Appendix D: Hazards and Hazardous Materials

John Wayne Airport Jet Fuel Pipeline Project

Risk Analysis

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John Wayne Airport Jet Fuel Pipeline Project Risk Analysis

1 Introduction

Wickland Pipelines LLC ("Wickland") is proposing to construct a California Public Utilities Commission ("CPUC") regulated common carrier jet fuel pipeline connecting the John Wayne Airport ("Airport") in Orange County, California to an existing products pipeline operated by Kinder Morgan Energy Partners ("Kinder Morgan"). This project will provide airline companies ("Airlines") operating at the Airport with an enhanced jet fuel storage and transportation system ("SNA Pipeline"). The proposed SNA Pipeline will increase Airport related jet fuel storage capabilities, while allowing Airlines to access jet fuel from all Long Beach area refineries and terminals entirely free from any dependency on highway truck transportation, resulting in the elimination of over 20 individual tanker truck deliveries per day.

1.1 Purpose of Risk Analysis

The purpose of this risk analysis is to assess the potential risk to the public and environment from this proposed project consisting of a new pipeline and storage facility. The analysis addresses the potential for many types of possible incidents including jet fuel releases, fires and explosions, and then estimates the areas that could be impacted by such incidents. The analysis also addresses the potential risk from the existing trucking of jet fuel to the storage facility at the airport. The risks of the current trucking operations are then compared to operation of the proposed pipeline system.

In addition, the potential risk of the pipeline to schools along the route has been assessed in accordance with the California Department of Education (CDE) *Guidance Protocol for School Site Pipeline Risk Analysis* (CDE 2007). Pipeline risk analyses are required when new schools are proposed to be sited within 1,500 feet of a high-pressure gas or hazardous liquid pipeline. Although this is not a situation involving the selection of a new school site, the methodology contained in CDE 2007 is valuable for risk assessment purposes. The details of this school risk analysis are contained in Appendix A to this document.

1.2 Methodology

Except as otherwise noted, this risk analysis has generally used the same methodology employed in the *Draft Environmental Impact No. 582 John Wayne Airport Settlement Agreement Amendment* (County of Orange, 2001). The same probabilities for truck and tank accidents were used and the same equations were used to calculate the probabilities of releases and fires. The only differences are that a more current model, ALOHA, is used to calculate the extent of the hazard footprints and a more current probability/frequency matrix is utilized to determine level of significance. Each aspect of the proposed project has been analyzed and potential hazards have been identified. Estimates of the expected frequency of such accidents have then been made based on historical data coupled with specific project design features. Modeling is then used to estimate the area that could be impacted by the accident. This is referred to as vulnerability analysis. Criteria have been established to determine level of significance based on a combination of expected frequency of an incident occurring and potential consequences of the incident. This methodology is further explained below.

1.2.1 Hazards Identification Methodology

Hazards identification provides information on situations that have the potential for causing injury to life or damage to property and the environment due to a materials spill or release. Hazards identification includes information on:

- Types and quantities of hazardous materials used, processed, or stored
- Quantities of hazardous materials that could be involved in a release or incident
- Conditions of storage, processing, and use
- Potential hazards associated with spills or other incidents

The primary material addressed in this risk analysis is jet fuel (Jet A) although other hazardous materials that may be used (primarily during construction) are also addressed. Jet A is described in Section 2.

1.2.2 Estimate Frequencies of Incidents

Estimations for the expected frequencies of the various incidents have been based on a combination of historical data and specific project design information. Estimates from County of Orange (2001) have been used as appropriate. The sources for other expected incident estimates are provided with justification.

1.2.3 Vulnerability Analysis Methodology

Vulnerable zones are estimates of the area surrounding an incident site where members of the public could experience adverse impacts. These adverse impact areas are based on levels of concern. For this analysis, the primary risk to members of the public is from a fire involving a release of Jet A. A fire creates radiant heat which can then cause harm to members of the public that are exposed to the radiant heat. A common radiant heat exposure level used in risk analyses and used in County of Orange (2001) is 5.0 kW/(sq m), which is the exposure level that can begin causing second degree burns within 60 seconds of exposure.

Because Jet A does not pose a toxic hazard to breath and because it has a relatively high flash point and low vapor pressure, vulnerable zones for breathing exposure and flammable gas clouds have been eliminated from further analysis. See Section 2 for a description of Jet A.

The vulnerable zones have been estimated using the Environmental Protection Agency (EPA) ALOHA model. This program is available from EPA on the internet. The Federal Emergency Management Agency (FEMA) ARCHIE model was utilized by County of Orange (2001) in the analysis of the existing operations. ALOHA was also used to establish the vulnerable zones in CDE (2007). ALOHA comprises a set of hazard assessment procedures and models that can be utilized to evaluate the off-site consequences of potential accidents involving hazardous materials. ALOHA is similar to ARCHIE but is a newer, updated model.

1.2.4 Significance Criteria

Guidance on determining the significance of environmental effects is provided in Section 15064 of the Guidance for Implementation of the California Environmental Quality Act (CEQA). The Guidelines state that a project may be deemed to have a significant effect on the environment from a public health and safety impact if it will:

- Create a hazard to the public or environment through the routine transport, use, or disposal of hazardous materials.
- Create a hazard to the public or environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing school.

To determine whether a significant hazard to the public or environment is created by the project, this risk analysis generally employs the frequency (probability)/severity (consequence) matrix approach. The risk matrix utilized in County of Orange (2001) was based on *The FEMA Handbook of Chemical Hazard Analysis* (FEMA 1990), and is now considered to be outdated. The FEMA (1990) risk matrix is now considered to underestimate the significance of certain accidents. Accordingly, a more conservative matrix has been used in this document. This newer matrix has been used in a number of recently completed environmental documents in the Port of Los Angeles (Port of Los Angeles 2011 and Port of Los Angeles 2008) and is described below.

Under the risk matrix used in this analysis, frequency is classified into six categories (frequent, periodical, occasional, unlikely, rare, and extraordinary) based on a predefined expected level of occurrence. The various environmental documents have used different terms for the categories. In addition, the "periodic" and "occasional" categories are often combined into a single category, usually called likely. The severity of consequence is classified into five categories (negligible, minor, major, severe, and catastrophic) based on the potential environmental and safety impact on the public. The frequency/severity matrix is presented in Figure 1. The potential for significant safety impacts increases proportionally to the frequency of occurrence and potential consequences of an event. Incidents that fall in the dark shaded area of the risk matrix (with cell entries of 1 and 2) would be classified as significant in the absence of mitigation, while the lighter shaded areas (with cell entries of 3) would be significant in the absence of engineering and/or administrative controls. Unshaded areas (with cell entries of 4) would be considered less than significant.

Consequences		Probability/Frequency					
		Extraordinary- >1,000,000 years	**Rare >10,000 <1,000,000 years**	**Unlikely >100 <10,000 years**	**Occasional >10 and <100 years**	**Periodic >1 and <10 years**	**Frequent (>1/year)**
	Catastrophic (> 100 severe injuries, more than 10 fatalities or >357,142 bbl)	4	3	2	1	1	1
	Severe (up to 100 severe injuries, up to 10,fatalities, or 2,380–357,142 bbls)	4	3	3	2	2	2
	Major (up to 10 severe injuries or 238–2,380 bbl)	4	4	3	3	3	3
	Minor (a few minor injuries or 10-238 bbl)	4	4	4	4	4	4
	Negligible (no minor injuries or <10 bbls)	4	4	4	4	4	4

Sources*:* Santa Barbara County, 1995; POLA 2011

Figure 1 Risk Matrix

1.3 Summary of Results

County of Orange (2001) concluded that the existing operation of supplying jet fuel by truck to the airport does not result in significant public safety impacts. The analysis was updated in this report to address the current level of trucking. In addition, the significance criteria were strengthened to reflect current standards. The potential public safety impacts from the current operations were once again deemed to be not significant. It is noted that the annual probability of a release from fuel-delivering trucks was estimated to be 0.11 per year or one spill every 9.5 years (see Table 3). The probability of a release of the entire contents of a truck was estimated to be 0.02 per year or once every 48 years (see Table 3). The probability of a tank truck release with an ensuing fire was estimated to occur approximately once every 45 years (see Table 1). The probability of a release with fire from the existing tank farm was estimated to be 1.6×10^{-5} or once every 62,500 years (see Table 1).

The proposed project adds the potential for accidents involving the pipeline and new tank farm and eliminates the risk from the trucks. The potential risk from the existing tank farm would remain the same. The probability of any size release from the proposed pipeline was calculated to be 0.014 per year or once every 72 years (see Table 7). The probability of a rupture is estimated to be 0.0029 or once every 347 years. As can be seen by these numbers, a release from a truck is approximately 7.5 times more likely than from the proposed pipeline. The probability of a pipeline release with ensuing fire was estimated to occur once every 11,600 years which is 250 times less than that of a truck release with fire. Truck accidents are much more likely to become ignited because of the truck engine and sparks created during an accident. The probability of a release with fire from the proposed new tank farm was estimated to be 2.0×10^{-5} or once every 50,000 years (see Table 8). The probability of an aircraft impacting the existing and proposed tank farms has been estimated to be 3.1×10^{-6} or once every 322,000 years (see Table 5) and 9.8×10^{-6} or once every 102,000 years (see Table 10) , respectively. The combined probability of an aircraft impacting one of the two tank farms is estimated to be 1.3×10^{-5} or once every 77,000 years. As can be seen from the Table 1, the potential impact of aircraft operations on the storage facilities is the lowest of all the potential risks. Table 1 compares the risk of release and release with fire of the existing operations (trucking plus existing tank farm and aircraft operations) and the proposed operations (pipeline plus proposed new tanks and existing tanks plus aircraft operations).

As can be seen by the above discussion and Table 1, the replacement of the trucking operations with the proposed pipeline would decrease the probability of a jet fuel release and a jet fuel release with ensuing fire.

Table 1 Comparison of Risk

	Annual Probability of Release	*Annual Probability of Fire*
Current Operations		
- Trucking	0.11 (once every 9.5 yrs)	0.02 (once every 48 yrs)
- Tank Farm	3.0×10^{-4} (once every 3,333 yrs)	1.6×10^{-5} (once every 62,500 yrs)
- Aircraft Impact	3.1×10^{-6} (once every 322,000 yrs)	1.6×10^{-6} (once every 625,000 yrs)
- Trucking, Tank Farm & Aircraft	**0.11 (once every 9.5 yrs)**	**0.02 (once every 48 yrs)**
- Proposed Operations		
- Pipeline	0.014 (once every 72 yrs)	8.6×10^{-5} (once every 11,600 yrs)
- Tanks (existing plus new)	5.0×10^{-4} (once every 2,000 yrs)	2.7×10^{-5} (once every 37,000 yrs)
- Aircraft Impact (existing plus new)	1.3×10^{-5} (once every 77,000 yrs)	6.5×10^{-6} (once every 154,000 yrs)
- Pipeline,Tank Farms & Aircraft	**0.014 (once every 72 yrs)**	**1.1×10^{-4} (once every 8,800 yrs)**

As can be seen From Table 1, the overall risks of a release and release with fire are substantially reduced with the proposed project. The overall risk of a release with fire is estimated to be 1.1 x 10-4 or once every 8,800 years. This potential overall risk is classified as “unlikely” by the risk matrix. The potential for injuries or fatalities would actually be less than this probability because people would have to be exposed to the fire some time before consequences would occur. As discussed in the various sections of this report, no fatalities and only a few injuries would be expected from incidents involving the proposed project. Thus, the consequences are classified as “major”. As evidenced by the list of mitigations attached to this Risk Analysis as Appendix B, the proposed project will be equipped with extensive engineering and administrative controls. In accordance with the Figure 1 risk matrix, compliance with these mitigations will render the analyzed project risks less than significant.

2 Description and Hazards of Jet Fuel

Jet fuel is produced by various refiners in a variety of grades. Currently, and for this project, only Jet-A is transported and stored. Jet-A is a kerosene based product. The American Society of Testing and Materials (ASTM) has established a standard (ASTM D 1655) which defines jet fuel grades including Jet-A. Table 2 presents the physical and chemical properties of Jet-A. The National Fire Protection Association (NFPA) classifies Jet-A as a Health Hazard of 1 (material that on intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury), a Flammability Hazard of 2 (material must be moderately heated or exposed to relatively high ambient temperature before ignition can occur), and Reactivity Hazard of 0 (material that in itself is normally stable, even under fire exposure conditions, and is not reactive with water). Table 2 presents some of the physical and chemical properties of Jet A.

Due to the physical properties of Jet A fuel (e.g., low volatility and low explosion potential), an explosion would only be expected under confined conditions and, as flame speeds associated with Jet A are not conducive to detonation, the probability of detonation is remote. Additionally, ignition is unlikely because Jet A fuel cannot be ignited from a single flame source; the fuel must be heated to at least its flash point before ignition can occur.

Table 2 Jet A Physical and Chemical Properties

Fire Classification	*Combustible Liquid (Flash Point of 100°F or higher)*
Flammable Properties	
Flash Point[a]	100°F (minimum)
Auto-ignition temperature [b]	410°F
Lower flammability limit[c] (% by volume in air)	0.7
Upper flammability limit[d] (% by volume in air)	5.0
Physical Properties	
Boiling point	304°F - 574°F
Molecular weight	~170
Specific gravity	~0.8
Vapor Pressure	~0.05 psia @ 68°F / ~ 0.1 psia @ 100°F
Vapor density	4.5
Percent volatile heat of combustion	~18,500 Btu/lb

Source: County of Orange, 2001

Notes::

a. Flash Point – Lowest temperature at which vapors over a liquid surface will ignite and burn when exposed to an ignition source
b. Auto-ignition – Minimum temperature necessary to initiate or cause self-sustaining combustion in the absence of a flame or spark
c. Lower flammability limit – Minimum concentration of a vapor in air that will ignite and propagate flame; Fuel concentrations below this limit will contain insufficient fuel to ignite and propagate flame (i.e., too lean to burn)
d. Upper flammability limit - Maximum concentration of a vapor in air that will ignite and propagate flame; Fuel concentrations above this limit will contain too much fuel an/or too little oxygen to ignite (i.e., too rich to burn)

3 Existing Risk

The existing risk of transporting jet fuel by tank truck and storing it in the three existing tanks at the airport has been estimated based on the previous analysis contained in County of Orange 2001.

3.1 Tank Truck Risk

The number of daily tank truck trip deliveries and miles driven has been updated to reflect current operations. Over the past four years, the average number of daily tank truck deliveries has varied from a low of 21.8 in 2011 to a high of 24.7 in 2008. The decline has most likely been due to the slowing economy. The average number of daily truck deliveries over the past four years (22.5) has been used in this analysis. The weighted average miles driven for each delivery over the past four years is 31.9 miles. Trucks have a capacity of 8,000 gallons.

In keeping with County of Orange (2001), an accident rate of 2.0 x 10^{-6} accidents per loaded truck mile traveled has been used to estimate the number of truck accidents associated with the current trucking operations. Also in keeping with County of Orange (2001), it has been assumed, on average, a spill will result from an accident approximately 20 percent of the time, with the following results:

- Ten percent tank container loss through a one-inch hole (800 gallons) 60 percent of the time
- Thirty percent tank container loss through a 2-inch hole (2,400 gallons) 20 percent of the time
- One hundred percent instantaneous (one-minute) tank container loss (8,000 gallons) 20 percent of the time

Using the above probabilities and assumptions, the annual probabilities of releases for the three size releases has been calculated and are presented in Table 3. Also presented in the table is the classification probability of spill category used in County of Orange (2001) and described Section 2.1 and in the updated risk matrix.

Table 3 Probabilities of a Release of Jet Fuel from Tank Truck Delivery

Spill Size	*Annual Probability of Occurrence*	*Expected Frequency between Spills*	*County of Orange Classification*	*New Classification*
800 gal (19 bbl)	0.06	16 years	Unlikely	Occasional
2,400 gal (57 bbl)	0.02	48 years	Unlikely	Occasional
8,000 gal (190 bbl)	0.02	48 years	Unlikely	Occasional
Any size	0.11	9.5 years	Likely	Periodic

As can be seen from Table 3, the probability of a spill of any size is classified as likely/periodic while the probability of a spill greater than 800 gallons is unlikely/occasional.

As described in Section 2.1, County of Orange (2001) used the ARCHIE computer program to estimate the size of fire hazard vulnerable zones associated with the three Jet A tank truck accidents. These are presented below. The fire hazard zones were also calculated using ALOHA for comparison. ALOHA could not be used to calculate the fire hazard zone for the 100% cargo loss case because of spill area modeling limitations.

- 10% cargo loss – 457 ft radius (ALOHA 490 ft radius)
- 30% cargo loss – 681 ft radius (ALOHA 730 ft radius)
- 100% cargo loss – 1,055 ft radius

Because the vapor pressure of Jet-A is very low and the flash point is above 100°F, a release would not result in the formation of a vapor cloud capable of moving away from the release and becoming ignited (i.e., forming a flammable vapor cloud). Since a vapor cloud is not possible, neither is an explosion.

While Jet-A exposure can cause health impacts if exposed for an extended time period, short-term exposure associated with accidental releases should not cause anything more than slight irritation to the eyes and nose (NOAA 2012). Hence, the only hazard zone calculated and presented is that of a fire hazard.

Based on the expected frequency of a tank truck accident and the potential consequences should an accident occur, County of Orange (2001) concluded that the tank truck transport of Jet-A does not result in a significant adverse impact to public health and safety. This conclusion would remain unchanged even with the current level of tank truck traffic and with the update risk matrix (see Figure 1). It is also noted here that County of Orange (2001) did not consider the probability of the release becoming ignited when considering their conclusion. MBA (2008) estimates this probability as approximately 20%.

3.2 Tank Storage Risk

Three 300,000 gallon tanks are currently used to store Jet-A (Figure 2). The three tanks are approximately 52 feet in diameter and 21 feet high and are constructed of welded steel. They have full contact internal floating roofs and overflow alarms, as well as a self-contained fire alarm and suppression system. The tanks are within a dike wall system that is four feet high and provides spill containment of 132% of the volume of a single tank. The containment area is approximately 18,000 sq. ft. County of Orange (2001) assumed a failure rate of 1.0×10^{-4} per tank-year. Also, County of Orange (2001) assumed that tank failures result in the following:

- Ten percent product loss resulting from a one-inch hole 90 percent of the time
- One-hundred percent instantaneous (one-minute release) product loss ten percent of the time

Although not considered in County of Orange (2001), the probability that a release into the secondary containment area becomes ignited is conservatively estimated to be 10% for a tank failure (MBA 2008 and ADL 2000).

The probabilities of release and release with fire for the three existing tanks are presented in Table 4. Please note that these accident probabilities, although very low, are higher than those reflected in County of Orange (2001) because they represent the chances that any one of the three tanks located in the existing tank farm will experience a 10 percent, 100 percent, or any size loss. In other words, the Table 4 calculations take into account the fact that there are three tanks in the existing tank farm, and that any one of them could at any time experience a release. By contrast, the tank release probabilities presented in Orange County (2001) are calculated based on a single tank, and do not reflect a three tank aggregation.

Figure 2 Existing Storage Facility

All tank farm release scenarios studied in County of Orange (2001) resulted in a frequency classification of “very unlikely” (less than once in 1,000 years) and a “low” probability of occurrence (unlikely during the expected lifetime of the facility). The tank farm accidents studied in Table 4 result in the same findings under the older risk matrix utilized in County of Orange (2001). If the storage tank accidents listed in Table 4 are classified under the new risk matrix set forth in Figure 1 of this risk analysis, the expected frequency of any loss (without fire) or a 10 percent loss (without fire) would be categorized as “unlikely”, while all other incidents would be designated as “rare”.

Table 4 Accident Probabilities for Existing Storage Tanks

Spill Size	*Annual Probability of Spill*	*Expected Frequency between Spills*	*Annual Probability of Spill with Fire*	*Expected Frequency between Fires*
10% loss (30,000 gal)	2.7×10^{-4}	3,700 yrs	2.7×10^{-5}	37,000 yrs
100% loss (300,000 gal)	3.0×10^{-5}	33,300 yrs	3.0×10^{-6}	333,000 yrs
Any Size Loss	3.0×10^{-4}	3,330	3.0×10^{-5}	33,300

As described in Section 2.1, County of Orange (2001) used the ARCHIE computer program to estimate the size of fire hazard vulnerable zones associated with the two storage tank accidents studied in that document. Because the size of fire vulnerable zone is based on the area on fire (in this case, the tank farm secondary containment), the two spill scenarios result in the same size hazard zone which was calculated to have a radius of 172 ft. The fire hazard zone was calculated to be 210 ft using ALOHA. These hazard zones overlap parts of the airport taxiways to the east and industrial/office space to the west. No residential or other visitor serving areas are overlapped.

Because the vapor pressure of Jet-A is very low and the flash point is above 100°F, a release from a tank into the secondary containment area would not result in the formation of a vapor cloud capable of moving away from the release and becoming ignited (i.e., forming a flammable vapor cloud). In addition, since the tanks are equipped with floating roofs, there is no space for vapor to accumulate and thus, explosions are extremely unlikely.

As discussed above, exposure associated with accidental releases should not cause anything more than slight irritation to the eyes and nose (NOAA 2012). Hence, the only hazard zone calculated and presented is that of a fire hazard.

Based on the expected frequency of a storage tank accident and the potential consequences should an accident occur, County of Orange (2001) concluded that storage tanks would not “result in a significant adverse impact to public health and safety under risk of upset conditions.” In the course of drawing this conclusion, City of Orange (2001) specifically noted that the potential for off-site public fatalities or injuries was low, and that the extent of the vulnerable zone associated with the hypothetical accidents was limited.

Using the updated risk matrix set forth as Figure 1, all existing tank farm accidents studied would be classified as either less than significant or less than significant with the application of engineering and/or administrative controls. This statement remains accurate whether the hypothetical accidents and probabilities as set forth in County of Orange (2001) are considered, or the accidents and probabilities listed in Table 4 of this analysis are evaluated. It should also be noted here that while the County of Orange (2001) calculated the fire hazard zone, they did not consider the probability of the release becoming ignited when considering their conclusion.

3.3 Aircraft Related Bulk Fuel Storage Facility Accidents

County of Orange (2001) evaluated the potential for aircraft accidents impacting the bulk jet fuel storage facility and concluded that this would not result in a significant impact. This potential impact has been reassessed using data from the *California Airport Land Use Handbook* (Caltrans, 2011). Appendix E of Caltrans (2011) is titled "Aircraft Accident Characteristics", and presents updated statistical data on aircraft accident locations. Appendix F of Caltrans (2011) discusses risk concepts. In part, Appendix E attempts to analyze recent aircraft accident data and break the accidents down into whether they occurred on takeoff or landing, and where they occurred relative to the runway.

The existing bulk jet fuel storage facility is located in the airport and encompasses approximately 18,000 sq. ft. The eastern wall of the tank farm is located approximately 600 ft. from Runway 19R-1L and 1,125 ft. from Runway 19L-1L. The south side of the tank farm is located approximately 460 ft. south of the north end of both runways. The number of aircraft operations by type was updated to 2011 (OCair.com, 2012) and is presented below. An operation is a landing or a takeoff and hence it has been assumed that half the operations are landings and half are takeoffs.

- Commercial 79,658
- Commuter 3,188
- General Aviation 169,870
- TOTAL 252,716

Virtually all operations at the airport involve a north to south traffic pattern. Thus, the potential for takeoff accidents have been eliminated from consideration because these types of accidents, should they occur, would be located down the runway to the south of the existing tank farm. Hence, only landing accidents have been considered in this analysis. This assumption is consistent with County of Orange (2001).

The 1980 through 1998 landing accident rate for the John Wayne Airport has been taken from Table 13 of Appendix M of County of Orange (2001) and is presented below. This same data was used by County of Orange (2001). Updated John Wayne Airport aircraft accident data is not available.

- Commercial 2.80 x 10-6
- Commuter 0
- General Aviation 1.88 x 10-6

The following equation has been used to calculate the probability of an aircraft landing impacting the existing storage facility for each aircraft type landing at each of the two runways.

P = (NO / 2) * LAR * PANR * PSA * PAAR * PATFR * PORW *(ATF / ARWLZ) where:

- NO = the number of aircraft operations. The numbers for each aircraft type are listed above. (These numbers are divided by two to get the number of landings).
- LAR = landing accident rate. The accident rates for each aircraft type are listed above.
- PANR = percent of accidents that occur on or immediately adjacent to the runway. According to Appendix E of Caltrans (2011), 72% of the general aviation landing accidents and 64% of commercial and commuter landing accidents take place on or immediately adjacent to the runway.
- PSA = percent of accidents that are serious or fatal. Sources indicate that these accidents are only serious or fatal 5% (Appendix M of County of Orange (2000)) to 11% (Appendix E of Caltrans (2011)) of the time. These values have been averaged and this averaged rate of 8% has been used in this analysis.
- PAAR = percent of landing incidents that occur within the first 1,640 ft of the runway. As noted earlier, the southern boundary of the existing tank farm is located approximately 460 ft. south of the north end of both runways. According to Appendix E of Caltrans (2011), 24% of landing accidents occur within the zone.
- PATFR = percent of accidents that occur within a distance that would impact the tank farm. This is referred to as the runway lateral zone. According to Appendix E to Caltrans (2011), about 4.5% of airport landing accidents occur in areas located between 492' and 820' from runway center lines. The existing tank farm is located on the western side of Runway 19R, approximately 600 ft to 715 ft back from the runway centerline. Thus, because the tank farm is located in this lateral area, it has a lateral landing accident exposure from Runway 19R of about 2.25%. (The percentage is half of 4.5% in recognition of the fact that a runway has two lateral sides.) According to Appendix E to Caltrans (2011), about 5.5% of airport landing accidents occur in areas located between 984' and 1,312' from runway center lines. The existing tank farm is located west of Runway 19L (the shorter runway), about 1,100 to 1,220' back from the runway centerline. Accordingly, because the tank farm is located in this lateral area, it has a lateral landing accident exposure from Runway 19L of about 2.75%. (Again, the percentage is halved to take into account the fact that a runway has two lateral sides.)
- PORW = percent of total landings that occur on each runway by type of aircraft. According to airport personnel, 100% of commercial aircraft landings take place on Runway 19R, commuter landings are split evenly between the two runways, and general aviations landings are split with 25% on Runway 19R and 75% on Runway 19L.
- ATF = area of the existing tank farm. This has been calculated to be approximately 18,000 sq. ft.

- ARWLZ – area of the runway lateral zone (see PATFR above). The lateral runway zone within which the existing tank farm is located is 1,640 ft long (see PAAR, above), and 328 ft wide (see PATFR above [830-492 = 328] and [1,312– 984 = 328]). This zone has an area of 537,920 sq. ft. ATF/ARWLZ is the percent of area of the existing tank farm to the total area of the landing zone.

Table 5 summarizes the data used in the analysis and the results for each aircraft type and the total risk to the existing tank farm. The total risk from all aircraft types was calculated to be 3.1×10^{-6} or once every 322,000 years. This is classified as very unlikely according to County of Orange (2001) and rare according to the current risk matrix (Figure 1).

The tanks, especially when containing liquid, are rigid and capable of withstanding a substantial impact. They could most likely withstand the impact of most smaller general aviation aircraft without rupturing. However, a commercial aircraft would most likely result in substantial damage to the tank resulting in a release with fire. To estimate the probability of a fire from an aircraft impact, it has been estimated that all impacts by a commercial or commuter aircraft would result in a fire while 25% of impacts by a general aviation aircraft would result in a fire. Thus, the probability of an ensuing fire is estimated to be 50%. Hence, the probability of aircraft impact with ensuing fire is estimated to be 1.6×10^{-6} or once every 625,000 years. This is also classified as rare according to the current risk matrix (Figure 1).

Table 5 Probability of Aircraft Operation Impacting Existing Tank Farm

Aircraft Type	*NO*	*LAR*	*PANR*	*PSA*	*PAAR*	*Runway*	*PATFR*	*PORW*	*ARWLZ*	*P*
Commercial	79,658	2.8×10^{-6}	0.64	0.08	0.24	19R	0.0225	1	537,920	$1.0. \times 10^{-6}$
						19L	0.0275	0	537,920	0
Commuter	3,188	0	0.64	0.08	0.24	19R	0.0225	0.5	537,920	0
						19L	0.0275	0.5	537,920	0
Gen Aviation	169,870	1.88×10^{-6}	0.77	0.08	0.24	19R	0.0225	0.25	537,920	4.4×10^{-7}
						19L	0.0275	0.75	537,920	1.6×10^{-6}
Total										$\mathbf{3.1 \times 10^{-6}}$

The consequences of such an accident would be dependent on many factors, including the type of aircraft involved. If the secondary containment walls are not breached, the consequence of the fire would be the same as that presented for a tank farm fire (see Section3.2). If the tank is ruptured and a wall is breached, then the jet fuel could escape and spread into the surrounding area. According to the risk matrix (Figure 1), an accident classified as rare is acceptable as proposed if its resulting consequence is major or less.

4 Proposed Project Risk

This section presents the potential risk from the proposed project including the pipeline and new and existing storage facilities, during both construction and operation. It also discusses the differences in risk for the various proposed alternatives. Figure 3 presents the alignment of the proposed pipeline route.

4.1 Pipeline

4.1.1 Construction

Pipeline construction operations have the potential to cause the following types of public safety/risk impacts:

- Traffic accidents caused by construction activities (this risk is addressed in the traffic analysis section of the environmental document)
- Releases of hazardous materials from construction equipment including refueling activities
- Damage to third party utilities
- Fires

Each is discussed below.

<u>Releases from Construction Equipment</u>

There are storm drain inlets along the pipeline routes. A release of a hazardous material during construction could potentially enter one of these openings. The storm drains flow into San Diego Creek and eventually Upper Newport Bay. In addition, the pipeline will pass under the Santa Ana Santa Fe Channel, Barranca Channel, the Lane Channel and Channel No. F01S01. Directional drilling will be used to pass under all four of these channels. All construction equipment utilized for the directional drills will be confined to public roadway right of way and Airport property.

Construction Plan - Wickland will develop a construction plan which will, among other things, identify specific sites for any equipment fuel storage required for pipeline construction. In general, equipment fuel storage sites will be located to provide adequate setbacks from existing water bodies (100-foot minimum) and water wells (200-foot minimum). Refueling of construction equipment will take place along the right-of-way using absorbent material to create temporary berms around the equipment. Prior to construction, Wickland will develop an emergency response plan, spill prevention plan, or similar document, as required by regulation.

Temporary Equipment/Supply Storage Areas - Wickland will utilize three locations for storage of temporary equipment, including pipe, backfill material, construction equipment, etc. These locations will be the undeveloped area at the intersection of Kensington Park Drive and Edinger Ave in Tustin, the empty lot on Aston Avenue between Deere Ave and Barranca Ave and adjacent to the BNSF railroad spur in Irvine, and a portion of the Airport located immediately east of the existing storage tanks.


Legend
Proposed Pipeline Alignment
Proposed Containment Area

Figure 3 Proposed Pipeline Alignment

Spill Prevention, Countermeasures, and Management Plan and Storm Water Pollution Prevention Plan - Wickland and the construction contractor will develop a Spill Prevention, Countermeasures, and Management Plan for the project. In addition, Wickland will develop a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP will contain a site map(s) which shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP will list Best Management Practices (BMPs) the contractor will use to protect storm water runoff, and the placement of those BMPs. Additionally, the SWPPP will contain a visual monitoring program and a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs. The construction contractor will be responsible for implementation of on-site spill prevention and response procedures during the construction phase of the project, including implementation of Wickland's SWPPP Plan.

Hazardous materials, which the contractor may bring on-site, include petroleum products, gasoline, hydraulic fluid, and diesel fuel. The following are material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to the job site.

Wickland's Spill Prevention, Countermeasures, and Management Plan will include, among other things, good housekeeping practices, Hazardous materials management, spill control practices, on site response equipment and materials.

Frac-Out Plan - Inadvertent returns of drilling mud ("frac-out") have the potential to occur during horizontal directional drilling (HDD) operations. HDD uses bentonite slurry, a fine clay material as a drilling lubricant. The bentonite is non-toxic and commonly used in farming practices, but benthic invertebrates, aquatic plants and fish and their eggs can be smothered by the fine particles if bentonite is discharged to waterways. Wickland will prepare a Frac-Out Plan prior to construction and will require the construction contractor to adhere to the plan. The following summarizes the elements of the Wickland Frac-Out Plan.

- Monitoring - Wickland and the contractor will monitor HDD activities for potential frac-outs. In addition, all project personnel working at the project site will be trained on frac-out detection, notification, and response. An Environmental and/or Construction Inspector will inspect, at minimum, the drill path in upland habitat areas and approximately 20-ft either side of the drill path. The inspectors will have appropriate communication equipment to contact the construction foreman in case a frac-out is detected outside of the drill path and approved work areas. The inspectors will have the authority to halt work if a frac-out has the potential to impact a sensitive resource.

- Assessment - In the event of a frac-out, the release will be assessed to determine the amount of drilling mud released and the potential for the release to reach a waterway or other sensitive resource. Surfaced drilling mud will be accessed based on the location and size of the frac-out and according to resource agency recommendations.

- Waterbody - In the event of a frac-out, the following steps will be taken to prevent or minimize the further release of drilling mud:
    - Initiate immediate suspension of drilling operations.
    - Notify Wickland management, who will notify the CDFG, the U.S. Army Corps of Engineers (Corps), and the Regional Water Quality Control Board (RWQCB).
    - Implement steps to contain frac-out material and evaluate the current drill profile to identify means to prevent further frac-out events.
    - Review and adjust, as needed, drill pressures, pump volume rates, and drill profile to prevent further releases into the sensitive resource area.
    - In consultation with resource agency representatives, evaluate the release and deploy appropriate response and containment methods.
    - Document the location and estimated volume of the frac-out and corrective measures taken to contain the frac-out. In addition, document preventive measures taken to reduce the likelihood of future frac-outs.
    - With direction from resource agency personnel, initiate clean-up procedures outlined in the following section on clean up.
- Notification - For all drilling mud releases during HDD crossing, the drilling foreman will temporarily halt drilling activities. The drilling foreman will immediately notify the appropriate Wickland representative. The Wickland representative will assess the severity of the release and determine if further notifications to other agencies are required.
- Clean Up - The contractor will work with Wickland representatives and resource agency representatives to determine the timing of clean up.

A frac-out does not present a safety threat to members of the public. The impacts of a frac-out that allows drilling fluid to reach the water is addressed in the Hydrology section of the environmental document. However, it is noted here that with the development and implementation of the Frac-Out Plan, the potential for a frac-out is very unlikely and the potential that fluids reach a water source is even more remote.

The amount of hazardous material that could be released during construction is limited to small amounts such as a fuel leak or lubrication release. A small release would not present a hazard to members of the public if responded to in a timely manner. With the myriad of regulations in place and measures proposed by Wickland, a construction equipment release is not considered to result in a significant public safety impact.

<u>Damage to Third Party Utilities</u>

During excavation operations, there is a risk of personal injury or death (primarily construction worker), environmental contamination, and/or property damage which could be caused by the striking or severance of existing substructures (e.g., power cables, foreign pipelines).

Section 7110 of the California Business and Professions Code imposes disciplinary action for failure of contractors to adhere to the State's "one call" regulations, among other things. California Government Code, Title 1, Division 5, Chapter 3.1 (Protection of Underground Infrastructure) provides the framework for the state's one-call system. This statute requires every operator of an underground facility, except the California Department of Transportation, to become a member of, participate in, and share the costs of the one-call system. Anyone planning an excavation must notify the appropriate regional notification center (either Northern or Southern California) and mark the excavation area at least 2 days, but not more that 14 days prior to commencing excavation. The one-call system then notifies all operators of underground facilities within the area. The operators are required to mark the location of their facilities in the field before the excavation date. A civil penalty of up to $10,000 may be imposed on any operator or excavator who negligently violates this article. A civil penalty of up to $50,000 may be imposed on any operator or excavator who knowingly and willfully violates this article. Further, if an excavator fails to comply with the requirements, the excavator is liable for any claim for damages to the subsurface installation arising from the excavation. Underground facility owners forfeit their claims for damages from an excavator, should they fail to comply with these requirements.

Although this and similar one-call services have been very effective in reducing unwanted damage to existing facilities, third party damage still causes approximately one-half of all hazardous liquid incident consequences. As a result, Wickland will require the construction contractor to implement additional mitigation measures as described below. Many of these actions have been recommended by the National Transportation Safety Board (NTSB, December 1997).

Wickland will monitor the construction contractor's compliance with existing state law, including the advance marking of all proposed excavations, the dates of all Underground Service Alert (USA) calls, and on-site meetings held with underground facility owners. Wickland will also require the construction contractor(s) to clear the right-of-way using a hand held line locator prior to excavation.

Prior to digging over, or within three feet of a known substructure, Wickland will require the construction contractor(s) to probe the area to positively locate the facility and measure the depth of the substructure; Wickland will also require the use of hand digging within two feet (horizontal and vertical) of any existing substructure and within five feet of any pedestal, closure, riser guard, pole, meter or other structure. When paralleling an existing underground facility, the facility will be exposed every 50 feet to positively verify the location and depth of the line.

When boring or directionally drilling, the boring equipment will be placed such that it is boring away from the majority of other underground facilities. When such facilities must be crossed, they will be exposed to verify their location and depth. The results may require that the bore route or depth be changed to avoid potential damage to the existing facility.

If during the course of the work, unmarked pipelines are encountered, Wickland will take appropriate measures to identify the owner of the facility. This will include, but is not limited to the following substructure research: USA notification; research of city, county, and state records; and communication with other utility owners in the area. If the owner of the facility cannot be determined, the proposed pipeline will be lowered to avoid any conflict. If it is impossible to avoid an existing substructure of unknown ownership or use, the pipe contents will be positively identified before any cutting of the substructure is allowed; this will be done by tapping or other means. The substructure may not be cut or removed until a safe procedure for doing so has been developed; this procedure will vary, depending on the pipe contents and site conditions. Once the facility has been removed, the remaining ends will be capped using the same construction techniques as the substructure's original construction to prevent leakage should the substructure be pressured. Cathodic protection tests will also be conducted. If the facility is cathodically protected, a bonding cable shall be installed to maintain the integrity of the facility's cathodic protection system.

Fires

Personal injury, death, or property damage can result from construction-caused fires. Fires can be caused by welding, grinding, vehicle exhausts, sparks, etc. Risk of fires is higher when pipeline construction takes place in undeveloped areas with dry vegetation along the route. The risk of fire for this proposed project and alternative alignments is minimal because all of the proposed pipeline routes are in roadways through developed office and industrially zoned land. Hence, the potential for a fire during construction is deemed to not be significant because of the pipeline route does not pass through any areas susceptible to fires.

4.1.2 Operation

The proposed pipeline will be 12-inches in diameter and approximately five miles in length. The proposed pipeline will tie in to the existing Kinder Morgan common carrier products pipeline at the northwest boundary of a property located at 14741 Franklin Avenue in the City of Tustin, and generally proceed underground southwest to the new proposed jet fuel tank farm being proposed for JWA. The proposed tank farm will be located on Airport property about 500 feet southwest of the existing Airport jet fuel tankage. The proposed pipeline will be located in Tustin and Irvine public streets and minimally on private office or industrially zoned property. An alternate route has also been proposed. This route is also located in Tustin and Irvine public streets and minimally on private office or industrially zoned property. Figure 3 shows the proposed route of the pipeline.

Although pipelines, especially new pipelines, are designed, constructed, and operated under strict regulations, the potential for incidents involving the release of product still exists. This section addresses the potential for many types of possible incidents, including jet fuel releases, fires, and explosions, and then estimates the areas and resources that could potentially be impacted by such incidents. In order to minimize the potential for incidents, the pipeline is being designed with extensive safety features. These are summarized below.

- **Pipeline Material**: The pipeline will be constructed of carbon steel and the walls will be at least 0.375 inches thick.

- **Pipeline Coating**: The pipeline will be coated with fusion bond epoxy (FBE) or similar pipe coating. In areas where the pipe is directionally drilled, a multi-part coating system will be employed consisting of fusion bond epoxy covered with a second abrasion-resistant layer of coating. Pipeline coating will typically be applied at a qualified coating facility before delivery to the construction site. However, field coating (heat shrink polyethylene sleeves) will be necessary on all field weld joints made at the site in order to provide a continuous coating along the pipeline. A detection test will be conducted to locate any coating discontinuities that could permit moisture to reach the pipe, such as thinning, or other mechanical damage. All coated pipe, including field joints, fittings, and bends will be tested and repaired as necessary, and before backfilling. The purpose of this coating is to minimize external corrosion.

- **Cathodic Protection**: Cathodic protection is a technique used to control the corrosion of a metal surface. The entire portion of the underground pipeline will have cathodic protection, which would include both FBE coating and a sacrificial magnesium anode system. Although the majority of piping would be above grade at the Airport, all buried piping and tank bottoms will also include cathodic protection. Insulating flanges will isolate the Kinder Morgan and existing Airport facilities from the Wickland pipeline and tank facilities.

- **Welding & Inspection:** All field welding will be performed by qualified welders in accordance with Wickland specifications, including API 1104 (Standard for Welding. Pipe Lines and Related Facilities) and the rules and regulations of the U.S. Department of Transportation (DOT) found in the Code of Federal Regulations (CFR) Title 49 (Part 195 for liquid pipelines). One hundred percent of the pipeline welds will be radiographically inspected, exceeding the 10 percent inspection requirement found in CFR Title 49, Part 195 (49 CFR Part 195).

- **Pipeline Depth:** The pipeline will have a minimum of four feet of cover to minimize third party damage. Directional drilling to a depth of over 40 feet will be used in a minimum of four places to pass under roadways and channels.

- **Hydrostatic Testing:** Hydrostatic testing (i.e., pressure testing) will be performed after construction and before startup. Federal regulations (49 CFR Part 195) mandate hydrostatic testing of new petroleum pipelines before the line can be placed into operation.

- **Control Systems:** The Pipeline will include a state-of-the-art computerized supervisory control and data acquisition ("SCADA") system with operational monitoring and control located at both the Kinder Morgan pipeline tie-in and Airport tank farm control room. The control system will allow operators to open and close motor operated valves, to start transfer pumps, and to continuously monitor pipeline flow rates, pressures, temperatures, and equipment status. A key component to the SCADA system is ongoing leak detection. During pipeline deliveries, the SCADA system monitors the two meters located at each end of the pipeline and continuously compares the measured flow rates and flow volumes. If a discrepancy is detected, the SCADA system will produce an alarm and automatically shutdown pipeline operations and close the pipeline isolation valves. During periods when the pipeline is not delivering, the SCADA system will monitor pressure to alert operators should a material drop in pipeline pressure occur. In addition to the ongoing leak detection provided by the SCADA system, the pipeline system will be subject to a rigorous preventative maintenance program, including periodic pressure and cathodic protection testing, as well as internal "smart pig" corrosion inspections.

- **Motor Operated Valves (MOVs):** The pipeline will be fitted with an MOV at the Kinder Morgan connection point and at the Airport tank farm.

- **Emergency Shutdown (ESD):** The pipeline will include an emergency shutdown system of hardwired ESD pushbutton switches at the Airport. The ESD system will shut down pipeline deliveries by closing the MOVs and isolating the Kinder Morgan pipeline, the SNA Pipeline, and the storage tanks from each other. ESD controls will also be available on all SCADA interface screens.

- **Internal Pipeline Integrity Investigation:** The pipeline will contain a pig launcher and pig receiver. This equipment is used to insert, launch and remove devices called "pigs" used for a variety of purposes, ranging from line cleaning to investigating the condition of the pipeline along the pipeline's entire length. The most sophisticated pigs are called "smart pigs". A smart pig is an internal inspection device used to measure and analyze conditions along the pipeline's inner and outer walls. As it travels through the pipe, the smart pig electronically reads and records the slightest change in wall thickness, pinpointing problems before they become leaks. Wickland will run a smart pig through the line within the first three months of startup (Year 1) , Year 3, Year 6 and at least once every 5 years thereafter.

- **One Call System:** Information on and the location of the pipeline will be provided to Underground Service Alert of Southern California, a.k.a. DigAlert. DigAlert is the One Call Notification Center that supports all of Southern California.

- **Oil Spill Contingency Plan:** Prior to operation, Wickland will develop an Oil Spill Contingency Plan (OSCP) specifically addressing the proposed pipeline and tank farm. The OSCP will address the following Oil Pollution Action (OPA '90) requirements:

    - Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA) 49 CFR Part 194 Response Plans for Onshore Pipelines (Oct. 1, 2003)

    - Occupational Safety and Health Administration (OSHA) 29 CFR Part 1910.119, Emergency Action Plan Regulation (July 1, 2004); and

    - Occupational Safety and Health Administration (OSHA) 29 CFR Part 19190120, HAZWOPER Regulation (July 1, 2004).

    The OSCP will address, among other things, the potential worst-case release, procedures for responding to various size releases, notification procedures, training procedures, response equipment, response contractors, equipment testing, and sensitive environmental areas.

4.1.2.1 Probability of Pipeline Incident

Liquid pipeline incidents involve the release of some or all of its contents. If the pipeline is buried, a small release can migrate underground and eventually reach the surface. A large release/rupture can result in the liquid forcing itself to surface quite rapidly resulting in a crater. Once the liquid reaches the surface it will flow with the terrain and possibly form a pool. If in the street, it can flow to storm drain openings and enter the storm drain system. It is also possible that the liquid can encounter an ignition source in which case a pool fire can ensue. Because Jet A has a high flash point and a low vapor pressure, a spill of Jet A is not capable of producing a vapor cloud with sufficient vapor capable of being ignited and exploding or forming a flash fire.

There are a number of sources available to estimate the probability of pipeline incidents. Table 6 lists some of these sources together with their estimated probabilities of pipeline incidents

Table 6 Probability of Pipeline Incidents

Source	*Pipeline Incident Frequency (per mile per year)*	*Notes*
Handbook of Chemical Hazard Analysis Procedures (FEMA 1989)	1.5×10^{-3}	For pipelines < 20" diameter 20% rupture 80% leak
San Francisco Bay to Stockton Phase III Navigation Channel Project	1.0×10^{-3}	For new pipelines 6-12 inches 30% rupture

FEIR/EIS (USACOE 1998)		70% leaks
Guidance Protocol for School Site Pipeline Risk Analysis (CDE 2007)	1.3×10^{-3}	All refined product pipelines 20% rupture 80% leak
SFPP Concord-Sacramento Pipeline DEIR (Aspen 2003)	2.88×10^{-3}	For new product pipelines
California Hazardous Liquid Pipeline Risk Assessment (CSFM 1993)	4.55×10^{-3} 9.7×10^{-4}	For product pipelines For pipelines constructed after 1980

As can be seen from Table 6, the probability of pipeline incidents on pipelines constructed after 1980 ranges from a low of 9.7×10^{-4} per mile per year (CSFM 1993) to a high of 2.88×10^{-3} per mile per year (Aspen 2003).

Aspen (2003) studied a pipeline similar to the proposed Wickland pipeline. Although Aspen (2003) adopted a more conservative pipeline incident frequency for new pipelines than the frequency reported in CSFM (1993), the raw data included in the latter mentioned document formed the basis for establishing the more conservative number. It was concluded in Aspen (2003) that California State Fire Marshall data were the most appropriate to use for estimating pipeline incidents for the following reasons:

- The CSFM (1993) data is the only completely audited, recent, relatively large data sample available. A team of field technicians visited the operational sites of every regulated pipeline operator within California. The team spent between one and five days at each site reviewing insurance records, release records, pipeline inventory data, drawings, internal incident reports, etc. and interviewing operator personnel. Using this approach allowed the team to collect data for very small releases, which were not reportable during the 1980s.

- The pipelines included in CSFM (1993) are representative of the proposed pipeline system (e.g., similar diameter, all hazardous liquid lines, variable terrain, all steel, etc.). Specifically, this study included 7,800 miles of interstate and intrastate regulated hazardous liquid pipelines. The length weighted mean pipe diameter of these lines was 12.3 inches. Approximately 43% of the pipeline mileage carried crude oil, 50% carried refined petroleum products, and 7% carried other hazardous liquids. (This study did not include crude oil flow lines, gathering lines, etc.)

- The study included a statistical analysis of the pipe contents (crude oil, refined petroleum projects, highly volatile liquids, or other) effects on the likelihood of an unintentional release. Specifically, crude oil lines were found to raise the possibility of an unintentional release caused by external corrosion. However, the study found that this was primarily a result of higher operating temperatures and pipe age, not the direct result of the pipe contents. These results have been incorporated into the analyses performed in this document.

- The CSFM (1993) data included a complete pipeline inventory and unintentional release data with many parameters. As a result, it allowed the authors to investigate the effects of various operational and design considerations (e.g., operating temperature, period of construction, etc.). The conclusions drawn from CSFM (1993) are useful in assessing the risks associated with the existing and proposed pipeline system. CSFM (1993) identified the effects of several pipeline parameters on the overall incident rates. This data facilitated the development of the anticipated frequency of unintentional releases from the existing and proposed pipeline using actual pipeline construction and operational conditions.

- The reader should note that the frequencies of unintentional releases presented in CSFM (1993) are higher than those reported by other sources. The higher frequency is due to the inclusion of all releases, regardless of release volume. Other sources only include releases meeting certain criteria; they typically only include DOT reportable releases.

- Since CSFM (1993) included a complete pipeline inventory, including the actual length of pipe installed for each of several parameters (e.g., operating temperature, external coating, type of steel, operating pipe stresses as a function of the specified minimum pipe stress, etc.), the data enabled a very comprehensive statistical analysis. Multinomial logic regressions were performed to evaluate the probability of pipeline incidents considering each of these variables. Using these statistical results and other data, anticipated pipeline incident rates have been developed for this project.

- The CSFM (1993) study also included complete release volume distribution data. These data included releases smaller than those included in other sources. These data have been used to develop the predicted frequency of releases of various volumes.

- Although the CSFM (1993) data set is now over 10 years old, national and international data suggest that the frequency of unintentional releases and their causes have not changed appreciably since the study was conducted. Although there are slight annual variations, the frequencies of releases, injuries, and fatalities have remained essentially constant since 1990.

Based on CSFM (1993), Aspen (2003) derived a probability of pipeline incident of 2.88×10^{-3} per year per pipeline mile. It is felt that this pipeline incident estimate is both conservative when compared to the values in Table 6 and the most representative since the specific design features of the pipeline were considered in its derivation.

CSFM (1993) also looked at the sizes of pipeline releases and found that the median release volume was 5 bbls (210 gallons) and that 27% of the incidents resulted in releases of 1 bbl (42 gallons) or less. In keeping with Table 6, it has been assumed that 80% of pipeline incidents are leaks while 20% are ruptures.

A fire could result from a pipeline release and source of ignition. The risk of a Jet A fire is low because it has a low vapor pressure and high flash point and would not produce a vapor cloud with sufficient flammable vapor to become ignited away from the spill site itself. As presented in Table 2, the flash point of Jet A is at least 100°F, which means it would have to be heated to at least that temperature before it would produce enough vapor to become ignited. An ignition source inside the spill area could heat the fuel sufficiently to ignite it.

A fire could cause injury or death to people close to the site, and could also result in property damage. It is difficult to estimate the potential extent of human injury because there are so many factors affecting the size of a fire, primarily the size of the pool of Jet A on fire which is controlled by the size of the release and the surrounding terrain.

In order for a fire to occur, there would first have to be a pipeline release. Because a small release does not generally result in a product pool, it is not likely that a small release would result in a fire. However, a pipeline rupture could result in the creation of a large enough pool of Jet A that a fire could result. CDE (2007) estimates that the probability of a pipeline release of a non-gasoline refined product becoming ignited is 3%.

Hence, the expected frequencies of a leak, rupture, and fire for the proposed pipeline are presented in Table 7, as is the frequency classification. The probability of release of any size was calculated by multiplying the probability of release per pipeline mile per year (2.88×10^{-3}) by the total length of the pipeline (5 mi) which equals 0.014 ($1.4 \text{ X } 10^{-2}$). The probability of a leak was calculated by multiplying the probability of any size release by 0.80 (80%) and the probability of a rupture by multiplying by 0.2 (20%).

Table 7 Annual Probability of SNA Pipeline Incident

Incident Type	*Probability*	*Probability with Fire*
Leak (80% of all releases)	1.1 X 10^{-2} (once in 87 years) Occasional	0
Rupture (20% of all releases)	2.9 X 10^{-3} (once in 347 years) Unlikely	8.6 X 10^{-5} (once in 11,600 years) Rare
Any Size Release	1.4 X 10^{-2} (once in 72 years) Occasional	8.6 X 10^{-5} (once in 11,600 years) Rare

4.1.2.2 Size of Pipeline Releases

The proposed pipeline will be 12-inches in diameter and approximately 5 miles in length. Hence it will hold approximately 3,700 bbls (155,100 gallons) of Jet A. The pipeline follows a relatively flat profile with the high point being approximately 40 feet higher than the low point not counting the four locations where the pipeline is directionally drilled below the four drainage channels and Interstate 405. At these locations the pipeline is approximately 65 to 85 feet below the high spot.

If a leak occurs in a pipeline, there are two factors that affect how much product is released. The first is pumping loss, which is the amount that escapes before the pumps are shutdown and the block valves are closed. The second is drain down, which is the amount that drains out of the pipeline due to gravity and is affected by the elevation profile of the pipeline.

The amount of pumping loss would be dependent on whether or not the pipeline is actively delivering Jet A to the Airport. The pumps will only operate when fuel is being delivered. The pipeline will deliver fuel to the Airport approximately once per week. At current demand levels, it is anticipated that the pipeline will operate about 4 to 10 hours per delivery at a rate between 3,500 and 7,000 bph at pressures between 400 and 900 psi. The new pipeline will be operated using an automated SCADA and leak detection system and will comply with all federal, state and local operating and safety standards.

If a rupture were to occur during the maximum delivery rate of 7,000 bph, the SCADA would detect flow imbalance or pressure drop instantly and send a signal to stop pumps and close isolation valves. Assuming a 5 second signal travel time and a valve closure time of 45 seconds, the flow would cease in approximately 30 seconds. The approximate volume that would escape would be 58 bbls (2,436 gal). Note that the spill volume would be reduced when the flow rate is less than 7,000 bph. A leak would most likely take longer to detect when the pipeline is delivering fuel because there would be less of a pressure drop and flow imbalance. However, the amount of fuel that would leak would be less because the leak rate would be less. The actual amount released would be dependent on the hole-size and shape, and the operating pressure.

During non-delivery (idle) times, the pipeline is pumped up to 300 psi. The volume that can be lost due to pressure drop (300 psi to 0 psi) is approximately 5.1 bbls (214 gallons). It is possible that the leak would be detected visibly prior to the SCADA system detecting it. This would be the same whether the release was due to a leak or rupture.

The worst-case release would be due to a rupture during delivery operations. As shown above, the pumping loss could be as high as 58 bbls (2,436 gal). Once the pumps are stopped and the valves are shut, additional fuel could leak due to drain down. The amount that could drain out would be a function of the location of the release relative to the elevation profile of the pipeline. Because the pipeline elevation profile is relatively flat and because of the hydraulics of the pipeline, only a portion of the contents would be released in the event of a rupture. Based on the elevation profile of the pipeline, the longest section that could drain would be 7,800 ft. Although it is highly unlikely that complete drain down would ever occur, such an event would theoretically result in a release of 984 bbls (41,300 gal) of fuel. Thus, the worst-case release would be the pumping loss (58 bbl) plus the drain down (984 bbls), for a total of 1,042 bbl (43,760 gal) of fuel.

During the 10-year study period analyzed in CSFM (1993), the following release distribution data were identified and are worth noting:

- 27% of the incidents resulted in release volumes of one barrel (42 gallons) or less
- The median release volume was 5 barrels (210 gallons)
- 61% of the incidents resulted in release volumes of 10 barrels (420 gallons) or less
- 67% of the incidents resulted in release volumes of 25 barrels (1,050 gallons) or less
- 74% of the incidents resulted in release volumes of 50 barrels (2,100 gallons) or less
- 82% of the incidents resulted in release volumes of 100 barrels (4,200 gallons) or less
- 90% of the incidents resulted in release volumes of 650 barrels (27,300 gallons) or less.

As can be seen by the above CSFM (1993) data, over 90% of the incidents resulted in releases of less than 650 bbls.

Once a release is detected, the pumps will be shut down, valves closed, and operator notified. Wickland would then immediately respond to the release in accordance with its oil spill contingency plan. Personnel would be immediately deployed to locate the spill and begin response procedures. Appropriate agencies would be notified of the release. Upon locating the source of the release, one early action would be to block storm drain openings in an attempt to stop Jet A from entering the storm drain system. Other containment techniques would be utilized to protect sensitive areas and to allow the fuel to collect in pools so it can be collected using vacuum trucks. Sorbent materials will also be used as appropriate. There would be no major health impacts from a fuel release unless the fuel becomes ignited. As presented in Section 4.1.2.1, 80% of the pipeline releases are assumed to be leaks. As can be seen by the CSFM (1993) data presented above, over 80% of releases are less than 100 bbl. Thus, the probability of a leak is classified as occasional because the size would be less than 238 bbls and no fatalities or injuries would be expected. Hence the consequence would be classified as minor and, according to the risk matrix (Figure 1), the risk would be less than significant.

Based on the above data, the expected frequency of a worst-case release (1,042 bbls) would be in the major category (between 238 bbls and 2,380 bbls) and would be classified as unlikely (see Figure 1). This would put the incident in the lightly shaded area (designated as “3” in Figure 1). An incident in this area would be considered significant in the absence of engineering and/or administrative controls, i.e., mitigated to the maximum extent feasible. In this case, Wickland has designed the pipeline system to the latest standards and has proposed extensive measures to both minimize the potential for accidents and to rapidly respond to and cleanup any releases that might occur (see Section 4.1, as well as the project mitigation measures listed in Appendix B). Hence, with these measures in place, a pipeline release would not be considered significant relative to its volume alone.

Such a spill would not be expected to cause any fatalities or injuries and as such, would be classified as has having minor consequences and therefore, not significant with respect to public safety (see Figure 1).

As stated above, the potential for a fire is 8.6 X 10^{-5} (once in 11,600 years) which would be classified as rare (Figure 1). The area that could be impacted by a fire would depend on the amount of fuel released and the size of the area on fire. Most often, as was done for the truck releases analyzed in County of Orange (2001), radiant heat vulnerable zones from a release with fire are analyzed assuming the release forms a circle. However, liquid pipeline releases under roadways that reach the surface are expected to form noncircular pools. CDE (2007) recommends modeling these types of releases as rectangles constrained by the width of the road. CDE (2007) also notes that liquid from such releases may also enter the storm drains, lessening the amount in the pool. It is also noted here that even though the area of a rectangular fire with one side considerably smaller than the other side, as would be the case in a roadway, may be the same as that of a circular fire, the radiant heat presented at a given location may be less because the fire is more spread out.

The roadway along the proposed pipeline route is generally between about 80 ft. and 100 ft. in width. Based on the topography of the roadway and the fact that there are curbs, it has been assumed that the worst-case release of 1,042 bbls (5,850 cubic ft) of fuel would spread to a depth of two inches. This would result in a pool size of 35,100 sq. ft. If this pool were to become ignited, the resulting radiant heat vulnerable zone would extend approximately 440 ft from the edge of the roadway. It is noted here that the CDE (2007) radiant heat hazard zones are based on the ALOHA model. This vulnerable zone should not cause any fatalities or major injuries.

As stated in Section 2, it is difficult to ignite Jet A due to its low volatility and high flash point. If it does become ignited, people located within the radiant heat hazard zone can begin experiencing second degree burns within 60 seconds of exposure. People will naturally move away from such heat. People inside buildings or located behind large structures will be shielded from the heat. It is possible that people walking near the roadway could sustain some level of burns. Appendix A presents a risk assessment of nearby schools and shows that the risk to them from the proposed pipeline would not be significant under the CDE (2007) methodology.

Because the expected frequency of a pipeline release with fire is categorized as rare and because no more than a few injuries would be expected (classified as major), the potential impact would be classified as not significant (Figure 1).

4.1.2.3 Risk from Connection Point

The connection point between the existing 16-inch Kinder Morgan pipeline and the new 12-inch pipeline will include a series of motor operated valves that will allow the SNA pipeline to be opened and the Kinder Morgan pipeline to be blocked so that jet fuel can be routed to the Airport. The motor operated valve on the Kinder Morgan 16-inch pipeline will be located in an underground vault. The motor operated valve on the SNA 12-inch pipeline will be installed near the connection point on an equipment skid with the following equipment: block valves, flow meter, meter prover, pig launcher, and pressure and temperature transmitters. The flow meter, temperature transmitter, and pressure transmitter will serve the dual purpose of custody transfer and leak detection. A small, rectangular drain down tank will be installed to allow for draining of equipment during maintenance activities. No fuel will be stored in the tank following the completion of maintenance work. The equipment skid will be located in a secure, fenced-in area.

Although the potential exists for releases at this location, these releases are expected to be small, resulting from valve or flange leaks or occurring during maintenance activities. Such leaks would remain contained. Once maintenance/repair work is completed, the drain down tank would be emptied and thus, no risk of leakage from the tank would remain. Such releases would not be considered significant because their severity is classified as minor.

4.2 Tank Farm

4.2.1 Construction

Figures 4 and 5 show the location and layout of the proposed tank farm. Tank farm construction operations have the potential to cause the following types of public safety/risk impacts:

- Traffic accidents caused by construction activities (this risk is addressed in the traffic analysis section of the environmental document)
- Releases of hazardous materials from construction equipment including refueling activities
- Damage to third party utilities
- Fires

Each is discussed below.

<u>Releases from Construction Equipment</u>

There are no storm drain inlets in the vicinity of the proposed new tank farm and hence, a release of a hazardous material during construction does not pose a threat to storm drains. All construction equipment will be confined to the vicinity of the tank farm on Airport property. A temporary equipment/supply storage area for tank farm and pipeline construction will be located on Airport property immediately east of the existing storage tanks. As described in Section 4.1.1, Wickland will develop a Construction Plan that will, among other things, specify that equipment refueling take place away from any water bodies. Prior to construction, Wickland will develop an emergency response plan, spill prevention plan, or similar document, as required by regulation. Also as described in Section 4.1.1, Wickland and the construction contractor will develop a Spill Prevention, Countermeasures, and Management Plan for the project and a Storm Water Pollution Prevention Plan (SWPPP).

Hazardous materials, which the contractor may bring on-site, include petroleum products, gasoline, hydraulic fluid, and diesel fuel. The material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances are described in Section 4.1.1.

As with pipeline construction, the amount of hazardous material that could be released during construction is limited to small amounts such as a fuel leak or lubrication release. A small release would not present a hazard to members of the public if responded to in a timely manner. With the myriad of regulations in place and measures proposed by Wickland, a construction equipment release is not considered to result in a significant public safety impact.

Figure 4 Location of Proposed Tank Farm

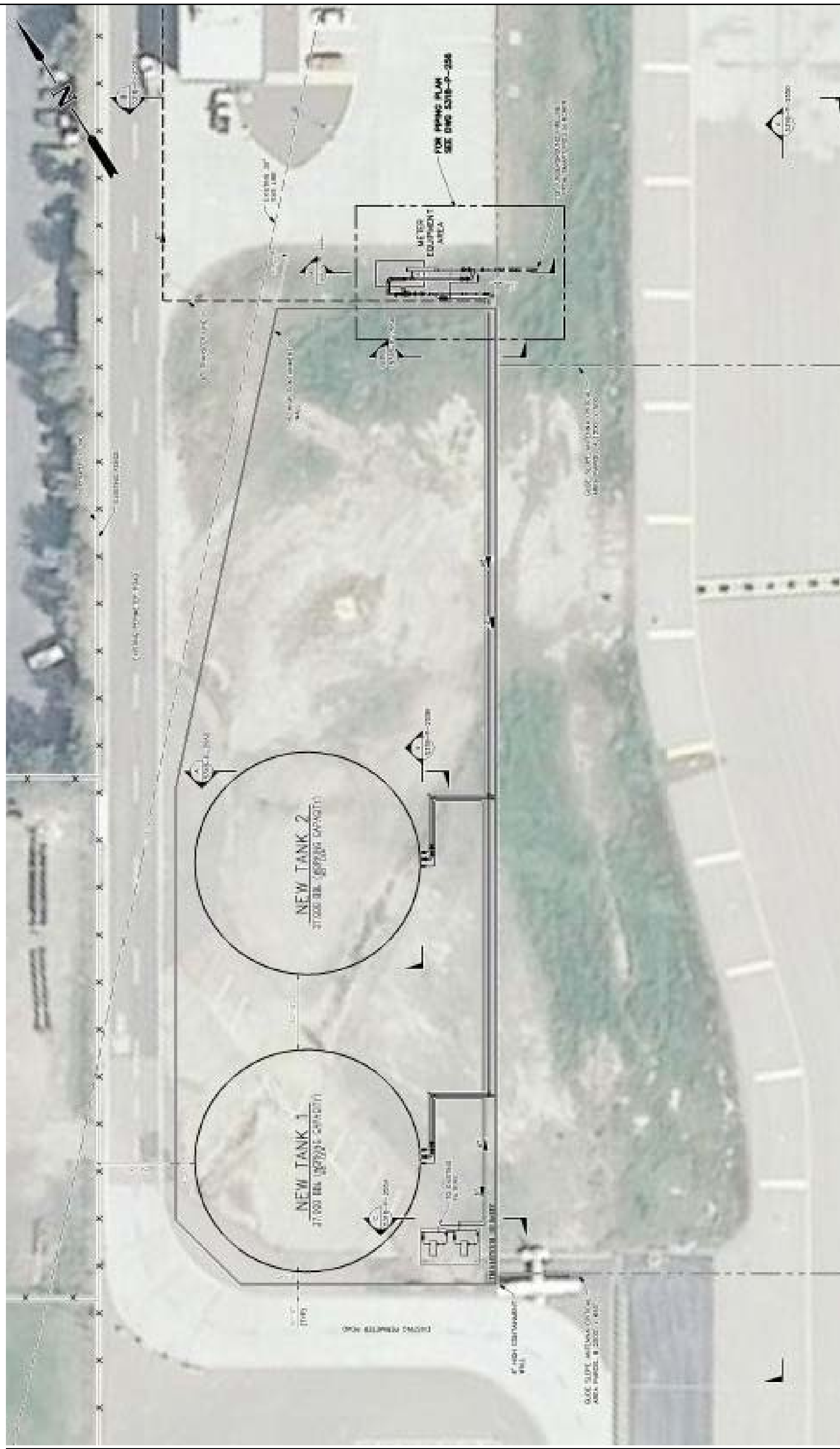

Figure 5 Layout of Proposed Tank Farm

Damage to Third Party Utilities

During excavation operations, there is a risk of personal injury or death (primarily construction worker), environmental contamination, and/or property damage which could be caused by the striking or severance of existing substructures (e.g., power cables, foreign pipelines). The proposed tank farm site is on airport property and Wickland will confer with airport personnel and use the “one call” system to identify any potential underground structures on the site. Thus, damage to third party utilities is not considered to result in a significant public safety impact.

Fires

Personal injury, death, or property damage can result from construction-caused fires. Fires can be caused by welding, grinding, vehicle exhausts, sparks, etc. Risk of fires is higher when construction takes place in undeveloped areas with dry vegetation along the route. The risk of fire for tank farm construction is minimal because the site is not an area with dry vegetation. Thus, the potential for a fire during construction is deemed to not be significant because the tank farm construction area does not constitute an area susceptible to fires.

4.2.2 Operation

Two proposed new 85 ft. diameter tanks, each with a shell capacity of 41,000 bbl (1,722,000 gal), will be constructed southwest of the existing tanks in a new containment area with six ft. high walls. In addition, ancillary equipment such as a redundant fuel delivery system will be added within the containment area. The existing tank farm will remain.

Although tank farms are designed, constructed, and operated under strict regulations, the potential for incidents involving releases or other incidents exist. This section addresses the potential for many types of possible incidents including jet fuel releases, fires, and explosions and then estimates the areas and resources that could potentially be impacted by such incidents. In order to minimize the potential for incidents, the tank farm is being designed with extensive safety features. These are summarized below.

- **Tank Foundations:** Tank foundations and retaining walls will be of concrete construction and designed per California Building Code and API 650 requirements.
- **Tank Construction:** The storage tanks will be of a cone roof design with internal floating roofs and double containment and leak detection.
- **Fire Protection:** All tanks will be equipped with automated foam protection systems and state of the art instrumentation, control and alarm systems. The Aircraft Rescue Firefighting (ARFF) station is located on the west side of the Airport in close proximity to the existing and new facilities.
- **Secondary Containment:** The storage tanks will be located within a lined 6-foot tall secondary containment wall. This wall and liner will provide the required containment plus freeboard for the new tanks.

- **Control Systems:** The control system described in Section 4.1.2 for the pipeline will also monitor and control the new tanks.

- **Cathodic Protection:** The proposed tanks will have cathodic protection as described in Section 4.1.2.

4.2.2.1 Probability of Tank Farm Incident

Potential tank farm incidents include release of some or all of a tank's contents, a tank or tank farm fire, and/or a tank explosion. The same methodology that was used by County of Orange (2001) to estimate the probability of an incident at the existing tank farm has been used for the proposed new tank farm (See Section 3.2). The potential risk from the existing tank farm will remain as shown in Section 3.2.

The following summarizes the County of Orange (2001) assumptions. The failure rate of a storage tank is 1.0×10^{-4} per tank-year with ten percent of the failures resulting in a loss of all the contents of the tank and 90 percent of the failures resulting in a release of ten percent of the contents of the tank.

Although not considered in County of Orange (2001), the probability that a release into the secondary containment area becomes ignited is conservatively estimated to be 10% for a tank failure (MBA 2008 and ADL 2000).

The probabilities of release and release with fire for the two proposed tanks are presented in Table 8. The probability of 10% of the tank contents being released is classified as unlikely while the probability of a release of the entire contents of a tank or a fire is classified as rare.

Table 8 Probabilities of Proposed Storage Facility Accidents

Spill Size	*Annual Probability of Spill*	*Expected Frequency between Spills*	*Annual Probability of Spill with Fire*	*Expected Frequency between Fires*
10% loss (126,000 gal)	1.8×10^{-4}	5,500 yrs	1.8×10^{-5}	55,500 yrs
100% loss (1,260,000 gal)	2.0×10^{-5}	50,000 yrs	2.0×10^{-6}	500,000 yrs
Any Size Loss	2.0×10^{-4}	5,000 yrs	2.0×10^{-5}	50,000 yrs

The ALOHA computer program has been used to estimate the size of the fire hazard vulnerable zones for the proposed tank farm. As presented in Section 3.2, the size of the fire vulnerable zones for both scenarios (release of entire contents of tank and 10 percent of the tank) are the same because the size of the hazard zone is based on the area on fire. The area of the secondary containment for the proposed new tank farm is approximately 53,100 ft^2. The size of the hazard vulnerable zone for a fire in this tank farm has been calculated to extend approximately 500 ft from the center of the containment area. As with the existing tank farm, this hazard zone would overlap parts of the airport taxiways to the east and industrial/office space to the west. No residential or other visitor serving areas would be overlapped. It is noted here that people located inside or behind buildings would be shielded from the radiant heat. At most, a few minor injuries could occur. In accordance with the risk matrix (Figure 1), a tank release with fire would not be considered to result in significant public safety impacts because the probability is classified as rare and the consequence as minor.

As explained in Sections 2 and 3.2, because the vapor pressure of Jet-A is very low and the flash point is above 100°F, a release from a tank into the secondary containment system area would not result in the formation of a vapor cloud capable of moving away from the release and becoming ignited (i.e., forming a flammable vapor cloud). In addition, because the proposed tanks will be equipped with floating roofs, there is no space for vapor to accumulate and thus, explosions are extremely unlikely.

Both the existing and proposed tanks would be present with the proposed project. Table 9 sums the probabilities of release and release with fire for the two storage areas.

Table 9 Probabilities of Combined Storage Facility Accidents

Spill Size	*Annual Probability of Spill*	*Expected Frequency between Spills*	*Annual Probability of Spill with Fire*	*Expected Frequency between Fires*
10% loss (126,000 gal)	4.5×10^{-4}	2,200 yrs	4.5×10^{-5}	22,200 yrs
100% loss (1,260,000 gal)	5.0×10^{-5}	50,000 yrs	5.0×10^{-6}	500,000 yrs
Any Size Loss	5.0×10^{-4}	2,000 yrs	5.0×10^{-5}	20,000 yrs

As discussed previously, exposure associated with accidental releases should not cause anything more than slight irritation to the eyes and nose. Hence, the only hazard zone calculated and presented for the proposed tank farm is that of a fire hazard.

Based on the expected frequency of a storage tank accident and the potential consequences should an accident occur, it is concluded that storage tank accidents do not result in significant adverse impacts to public health and safety.

4.3 Aircraft Related Bulk Fuel Storage Facility Accidents

The potential impact of aircraft operations at John Wayne Airport impacting the proposed tank storage facility has been assessed using data from the California Airport Land Use Handbook (Caltrans, 2011). This same methodology was used to determine the potential impact to the existing tank storage facility in Section 3.3.

The proposed bulk jet fuel storage facility is located in the airport and encompasses approximately 56,670 sq. ft. The eastern wall of tank farm is located approximately 560 ft. from Runway 19R-1L and 1,075 ft. from Runway 19L-1L. The south side of the tank farm is located approximately 1,220 ft. south of the north end of both runways. The number of aircraft operations by type was updated to 2011 (OCair.com, 2012) and is presented below. An operation is a landing or a takeoff and hence it has been assumed that half the operations are landings and half are takeoffs.

- Commercial 79,658
- Commuter 3,188
- General Aviation 169,870
- TOTAL 252,716

Virtually all operations at the airport involve a north to south traffic pattern. Thus, the potential for takeoff accidents have been eliminated from consideration because these types of accidents, should they occur, would be located down the runway to the south of the existing tank farm. Hence, only landing accidents have been considered in this analysis. This assumption is consistent with County of Orange (2001).

The 1980 through 1998 landing accident rate for the John Wayne Airport has been taken from Table 13 of Appendix M of County of Orange (2000) and is presented below. This same data was used by County of Orange (2001). Updated John Wayne Airport aircraft accident data is not available.

- Commercial 2.80 x 10-6
- Commuter 0
- General Aviation 1.88 x 10-6

The following equation has been used to calculate the probability of an aircraft landing impacting the proposed storage facility for each aircraft type landing at each of the two runways.

P = (NO / 2) * LAR * PANR * PSA * PAAR * PATFR * PORW *(ATF / ARWLZ) where:

- NO = the number of aircraft operations. The numbers for each aircraft type are listed above. (These numbers are divided by two to get the number of landings).
- LAR = landing accident rate. The accident rates for each aircraft type are listed above.
- PANR = percent of accidents that occur on or immediately adjacent to the runway. According to Appendix E of Caltrans (2011), 72% of the general aviation landing accidents and 64% of commercial and commuter landing accidents take place on or immediately adjacent to the runway.
- PSA = percent of accidents that are serious or fatal. Sources indicate that these accidents are only serious or fatal 5% (Appendix M of County of Orange (2000)) to 11% (Appendix E of Caltrans (2011)) of the time. These values have been averaged and this averaged rate of 8% has been used in this analysis.
- PAAR = percent of landing operations that occur within the first 1,640 ft of the runway. As noted earlier, the southern boundary of the existing tank farm is located approximately 1,220 ft. south of the north end of both runways. According to Appendix E of Caltrans (2011), 24% of landing accidents occur within the zone.
- PATFR = percent of accidents that occur within a distance that would impact the tank farm. This is referred to as the runway lateral zone. According to Appendix E to Caltrans (2011), about 4.5% of airport landing accidents occur in areas located between 492’ and 820’ from runway center lines. The existing tank farm is located on the western side of Runway 19R, approximately 560 ft to 715 ft back from the runway centerline. Thus, because the tank farm is located in this lateral area, it has a lateral landing accident exposure from Runway 19R of about 2.25%. (The percentage is half of 4.5% in recognition of the fact that a runway has two lateral

sides.) According to Appendix E of Caltrans (2011), about 5.5% of airport landing accidents occur in areas located between 984' and 1,312' from runway center lines. The existing tank farm is located west of Runway 19L (the shorter runway), about 1,220 to 1,220 ft back from the runway centerline. Accordingly, because the tank farm is located in this lateral area, it has a lateral landing accident exposure from Runway 19L of about 2.75%. (Again, the percentage is halved to take into account the fact that a runway has two lateral sides.)

- PORW = percent of total landings that occur on each runway by type of aircraft. According to airport personnel, 100% of commercial aircraft landings take place on Runway 19R, commuter landings are split evenly between the two runways, and general aviations landings are split with 25% on Runway 19R and 75% on Runway 19L.

- ATF = area of the existing tank farm. This has been calculated to be 56,670 sq. ft.

- ARWLZ – area of the runway lateral zone (see PATFR above). The lateral runway zone within which the existing tank farm is located is 1,640 ft long (see PAAR, above), and 328 ft wide (see PATFR above [830-492 = 328] and [1,312– 984 = 328]). This zone has an area of 537,920 sq. ft. ATF/ARWLZ is the percent of area of the existing tank farm to the total area of the landing zone.

Table 10 summarizes the data used in the analysis and the results for each aircraft type and the total risk to the proposed tank farm. The total risk from all aircraft types was calculated to be 9.8 x 10^{-6} or once every 102,000 years. This is classified as rare according to the current risk matrix (Figure 1). . The tanks, especially when containing liquid, are rigid and capable of withstanding a substantial impact. They could most likely withstand the impact of most smaller general aviation aircraft without rupturing. However, a commercial aircraft would most likely result in substantial damage to the tank resulting in a release with fire. To estimate the probability of a fire from an aircraft impact, it has been estimated that all impacts by a commercial or commuter aircraft would result in a fire while 25% of impacts by a general aviation aircraft would result in a fire. Thus, the probability of an ensuing fire is estimated to be 50%. Hence, the probability of aircraft impact with ensuing fire is estimated to be 4.9 x 10^{-6} or once every 204,000 years. This is also classified as rare according to the current risk matrix (Figure 1).

The combined probability of an aircraft impacting one of the two tank storage areas (existing or proposed) would be 1.3 x 10^{-5} or once every 77,000 years. This would still be classified as rare. The probability of an aircraft impact with ensuing fire is estimated to be 6.5 x 10^{-6} or once every 154,00 years. This is also classified as rare according to the current risk matrix (Figure 1).

Table 10 Probability of Aircraft Operation Impacting Proposed Tank Farm

Aircraft Type	*NO*	*LAR*	*PANR*	*PSA*	*PAAR*	*Runway*	*PATFR*	*PORW*	*ARWLZ*	*P*
Commercial	79,658	2.8 x 10^{-6}	0.64	0.08	0.24	19R	0.0225	1	537,920	3.2 x 10^{-6}
						19L	0.0275	0	537,920	0
Commuter	3,188	0	0.64	0.08	0.24	19R	0.0225	0.5	537,920	0
						19L	0.0275	0.5	537,920	0
Gen Aviation	169,870	1.88 x 10^{-6}	0.77	0.08	0.24	19R	0.0225	0.25	537,920	1.4 x 10^{-6}

						19L	0.0275	0.75	537,920	5.1×10^{-6}
Total										**9.8×10^{-6}**

The consequences of such an accident would be dependent on many factors, including the type of aircraft involved. If the secondary containment walls are not breached, the consequence of the fire would be the same as that presented for a tank farm fire (see Section4.2). If the tank is ruptured and a wall is breached, then the jet fuel could escape and spread into the surrounding area. According to the risk matrix (Figure 1), an accident classified as rare is acceptable as proposed if its resulting consequence is major or less. If the resulting consequence is severe or catastrophic, the risk is still classified as acceptable if the project is equipped with engineering and/or administrative controls. In this case, as evidenced by Appendix B, such controls have been imposed to the maximum extent feasible in the form of project mitigation measures. With these measures in place, this risk is classifiable as less than significant.

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Appendix A

School Risk Analysis

A.1 Introduction

The proposed pipeline route passes near the Heritage Elementary School/Sycamore High School located at 15400 Lansdowne Rd. The Village of Hope, a homeless shelter, is located near the school at 1 Hope Dr. Another school, the AG Currie Middle School, is located at 1402 Sycamore Avenue, approximately 800 ft. from the proposed pipeline route. There are no schools located near the proposed tank farm. The California Department of Education (CDE) has developed the Guidance Protocol for School Site Pipeline Risk Analysis (CDE 2007). The CDE School Facilities Planning Division (SFPD) has established standards for use by Local Educational Agencies (LEAs) (i.e., school districts, county offices of education and charter school entities) in the selection of safe and educationally appropriate school sites (authority per Education Code section 17251). These standards have been adopted by the State Board of Education in the California Code of Regulations Title 5, Section 14010 – Standards for School Site Selection. Both locally funded and state funded new school sites, and land expansions of existing sites, must comply with these standards as well as other requirements not described herein. CDE also requires that when seeking approval for new construction or modernization plans on existing school sites, LEAs certify that the project will not create nor substantially exacerbate an existing safety hazard, including those listed in Title 5 related to pipelines. In such cases, LEAs may also choose to follow the Protocol guidance in determining whether such certification is warranted.

While technically this process does not apply to this project because it does not involve the siting of a new school or the expansion of an existing school, the process/methodology has been applied here as part of the CEQA process in determining if the proposed pipeline project would have a significant impact on an existing school.

A.2 Purpose and Scope

The purpose of this analysis is to determine whether the proposed project could pose an unacceptable safety hazard to existing schools located along the pipeline route. As stated above, there are no schools located near the proposed tank farm.

The CDE Protocol presents a three-stage approach for conducting a risk analysis. Stage 1 is a relative screening analysis that will indicate whether a school site meets pre-defined risk criteria based on certain characteristics of commonly encountered pipeline and site situations. If a proposed site does not meet the Stage 1 requirements, then a more detailed Stage 2 risk analysis is required. The Stage 2 process requires more site-specific data. The CDE Protocol contains necessary consequence graphs and failure rate data tables that can be used to estimate the risk for a school site. An Individual Risk Criterion is provided for evaluating the quantitative analysis results. Under certain conditions, a Stage 3 analysis might be required for a school site. A Stage 3 analysis applies for circumstances not covered in this Protocol, which include special situations of site topography, unusual configurations of the pipeline or school site, or the specific product being transported in the pipeline. A Stage 3 assessment is needed for special complex pipeline scenarios that are beyond the scope of the scenarios analyzed in the CDE Protocol.

Because there are known schools located within 1,500 ft of the proposed jet fuel pipeline, a Stage 1 analysis is not appropriate. Because there are no unusual circumstances requiring a Stage 3 analysis, a

Stage 2 analysis has been conducted. Because it is possible that not all schools located along the pipeline have been identified or that other schools that may have been proposed along the pipeline route have not been identified, the Stage 2 analysis has been conducted on a non- existent generic school located directly adjacent (worst-case assumption) to the pipeline.

The Stage 2 analysis uses a standard calculation Protocol and default data contained within the CDE protocol to arrive at a numerical estimate for Individual Risk (IR). The IR value is the probability of fatality of an exposed individual at a specified receptor location. CDE specifies an IR maximum criterion of 1.0 $x10^{-6}$ (one in a million) at the center of the property line nearest the pipeline. This is the most exposed individual at the school site. If the IR is calculated to be less than 1.0 $x10^{-6}$ (one in a million), then the risk is determined to be acceptable.

A.3 Analysis and Results

The Protocol exams the following six potential hazards from a liquid pipeline accident:

- Flash fire from a leak (LFF)
- Flash fire from a rupture (RFF)
- Explosion from a leak (LEX)
- Explosion from a rupture (REX)
- Pool fire from a leak (LPF)
- Pool fire from a rupture (RPF)

The Protocol determined the distance to the 1% mortality rate for each of the potential hazards. This distance is labeled RX. Thus, in the tables below RX(RPF) is the hazard distance from a rupture pool fire. Because jet fuel has a low vapor pressure and a high flash point, a release would not produce enough vapor to form a vapor cloud which could drift away from the release location. Hence, flash fires are not possible. Likewise, because a vapor cloud would not be produced, explosions are not possible. Also, it has been determined that pool fires from leaks have an extremely low probability because in most cases the product will not reach the surface and hence, the probability is assumed to be 0. Thus, the only potential hazard to a school is the radiant heat from a pool fire created by a rupture.

The length of the pipeline that could impact the nearest point of the school site from an incident is labeled XSEG. Thus, in the tables below XSEG(RPF) is the length of pipeline where a pool fire from a rupture could impact the school site. Figure 1 illustrates this concept.

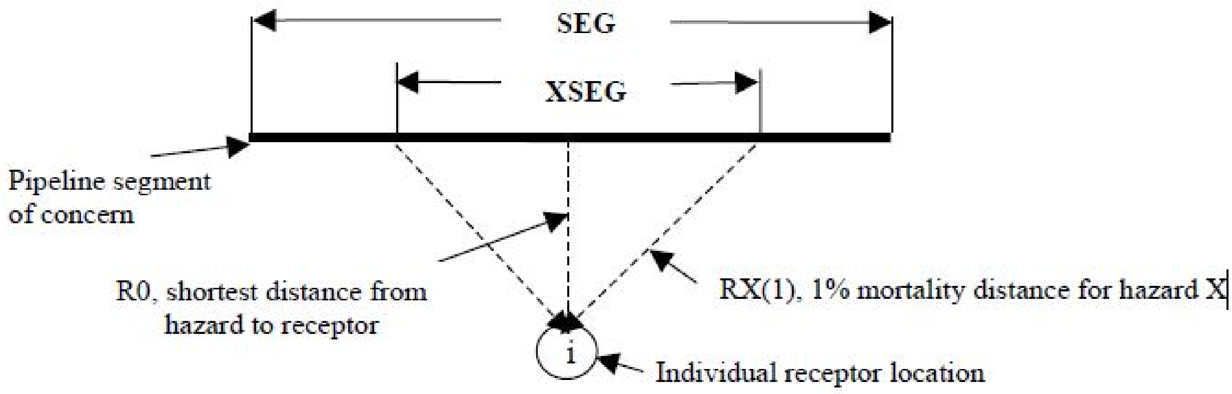

Figure 1 Basis for XSEG Determination

The other variables used in the analysis are defined as follows:

- RO = shortest distance from pipeline to receptor (In this case, to be conservative, it has been assumed that the generic school is adjacent to the pipeline and therefore, R0 = 0)
- FO = the average release frequency for the pipeline in releases/mi-year
- PO = the annual release probability for the pipeline (For small frequency numbers, PO = FO)
- PAF = probability adjustment factor (No adjustment is required for this analysis)
- PA = adjusted base probability (In this case PA = PO = FO)
- IR = Individual risk

Table 1 contains the conditional probabilities to be used in the analysis suggested by the CDE Protocol.

Table 1 Conditional Probabilities

Conditional Probability of Occurrence Associated with a Jet Fuel Release	Variable Designation	Liquid Pipeline Value
Probability of leak	PC(L)	0.8
Probability of rupture	PC(R)	0.2
Probability of or pool fire (liquid pipelines)	PC(PF)	.03
Probability of occupancy	PC(OCC)	0.16
Probability of outdoor exposure	PC(OUT)	0.25

The next step in the analysis is to calculate the length of the pipeline segment (XSEG) that can produce a rupture with subsequent pool fire that can impact someone at the generic school. The worst-case release would be due to a rupture during delivery operations.

The maximum pumping loss has been calculated to be 58 bbls (2,436 gal). Once the pumps are stopped and the valves are shut, additional fuel could leak due to drain down. The amount that could drain out would be a function of the location of the release relative to the elevation profile of the pipeline. Because the pipeline elevation profile is relatively flat and because of the hydraulics of the pipeline, only a portion of the contents would be released in the event of a rupture. Based on the elevation profile of the pipeline, the longest section that could drain would be 7,800 ft. This would result in a worst-case drain down release of 984 bbls (41,300 gal) of fuel. In actuality, as explained in the John Wayne Airport Jet Fuel Pipeline Project Risk Analysis to which this appendix is attached, the probability of such a worst-case drain down is extremely remote. Nevertheless, to be conservative, the maximum drain down volume theoretically possible has been used in this analysis.

Based on the above, the worst-case release would be the sum of the pumping loss (58 bbl) and the maximum theoretical drain down loss (984 bbls) resulting from a rupture of the pipeline, for a total of 1,042 bbl (43,760 gal) of fuel.

The roadways along the proposed pipeline route are generally between about 80 ft. and 100 ft. in width. Based on the topography of the roadways and the fact that there are curbs, it has been assumed that the worst-case release of 1,042 bbls (5,850 cubic ft) of fuel would spread to a depth of two inches. This would result in a pool size of 35,100 sq. ft. To be extremely conservative, this area has been equated to a circular area with a diameter of 210 ft. As stated previously, a pool fire produces radiant heat or heat flux. Figure 4-4 from CDE (2007), shown here as Figure 2, shows the estimated mortality from exposure to fire heat radiation. At an exposure level of 5,000 Btu/hr-ft^2, a mortality rate of 1% is expected while 100% mortality is expected for exposure to 12,000 Btu/hr-ft^2. To be extremely conservative for this analysis, it has been assumed that there would be 100% mortality for exposure not only to the 12,000 Btu/hr-ft^2 but also to the 5,000 Btu/hr-ft^2, while exposure to a lower level would not cause any fatalities.

Figure 4-20 from the CDE Protocol (shown here as Figure 3) was then used to determine the pool fire radiation impact distance to 5,000 Btu/hr-ft^2 from a fire with a diameter of 210 ft. This distance was determined to be 440 ft.

Next, the IR has been calculated using the following formula:

IR = PA x XSEG(RPF) / 5,280 PC(R) x PC(R) x PC(PF) x PC(OCC) x PC(OUT) where:

- IR is the Individual Risk
- PA is the adjusted base annual probability of pipeline release per mile. The PA value for product pipelines recommended by the CDE Protocol is 1.3 x 10^{-3} releases per pipeline mile per year. The environmental risk analysis assumed a more conservative value of 2.88 x 10^{-3}. The more conservative value of 2.88 x 10^{-3} has been used in this analysis.
- XSEG(RPF) is the length of the pipeline that could impact the nearest point of the school site from a rupture with pool fire. Since the nearest point of the school site is adjacent to the pipeline, XSEG(RPF) would be equal to two times the pool fire radiation impact distance to 5,000 Btu/hr-ft^2 which equals 2 x 440 ft = 880 ft. Note that XSEG(RPF) is divided by 5,280 ft/mile to convert the distance to miles because PA is in releases per mile.
- PC(R) is the probability of a pipeline rupture given there is a release. CDE estimates this probability as 0.2.
- PC(PF) is the probability of ignition of the pool. The PC(PF) value for product pipelines recommended by the CDE Protocol is 0.03.

- PC(OCC) is the probability of school occupancy in any given year. This is estimated for an individual campus for the average individual. A default values for this parameter has been estimated by CDE based on occupancy for 180 days per year, 8 hours per day which equals 0.16.
- PC(OUT) is the probability that an individual is outdoors. CDE has estimated this value as 0.04 based on the assumption that an individual is outdoors 2 hours per 8 hour day.

Hence IR = $(2.88 \times 10^{-3}) \times (880/5{,}280) \times 0.2 \times 0.03 \times 0.16 \times 0.25 = 2.2 \times 10^{-7}$.

This above stated IR equates to a ratio of approximately one in 4.55 million, and is well below the threshold value of 1.0×10^{-6} (one in one million) established in CDE 2007. Thus, the risk is deemed to be acceptable for school siting purposes. By analogy, this also demonstrates that the impacts discussed in this analysis are less than significant.

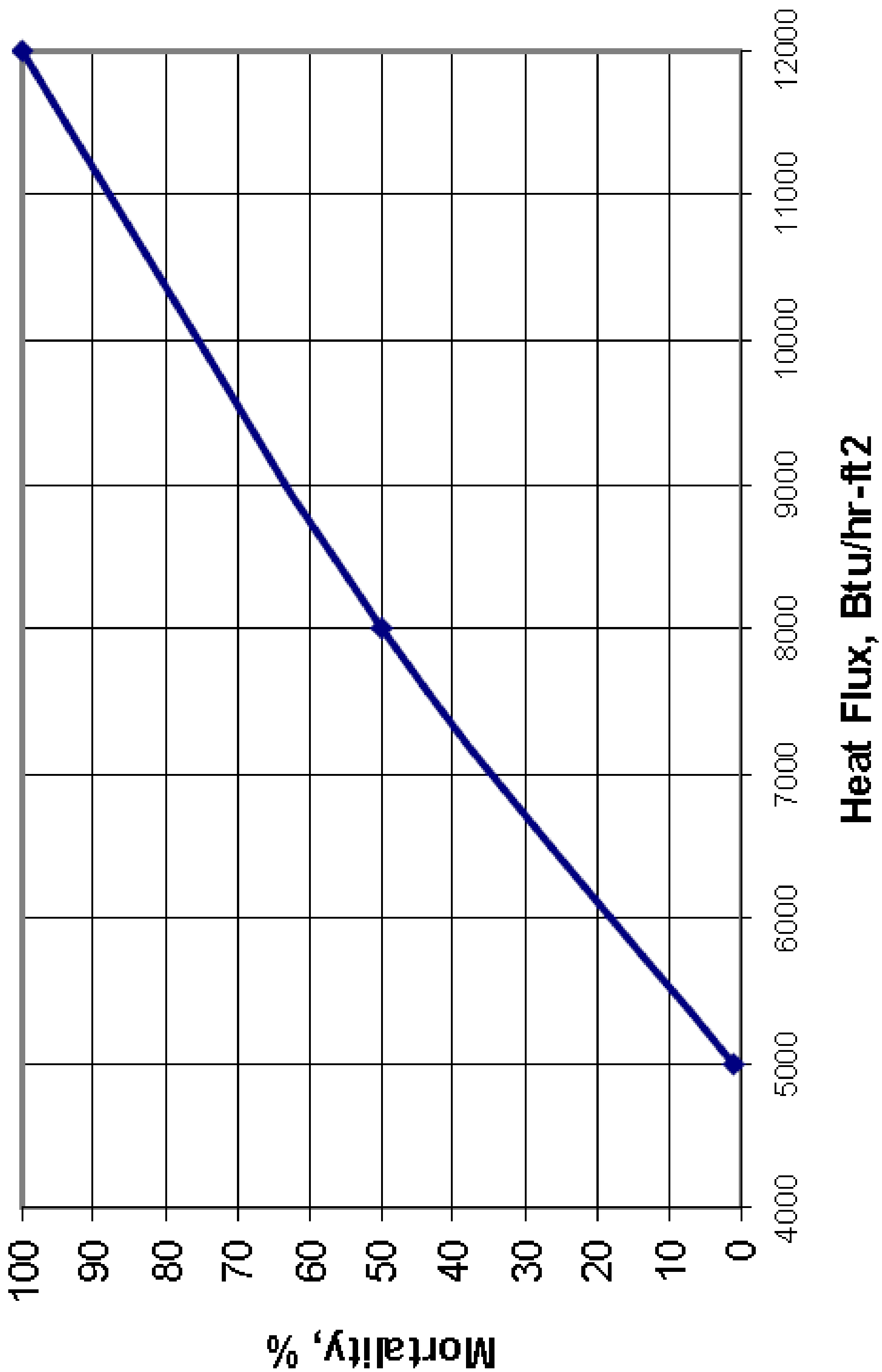

Figure 2 Estimated Mortality vs. Fire Heat Radiation Intensity

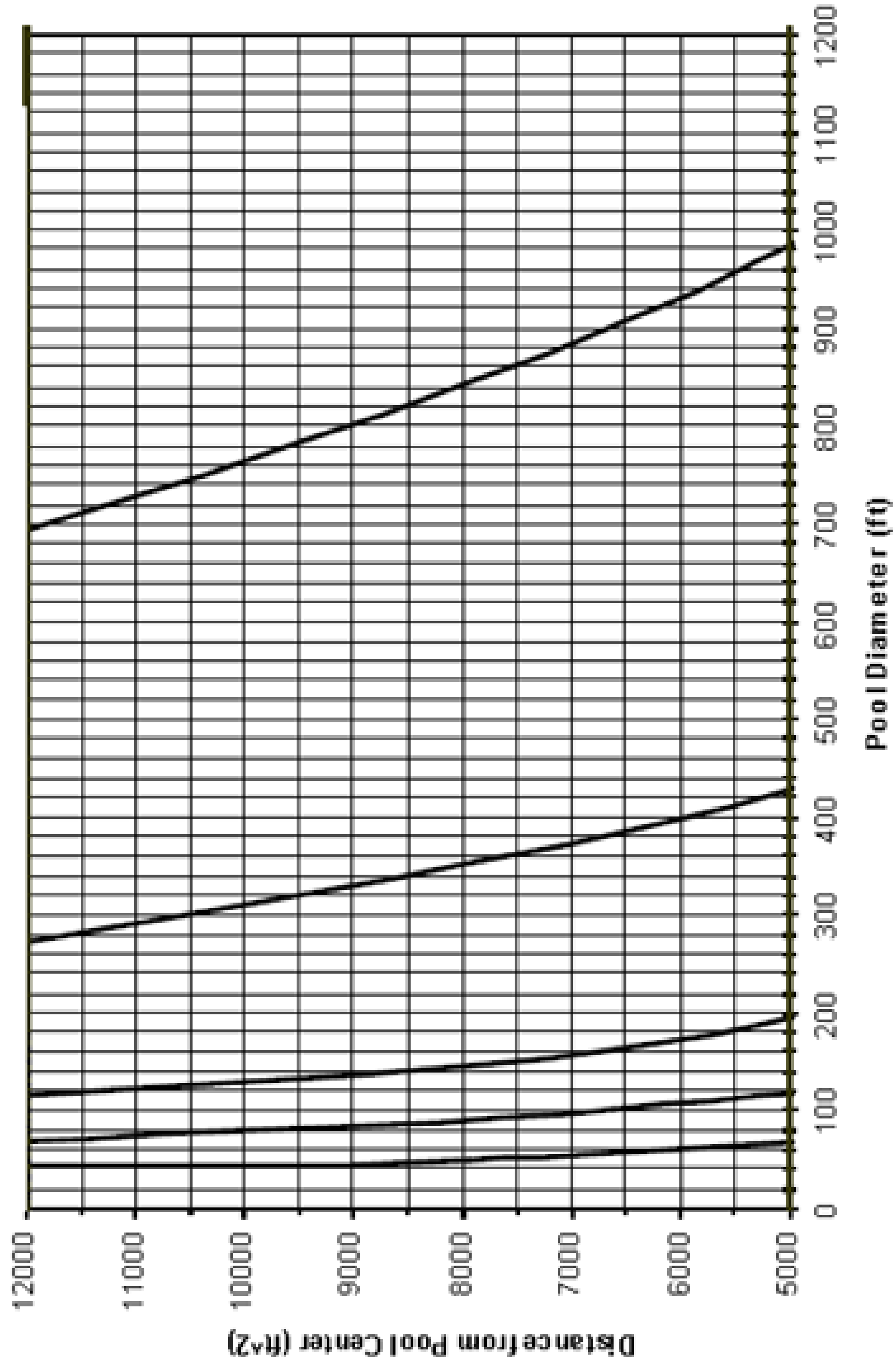

Figure 3 Liquid Release Pool Fire Heat Radiation Impact Distance

Appendix B

Engineering and Administrative Controls

Engineering and Administrative Controls

Project Design Features

The proposed project includes a number of specific project design features that are intended to reduce the potential impacts associated with Hazards and Hazardous Materials. In addition to the components discussed in the Project Description for this Initial Study, the following specific project design features will be included in the Mitigation Monitoring Plan (MMP), and will be enforceable as mitigation measures during construction and operation of the project.

- The new jet fuel tanks shall be located within the John Wayne Airport Environs Land Use Plan's (AELUP) Safety Compatibility Zone 5 (Sideline Zone). Aboveground storage tanks such as the jet fuel tanks that are proposed are uses that are allowed in the Sideline Zone.

- Prior to operations, an above ground storage leak detection system plan shall be prepared in accordance with all local, state, and federal requirements The proposed above ground storage tanks shall have a double containment leak detection system.

- Prior to construction, the applicant shall apply for and receive all required FAA approvals of improvements at the tank farm.

- The tank farm shall be manned 24-hours a day with technicians trained to respond to emergencies.

- During project construction, all welding shall be performed by qualified welders in accordance with API 650, API 1104 (Standard for Welding. Pipe Lines and Related Facilities) and Wickland specifications. One hundred percent of the pipeline welds shall be radiographically inspected, exceeding the 10 percent inspection requirement found in CFR Title 49, Part 195 (49 CFR Part 195).

- Tanks will be constructed with solid cone roofs. No external floating roof tanks shall be included in the tank farm design..

- The tanks shall be equipped with an internal floating roof with South Coast Air Quality Management District's (SCAQMD) approved seals and all other SCAQMD control requirements.

- In conformity with all applicable FAA requirements, a red obstruction lighting system shall be installed in the new tank farm.

- An emergency fire foam system shall be installed in accordance with NFPA-11, and shall include dedicated lines tied to each storage tank. The foam shall be delivered to four foam chambers mounted on each tank's rim. In addition, separate foam monitors that are capable of being directed at any burning object within the tank farm will be installed.

- Prior to construction a Fire Protection System Technical Report shall be prepared that shall discuss, at a minimum, all firefighting control systems, fire water supply, and station layout in compliance with the 2010 California State Fire Code. The report shall be approved by the Orange County Fire Department.

- The tank farm secondary containment area shall be designed to hold the contents of the largest tank in the event of a catastrophic tank failure. Although 40 CFR 112 requires only that the containment be able to hold the liquid for a short time period the proposed tank farm containment area shall be secondarily lined with a geo-membrane fabric that is designed to prohibit leakage into the subsurface. The geo-membranes shall be compatible with jet fuel and have been tested in constant contact with Jet A with no damage or loss of strength.

- The tanks shall be painted with a non-reflective paint to minimize glare.

- All jet fuel main line piping shall exceed the industry standard pipeline thickness of .250-inches by 50%. This shall result in a minimum pipeline thickness of .375-inches.

- All new underground jet fuel mainline piping shall have a minimum of 4-feet of cover above the pipe.

- The jet fuel line shall be equipped with motor operated valves to quickly close flow in the event of an emergency.

- The new tanks and pipeline shall include an emergency shutdown system of hardwired ESD pushbutton switches. The ESD system will shut down pipeline deliveries by closing the motor operated valves and isolating the pipeline and the storage tanks from each other. ESD controls shall also be available on all SCADA interface screens.

- The tanks shall be provided with a level gauging system that provides constant readout and monitoring by the SCADA system. A high level alarm shall be activated if the tank level exceeds the normal operating level. A “High-High” level along with a redundant “High-High” level switch will activate an additional alarm on the SCADA system and automatically close the incoming valve to prevent an overfill of the storage tanks.

- The storage tanks shall be provided with a fixed roof to conform to environmental requirements which will reduce the chance of ignition in the case of a lightning strike. The floating roof rim seals shall have electrical shunts at the seal space to further reduce the chance of ignition in the case of a lightning strike.

- A “hot work” permit system shall be used at the storage tank facility. This system will regulate welding and any open flames. Smoking shall absolutely be prohibited except in designated safe smoking areas.

- Equipment shall be designed and inspected in accordance with API standards, regulatory codes and nationally recognized engineering codes and standards. Storage tanks shall be inspected every five years in accordance with API-653, “Tank Inspection, Repair, Alteration and Reconstruction.” This inspection will identify if any modifications are required to the tank.

- The pipeline shall be coated with fusion bond epoxy (FBE) or similar pipe coating. In areas where the pipe is directionally drilled, a multi-part coating system will be employed consisting of fusion bond epoxy covered with a second abrasion-resistant layer of coating. Pipeline coating will typically be applied at a qualified coating facility before delivery to the construction site. However, field coating (heat shrink polyethylene sleeves) will be necessary on all field weld joints made at the site in order to provide a continuous coating along the pipeline. A detection test shall be conducted to locate any coating discontinuities that could permit moisture to reach the pipe, such as thinning, or other mechanical damage. All coated pipe, including field joints, fittings, and bends shall be tested and repaired as necessary, and before backfilling. The purpose of this coating is to minimize external corrosion.

- Cathodic protection is a technique used to control the corrosion of a metal surface. The entire portion of the underground pipeline shall have cathodic protection, which will include both FBE coating and a sacrificial magnesium anode system. Although the majority of piping will be above grade at the Airport, all buried piping and tank bottoms will also include cathodic protection. Insulating flanges will isolate the Kinder Morgan and existing Airport facilities from the Wickland pipeline and tank facilities.

- Hydrostatic testing (i.e., pressure testing) of the pipeline shall be performed after construction and before startup. Federal regulations (49 CFR Part 195) mandate hydrostatic testing of new petroleum pipelines before the line can be placed into operation.

- Hydrostatic testing shall be performed on all new tanks after construction. API 650 mandates hydrostatic testing of new tanks before tanks can be placed into operation.

- All required information, including pipeline location, shall be provided to Underground Service Alert of Southern California, a.k.a. DigAlert. DigAlert, is the One Call Notification Center that supports all of Southern California.

- To avoid third party damage to the pipeline during underground trenched construction, reflective marker warning tape will be installed approximately 2’ below the ground surface and 2’ above the pipeline along the entire pipeline alignment. The warning tape will be marked with “Caution Buried Pipeline.”

- Personnel assigned to the pipeline shall be required to respond to any segment of the pipeline within a few minutes of an alarm sounding. This will allow rapid response in the event of a pipeline emergency.

MITIGATION MEASURES:

- Prior to the start of construction the Construction Contractor shall ensure that all construction personnel attend an educational program regarding pipeline construction safety.

- Prior to commencement of operations, the applicant shall prepare an Injury and Illness Prevention Plan, and Hazard Communication Plan for the pipeline and related facilities and submit the plans to the County’s Environmental Principal Planner.

- Prior to the start of construction the applicant shall ensure that an Initial Site Assessment is prepared for the entire project area to identify potentially contaminated sites along the pipeline alignment which shall be screened for hazardous material contamination prior to beginning construction. If the potential for workers to encounter hazardous is identified, the applicant shall prepare and adhere to a plan for workers safety following all relevant OSHA requirements, and submit the plan to the County’s Environmental Principal Planner for approval.

- During all Project excavation activities, the contractor shall regularly inspect the exposed soil for visual evidence of contamination. If visual contamination indicators are identified during excavation or grading activities, all work shall stop, and an investigation shall be designed and performed by a qualified environmental consultant to verify the presence and extent of contamination at the site. Results of the investigation shall be reviewed and approved by the Orange County Environmental Health Division prior to the resumption of construction. The investigation shall include collecting samples for laboratory analysis and quantification of contaminant levels within the proposed excavation and surface disturbance areas. Subsurface investigation shall determine appropriate worker protection and hazardous material and disposal procedures appropriate for the subject site. Areas with contaminated soil and groundwater determined to be hazardous water shall be removed by personnel who have been trained through the OSHA-recommended 40 hour safety program (29 CFR 1910.120) with an approved plan for ground water extractions, soil excavation, control of contaminant releases to the air, and offsite transport or onsite treatment. A health and safety plan, prepared by a qualified and approved industrial hygienist, shall be used to protect the general public and all workers in the construction area.

- The pipeline shall include a computerized supervisory control and data acquisition ("SCADA") system with operational monitoring and control located at both the Kinder Morgan pipeline tie-in and Airport tank farm control room. The control system shall allow operators to open and close motor operated valves, to start transfer pumps, and to continuously monitor pipeline flow rates, pressures, temperatures, and equipment status. A key component to the SCADA system is ongoing leak detection through various methods. During pipeline deliveries, the SCADA system shall monitor the two meters located at each end of the pipeline and continuously compares the measured flow rates and flow volumes. If a discrepancy is detected, the SCADA system will produce an alarm and automatically shut down pipeline operations and close the pipeline isolation valves. During periods when the pipeline is not delivering, the SCADA system shall monitor pressure to alert operators should a dramatic drop in pipeline pressure occur. In addition to the ongoing leak detection provided by the SCADA system, the pipeline system shall be subject to a preventative maintenance program, including periodic pressure and cathodic protection testing, as well as internal "smart pig" corrosion inspections.

- The pipeline shall contain a pig launcher and pig receiver. This equipment is used to insert, launch and remove devices called "pigs" used for a variety of purposes, ranging from line cleaning to investigating the condition of the pipeline along the pipeline's entire length. The most sophisticated pigs are called "smart pigs". Smart pigs are an internal inspection device used to measure and analyze conditions along the pipeline's inner and outer walls. As it travels through the pipe, the smart pig electronically reads and records the slightest change in wall thickness, pinpointing problems before they become leaks. Although not required by regulation, Wickland shall run a smart pig through the new mainline pipeline within 120 days after system startup and thereafter as required by Federal and State regulations.

- Interior cross walls or berms shall be included in the tank farm secondary containment area design to create small cells so that in the event of a fire or release the area affected is limited in size and can be mitigated in a shorter period of time.

- The secondary containment walls shall be made of reinforced concrete. The secondary containment wall closest to the runway will be built to FHWA Testing Level 5 Standards per

NHCRP Report 350 and will be able to absorb the impact of vehicular airport traffic including typical general aviation planes.