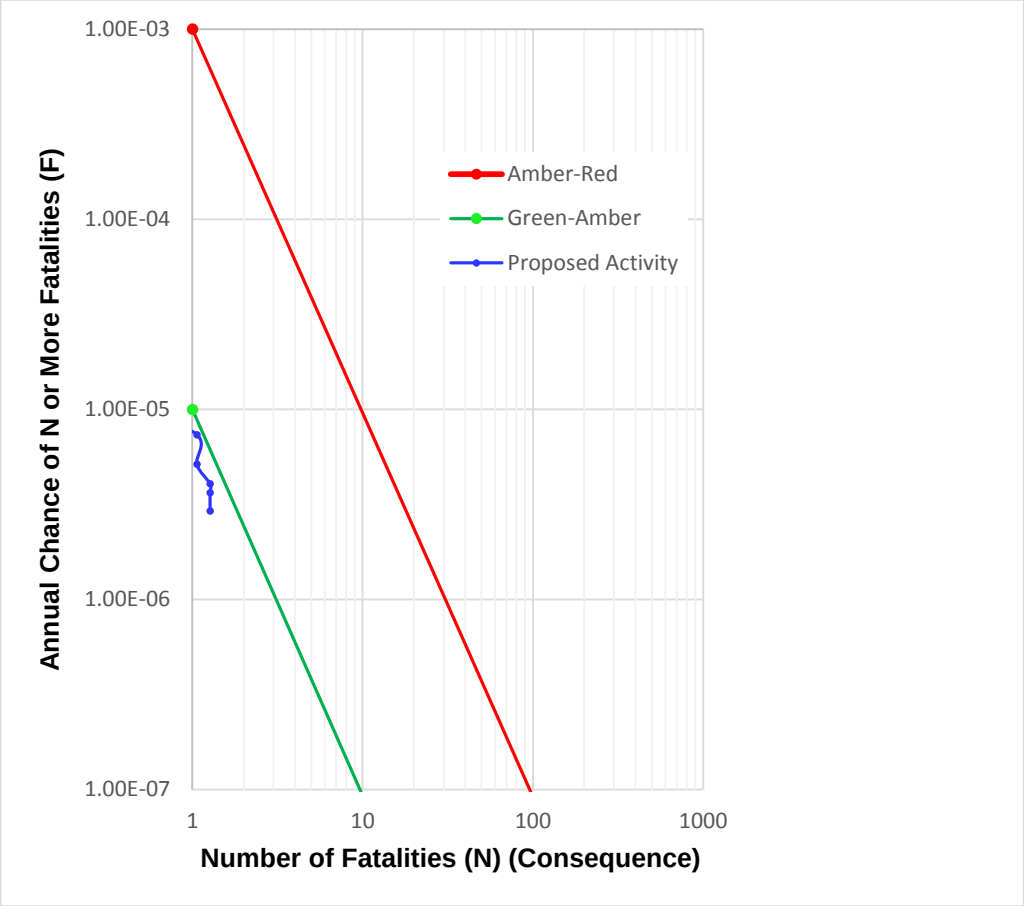


Figure 4 LFC product trucking public fatality F-N curve 70 trucks per day to PAAPL Pentland Station

ATTACHMENT C.3
LFC TRUCK LOADING INDUSTRIAL RISK ANALYSIS

ExxonMobil SYU LFC Interim Trucking

Industrial Risk Analysis

Application to County of Santa Barbara

Planning & Development Department

Energy & Minerals Division

September 2017

Prepared by:

InterAct
260 Maple Court, Suite 210
Ventura, CA 93003
805-658-5600
www.interactprojects.com

Prepared for:

ExxonMobil
12000 Calle Real Road
Goleta, CA 93117

TABLE OF CONTENTS

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2.0 Description of the Proposed LFC Crude Oil Truck Loading 2

3.0 Loading Risk Assessment Methodology 5

3.1 Hazards Identification 5

3.2 Existing and Proposed Safety Measures and Environmental Controls 6

3.3 Probability and Consequence Analysis 6

3.4 Safety Risks 8

4.0 Probability and Consequence Analysis 9

5.0 Conclusions 9

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APPENDICES

Appendix 1 Truck Loading Schematic

Appendix 2 LFC Truck Loading Site Plan

Appendix 3 Truck Routing within Truck Loading Area

Appendix 4 Risk Calculation Details

Appendix 5 U.S. Department of Transportation Risk Matrix

Appendix 6 Proposed Product Loading Risk Matrix

1.0 Introduction

ExxonMobil is requesting approval for Interim Trucking to transport Santa Ynez Unit (SYU) processed crude oil (product) from the Las Flores Canyon (LFC) facility to market destinations due to the shutdown of Line 901/903 operated by Plains All American Pipeline Company (PAAPL). This industrial risk analysis (IRA) evaluates scenarios associated with the truck loading process at the LFC facility that could potentially lead to a loss of containment or a spill.

Based on this IRA, most of the hazardous events that could occur from the truck loading activities are considered unlikely. Some events have a higher likelihood of happening; however they would result in negligible consequences and would not result in any significant risk to the public. Therefore, the risk impacts within the LFC facility from the truck loading activities are considered less than significant (Class III).

It should be noted that the destination unloading facilities (i.e., Phillips 66 Station in Santa Maria and Pentland PAAPL station in Maricopa) are designed for truck unloading and already unload many trucks per day from various suppliers. Trucks with ExxonMobil product will be received and unloaded within the permitted and design capacities of these facilities. There is no expected change in the unloading facilities operations and no increase in risk will result from the truck unloading of ExxonMobil product at these designated unloading facilities.

The LFC facility is not accessible to the public; therefore, there is virtually no potential for public exposure to any hazards that occur within the LFC facility boundaries associated with the trucking loading activities.

Santa Barbara County does not specify risk thresholds for hazards that do not impact public safety. Therefore, this IRA was prepared in accordance with industry best practice in process safety to help identify major hazards arising from truck loading

operations and measure their likelihood and severity. [Refs. 1 and 2]. Failure rate data selected for this study is representative of industry experience and the specific operations under consideration [Refs 3, 4, 5 and 6].

2.0 Description of the Proposed LFC Crude Oil Truck Loading

Truck loading of product at the LFC facility would occur at the Truck Loading Area, located in a previously disturbed open graded area immediately north of the crude oil storage tanks. Facility modifications include the installation of loading stations and the extension of piping to transfer product to the loading stations and the truck vapors back into the LFC vapor recovery system. Land disturbance may include installation of footings for pipe supports and equipment as well as potential paving of loading lanes across the Truck Loading Area. Piping to and from the loading stations will be routed along pipe racks and within the existing containment area for the Crude Storage Tanks.

Each loading station will include a Lease Automatic Custody Transfer (LACT) Unit for custody transfer as required by the Bureau of Safety and Environmental Enforcement (BSEE). Loading connections will be of the dry-lock type to eliminate potential leaks and additional emissions points. Also, each LACT unit will incorporate grounding and overfill protection to stop the loading process in the case of interrupted ground or a high level scenario. Appendix 1 includes a Truck Loading Schematic that illustrates the truck loading process. The LFC truck loading stations and facility modifications, as well as spill containment measures are shown in Appendix 2.

Trucks will follow the main plant road from the front gate on Calle Real to access the Truck Loading Area. Truck routings to and from the Truck Loading Area will follow one of two options under consideration. Option 1: Trucks will enter the Truck Loading

Area to the left hand side, and after loading, leave the Truck Loading Area and continue on the same road to the north, which loops back around to the main plant road. Option 2: Trucks will enter the Truck Loading Area on the right hand side, and once finished loading leave the Truck Loading Area and continue on the same road to the south, which loops back around to the main plant road. Appendix 3 shows an aerial view of the Truck Loading Area and the truck routing within the LFC facility.

Empty trucks will arrive at LFC and proceed to one of the four loading stations via one of the route shown in Appendix 3. Once the trucks are at the proper loading location, the truck wheels will be chocked. The truck will then undergo a safety inspection by the ExxonMobil operator prior to loading. The loading hose and vapor recovery hose will be connected to the truck. The ExxonMobil operator will open the vapor recovery system (VRS) valve and then the oil line valve to start loading. Processed crude oil (product) will be transported in a pipe from a tie-in point at the Transportation Terminal (TT) to the Truck Loading Area. Vapors displaced during truck loading operations will be contained and transported in a pipe to a tie-in point at the existing TT Vapor Recovery Compressors. During loading both the ExxonMobil operator and the truck driver will be in attendance at all times. The product level in the truck will be continuously monitored via a gauge. Once the truck final level is achieved, the oil and vapor recovery line valves will be closed, the hoses will be disconnected and the truck will leave the Truck Loading Area to be weighed, and then leave LFC to proceed to one of the unloading facilities.

Information on the product truck loading is summarized in Table 1 below.

Table 1 Truck Loading Details

Parameter	Value
Maximum number of trucks	70 trucks per day
Maximum volume of product per truck	160 barrels (bbls) (worst case scenario for a single truck incident, which is the maximum volume of oil potentially spilled from a single truck)
Annual number of truck trips	70 x 365 = 25,550
Maximum duration of Interim Trucking	From the approval of the Interim Trucking Permit until a pipeline alternative becomes available
Annual volume of oil transported	Approximately 4 million barrels (MM BBL)

The loading facility modifications are expected to consist of the following components:

- Truck loading rack with lighting for nighttime operations;
- Four LACT Units;
- Product transfer line and connections to the four loading stations;
- Vapor recovery line and connections to the four loading stations;
- Hoses to connect from the product and vapor lines to the trucks; hoses equipped with dry-lock connectors;
- Fuel gas line and connections to the vapor recovery line;
- Associated utility connections;
- Loading safety protection including trucking ground monitoring and overfill protection
- Operator shelter.

3.0 Loading Risk Assessment Methodology

The LFC Truck Loading IRA evaluated risks using the following steps:

1. Potential hazards identification
2. Existing and proposed safety and environmental controls to reduce hazards
3. Probability and consequence analysis
4. Safety risks analysis.

3.1 Hazards Identification

Hazardous events that could lead to a loss of containment and a spill could occur due to equipment failure, operator error or both. As shown below, equipment and human failures that could lead to an event (incident) include but are not limited to:

1. Piping, valve or connection leak/rupture;
2. Improper hose connection during the loading process leading to a spill (operator error);
3. Accidental hose disconnection during loading process;
4. Failure to close the loading valve leading to a truck overfilling and a spill;
5. A hole in the hose and failure to inspect before loading;
6. Catastrophic hose rupture during loading;
7. An onsite truck accident (impact with another vehicle or object).
8. Static electricity during truck filling

3.2 Existing and Proposed Safety Measures and Environmental Controls

During loading, The Truck Loading Area will have the following safety and mitigation measures to reduce or eliminate the impact of spills and fires:

- The Truck Loading Area is graded to drain into the already existing containment channel for the Crude Oil Storage Tanks that connects to the Emergency Containment Basin (ECB);
- Additional berms and containment barriers will be installed around the loading location as needed;
- Spill containment and absorption materials stored onsite;
- Containment container will be placed under truck product hose connections to capture any leakage when hoses are connected and disconnected;
- Firefighting equipment including a fire monitor (converted from a hydrant);
- ExxonMobil operator will be present during truck loading;
- Truck overfill protection, instrumented communication from truck level to LACT unit (Through Scully System or similar) to stop filling if tank is overfilled.
- Ground protection on truck with continue monitoring from LACT skid unit
- Truck driver will also be present during truck loading;
- Truck drivers and loading operators will be trained on the specific loading procedures;
- ExxonMobil operator will have access to the valve shut off for the loading line
- LFC facility has spill response plan and equipment onsite.

3.3 Probability and Consequence Analysis

The probability of each of the hazardous events reference in Section 3.1 occurring was estimated as follows:

- Nominal failure rates [Ref. 7] were considered per Table 2 below.
- Probabilities of events that need to occur at the same time in order for a spill to occur were multiplied.
- Probabilities of events that can occur independently for a spill to occur were added together.

Probabilities of events that would result in a small leak were not estimated (e.g., a small hole in a transfer hose, small leak in hose connection, etc.), because these scenarios would result in a negligible consequence that could be quickly remedied by operating personnel.

Table 2 Failure Types and Their Probabilities [Ref. 3, 5 and 7]

Type of Failure	Nominal Failure Rate Failures per year of operation
Truck Transfer: Rupture of transfer arm	3×10^{-4} per transfer arm [Ref. 7]
Truck Transfer: Rupture of transfer hose	4×10^{-2} per transfer hose [Ref. 7]
Piping (General): Rupture at valve	9×10^{-6} per valve [Ref. 7]
Piping (General): Failure of gasket	3×10^{-2} per gasket [Ref. 7]
Piping: 150-mm (6-inch) ≤d< 299-mm (12-inch) catastrophic rupture	2×10^{-7} per meter of piping [Ref. 7]
Procedure failure (operator error)	5.5×10^{-2} per operation [Ref. 7]
Incorrect hose coupling	4.4×10^{-3} per operation [Ref. 7]
Truck accidents	0.2 per million miles [Ref. 3]
Spills from a truck after an accident	20% of the accident rate
Large spill as percentage from all truck spills	25% (reasonable assumption)
Ignition of a spilled pool as percentage of all spills	2% [Ref. 5]

Table 3 Failure Types and Their Consequence

Type of Failure	Worst Case Spill
Rupture or leak of transfer arm or hose	Several barrels. Spill will be stopped when the operator identifies event and shuts off the valve that allows product flow into the hose. Contained onsite.
Rupture at the oil piping valve or connection	Several barrels. Spill will be stopped when the operator identifies event and shuts off the valve that allows product flow into the piping. Contained onsite.
Incorrect hose coupling	Several barrels. Spill will be stopped when the operator identifies event and shuts off the valve that allows product flow into the hose. Contained onsite.
Hose disconnect	Several barrels. Spill will be stopped when the operator identifies event and shuts off the valve that allows product flow into the hose. Contained onsite. (The trucks are equipped with a check valve that will prevent back flow from the filled truck if the loading hose accidently disconnects.)
Full tanker truck failure	160 bbls – full truck contents

Consequences from piping or hose ruptures or leaks would result in a product spill with the maximum volume of 160 bbls (full truck contents). The calculation details of the probabilities are provided in Appendix 4. As shown, product spill incidents from the loading operations are unlikely. Ignition of spilled product is estimated to be 2% of spills, thus a fire hazard scenario is even less likely.

3.4 Safety Risks

Risk is a combination of probability (chance of occurrence) and consequences (serious injury or fatality) of the evaluated incident scenarios. The estimated risks were compared to the U.S. Department of Transportation's Risk Matrix [Ref. 2 and 3] (see

Appendix 5) to determine if adverse impacts from the proposed product transportation are potentially significant.

Class I – High probability and severe consequence events

Class II – High probability or severe consequence events

Class III – Low probability and negligible consequence events.

4.0 Probability and Consequence Analysis

The details of hazard scenarios probabilities calculations are presented in Appendix 4. Proposed product loading probability and consequence values were entered into a Risk Matrix, see Appendix 6.

5.0 Conclusions

As shown on the Risk Matrix in Appendix 6, most of the hazardous events that could occur from the truck loading activities are considered unlikely. Those events that have a higher frequency of happening fall in the green area (low severity). Therefore, the risk impacts within the LFC facility from the truck loading operations are less than significant.

6.0 References

1. http://www.cgerisk.com/knowledge-base/risk-assessment/risk-matrices CGI Risk Matrix
2. https://www.fhwa.dot.gov/ipd/pdfs/p3/p3_guidebook_risk_assessment_030314.pdf Department of Transportation Risk Matrix

3. Harwood, et. al., *Procedure for Developing Truck Accident and Release Rates for Hazardous Materials Routing*, Journal of Transportation Engineering, Vol 119, No. 2, March/April 1993.

4. Marine Research Specialists (MRS), *Nuevo LPG Transportation Risk Assessment Final Draft Report*, MRS, Ventura, CA March 2004.

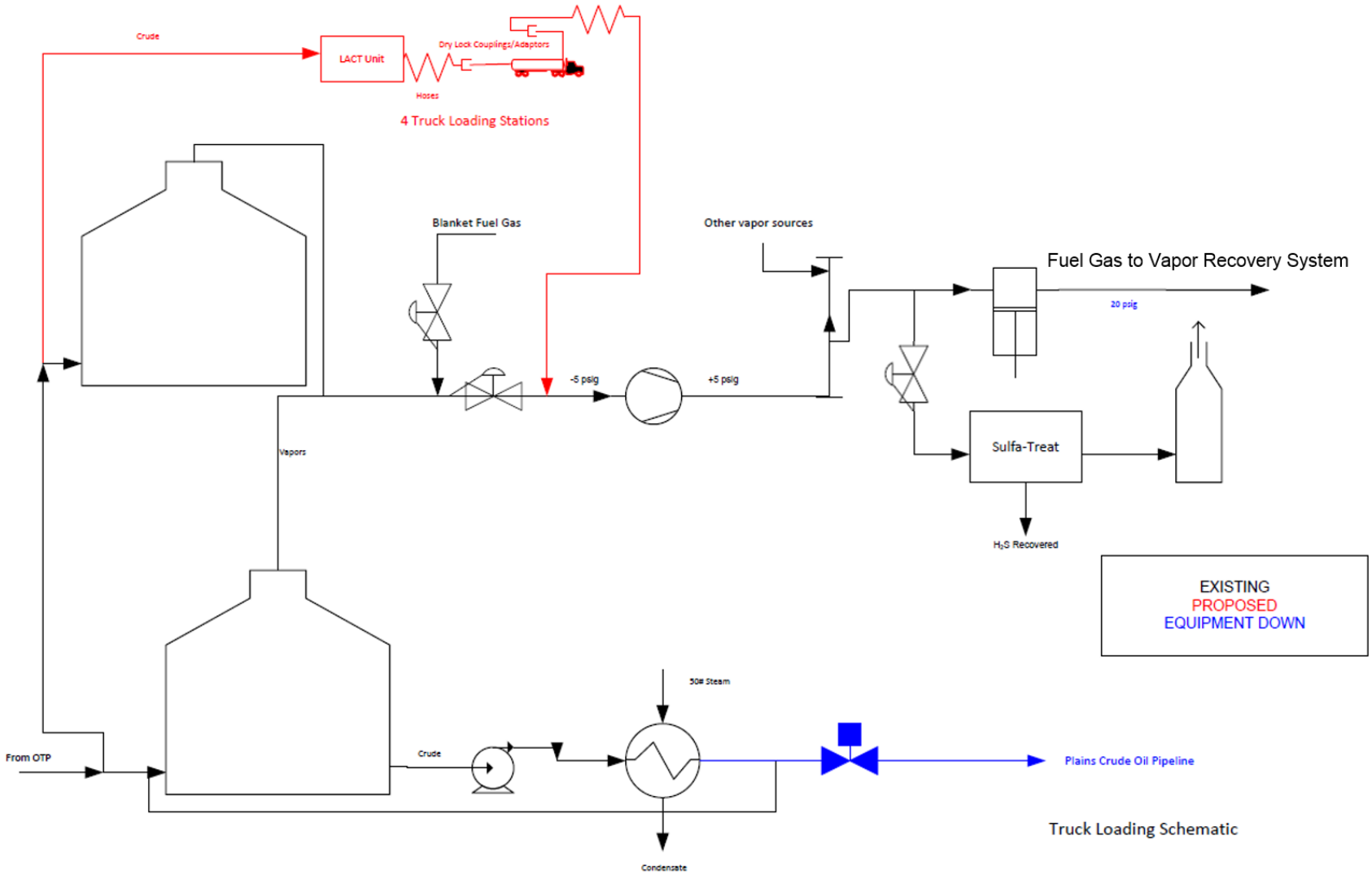
5. Golder Associates, *Chevron San Ardo to Coalinga Heated Crude Oil Pipeline Risk Assessment Final Report*, Golder Associates, Inc., Roseville, CA, September 2007.

6. FEMA, USDOT, and USEPA, Handbook of Chemical Hazard Analysis Procedures, Washington D.C.

7. Department of Transportation (DOT) and PHIMSA, Nominal Failure Rates, Feb 2015. https://primis.phmsa.dot.gov/lng/docs/Failure%20Rate%20Table%201.pdf

APPENDIX 1

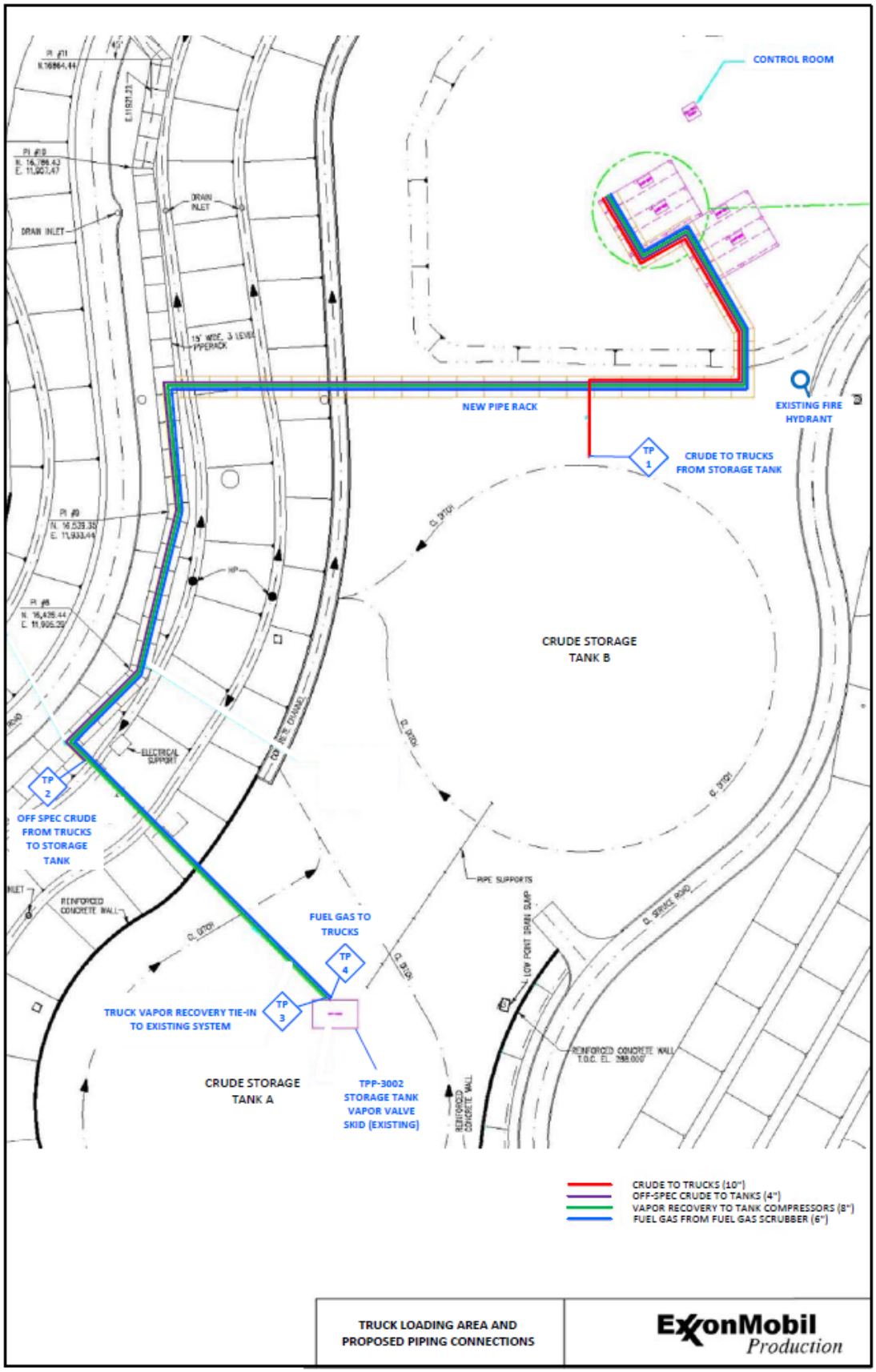
TRUCK LOADING SCHEMATIC



Truck Loading Schematic

APPENDIX 2

LFC TRUCK LOADING SITE PLAN


CONTROL ROOM
NEW PIPE RACK
EXISTING FIRE HYDRANT
TP 1
CRUDE TO TRUCKS FROM STORAGE TANK
CRUDE STORAGE TANK B
TP 2
OFF SPEC CRUDE FROM TRUCKS TO STORAGE TANK
FUEL GAS TO TRUCKS
TP 4
TP 3
TRUCK VAPOR RECOVERY TIE-IN TO EXISTING SYSTEM
CRUDE STORAGE TANK A
TPP-3002 STORAGE TANK VAPOR VALVE SKID (EXISTING)
DRAIN INLET
PIPERACK
ELECTRICAL SUPPORT
REINFORCED CONCRETE WALL
PIPE SUPPORTS
LOW POINT DRAIN SUMP
REINFORCED CONCRETE WALL T.O.C. EL. 288.000'
CRUDE TO TRUCKS (10")
OFF-SPEC CRUDE TO TANKS (4")
VAPOR RECOVERY TO TANK COMPRESSORS (8")
FUEL GAS FROM FUEL GAS SCRUBBER (6")
TRUCK LOADING AREA AND PROPOSED PIPING CONNECTIONS
ExxonMobil Production

APPENDIX 3

TRUCK ROUTING WITHIN TRUCK LOADING AREA

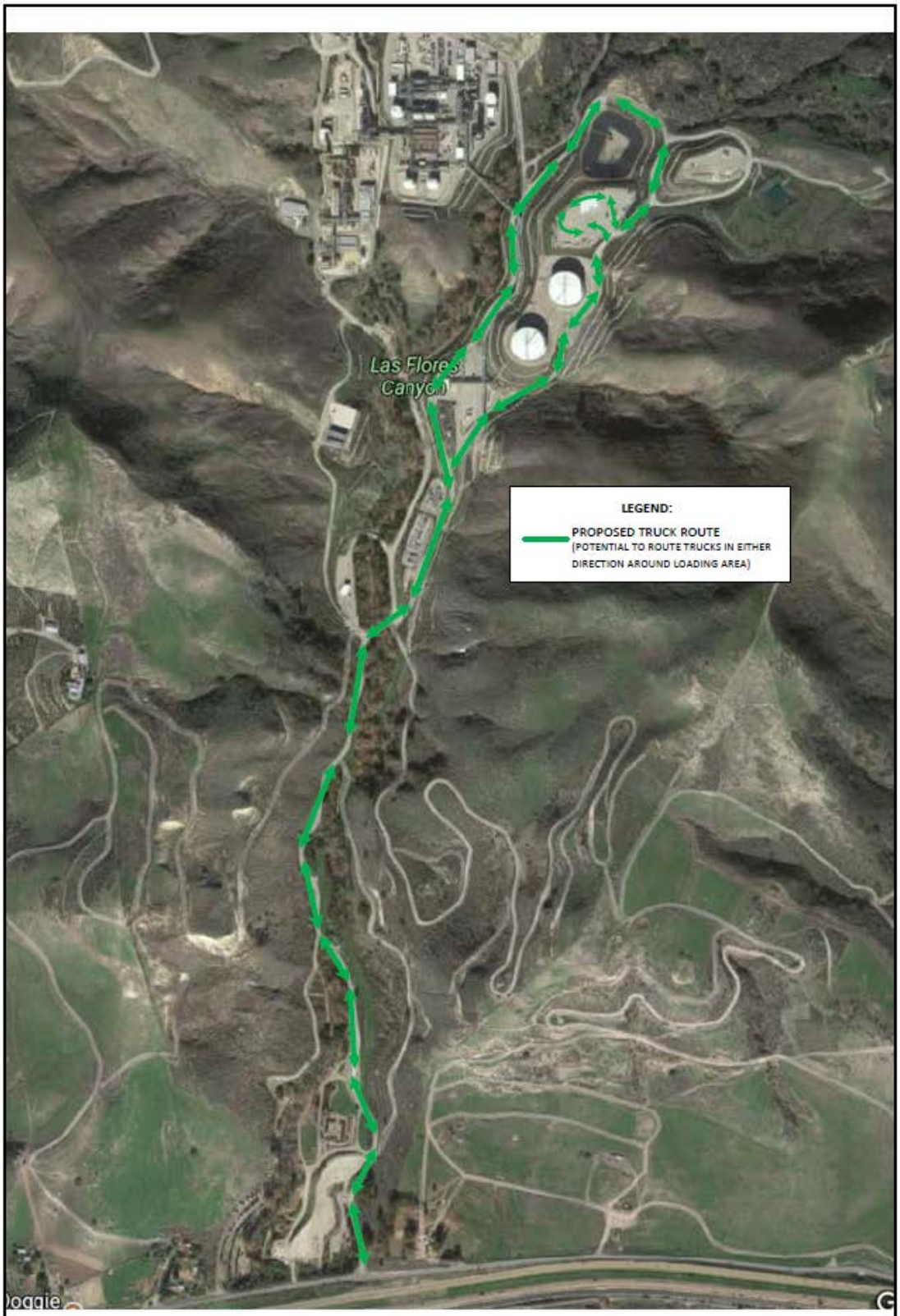
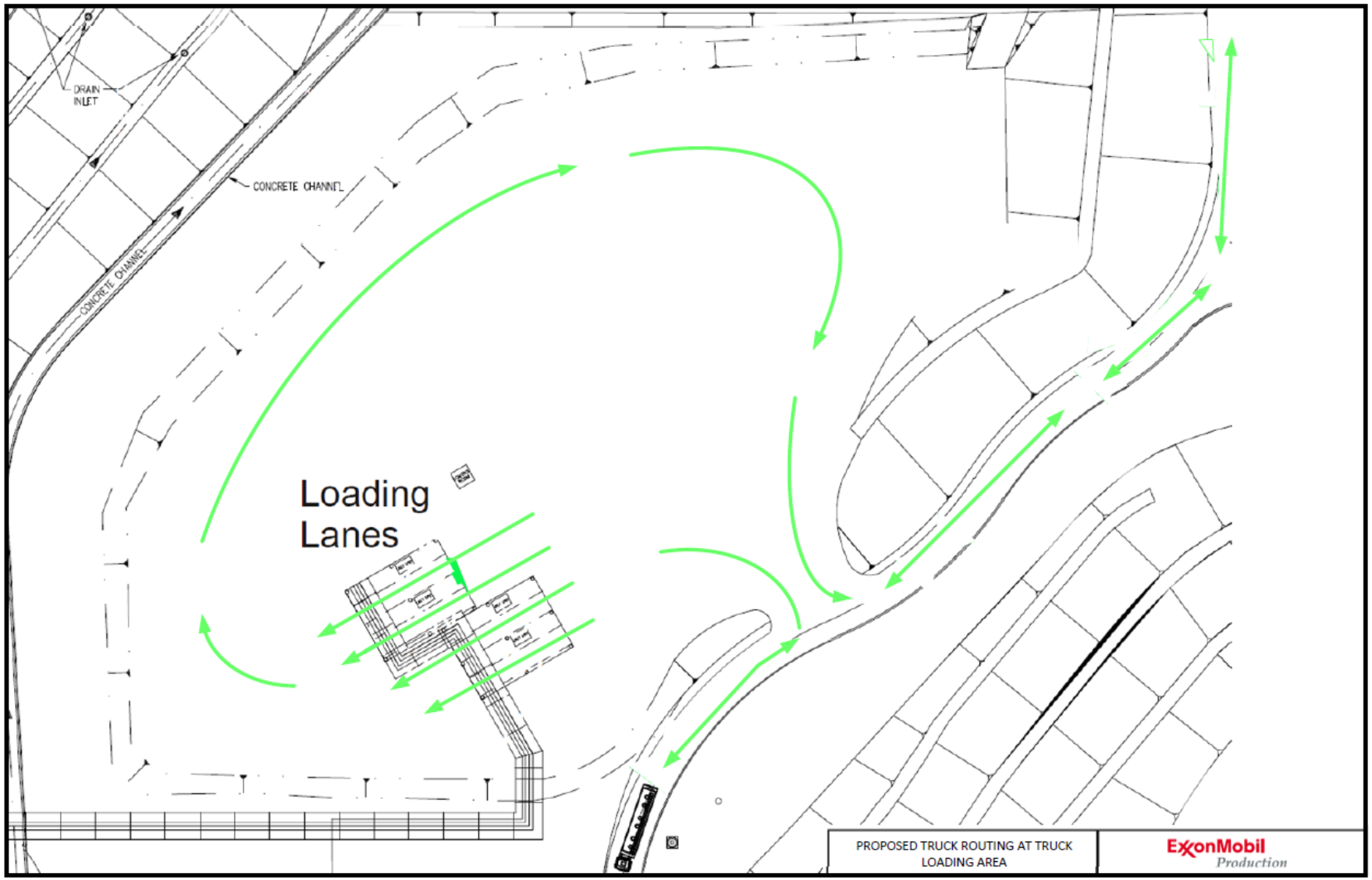


EXHIBIT 3: INTERIM TRUCK ROUTING WITHIN LFC

ExxonMobil Production


DRAIN INLET
CONCRETE CHANNEL
CONCRETE CHANNEL
Loading Lanes
PROPOSED TRUCK ROUTING AT TRUCK LOADING AREA
ExxonMobil Production

APPENDIX 4

RISK CALCULATION DETAILS

Incremental Risk - Proposed Truck Loading: Calculations

Number	Event	Failure rate or probability	Units	Number	Event rate or probability	Reference	Total rate	Value per years (X)
Scenario 1a Release of Crude Oil and Subsequent Fire							**8.69E-11**	**X=11514104778**
1a1	Tanker Truck accident (1 mile within LFC)	1.93E-07	/mile/yr	1	1.93E-07	see QRA for this project		**Occurs every X years**
1a2	Probability of a release	9.00E-02	/accident	1	9.00E-02	see QRA for this project		
1a3	Full load spill (160 bbls)	2.50E-01	/accident	1	2.50E-01	see QRA for this project		
1a4	Probability of ignition	2.00E-02	/spill	1	2.00E-02	see QRA for this project		
Scenario 1b Release of Crude Oil, no fire							**4.34E-09**	**X=230282095**
1a1	Tanker Truck accident (1 mile within LFC)	1.93E-07	/mile/yr	1	1.93E-07	see QRA for this project		**Occurs every X years**
1a2	Probability of a release	9.00E-02	/accident	1	9.00E-02	see QRA for this project		
1a3	Full load spill (160 bbls)	2.50E-01	/accident	1	2.50E-01	see QRA for this project		
Scenario 2 Spill from oil loading - Piping							**2.08E-02**	**X=48**
2a1	Hole in pipe	2.83E-05	/miles/yr	0.095	2.68E-06			**Occurs every X years**
2a2	Leak at valve	5.54E-04	/valve.yr	6	3.33E-03	*Assume 90% of leaks are significant but not catastrophic rupture*		
2a3	Rupture of small threaded connection	2.08E-05	/conn.yr	20	4.17E-04	CCPS with correction for annual fugitive I&M program, 10% ruptures		
2a4	Rupture of small welded connection	2.63E-06	/conn.yr	20	5.26E-05	WASH 1400, weld leaks, 10% to rupture		
2a5	Pump leak	1.70E-02	/yr	1	1.70E-02	HLID, leakage, 10% to rupture		
Scenario 3 Spill from oil loading - Hose							**7.39E-01**	**X=1**
2a6	Hole in loading hose	4.00E-04	/operation	1	4.00E-04	Shell rupture per operation. Leaks assumed to be 10 times greater probability.		**Occurs every X year**
2a7	Incorrect hose coupling	4.40E-03	/operation	1	4.40E-03	Rijnmond 1982		
2a8	Failure to Close valve (operator error)	5.50E-02	/operation	1	5.50E-02	Rijnmond 1982, failure to follow instructions		
2a9	Loading operations	2800	Operations	1	2.80E+03	Number of annual loading operations		

Notes

Piping Failure Rate: Rupture	*4.50E-07*	*Average between WASH, Rijnmond, Lees and CCPS*
Piping Failure Rate: Leak	*2.83E-05*	*Average between WASH, Rijnmond, Lees and CCPS*

Data - Worst possible case (not based on the Air Quality Permit data)

Length of new piping (max)	500	feet
Number of connections	30	
Number of Valves	10	

References

1. Rijnmond,1982. Risk Analysis of Six Potentially Hazardous Industrial Objects in the Rijnmond Area, A Pilot Study
2. CCPS, 1989. Guidelines for Process Equipment Reliability Data, with Data Tables
3. WASH-1400. Reactor and Safety Study. 1975 (mechanical and human failure rates)
4. Lee's Loss Prevention in the Process Industries. 2005

APPENDIX 5

U.S. DEPARTMENT OF TRANSPORTATION RISK MATRIX

Risk Assessment Matrix - Risk Prioritization = Severity vs. Likelihood

Severity Table

#	Severity level	Workplace Safety	Workplace Health	Environment	Fire Damage
5	Critical	Fatality, single or multiple, permanent body injury	Acute Poisoning, Failure of Major Bodily Functions	Large Spills >1000 bbls to Sensitive Resources	More Than $10 million damages
4	Very Serious	Injury requiring 30 days of hospitalization and/or medical leave	Moderate exposure, Reversible injury to Bodily Functions on prolong recovery	Large Spills >1000 bbls to offsite locations, no sensitive resources impacted	More Than $1 million damages
3	Serious	Injury requiring 10 days of hospitalization and/or medical leave	Mild exposure, Reversible injury to Bodily Functions with less than 30 days recovery	Large Spills >1000 bbls outside containment within facility	More Than $100k damages
2	Marginal	Injury requiring maximum of 3 days of medical leave only	Very Mild exposure, Reversible injury to Bodily Functions with less than 3 days recovery	Medium spills 100-200 bbls within facility outside containment	More Than $10k damages
1	Negligible	First aid treatment only, no significant downtime	Very Mild exposure, Reversible injury to Bodily Functions with less than 3 days recovery	Spills inside containment	Less than $5k damages

Likelihood Table

#	Likelihood Level	Likelihood of Occurrence / Exposure Criteria
5	Frequent	Likely to occur many times per year
4	Moderate	Likely to occur once per year
3	Occasional	Might occur once in three years
2	Remote	Might occur once in five years
1	Unlikely	Might occur once in ten years

Risk Level Matrix

		SEVERITY				
		Critical (5)	Very Serious (4)	Serious (3)	Marginal (2)	Negligible (1)
LIKELIHOOD	Frequent (5)	25 Not permissible	20 Not permissible	15 High priority	10 Review at appropriate time	5 Risk acceptable
	Moderate (4)	20 Not permissible	16 Not permissible	12 High priority	8 Review at appropriate time	4 Risk acceptable
	Occasional (3)	15 High priority	12 High priority	9 Review at appropriate time	6 Risk acceptable	3 Risk acceptable
	Remote (2)	10 Review at appropriate time	8 Review at appropriate time	6 Risk acceptable	4 Risk acceptable	2 Risk acceptable
	Unlikely (1)	5 Risk acceptable	4 Risk acceptable	3 Risk acceptable	2 Risk acceptable	1 Risk acceptable

APPENDIX 6

PROPOSED PRODUCT LOADING RISK MATRIX

RISK MATRIX		SEVERITY				
		Negligible (1)	Marginal (2)	Serious (3)	Very Serious (4)	Critical (5)
LIKELIHOOD	Frequent (5)					
	Often (4)	Hose rupture/Leak Hose disconnect				
	Occasion (3)					
	Seldom (2)					
	Unlikely (1)	Piping or valve failure	Truck accident with a leak	Truck accident with a full tank spill		

ATTACHMENT C.4

SYU LFC INTERIM TRUCKING

CRUDE OIL TRANSPORTATION RISK MANAGEMENT AND PREVENTION PROGRAM (CO-TRMPP)

1.0 Introduction and Objective

ExxonMobil's Santa Ynez Unit Facility (SYU) finalized permitted and construction and began operations in 1993. Since that time, all crude oil export has occurred via the Plains All American Pipeline Line 901 and 903 (PAAPL) which is connected to the LFC facilities at the LFC Transportation Terminal. In May 2015, the PAAPL Line 901 pipeline experienced an incident where a failure resulted in the shutdown of both Line 901 and 903 that SYU utilized to transport crude to refineries.

ExxonMobil is submitting the SYU LFC Interim Trucking application to allow production operations to re-start at the Santa Ynez Unit following shutdown of the PAAPL pipeline and subsequent preservation of the SYU facilities. The application requests operation of interim trucking until a pipeline alternative is available. The interim trucking facilities would be located in Las Flores Canyon (LFC) approximately twelve (12) miles west of Goleta and consist of the activities described in Attachment A.3 Description..

All highway transportation from LFC will be limited to State Highway 101; no truck traffic will be directed through State Highway 154. Transportation in urban areas will be limited to the extent feasible.

Truck loading and transportation operations would occur seven days a week, 24-hours per day except as noted below. After unloading at one of the designated facilities, the trucks could return directly back to LFC to reload or they could be reassigned to other operations.

This Crude Oil Transportation Risk Management and Prevention Program (CO-TRMPP) has been developed to ensure that the interim trucking is conducted in a safe and efficient manner.

2.0 Elements of the CO-TRMPP

The CO-TRMPP shall apply to any and all highway shipments of product from ExxonMobil's SYU facility in Las Flores Canyon to the regional receiving locations as part of the LFC interim trucking.

Product carriers shall be required to complete the "Crude Oil - Motor Carrier Safety Survey" (Exhibit A) prior to starting shipments from LFC. LFC Operations personnel will verify that each carrier meets or exceeds the safety standards. LFC Operations personnel will also conduct a safety and operability inspection (checklist) of trucks prior to loading and prior to transport from LFC. Any truck that receives an unsatisfactory inspection will no longer be permitted to transport product until the issue has been corrected.

LFC Operations has also developed a procedure for the trucks to follow during the truck loading. If, based on ExxonMobil operator observations, the carrier's actual performance in loading at LFC is inconsistent with the Safety Survey, safety inspection, or the procedure, ExxonMobil will re-evaluate the carrier's ability to safely load and haul product. If the issues cannot be resolved to demonstrate the carrier's ability to safely load and haul product, use of that carrier will be discontinued until they successfully satisfy ExxonMobil's requirements.

There are no specific, pre-established criteria for terminating use of a carrier insofar as there are potentially many different situations in which ExxonMobil may decide to take such action. For the most part, this decision will be based on operational and technical judgment made by LFC operating and engineering personnel after reviewing the facts of the situation at that time. In general, any human or mechanical issues that pose the potential to compromise safe operations will be cause for discontinuing use of any carrier until such issues are resolved to ExxonMobil's satisfaction.

An ExxonMobil operator will be present during the loading activities. The operators will be trained prior to commencing loading operations and what to inspect using the developed procedure and checklist. The operator will advise his or her supervisor if there is an issue with the truck or driver. If an issue is observed prior to loading, the truck will not be loaded and the carrier's dispatcher will be notified to correct the issue before the truck will be loaded or to send another truck. If an issue is discovered after a truck is loaded (e.g., overload, leak), the driver will be instructed not to leave LFC until the issue is corrected.

In addition to the ExxonMobil LFC company compliance plans, the selected carrier will have compliance plans in place to respond to accidents and other incidents such as listed below:

- Emergency Action Plan
- Spill Prevention Emergency Response Containment Plan
- Incident Investigation and Reporting Policy
- Incident Reporting Flow Chart

ExxonMobil will include provisions in its contracts with each carrier to require a number of safety and operational requirements. The requirements are included in the Crude Truck Loading Procedure and the LFC Site Specific Safety Training for All Truck Drivers.

A number of the safety and operational requirements are summarized below (Reference Crude Transport Truck Driver Training):

Required Pre-Mobilization Training Requirements

- Carrier(s) Driver Orientation and Passport Safety Training
- ExxonMobil Las Flores Canyon Site Specific Training
- LFC Crude Transport Truck Driver Training

Required Clothing and PPE for Drivers in LFC:

- Compliance with Facial Hair Policy
- FRCs (Coveralls or Long Sleeve Shirt and Long Paints)
- Sturdy Steel-Toed Work Boots
- Safety Glasses/Goggles, Impact Resistant Gloves, and Hardhat
- Personal H_2S Monitor
- Earplugs

Reminders:

- Smoking not allowed when within LFC
- Zero tolerance for Alcohol / Drugs / Firearms – Do not bring on site; Subject to random search
- No liquids (e.g., water, coffee, etc.) allowed to be poured on the ground when within LFC

Truck Restrictions:

- Truck equipped with operating speed monitoring system
- Truck trailer empty when arriving at LFC per contract
    - Trailers used for The LFC interim trucking exclusively dedicated to crude oil transportation service
    - Trailer empty prior to loading
- Truck/Trailer placards in accordance with DOT regulations
- Crude Oil Safety Data Sheet (SDS) in Truck
- Crude Transport Truck Driver Training document in Truck

- Maximum Truck/Trailer height cannot exceed 13.5 feet
- Maximum Truck/Trailer weight with full load cannot exceed 80,000 pound limit

Truck Route Restrictions

- Routes to and from LFC restricted
  - Use of Hwy 101 El Capitan Beach exit not allowed
- Truck operations to occur 24-Hours per day, 7 days per week
  - Exception: All trucks involved in the LFC interim trucking will observe a curfew when travelling on Calle Real if deemed appropriate. Truck traffic will not travel on Calle Real between El Capitan exit and Refugio exit during the hours of 7:45 am to 8:30 am and 2:55 pm to 3:40 pm. This restriction only applies when the school is in regular operation and students are being bussed.

Driving in LFC

- Protected species known to be on site
  - Do not approach, harass or intentionally harm any wildlife
- Watch for wildlife on and adjacent to road: Avoid where safe to do so; All wildlife is protected on site. Includes deer, rabbits, foxes, bobcats, frogs, turtles, etc.
- Report observations of injured, dead or potentially dangerous wildlife to ExxonMobil representative
- Truck speed limit within LFC is 15 MPH – no exceptions
- Watch for oncoming traffic. Some areas of the road are narrow and have blind curves
- Watch for directional signs to Weigh Area, Holding Area, and Loading Area
- Drivers to have an operating cell phone; Phone use prohibited within LFC facility (includes driving, waiting or loading)