CORNERSTONE EARTH GROUP

Type of Services	**Screening Level Vicinity Hazardous Materials Risk Appraisal Addendum**
Location	**Proposed Senior Housing Development** **Mission Falls Court** **Fremont, California**
Client	**East Warren Park LLC**
Client Address	**47289 Mission Falls Court** **Fremont, California 94539**
Project Number	**531-2-1**
Date	**July 30, 2013**

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EXECUTIVE SUMMARY

East Warren Park LLC., a fully owned subsidiary of the Mission Peak Company, owns an approximately 23.5 acre property located within the Mission Falls Court Business Park, off of the Warren Boulevard/Highway 880 exit (Site, Figure 1). The Site consists of 5.2 acres of vacant land and 18.3 acres of underutilized R & D buildings constructed during the 1980's. The City of Fremont placed the land and its surroundings areas into the Warren Boulevard General Plan Study Area as part of the City of Fremont General Plan update in 2011. The Study Area designation was adopted to allow for the analysis of the area for a future land use conversion to a retail and residential center.

Based on the City Council actions creating the Study Area, the East Warren Park LLC owners submitted a preliminary concept plan that would develop the 23.5 acre Site into a new, inclusive senior community. As a result of this submittal, the City of Fremont commissioned TRC Environmental Solutions, Inc. who completed the "Hazardous Materials Risk Assessment, Mission Falls Court Project Site, 47003, 47201, 47212, 47315 and 47320 Mission Falls Court, Fremont, California" dated March 9, 2012. The purpose of the report was to analyze potential hazardous materials conflicts with the Site's intended conversion to a residential use.

Historically the City of Fremont had a residential land use designation for all of the land east of the adjacent rail lines between Warren Blvd and Scott Creek Road. However, the land use designation was amended to Article 15: Restricted Industrial District (a very restricted designation due to the residential uses across Warm Springs Road) in 1980. As a result of this restricted designation, the majority of the surrounding office buildings are occupied by churches, educational operations, universities, storage and office uses.

The East Warren Park LLC owners engaged Cornerstone Earth Group to review, evaluate and update the March 9, 2012 Hazardous Risk Assessment authored by TRC Environmental Solutions. This Screening Level Vicinity Hazardous Materials Risk Appraisal Addendum presents the results of additional chemical review and release modeling performed for the Site.

Based on a March 2012 vicinity risk assessment prepared by TRC, several businesses and facilities were identified that used, stored or transported hazardous materials in the Site vicinity. The primary risks to Site occupants associated with hypothetical airborne releases of hazardous materials evaluated were from: 1) Seagate Technology Building A at 47050 Kato Road (chlorine gas); 2) a truck to rail transfer facility adjacent to the west (isopropanol); and, 3) petroleum products in a Chevron pipeline located within the railroad right-of-way to the west.

The truck to rail transfer facility was operated by Truck-Rail Handling (THR) adjacent to the west of the site at 610 Warren Avenue. Based on information provided by THR to Cornerstone during this risk appraisal, THR no longer handles hazardous materials at the adjacent rail spurs due to construction of the new Bay Area Rapid Transit (BART) tracks. Therefore, the adjacent rail to truck facility was eliminated as a potential concern for the Site.

The chlorine hypothetical release modeling indicates that potentially significant impacts could occur under a worst-case scenario. However, with respect to a worst-case scenario, exposure duration would be short (approximately 10 minutes). We would discount the potential significance of this release because of its short duration and because of building obstacles between the emitting location and the Site. The exterior concentrations would likely be lower than that projected by ALOHA. Chorine reportedly is used by Seagate in Building A in small amounts inside the facility, according to the available Hazardous Materials Business Plan for this facility. The alternative release scenario modeled indicated that a restricted flow orifice release (i.e. release through a broken valve stem) would not have a significant impact to the Site. A Seagate representative reported to Cornerstone that this material is located in a ventilated gas cabinet. Thus, a more likely release scenario would be an interior release, passively mitigated by the building. In addition, Seagate reported to Cornerstone that they are planning to relocate to a new facility approximately 2,100 feet south of the Site in two years, which will significantly reduce risk to the Site occupants from a hypothetical chlorine release.

For the Chevron Pipeline, release modeling indicates potentially significant impacts from both Worst-case and Alternative case releases. To help evaluate the likelihood of a pipeline failure (rupture) resulting in an explosion or fire, the probability of a release was estimated following the procedures provided by the California Department of Education (CDE, 2007). The CDE guidance was developed to estimate risks to school sites from pipeline rupture, and the guidance is applicable to other land uses, including residential. Probability estimates following the CDE guidance indicate the probability of a pipeline rupture resulting in an explosion as roughly one chance in ten million that this event will occur in any given year along the pipeline segment adjacent to the property. In addition, the probability of a fire resulting from a pipeline rupture is roughly three chances in one million that this event will occur in any given year adjacent to the site. Because the pipeline is used to transport a variety of petroleum products, some of which have significantly lower risk of explosion and fire (i.e. diesel), the risk from a pipeline rupture releasing gasoline is likely lower than these estimates. The risk of such releases should be considered to be within the acceptable range of risks (one chance in a million each year) which has been selected based on regulatory practice for the siting of industrial facilities with hazardous chemicals in the United States.

Within the past several years, numerous residential developments have been built in the Bay Area in close proximity to petroleum pipelines, including a development within Fremont approximately 1 ½ mile south of the Site. Therefore, construction of the proposed senior housing development appears consistent with local and regional project approvals by municipalities with respect to petroleum pipeline rupture risks.

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Type of Services	**Screening Level Vicinity Hazardous Materials Risk Appraisal Addendum**
Location	**Proposed Senior Housing Development Fremont, California**

SECTION 1: INTRODUCTION

1.1 BACKGROUND

East Warren Park LLC., a fully owned subsidiary of the Mission Peak Company, owns an approximately 23.5 acre property located within the Mission Falls Court Business Park, off of the Warren Boulevard/Highway 880 exit (Site, Figure 1). The Site consists of 5.2 acres of vacant land and 18.3 acres of underutilized R & D buildings constructed during the 1980's. The City of Fremont placed the land and its surroundings areas into the Warren Boulevard General Plan Study Area as part of the City of Fremont General Plan update in 2011. The Study Area designation was adopted to allow for the analysis of the area for a future land use conversion to a retail and residential center.

Based on the City Council actions creating the Study Area, the East Warren Park LLC owners submitted a preliminary concept plan that would develop the 23.5 acre Site into a new, inclusive senior community. As a result of this submittal, the City of Fremont commissioned TRC Environmental Solutions, Inc. who completed the "Hazardous Materials Risk Assessment, Mission Falls Court Project Site, 47003, 47201, 47212, 47315 and 47320 Mission Falls Court, Fremont, California" dated March 9, 2012. The purpose of the report was to analyze potential hazardous materials conflicts with the Site's intended conversion to a residential use.

Historically the City of Fremont had a residential land use designation for all of the land east of the adjacent rail lines between Warren Blvd and Scott Creek Road. However, the land use designation was amended to Article 15: Restricted Industrial District (a very restricted designation due to the residential uses across Warm Springs Road) in 1980. As a result of this restricted designation, the majority of the surrounding office buildings are occupied by churches, educational operations, universities, storage and office uses.

The East Warren Park LLC owners engaged Cornerstone Earth Group to review, evaluate and update the March 9, 2012 Hazardous Risk Assessment authored by TRC Environmental Solutions. This Screening level Vicinity Hazardous Materials Risk Appraisal Addendum presents the results of additional chemical review and release modeling performed for the Site.

1.2 2012 HAZARDOUS MATERIALS RISK ASSESSMENT

A previous hazardous materials risk appraisals incorporated worst-case assumptions and alternative-case assumptions for hypothetical hazardous materials releases originating from facilities in the vicinity of the Site (TRC, 2012). This report provides an update to the prior report

titled "*Hazardous Materials Risk Assessment, Mission Falls Court Project Site, 47003, 47201, 47212, 47315 and 47320 Mission Falls Court, Fremont California"* dated March 9, 2012 based on updated information regarding hazardous materials use and storage practices and revised modeling assumptions.

Based on the March 2012 vicinity risk assessment, several businesses and facilities were identified that used, stored or transported hazardous materials in the Site vicinity. The primary risks to Site occupants associated with hypothetical airborne releases of hazardous materials evaluated were from: 1) Seagate Technology Building A at 47050 Kato Road (chlorine gas); 2) a truck to rail transfer facility adjacent to the west (isopropanol); and, 3) petroleum products in a Chevron pipeline located within the railroad right-of-way to the west. Based on modeling of hypothetical worst case releases, mitigation measures were recommended to reduce risk to Site occupants.

1.3 UPDATED HAZARDOUS MATERIALS USE INFORMATION

To evaluate current hazardous materials practices associated with the facilities modeled for the prior assessment (TRC, 2012), Cornerstone contacted representatives of the adjacent truck to rail transfer facility and Seagate. In addition, Mission Peak Properties contacted Bay Area Rapid Transit District (BART) regarding information regarding the nearby Chevron pipeline. Information provided to Cornerstone is summarized below.

1.3.1 Truck to Rail Facility

The truck to rail transfer facility operated by Truck-Rail Handling (THR) was reported by TRC to be adjacent to the west of the site at 610 Warren Avenue. Based on THR's website, they specialize in the trans-loading of both dry and liquid commodities between railcars and trucks, and handle non-hazardous and hazardous commodities, ranging from food grade materials to a variety of chemicals. Mr. Jason Minetti, Directory of Safety and Compliance for THR, was contacted by Cornerstone to inquire about their activities at the adjacent rail facility. Mr. Minetti reported that THR no longer handles hazardous materials at the tracks adjacent to the Site because of safety concerns that were raised by BART.

1.3.2 Seagate Technology – Building A

To help evaluate current usage of chlorine by Seagate at 47050 Kato Road, we contacted a representative of Seagate's Environmental Health and Safety department. The representative stated that chlorine gas is still used by Seagate at this address. Seagate reportedly stores up to approximately 540 cubic feet of chlorine in one cylinder that is located in a cabinet designed to contain leaking gas and that is equipped with alarms in the event a leak is detected. Cylinders of this capacity are typically approximately 5 feet in height and 1 foot in diameter. The representative also reported that Seagate uses chlorine only intermittently for their research and development activities.

Additional hazardous materials listed in a February 2012 Hazardous Materials Inventory Statement (HMIS), obtained from the Fremont Fire Department, included hydrogen bromide (maximum 480 cubic feet). Based on the toxicity, mobility and quantity of hazardous materials listed in the HMIS, chlorine gas was selected for release risk modeling, as discussed in Section 2.1.

In addition, the Seagate representative reported that Seagate is planning to relocate to a new facility at 47488 Kato Road in approximately two years. The new facility is approximately 2,100 feet south of their existing Building A.

1.3.3 Chevron Pipeline

Based on information provided by BART to Mission Peak Company, Chevron recently relocated and replaced their petroleum pipeline. The pipe is reportedly approximately 10 feet west of the west property boundary and is at a depth of approximately 5 feet below the ground surface along the southern approximately 650 foot segment along the property boundary. The pipeline was recently relocated to a depth of approximately 80 feet along the remainder of the segment near the property boundary to provide clearance for the upcoming BART project and Warren Avenue undercrossing.

1.3.4 Summary of Updated Hazardous Materials Information

Hazardous materials facilities that are used for this updated risk appraisal are summarized in Table. 1.

Table 1. Screening Level Summary of Chemical Inventories (Previously Identified Facilities)

Map ID	Facility Name and Address	Summary of Chemical Information (Largest Container Sizes)
1	**Seagate Technology** Building A 47050 Kato Road	Seagate reports a variety of materials in small and moderate quantities, including hydrogen bromide (480 cubic feet), sulfuric acid (934 pounds), and chlorine gas (540 cubic feet).
2	Chevron Pipeline Approximately 10 feet west of west property boundary	Variety of petroleum products assumed.

1.4 PURPOSE

This Screening Level Vicinity Hazardous Materials Risk Appraisal Addendum was conducted to evaluate selected hypothetical catastrophic and alternative releases of hazardous materials under worst-case and normal wind speed and atmospheric conditions. These releases consisted of:

- Chlorine gas release
- Petroleum pipeline release

1.5 MODELING

The Screening Level Vicinity Hazardous Materials Risk Appraisal used screening level computer aided dispersion algorithms to evaluate potential Site impacts. Specifically, the ALOHA CAMEO and U.S. EPA Screen3 Models were used to conduct a screening level evaluation of potential impacts to the future Site development, assuming catastrophic releases of hazardous substances from the nearby facility. In accordance with U.S. EPA and Cal/EPA guidelines, potential risks were first estimated using worst-case release

assumptions. Where the potential impacts were considered potentially significant, those releases were remodeled using alternative-case atmospheric conditions. Specifically, a worst-case release assumes the loss of the entire container contents over 10-minute period with a 1.5 meter per second (m/s) wind speed and stable atmospheric conditions (Stability Class F). Alternative-case atmospheric conditions are considered more normal and assume a 3.0 m/s wind speed (Stability Class D).

Previous Investigators (TRC 2012) have concluded that potential significant impacts could be associated with the Chevron Pipeline and chlorine from the Seagate Technology Facility.

With respect to the pipeline release scenario, the worst-case release was estimated using ALOHA with pentane as a surrogate for the gasoline formulation. The use of pentane as a gasoline surrogate, more likely than not, causes risk overestimation since it has a higher volatility than gasoline. While we do not disagree with the conservative assessment, this report revisits this release to investigate the potential consequences using both average gasoline properties and U.S. EPA RMP Methods for estimating volatile emissions. In addition, the probabilities of such a release are also estimated in this report.

1.6 AEGL, ERPG, IDLH, AND TEEL DEFINITIONS

Predicted downwind impacts are compared to emergency planning concentration criteria. The Bay Area Air Quality Management District (BAAQMD) recommends the use of Emergency Response Planning Guidelines exposure level 2 (ERPG-2) as criteria for evaluating significant impact. In addition, the U.S. EPA generally defines “distance to toxic endpoint” in the Risk Management Program (RMP) for off-site consequent analysis as the ERPG-2 concentration. In the absence of ERPG guidelines, the U.S. EPA has recommended 1/10 of the Immediately Dangerous to Life and Health (IDLH) concentrations for planning purposes. ERPGs and IDLH definitions are provided below

Emergency Response Planning Guidelines (ERPGs) are values developed by the American Industrial Hygiene Association to assist emergency response personnel planning for accidental or intentional catastrophic chemical releases to the community. Due to the variability of human responses over a wide range of concentrations, AIHA cautions that ERPGs should not be expected to protect everyone, but should be applicable to most individuals in the general public. In addition, it must be recognized that in all populations, there are hypersensitive individuals who will show adverse responses at exposure concentrations far below levels at which most individuals normally would respond.

Temporary Emergency Exposure Limits (TEELs) are temporary Toxic Levels of Concern similar to ERPGs, and defined by the U.S. Department of Energy for use when ERPGs are not available. Unlike ERPGs, TEELs are not peer-reviewed and are intended as temporary guidance. ERPGs and TEELs do not incorporate safety factors. Rather, they are designed to represent the predicted response of members of the general public to different concentrations of a chemical during an incident.

TEELs are derived according to a specific, standard methodology. Unlike the ERPGs, which are derived from extensive reviews of animal and human studies, the TEEL methodology prescribes using the ERPG when available, and when no ERPG exists, using

available levels of concern (LOCs) and manipulating current data using a peer-reviewed, approved procedure. As a result, TEELS are available for many chemicals.

The TEEL methodology, which uses more widely available data than is required for the ERPG, can be used to derive a LOC for a broad range of chemicals; more chemicals than ERPGs at this time. The power of TEELs is not as substantial ERPGs, but TEELs can provide a useful reference when no other LOC is available.

In the absence of ERPGs, IDLHs, TEELs, other available toxicity criteria include Acute Exposure Guideline levels (AEGLs). AEGLs are under development by the National Research Council's National Advisory Committee on AEGLs. AEGLs take into account sensitive individuals and are meant to protect nearly all people. The committee's objective is to define AEGLs for the 300+ extremely hazardous substances listed in Title III of the Superfund Amendment and Reauthorization Act (the U.S. Environmental Protection Agency offers an online list of these substances).

AEGLs, ERPGs, IDLH, and TEELS are defined below:

AEGL-1
The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL-2
The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL-3
The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

ERPG-1
The ERPG exposure level 1 is defined as the maximum airborne concentration that nearly all individuals could be exposed to for up to 1 hour without experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.

ERPG-2
The ERPG exposure level 2 is defined as the maximum airborne concentration that nearly all individuals could be exposed to for up to 1 hour without experiencing or developing irreversible or other serious side effects of symptoms that could impair an individual’s ability to take protective action.

ERPG-3
The ERPG exposure level 3 is defined as the maximum airborne concentration that nearly all individuals could be exposed to for up to 1 hour without experiencing or developing life-threatening health effects.

IDLH
Immediately Dangerous to Life and Health (IDLH) concentrations represent maximum concentrations from which, in the event of a respirator failure, one could escape within 30 minutes without a respirator and without experiencing escape impairing or irreversible health effects. IDLHs are assumed to be applicable to healthy adult workers in the work place and do not take into account exposure of more sensitive individuals.

TEEL-1
Maximum concentration in air that nearly all individuals could be exposed without experiencing other than mild transient health effects or perceiving a clearly defined objectionable odor.

TEEL-2
Maximum concentration in air that nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

TEEL-3
Maximum concentration in air below that nearly all individuals could be exposed without experiencing or developing life-threatening health effects.

SECTION 2: RELEASE SCENARIOS

Based on the findings of the 2012 hazardous materials risk assessment and updated information obtained by Cornerstone, two release scenarios were chosen to evaluate potential risks to the Site. The scenarios appear improbable but should be considered possible. Worst-case releases were assumed to occur outside and were modeled assuming urban dispersion coefficients: wind speed of 1.5 m/s, atmospheric stability class F and an outside temperature of 70 degrees Fahrenheit.

Alterative-case releases (normal atmospheric conditions) also were assumed to occur outside and were modeled assuming urban dispersion coefficients: wind speed of 3.0 m/s, atmospheric stability Class D and an outside temperature of 70 degrees Fahrenheit.

The selected release scenarios are summarized below.

2.1 SEAGATE TECHNOLOGY LLC, BUILDING A

This facility (approximately 650 feet west of the Site) reported a variety of hazardous materials. Chlorine gas was selected as the chemical of concern for release exposure modeling.

<u>Chlorine</u>
540 cubic feet stored in one container located within a gas-tight secondary containment with release alarms. Chlorine supplied to process equipment as needed through double walled piping/tubing. Chlorine cylinders of this capacity are typically approximately 5 feet high and 1 foot in diameter.

Worst Case Chlorine Release

The worst-case chlorine release assumes the loss of container contents of a ten minute period during worst-case atmospheric conditions described in Section 1.4 above.

Alternative Case Release

For the special case of semiconductor gases, alternative release assumptions incorporated flow through a restrictive orifice since the California Fire Code (CFC) regulates semiconductor facilities and other toxic gas users. CFC requires that these gases be housed in secondary containment facilities that typically include ventilated gas cabinet storage with leak detection and treatment capability for discharged gases. In addition, other standard industry controls include valves equipped with restrictive flow orifices (RFO) to limit the release of toxic gases in the rare event of an equipment and/or valve failure during processing.

The opportunity for an exterior release is generally associated with cylinder delivery where an accidental fall could possibly damage the valve cover and valve. In this unlikely event, the rate of release through a RFO is a reasonable proxy for a release through a damaged cylinder valve (i.e. valve stem/packing leak). The supply pressure of the gas and the area of the orifice will determine gas flow through a RFO device.

For this alternative case assessment, we incorporate both U.S. EPA default assumptions and flow through RFOs for release rate estimates. The maximum RFO size supplied for chlorine was taken from *"Pure Gases, Gas Mixtures, Gas Delivery Equipment, Version 9.0*" Scott Semiconductor Gases (Scott 9.0). In addition, for the release modeled using flow through RFOs, the duration of the release was conservatively limited to 1 hour. Release rates through RFOs are estimated from Scott 9.0 as follows:

$$Flow\ (ft^3 hr^{-1}) \quad = [\,767\ x\ A\ x\ P_s\,]\ x\ CF^{0.5}$$

Where:

Flow = Standard cubic feet per hour
A = Area of orifice (in^2)
P_s = Supply pressure of the gas (psi), and
CF = Correction Factor for the Gas, molecular weight of air divided by the molecular weight of the gas/gas mixture ($28.96/MW_{gas}$)

At the supplied pressure of 99.7 psi, the leak rate through a maximum sized orifice diameter of 0.04 inches, the leak rate of chlorine is estimated at 0.185 lbs per minute. (Attachment A).

2.2 CHEVRON PIPELINE

The chevron pipeline reportedly is located at a depth of approximately 5 feet below the ground surface approximately 10 feet west of the west property boundary. The area of the pipeline appears to be unpaved.

Petroleum Product

A variety of petroleum products are likely transferred through the pipeline. For release modeling, gasoline was selected as the constituent of concern. As mentioned above, pentane was previously used for the worst-case assessment. For this assessment we use U.S. Department of Energy (DOE) average physio-chemical properties for vapor pressure, specific gravity and molecular weight (Appendix A).

Gasoline molecular weight and vapor pressure properties were then entered into U.S. EPA 1999 and 1999B volatility models (Equations 3.7, D-1, D-3) to estimate gasoline vapor emissions. Since it did not appear in TRC 2012 that pipe line flow rates were revealed in correspondence with Chevron, this assessment incorporated the spill rate used by TRC (1,030 lbs/minute or 26.5 cubic feet per minute) to provide a comparable risk estimate. The total amount spill is thus assumed to be 18,630 pounds over a 15 minute period

EPA methods to determine the area of an unconfined spill of gasoline, suggest a 12,060 square foot pool, assuming a one centimeter depth. However, for an 18,630 pound spill, an evaporating pool of this size of will not likely occur since the ground at this location consists of bare uncovered soil.

Assuming a natural boundary condition provided by the railway including a slight depression (swale) parallel to the rail way that confines the spill to a rectangular area, and hypothetically assuming a 3 inch depth of the evaporating pool, a 1600 ft^2 pool is hypothetical formed.

For an alternative release, we incorporate the same release rate limited to 5 minutes (TRC 2012) for a total release if 6,204 pounds. This release is also modeled as a confined evaporating pool approximately three inches deep with an approximate surface area of 528 square feet (unconfined is approximately 4015 square feet).

The U.S. EPA Screen3 Dispersion Model is used to evaluate this hypothetical gasoline release under both worst-case and alternative case atmospheric assumptions.

Explosions

Based on US EPA RMP Guidance (US EPA 1999D), release rates are not considered for worst-case release of flammable gases and volatile flammable liquids. The total quantity of the flammable substance is assumed to form a vapor cloud, the entire contents of the cloud are assumed to be within the flammability limits, and the cloud is assumed to explode. For the worst-case, analysis, 10 percent of the flammable vapor in the cloud is assumed to participate in the explosion (i.e., the yield factor is 0.10). Consequence distances to an overpressure level of 1 pound per square inch (psi) are determined using the TNT-equivalency method as described in Exhibit C of US EPA 1999.

Appendix A presents emission rate calculations and modeling results.

SECTION 3: SUMMARY OF SCREENING LEVEL RISK APPRAISAL

3.1 RESULTS OF MODELING

The results of the case modeling are summarized in Table 2 (the results of assumed worst-case release conditions) and Table 3 (the results of the alternative-case release conditions).

Table 2. Screening Level Appraisal Results (Worst-Case Release Conditions Assumed)

Release	Approximated Maximum Threat Zone	Approximated Maximum Site Outdoor Concentration[a]	Emergency Planning Guidelines (ppm)
Seagate Technology (approximately 650 feet from the Site)			
1. Chlorine Gas Loss of contents (540ft^3) of the container over 10 minutes. Distance to Toxic Endpoint	5,241 feet (ERPG-2)	76 ppm	IDLH = 10 ERPG-1 = 1 ERPG-2 =3 ERPG-3 = 20
Chevron Petroleum Pipeline			
1. Gasoline Liquid leak of 18,632 lbs of refined product as gasoline, forming a confined evaporating pool 20 feet wide by 80 feet long and 3 inches deep. Distance to Toxic Endpoint Distance to psi overpressure	460 feet (ERPG-2) 1,152 feet	>5,180 ppm	IDLH = NE ERPG-1 = 200 ERPG-2 =1000 ERPG-3 = 4000 LEL= 14,000 1 psi

Table 2 Notes
All releases assume U.S. EPA Worst -Case conditions: Stability Class F and Wind Speed of 1.5 m/s.
NE= Not established.

a. The maximum outdoor concentration is the concentration predicted at the Site exterior after the plume reaches the Site (ALOHA or Screen3 Model).

Gasoline Release
U.S. EPA Risk Management Program Guidance for Offsite Consequence Analysis, Appendix D Technical Background (EPA 1999D) Sections D-2 (Equation D-1) provides the expression for estimating the release rate of a water solution of regulated substance. In addition, Section 3.3 Release Rates for Water Solutions, pages 3-16 and 3-17 of EPA 1999 directs the reader to Appendix D to calculate releases of solutions with known vapor pressures. The Release Rate Determined by:

$$QR = \frac{0.284\ x\ U^{0.78}\ x\ MW^{2/3}\ x\ A\ x\ VP}{82.05\ x\ T}\ (Equation\ 1)$$

Where:

QR = Evaporation rate (lbs/min),
U = wind speed (1.5 m/s),
MW = molecular weight (30.03),
A= area (10,000 ft^2),
VP = vapor pressure (335 mm Hg),
T = temp (K^o).

Table 3. Screening Level Appraisal Results (Alternative-Case Release Conditions Assumed)

Release	Approximated Maximum Threat Zone	Approximated Maximum Site Outdoor Concentration[a]	Emergency Planning Guidelines (ppm)
Seagate Technology (approximately 650 feet from the Site)			
1. Chlorine Gas Valve stem/packing leak simulated by a release through a 0.04 inch diameter restrictive flow orifice (RFO) Distance to Toxic Endpoint	303 feet (ERPG-2)	0.7 ppm	IDLH = 10 ERPG-1 = 1 ERPG-2 =3 ERPG-3 = 20
Chevron Petroleum Pipeline			
1. Gasoline Liquid leak of 6204 lbs of refined product as gasoline, forming a confined evaporating pool 12 feet wide by 44 feet long and 3 inches deep. Distance to Toxic Endpoint Distance to psi overpressure	 80 feet (ERPG-2) 780 feet	 1,150 ppm	IDLH = NE ERPG-1 = 200 ERPG-2 =1000 ERPG-3 = 4000 LEL= 14,000 1 psi

Table 3 Notes
All releases assume U.S. EPA Alternative-Case conditions: Stability Class D and Wind Speed of 3.0 m/s.
NE= Not established.
a. The maximum outdoor concentration is the concentration predicted at the Site exterior after the plume reaches the Site (ALOHA model).

Gasoline Release – release rate calculations described above.

3.2 Discussion

3.2.1 Probability Estimates for Pipeline Release

Potentially significant impacts are associated with the pipe line and with a worst case chlorine release. We first discuss the event likelihoods.

The California Department of Education (CDE 2007) "*Guidance Protocol for School Site Pipeline Risk Analysis"* Volume 4, provides guidance for estimating the probability of pipeline release event resulting in catastrophic impacts. According to CDE 2007, the fundamental approach to risk estimating is based on principles established in the technical literature for accidental chemical releases.

The overall methodology is based on established techniques well known and documented in the field of loss prevention. The foundation of this risk estimate is an event tree analysis. The event tree is a standard analytical structure for examining the consequences of a base event, in this case, a pipeline failure and product release that can result in a release with an un-ignited dispersion of gas or liquid vapors, or a fire or an explosion that harms persons within an impact zone defined by harmful intensity levels of the physical effects.
The calculation begins with a base probability for pipeline failure, followed by calculations using conditional probabilities for ensuing events. The probability of the final event is the mathematical product of the individual event probabilities, as illustrated in the event tree. The event tree for a pipeline and ensuing events (Figure 4.2 of CDE 2007) is provided in Appendix B.

Base probability values are presented in Table 4-3 of CDE 2007, and conditional probabilities for the event tree analysis are provided in Table 4-4 of CDE 2007. These tables are provided in Appendix B of this report. Probability data are based on historical data from the OPS Gas Pipeline Incident Database or Hazardous Liquid Pipeline Accident Database. These failure rates are based on historical data for significant releases specific to pipelines in California.

Based on TRC 2012, we evaluated the likelihood of a pipeline failure (rupture) resulting in an explosion and the likelihood of a pipeline rupture release resulting in a fire. These events were identified as worst-case releases associated with the Chevron Pipeline the TRC Report.

Pipeline Rupture Resulting in Explosion

Based on CDE 2007, the probability of this event is estimated by:

P(A) x P(Rup) x P(IGN) x P(Exp)

Where: P (A) is the baseline probability of a failure along the length of pipeline (650 feet) adjacent to the property for the segment buried at a depth of approximately 5 feet.

P (Rup) is the probability that the release is a full diameter rupture.

P (IGN) is the probability that the release will ignite

P (Exp) is the probability that the ignition will result in an explosion.

From Table 4-3, the baseline probability (failure rate) for a refined product pipeline is 1.3E-03 per mile per year (1.3 chances in 1000). For a 650 foot segment the baseline probability is 1.6E-04. From Table 4-4, P (Rup) is 0.2, P (IGN) is 0.09, and P (Exp) is 0.05.

Therefore the estimated probability for this event is:

1.6 E-04 x 0.2 x 0.09 x 0.05 = 1.44 E-07.

Or roughly one chance in ten million that this event will occur in any given year along the 650 foot segment of the pipeline adjacent to the property that is at a depth of approximately 5 feet.

Similarly the probability of a fire resulting from a full diameter rupture is estimated as:

1.6 E-04 x 0.2 x 0.09 x 0.95 = 2.7 E-06

We note here, from Table 4-4, the probability of fire from ignition is 0.95. The probability of fire is roughly three chances in one million that this event will occur in any given year along the 650 foot segment of the pipeline adjacent to the property that is at a depth of approximately 5 feet.

The probability presented above assumes the pipeline is operating to transfer gasoline continuously. However, the pipeline is used to transfer a variety of refined petroleum products, including diesel and aviation fuel, which have significantly lower risk of fire compared to gasoline. In addition, the pipeline may not be in-use (pressurized) continuously. Therefore, the likely part time operation of the pipeline to transfer gasoline would significantly lower the probability of a gasoline release from the pipeline. For example, assuming the pipeline contains gasoline approximately ¼ of the time, the probability of fire associated with a gasoline release is reduced to roughly 4 chances in ten million that this event will occur in any given year along the 650 foot segment of the pipeline adjacent to the property that is approximately 5 feet below the ground surface.

3.2.2 Compatible Land Use Evaluation

As detailed in this report, the Site is located adjacent to a rail storage yard, two Seagate buildings and the Chevron transmission pipeline which is located at a depth of approximately 80 feet for much of its extent near the property boundary. As noted, the rail yard operator does not allow for hazardous materials transfers and is part of the greater rail operation to the north. The Seagate operation utilizes a fully contained chlorine tank similar in quantities used at a typical large public swimming pool. All of these sources are typically located throughout the San Francisco Bay Area and are common adjacent to existing and new residential development. We have included Figures 2, 3, 4 and 5 showing the pipeline locations extending through areas in the Fremont/Milpitas area and Pleasanton area where land uses are similar to the proposed residential development of the Site.

3.2.3 Examples of Similar Developments Near Petroleum Pipelines

Based on regional maps presented in the National Pipeline Mapping System website (https://www.npms.phmsa.dot.gov/), petroleum pipelines extend along the railroad right-of-way adjacent from the Site from near Washington Boulevard south through Alameda County and the north portion of Santa Clara County. The petroleum pipeline extends to San Jose Airport and a fuel distribution depot near Berryessa Road and Interstate 101. The approximate locations of the petroleum pipeline in the Fremont and Milpitas area is shown on Figures 2, 3 and 4. The pipelines pass adjacent to multiple residential developments that have been constructed in the past approximately 5 to 10 years, including a residential development built in 2009 and 2010 adjacent to the railroad right-of-way and petroleum pipeline in Fremont, approximately 1 ½ mile south of the Site. Local jurisdictions, including the City of Fremont, appear to have concluded that the risk associated with residential development adjacent to active petroleum pipelines presents an acceptably low risk. The planned on-Site senior housing project, therefore, appears consistent with residential developments approved in San Francisco Bay Area with respect to petroleum pipeline rupture risk.

SECTION 4: CONCLUSIONS

Worst-case release modeling indicates potentially significant Site impacts from hypothetical releases of chlorine and gasoline

The chlorine hypothetical release modeling indicates that potentially significant impacts could occur under worst-case. However, with respect to the latter conditions, exposure duration would be short (approximately 10 minutes). We would discount the potential significance of this release because of its short duration and because of building obstacles between the emitting location and project site. The exterior concentrations would likely be lower than that projected by ALOHA. In addition, this material is used in small amounts inside the facility according the available Hazardous Materials Business Plan for this facility. Thus, a more likely release scenario would be an interior release, passively mitigated by the building. A Seagate represented reported to Cornerstone that this material is located in a ventilated gas cabinet.

For the Chevron Pipeline, release modeling indicates potentially significant impacts from both Worst-case and Alternative case releases. However, based on event probabilities, the risk e.g. likelihood of such releases should be considered to be within the acceptable range of risks (one chance in a million each year) which has been selected based on regulatory practice for the siting of industrial facilities with hazardous chemicals in the United States. Based on the above, the worst–case release from TRC 2012 is considered a high consequence but very low likelihood event.

With respect to the alternative release for the pipeline, we suspect that the EPA Method may overestimate the consequence (distance) to 1 psi overpressure, since the method assumes 100 % of the material spilled volatilizes and 10% of the vapor is over the LEL. Dispersion modeling indicates that vapor concentrations (1,150 ppmv) within 25 meters of the evaporating pool are far below the LEL concentration of 14,000 ppmv.

SECTION 5: UNCERTAINTY

Cornerstone Earth Group performed this Screening Level Vicinity Hazardous Materials Risk Appraisal Addendum Report to support East Warren Park LLC in evaluating the impact to the Site from selected catastrophic releases of hazardous materials from nearby facilities. East Warren Park LLC understands that no modeling assessment can wholly eliminate uncertainty regarding the impact to the Site from accidental and catastrophic releases of hazardous materials. This screening level risk appraisal modeling is intended to reduce, but not eliminate, uncertainty regarding the potential for impacts to the Site from such catastrophic releases. East Warren Park LLC understands that the extent of information obtained for the modeling is based on the reasonable limits of time and budgetary constraints.

The primary uncertainties associated with this appraisal included the selection of chemicals for evaluation, the size of each release, assumptions concerning release location, the physical properties of released liquids, assumed area of liquid spills, and atmospheric conditions during the release.

Information regarding facilities and the chemicals used, stored and generated at these facilities were based on information readily available in public records. Therefore, the accuracy and completeness of the information cannot be assessed. Cornerstone cannot verify the accuracy or completeness of this data, nor is Cornerstone obligated to identify mistakes or insufficiencies in the information obtained.

The exact locations of selected chemicals for release modeling could not be determined from the available information. Releases of chemicals were assumed to be from 450to 800 feet from the Site. Releases closer to the Site could result in higher Site concentrations. More distant releases would be more likely to result in lower Site concentrations.

With respect to chemical selection, chemicals were selected based on volumes, their Physiochemical properties and recognized toxicity. Therefore the chemicals selected appeared to be representative of potential release risks posed by the facilities. However, other chemicals, if released in large quantities could have impacts at the Site depending on concentrations, amounts, and distance from the site.

With respect to evaporating pools of spilled hazardous materials, sources of uncertainty include assumptions concerning the areas of spilled liquids, concentrations of the chemical in each release, and the use of surrogates to simulate chemicals spilled. In general, the greater the area of an evaporating pool, the greater the emission rate of the substance, and the greater the distance of off-Site impacts.

Finally, atmospheric conditions considered assumed normal conditions. The conditions modeled generally represent daytime conditions during which vertical and horizontal dispersion is facilitated. These conditions generally occur at a greater percentage of the time over any yearly time period. Further, all releases assumed that the Site was located plume centerline, downwind, at the time of the release. Wind speed and wind direction vary over time.

This report, an instrument of professional service, was prepared for the sole use of East Warren Park LLC and may not be reproduced or distributed without written authorization from Cornerstone. This report was based on information readily available as of May 2013 and is subject to change. Cornerstone makes no warranty, expressed or implied, except that our services have been performed in accordance with the environmental principles generally accepted at this time and location.

SECTION 6: REFERENCES

AIHA 2011. The AIHA 2012 Emergency Response Planning Guidelines and Workplace Environmental Exposure Level Handbook. American Industrial Hygiene Association Fairfax, Virginia.

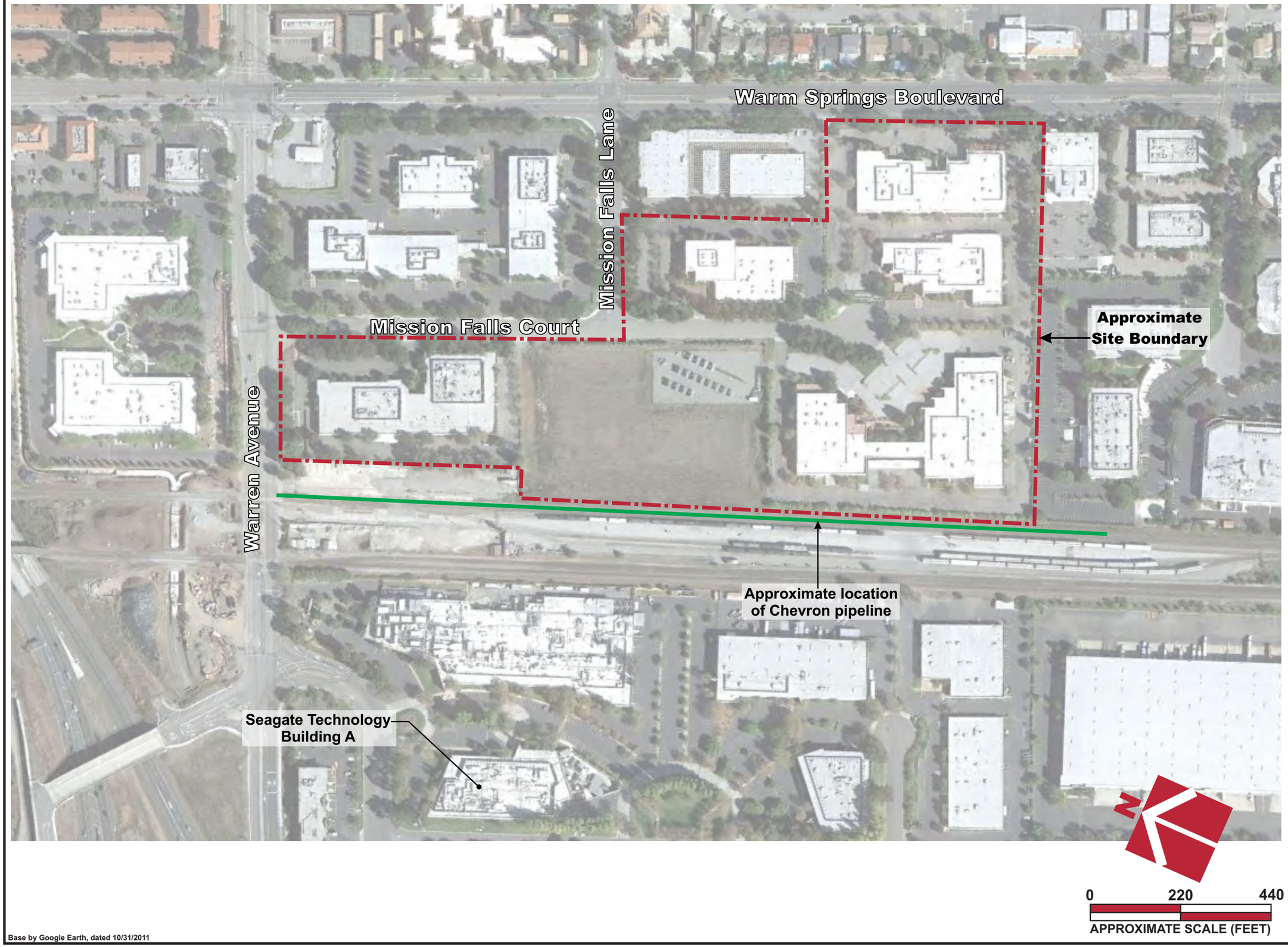
DOE. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Alternative Fuels Data Center

EPA 1999. U.S. EPA Risk Management Program Guidance for Offsite Consequence Analysis. U.S. EPA Office of Solid Waste and Emergency Response. April 1999. (EPA 550-B-99-009)

EPA 1999D. Appendix D Technical Background Document, U.S. EPA Risk Management Program Guidance for Offsite Consequence Analysis. U.S. EPA Office of Solid Waste and Emergency Response. April 1999. (EPA 550-B-99-009)

FEMA 1985. Handbook of Chemical Hazard Analysis Procedures. Federal Emergency Management Agency, U.S. Department of Transportation, U.S. Environmental Protection Agency. Federal Emergency Management Agency Publications Office 500 C Street, S.W. Washington, DC 20472.

TRC, Inc. March 9, 2012. Hazardous Materials Risk Assessment, Mission Falls Court Project Site 47003, 47201, 47212, 47315 and 47320 Mission Falls Court, Fremont, CA



Base by Google Earth, dated 10/31/2011

Project Number 531-2-1

Figure Number Figure 1

Date April 2013

Drawn By RRN

Site Plan

Mission Falls Court Proposed Senior Housing
47829 Mission Falls Court
Fremont, CA

CORNERSTONE EARTH GROUP

Approximate pipeline locations based on information obtained from National Pipeline Mapping System (www.npmsa.dot.gov)

Base by Google Earth, dated 10/31/2011

Legend

Approximate location of petroleum pipeline

N

0 800 1600

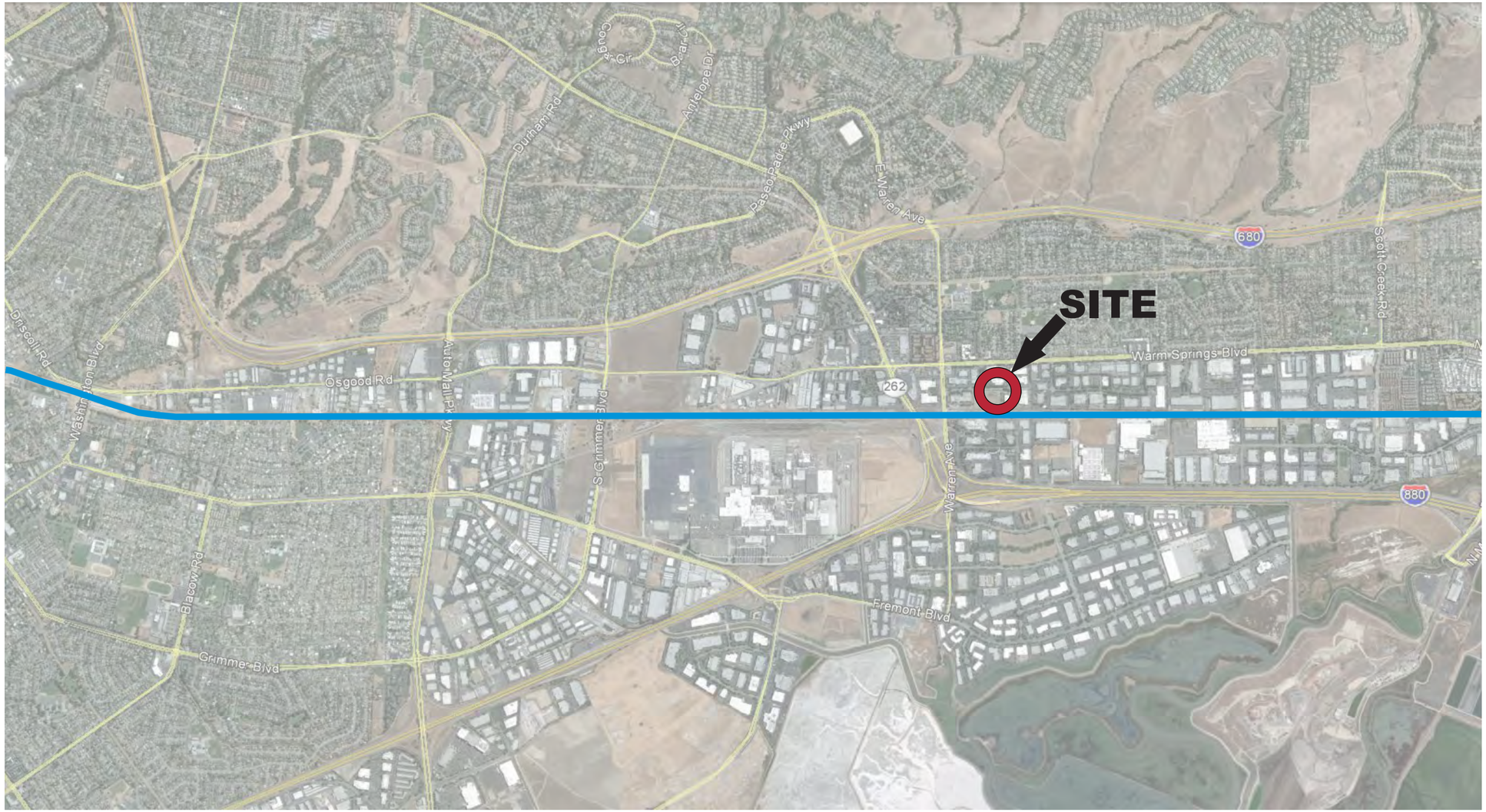
APPROXIMATE SCALE (FEET)

Approximate Location of Petroleum Pipeline in Fremont - Site Vicinity

Mission Falls Court Proposed Senior Housing
Fremont, CA

CORNERSTONE EARTH GROUP

Project Number	531-2-1
Figure Number	Figure 2
Date	May 2013
Drawn By	RRN



Approximate pipeline locations based on information obtained from National Pipeline Mapping System (www.npmsa.dot.gov)

Base by Google Earth, dated 10/31/2011

Legend

Approximate location of petroleum pipeline

N

0 2500 5000

APPROXIMATE SCALE (FEET)

Project Number	531-2-1
Figure Number	Figure 3
Date	May 2013
Drawn By	RRN

Approximate Location of Petroleum Pipeline in Fremont Area

Mission Falls Court Proposed Senior Housing
Fremont, CA

CORNERSTONE EARTH GROUP

Approximate pipeline locations based on information obtained from National Pipeline Mapping System (www.npmsa.dot.gov)

Base by Google Earth, dated 10/31/2011

Legend

Approximate location of petroleum pipeline

0 2000 4000

APPROXIMATE SCALE (FEET)

Project Number	531-2-1
Figure Number	Figure 4
Date	May 2013
Drawn By	RRN

Approximate Location of Petroleum Pipeline in Fremont and Milpitas Area

Mission Falls Court Proposed Senior Housing
Fremont, CA

CORNERSTONE EARTH GROUP

Approximate pipeline locations based on information obtained from National Pipeline Mapping System (www.npmsa.dot.gov)

Base by Google Earth, dated 10/31/2011

Legend

Approximate location of petroleum pipeline

0 2600 5200

APPROXIMATE SCALE (FEET)

Approximate Location of Petroleum Pipeline in Pleasanton Area

Mission Falls Court Proposed Senior Housing
Fremont, CA

CORNERSTONE EARTH GROUP

Project Number	531-2-1
Figure Number	Figure 5
Date	May 2013
Drawn By	RRN

APPENDIX A – MODELING INPUT PARAMETERS AND RESULTS

Section: BIOFUELS
Fuel Property Comparison for Ethanol, Gasoline and No. 2 Diesel

Property	Ethanol	Gasoline	No. 2 Diesel
Chemical Formula	C2H5OH	C4 to C12	C3 to C25
Molecular Weight	46.07	100–105	≈200
Carbon	52.2	85–88	84–87
Hydrogen	13.1	12–15	33–16
Oxygen	34.7	0	0
Specific gravity, 60° F/60° F	0.796	0.72–0.78	0.81–0.89
Density, lb/gal @ 60° F	6.61	6.0–6.5	6.7–7.4
Boiling temperature, °F	172	80–437	370–650
Reid vapor pressure, psi	2.3	8–15	0.2
Research octane no.	108	90–100	--
Motor octane no.	92	81–90	--
(R + M)/2	100	86–94	N/A
Cetane no.(1)	--	5–20	40–55
Fuel in water, volume %	100	Negligible	Negligible
Water in fuel, volume %	100	Negligible	Negligible
Freezing point, °F	-173.2	-40	-40–30[a]
Centipoise @ 60° F	1.19	0.37–0.44[b]	2.6–4.1
Flash point, closed cup, °F	55	-45	165
Autoignition temperature, °F	793	495	≈600
Lower	4.3	1.4	1
Higher	19	7.6	6
Btu/gal @ 60° F	2,378	≈900	≈700
Btu/lb @ 60° F	396	≈150	≈100
Btu/lb air for stoichiometric mixture @ 60° F	44	≈10	≈8
Higher (liquid fuel-liquid water) Btu/lb	12,800	18,800–20,400	19,200–20000
Lower (liquid fuel-water vapor) Btu/lb	11,500	18,000–19,000	18,000–19,000
Higher (liquid fuel-liquid water) Btu/gal	84,100	124,800	138,700
Lower (liquid fuel-water vapor) Btu/gal @ 60° F	76,000[b]	115,000	128,400
Mixture in vapor state, Btu/cubic foot @ 68° F	92.9	95.2	96.9[c]
Fuel in liquid state, Btu/lb or air	1,280	1,290	–
Specific heat, Btu/lb °F	0.57	0.48	0.43
Stoichiometric air/fuel, weight	9	14.7[b]	14.7
Volume % fuel in vaporized stoichiometric mixture	6.5	2	–

Source: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Alternative Fuels Data Center http://www.afdc.energy.gov/afdc/fuels/properties.html

[a]Pour Point, ASTM D 97.
[b]Calculated.
[c]Based on Cetane.

$$P = \exp\left\{\left[\left(\frac{2{,}799}{T+459.6}\right) - 2.227\right]\log_{10}(RVP) - \left(\frac{7{,}261}{T+459.6}\right) + 12.82\right\}$$

Where:

P = stock true vapor pressure, in pounds per square inch absolute.
T = stock temperature, in degrees Fahrenheit.
RVP = Reid vapor pressure, in pounds per square inch.

Note: This equation was derived from a regression analysis of points read off Figure 7.1-13a over the full range of Reid vapor pressures, slopes of the ASTM distillation curve at 10 percent evaporated, and stock temperatures. In general, the equation yields *P* values that are within +0.05 pound per square inch absolute of the values obtained directly from the nomograph.

Figure 7.1-13b. Equation for true vapor pressure of crude oils with a Reid vapor pressure of 2 to 15 pounds per square inch.[4]

$$P = \exp\left\{\left[0.7553 - \left(\frac{413.0}{T+459.6}\right)\right]S^{0.5}\log_{10}(RVP) - \left[1.854 - \left(\frac{1{,}042}{T+459.6}\right)\right]S^{0.5}\right.$$

$$\left. + \left[\left(\frac{2{,}416}{T+459.6}\right) - 2.013\right]\log_{10}(RVP) - \left(\frac{8{,}742}{T+459.6}\right) + 15.64\right\}$$

Where:

P = stock true vapor pressure, in pounds per square inch absolute.
T = stock temperature, in degrees Fahrenheit.
RVP = Reid vapor pressure, in pounds per square inch.
S = slope of the ASTM distillation curve at 10 percent evaporated, in degrees Fahrenheit per percent.

Note: This equation was derived from a regression analysis of points read off Figure 7.1-14a over the full range of Reid vapor pressures, slopes of the ASTM distillation curve at 10 percent evaporated, and stock temperatures. In general, the equation yields *P* values that are within +0.05 pound per square inch absolute of the values obtained directly from the nomograph.

Figure 7.1-14b. Equation for true vapor pressure of refined petroleum stocks with a Reid vapor pressure of 1 to 20 pounds per square inch.[4]

$$A = 15.64 - 1.854\,S^{0.5} - (0.8742 - 0.3280\,S^{0.5})\ln(RVP)$$
$$B = 8{,}742 - 1{,}042\,S^{0.5} - (1{,}049 - 179.4\,S^{0.5})\ln(RVP)$$

where:

RVP = stock Reid vapor pressure, in pounds per square inch
ln = natural logarithm function
S = stock ASTM-D86 distillation slope at 10 volume percent evaporation (°F/vol %)

Figure 7.1-15. Equations to determine vapor pressure constants A and B for refined petroleum stocks.[8]

Text Summary

ALOHA® 5.4.3

```
SITE DATA:
  Location: SAN JOSE, CALIFORNIA
  Building Air Exchanges Per Hour: 1 (user specified)
  Time: April 4, 2013  1516 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: CHLORINE                Molecular Weight: 70.91 g/mol
  AEGL-1 (60 min): 0.5 ppm   AEGL-2 (60 min): 2 ppm   AEGL-3 (60 min): 20 ppm
  IDLH: 10 ppm
  Ambient Boiling Point: -29.4° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 1.5 meters/second from 0° true at 10 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 70° F
  Stability Class: F (user override)
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Direct Source: 54 cubic feet/min       Source Height: 0
  Source State: Gas
  Source Temperature: equal to ambient
  Source Pressure: equal to ambient
  Release Duration: 10 minutes
  Release Rate: 9.98 pounds/min
  Total Amount Released: 99.8 pounds

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 1747 yards --- (3 ppm = ERPG-2)

THREAT AT POINT:
  Concentration Estimates at the point:
  Downwind: 650 feet                     Off Centerline: 0 feet
  Max Concentration:
     Outdoor: 76.1 ppm
     Indoor:  11.4 ppm
```

Concentration at Point

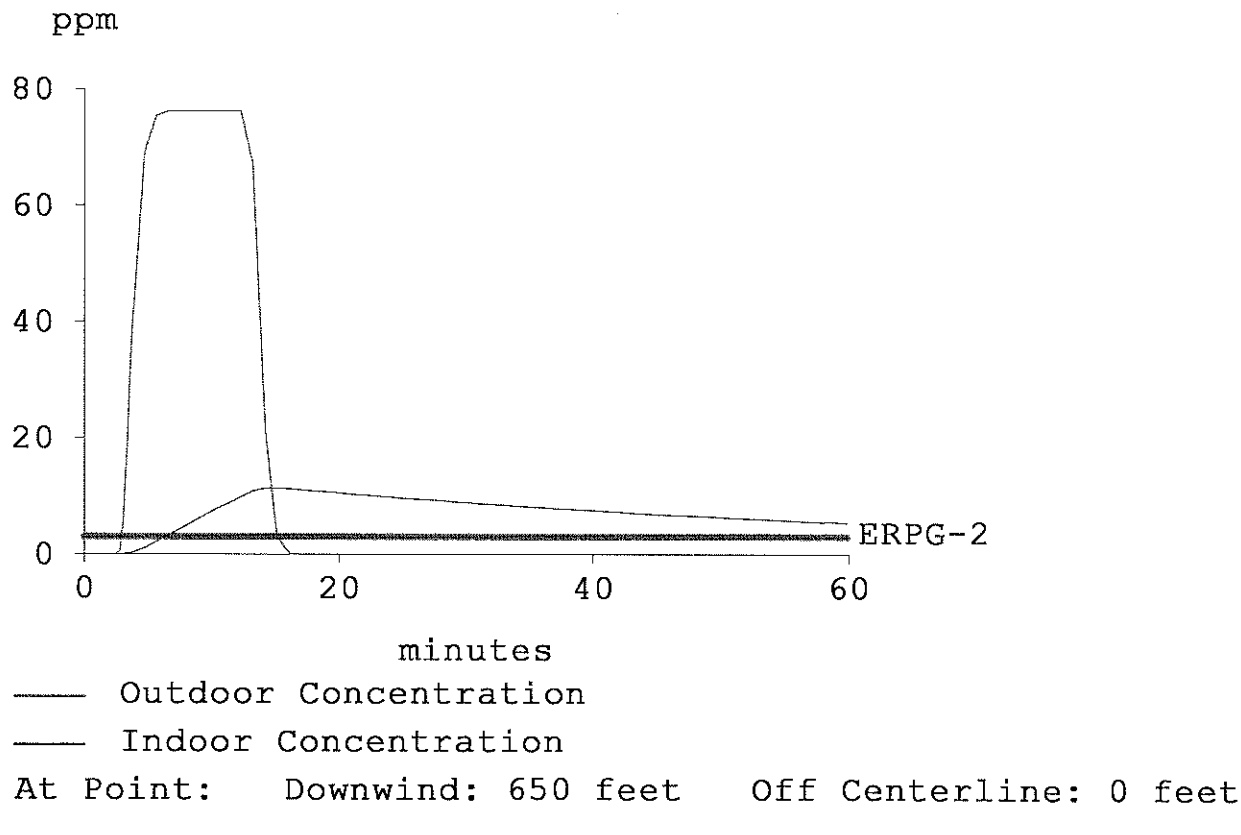
ALOHA® 5.4.3

Time: April 4, 2013 1516 hours PDT (using computer's clock)

Chemical Name: CHLORINE

Building Air Exchanges Per Hour: 1 (user specified)

THREAT AT POINT:
Model Run: Heavy Gas
Concentration Estimates at the point:
Downwind: 650 feet Off Centerline: 0 feet
Max Concentration:
Outdoor: 76.1 ppm
Indoor: 11.4 ppm



At Point: Downwind: 650 feet Off Centerline: 0 feet

Toxic Threat Zone

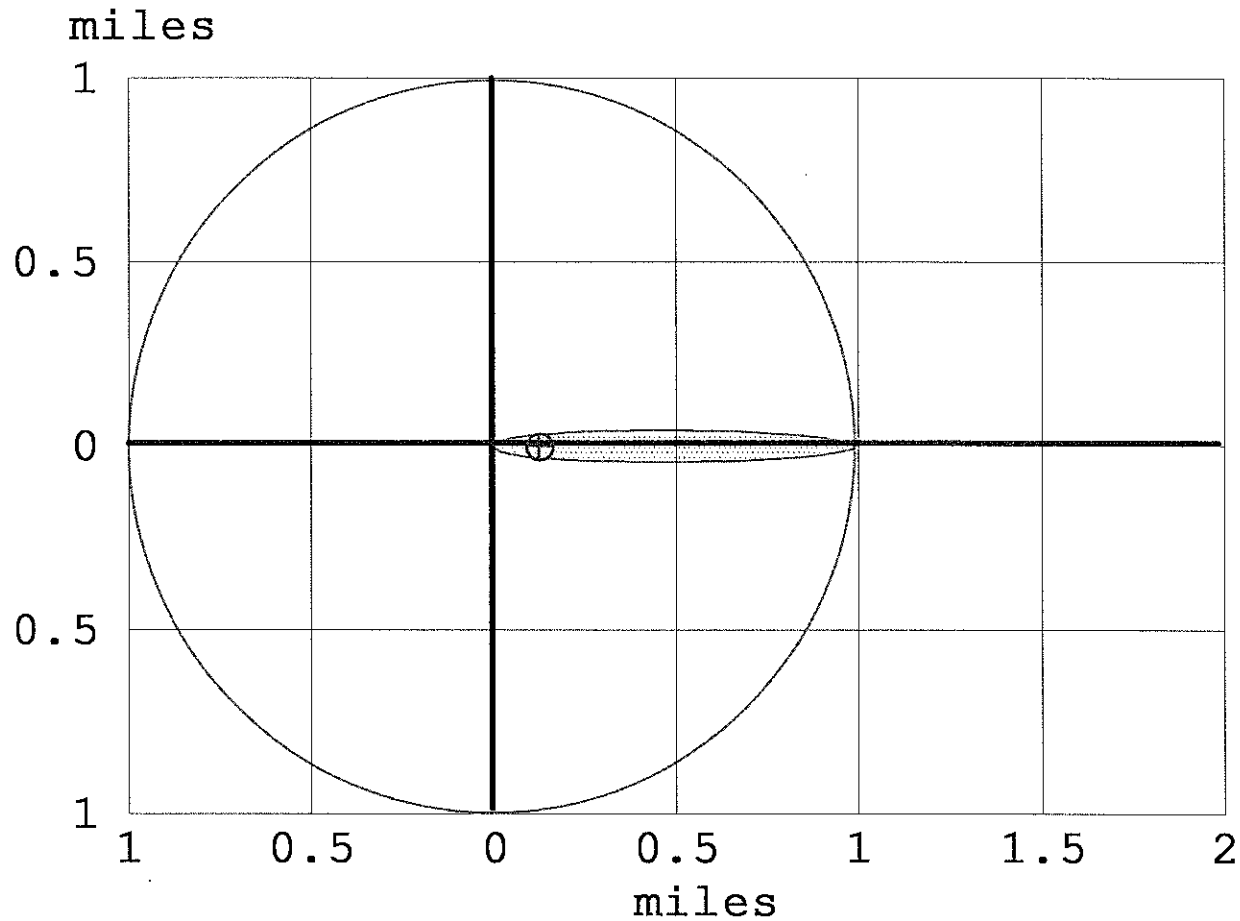
ALOHA® 5.4.3

Time: April 4, 2013 1516 hours PDT (using computer's clock)

Chemical Name: CHLORINE

Wind: 1.5 meters/second from 0° true at 10 meters

THREAT ZONE:
Model Run: Heavy Gas
Red : 1747 yards --- (3 ppm = ERPG-2)



greater than 3 ppm (ERPG-2)

Confidence Lines

```
SITE DATA:
  Location: SAN JOSE, CALIFORNIA
  Building Air Exchanges Per Hour: 1 (user specified)
  Time: April 11, 2013  1100 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: CHLORINE                Molecular Weight: 70.91 g/mol
  AEGL-1 (60 min): 0.5 ppm   AEGL-2 (60 min): 2 ppm   AEGL-3 (60 min): 20 ppm
  IDLH: 10 ppm
  Ambient Boiling Point: -29.4° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 3 meters/second from 0° true at 10 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 70° F
  Stability Class: D (user override)
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Direct Source: 0.185 pounds/min        Source Height: 0
  Release Duration: 60 minutes
  Release Rate: 0.185 pounds/min
  Total Amount Released: 11.1 pounds
  Note: This chemical may flash boil and/or result in two phase flow.

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 101 yards --- (3 ppm = ERPG-2)

THREAT AT POINT:
  Concentration Estimates at the point:
  Downwind: 650 feet                     Off Centerline: 0 feet
  Max Concentration:
     Outdoor: 0.706 ppm
     Indoor:  0.439 ppm
```

Concentration at Point

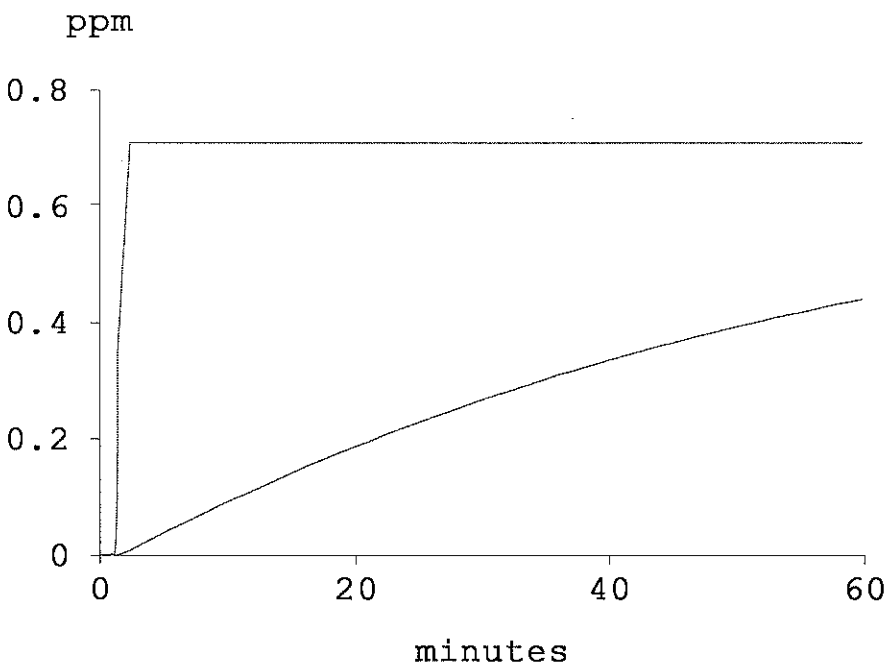
ALOHA® 5.4.3

Time: April 11, 2013 1100 hours PDT (using computer's clock)

Chemical Name: CHLORINE

Building Air Exchanges Per Hour: 1 (user specified)

THREAT AT POINT:
Model Run: Heavy Gas
Concentration Estimates at the point:
Downwind: 650 feet Off Centerline: 0 feet
Max Concentration:
Outdoor: 0.706 ppm
Indoor: 0.439 ppm



—— Outdoor Concentration
—— Indoor Concentration
At Point: Downwind: 650 feet Off Centerline: 0 feet

Toxic Threat Zone

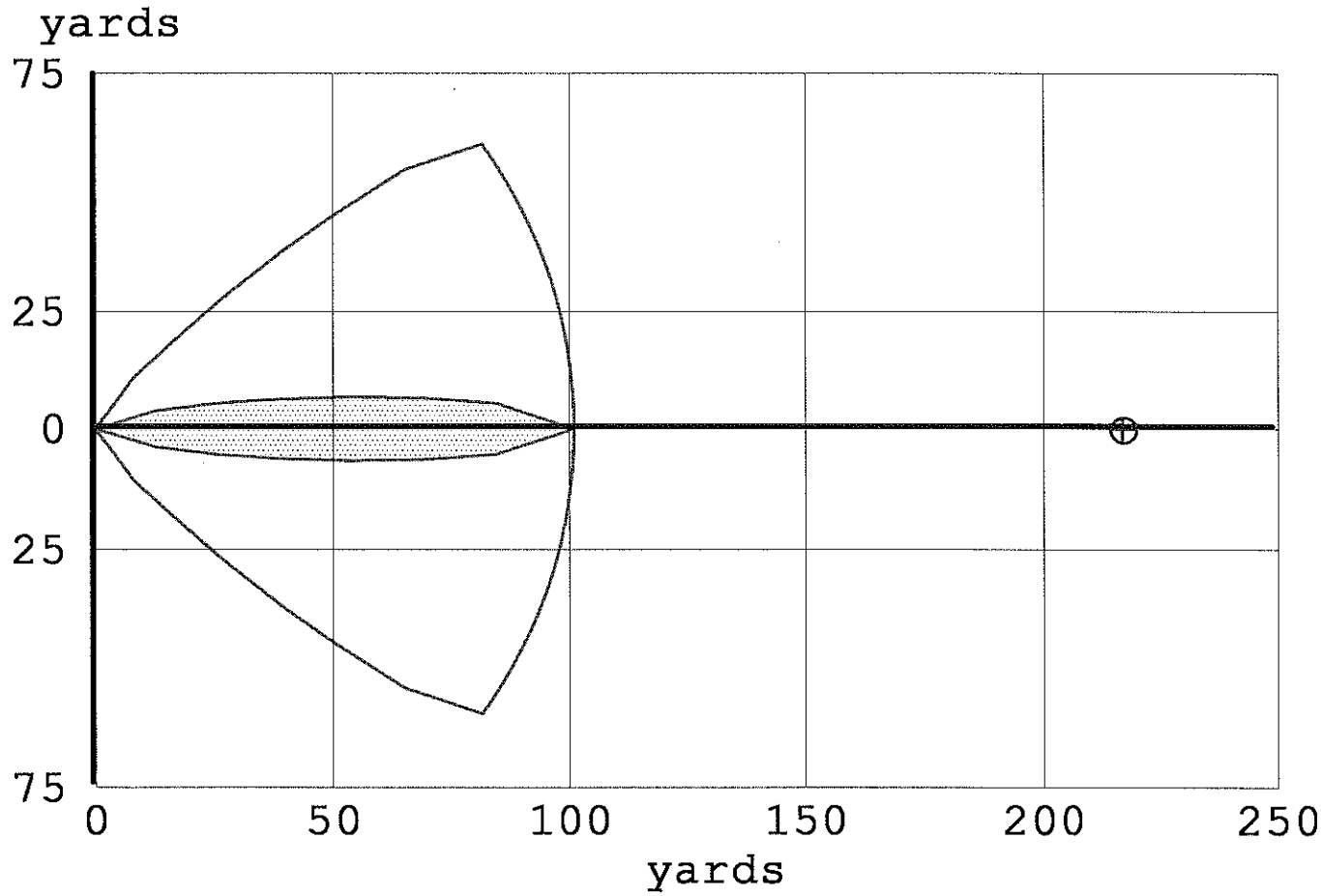
ALOHA® 5.4.3

Time: April 11, 2013 1100 hours PDT (using computer's clock)

Chemical Name: CHLORINE

Wind: 3 meters/second from 0° true at 10 meters

THREAT ZONE:
Model Run: Heavy Gas
Red : 101 yards --- (3 ppm = ERPG-2)



greater than 3 ppm (ERPG-2)

Confidence Lines

04/09/13
10:54:51

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

Gasoline Worst Case

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE                =        AREA
   EMISSION RATE (G/(S-M**2)) =     16.4000
   SOURCE HEIGHT (M)          =       .0000
   LENGTH OF LARGER SIDE (M)  =     24.4000
   LENGTH OF SMALLER SIDE (M) =      6.1000
   RECEPTOR HEIGHT (M)        =      2.0000
   URBAN/RURAL OPTION         =       URBAN
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

*** STABILITY CLASS  6 ONLY ***
*** ANEMOMETER HEIGHT WIND SPEED OF   1.50 M/S ONLY ***

**********************************
*** SCREEN DISCRETE DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC              U10M   USTK  MIX HT   PLUME  MAX DIR
   (M)   (UG/M**3)   STAB   (M/S)  (M/S)    (M)    HT (M)   (DEG)
-------  ----------  ----  -----  -----  ------  ------  -------
    50.   .2118E+08    6     1.5    1.5 10000.0     .00      0.
    75.   .1050E+08    6     1.5    1.5 10000.0     .00      0.
   100.   .6202E+07    6     1.5    1.5 10000.0     .00      0.
   150.   .2930E+07    6     1.5    1.5 10000.0     .00      0.
   200.   .1724E+07    6     1.5    1.5 10000.0     .00      0.
   300.   .8285E+06    6     1.5    1.5 10000.0     .00      0.
   400.   .4988E+06    6     1.5    1.5 10000.0     .00      0.

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION         MAX CONC    DIST TO   TERRAIN
  PROCEDURE         (UG/M**3)    MAX (M)    HT (M)
--------------     -----------   -------   -------
SIMPLE TERRAIN       .2118E+08      50.        0.

***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************
```

04/11/13
15:19:51

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

Gasoline Alternative

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE                =        AREA
   EMISSION RATE (G/(S-M**2)) =     16.4000
   SOURCE HEIGHT (M)          =       .0000
   LENGTH OF LARGER SIDE (M)  =     13.4000
   LENGTH OF SMALLER SIDE (M) =      3.7000
   RECEPTOR HEIGHT (M)        =      2.0000
   URBAN/RURAL OPTION         =       URBAN
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

*** STABILITY CLASS  4 ONLY ***
*** ANEMOMETER HEIGHT WIND SPEED OF   3.00 M/S ONLY ***

**********************************
*** SCREEN DISCRETE DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	MAX DIR (DEG)
25.	.5292E+07	4	3.0	3.0	960.0	.00	0.
50.	.1513E+07	4	3.0	3.0	960.0	.00	0.
75.	.6914E+06	4	3.0	3.0	960.0	.00	0.
100.	.3948E+06	4	3.0	3.0	960.0	.00	0.
150.	.1792E+06	4	3.0	3.0	960.0	.00	2.
200.	.1026E+06	4	3.0	3.0	960.0	.00	2.
300.	.4714E+05	4	3.0	3.0	960.0	.00	2.
400.	.2736E+05	4	3.0	3.0	960.0	.00	2.

```
     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************
```

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	.5292E+07	25.	0.

```
***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************
```

EPA Guidance

Chemical	MW	VPmmhg	SG	AMT-gals
Gasoline	100	335	0.75	2977

Eq	Factor	WS (m/s) U^0.78	MW^2/3	Area Spill A (ft2)	VP mHg	T(K)^-1	Fact^-1	lbs/min	g/m	g/s	For Screen g/s/m2
D-1	0.284	2.355888	21.57744	1600	335	0.003356	0.012188	316.4775	143680.8	2394.68	16.11007

		Fact	MW^2/3	VP(mm)	Factor^-1	T(K)^-1	LFA
D-3	"LFA"	0.284	21.4783	335	0.012188	0.003356	0.083573

	Factor	Exh B-3 LFA	A (ft2)	lbs/min	g/m	g/s	g/s/m2
Eq. 3-7	2.4	0.083573	1600	320.922	145698.6	2428.31	16.33632

ARCHIE	VP Of Hydrazine (Psh)				total	Atm	Archie Calc mmhg	EPA mmhg
	65.3319	-24.3128	-46.8301	1.834399	-3.97656	0.01875	14.25	14.4

Temp Corr Fact

		Pool Temp (Formaldehyde Only) C - deg.	CF
1	4.30E-03	25	3.69E+00

B.16 Volatile Flux (lbs/min/ft2)

1.5 m/s = 3.3555mph

Factor	U^.75 (mph)	Temp CF	VP Ps	MW	hydrazine Psh	lb/min/ft2	A ft2	lbs/min	g/m	g/s
4.66E-06	6.712	3.69E+00	335	100	14.4	0.166701	1600	266.7222	121091.9	2018.198

Ft2	Side ft	side (m)	A m2	g/s/m2
1600	40	12.192	148.6449	13.57732

Pool Size in Containment

Consistency Check

Wt H2O lbs/ft3	SG	COC lbs/ft3	Wt-H2O lbs/gal	COC lbs/gal	Amt COC gals	Total Wt COC - lbs	Vol COC ft3
62.43	0.75	46.8225	8.345	6.25875	2977	18632.3	397.9347

Depth ft	Area ft2	Assume ft2
0.25	1591.739	1600

Distance to 1 PSI over Pressure (Exhibit C- U.S. EPA OCA Guidance)

K		COC wt (lbs)	HC COC kJ/kg	HC TNT kj/kg	Distance Miles
0.0081	0.1	18632.3	47300	4680	0.214793

EPA Guidance

Chemical	MW	VPmmhg	SG	AMT-gals
Gasoline	100	335	0.75	991

Eq		WS (m/s)		Area Spill							For Screen
	Factor	U^0.78	MW^2/3	A (ft2)	VP mHg	T(K)^-1	Fact^-1	lbs/min	g/m	g/s	g/s/m2
D-1	0.284	2.355888	21.57744	528	335	0.003356	0.012188	104.4376	47414.66	790.2444	16.11007

		Fact	MW^2/3	VP(mm)	Factor^-1	T(K)^-1	LFA
D-3	"LFA"	0.284	21.4783	335	0.012188	0.003356	0.083573

	Factor	Exh B-3 LFA	A (ft2)	lbs/min	g/m	g/s	g/s/m2
Eq. 3-7	2.4	0.083573	528	105.9043	48080.54	801.3423	16.33632

ARCHIE	VP Of Hydrazine (Psh)				total	Atm	Archie Calc mmhg	EPA mmhg
	65.3319	-24.3128	-46.8301	1.834399	-3.97656	0.01875	14.25	14.4

Temp Corr Fact

		Pool Temp (Formaldehyde Only)	
		C - deg.	CF
1	4.30E-03	25	3.69E+00

B.16 Volatile Flux (lbs/min/ft2)

1.5 m/s = 3.3555mph

	U^.75	Temp	VP		hydrazine	lb/min/ft2		lbs/min	g/m	g/s
Factor	(mph)	CF	Ps	MW	Psh		A ft2			
4.66E-06	6.712	3.69E+00	335	100	14.4	0.166701	528	88.01833	39960.32	666.0054

Ft2	Side ft	side (m)	A m2	g/s/m2
528	22.97825	7.003771	49.05281	13.57732

Pool Size in Containment

Consistency Check

Wt H2O lbs/ft3	SG	COC lbs/ft3	Wt-H2O lbs/gal	COC lbs/gal	Amt COC gals	Total Wt COC - lbs	Vol COC ft3
62.43	0.75	46.8225	8.345	6.25875	991	6202.421	132.4667

Depth ft	Area ft2	Assume ft2
0.25	529.8667	

Distance to 1 PSI over Pressure (Exhibit C- U.S. EPA OCA Guidance)

K		COC wt (lbs)	HC COC kJ/kg	HC TNT kj/kg	Distance Miles
0.0081	0.1	6202.421	47300	4680	0.148917

Release Rate Calculations

Alternative Release Rates
Source:

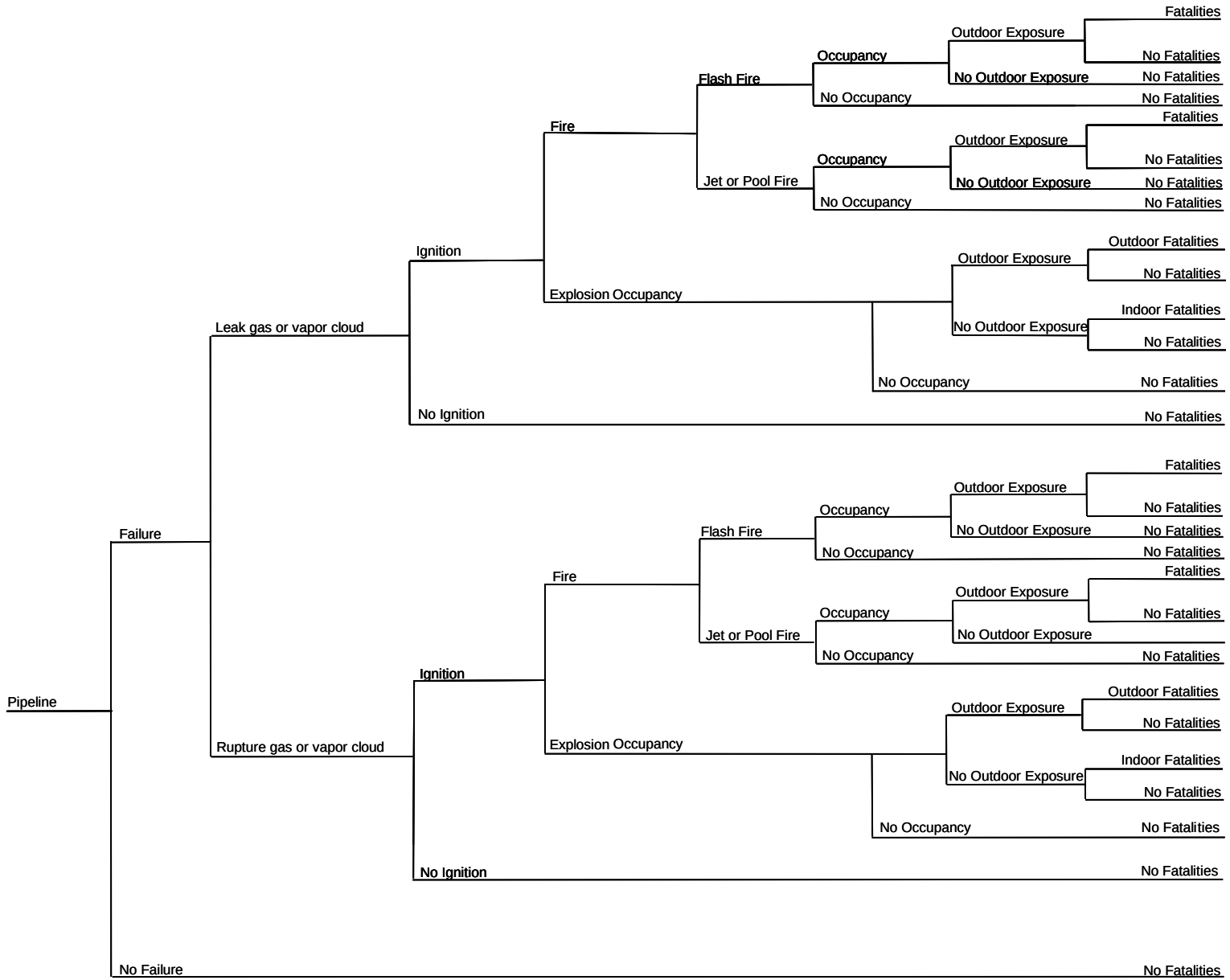
	Seagate
	Chlorine
rfo inc'	0.04
mw	70.91
psi	85
vol ft3	540

Scott Calc

k	767
Area	1.26E-03
psi	99.7
scfh (air)	96.10
CF	0.64
scfh gas	61.41
g/hr	5043.93
lbs/min	1.85E-01

vol ft3	540
liters	15292.8
mole	625.4723926
grams	44352.24736
pounds	97.69217481

APPENDIX B – PIPELINE RUPTURE EVENT TREE AND PROBABILITY VALUES


Pipeline
Failure
No Failure
Leak gas or vapor cloud
Rupture gas or vapor cloud
Ignition
No Ignition
Fire
Explosion Occupancy
Flash Fire
Jet or Pool Fire
Occupancy
No Occupancy
Outdoor Exposure
No Outdoor Exposure
Fatalities
No Fatalities
Outdoor Fatalities
Indoor Fatalities

Accident Database (available at www.phmsa.dot.gov). Data for use in the Protocol is presented in Table 4-3. These failure rates are based on historical data for significant releases specific to pipelines in California. See Volume 2 for details on derivation.

Table 4-3. Normalized Pipeline Average Failure and Release Frequencies (F0) for California Pipelines (1984-2001 Period)

Pipeline Product	Pipeline Service Type[a]	F0, Number of Releases/mile-year	
Natural Gas	Transmission Line	1.2E-04	(0.00012)
Natural Gas	Gathering Line	2.1E-04	(0.00021)
Natural Gas	Distribution Main Line	4.6E-05	(0.000046)
Hazardous Liquids – All Commodity Types	Transmission Line	1.8E-03	(0.0018)
Crude Oil	Transmission Line	2.3E-03	(0.0023)
Refined Product	Transmission Line	1.3E-03	(0.0013)

Source: OPS Gas Pipeline Incident and Hazardous Liquid Pipeline Accident Databases, 2000.

[a] As defined in OPS regulations.

The values in the table compare with values of between 5.0E-04 and 1.5E-03 for all pipelines presented in the "Brown Book", and suggested for estimating pipeline failure rates for frequency calculations in emergency planning (FEMA 1989).

Base Release Probability

The probability of a pipeline failure resulting in the release of product with a specified hazard begins with calculation of base probability from the base release frequency (F0), using a Poisson probability estimate of "one or more" releases in a given year of pipeline operation. A mathematical derivation leads to the following equation:

$$P0 = 1 - e^{(-F0 \times t)} \qquad \text{(Eqn. 4-7)}$$

Where,

F0 = the average release frequency for the pipeline in releases/mi-year; and

t = the time period for which the probability is sought; all probabilities in this Protocol are based on one year, so t =1.

For the small frequency numbers encountered for pipeline failure rates, the equation yields an annual probability value that is numerically equal to the annual frequency as illustrated below:

$P0 = 1 - \exp(-F0 \times t)$, where t is taken to be a probability time basis of 1 year

$P0 = 1 - \exp[(-1.2E\text{-}04) \times (1)]$

$P0 = 1.2E\text{-}04$ (or 0.00012, expressed as a decimal)

This probability is adjusted as needed to account for special site conditions that suggest the average failure rate should be adjusted. Guidance on this point is provided in Volume 2 of the Protocol. This is then followed by the application of various conditional probabilities associated with specific hazard scenarios that derive from the initial product release as was illustrated in the event tree of Figure 4-2, shown earlier.

Adjusted Base Probability

The base probability (P0) is multiplied by a probability adjustment factor (PAF) to yield the Adjusted Base Probability (PA):

$$PA = P0 \times PAF \qquad \text{(Eqn. 4-8)}$$

Failure frequencies can increase or decrease depending on a number of conditions, such as the quality of the maintenance program, corrosive soil conditions at one location compared with another, and types of third party activity likely to be encountered near a specific segment. These variations contribute to the inherent uncertainty in estimated risk values. The Probability Adjustment Factor (PAF) allows for the modification of the base value by expert judgment, based on knowledge of specific segment conditions and changes in pipeline management over time.

The probability adjustment factor is a convenient way to account for special circumstances surrounding seismic effects and other "earth movement" phenomena unique to certain locations in California.

The California data from the OPS database already account for seismic and other earth movements as causes for reportable incidents in the data compilation period. However, because of the potential damage to pipelines from earthquakes may vary significantly throughout the State, the PAF provides a mechanism for incorporating local seismic event-induced probability considerations into the analysis if deemed necessary. Whether further geotechnical review or other qualified geotechnical/pipeline specialists (e.g., CA certified, registered) are required for this issue will be at the discretion of the risk analyst. If the threat to a pipeline from a local geologic condition is deemed significant, appropriately qualified professionals would then need to determine the amount of upwards adjustment to the pipeline failure and product release base probability that is already provided in the Protocol.

A potential trigger for additional geotechnical review and possible upward probability adjustment is if the pipeline segment within 1,500 feet of the site is located within identified seismic hazard areas. Maps of these areas are prepared by the California Geological Survey and

delineate areas subject to a high potential for significant ground displacement by faulting, liquefaction, landslides and strong ground motion. Other sources of information regarding a local seismic threat could include prior geologic/geotechnical studies independently completed for the school site or nearby locations, pipeline owner/operator data, and/or city/county general plans. Additional discussion on seismic issues and information resources are provided in Volume 2, Section 5.

4.5.2.5 Base Probability for Each Hazard Segment Length (XSEG)

Only the length of pipe defined by each XSEG length is capable of yielding an IR impact at the receptor location for the corresponding hazard, X. Product releases outside the XSEG do not threaten the receptor with a fatality, since the XSEG lengths were defined by the limits of such impacts reaching the receptor. The PA is converted to PA(X) for each hazard scenario as follows:

$$PA(X) = (XSEG/5{,}280) \times PA \qquad \text{(Eqn. 4-9)}$$

XSEG/5280 is merely the ratio of the given hazard segment length, XSEG in feet to the number of feet in a mile (5,280).

4.5.2.6 Conditional Probability for Each Hazard Impact

The conditional probabilities for the various hazard impacts, PCI(X), are determined by the following equations:

Leak Jet or Pool Fire: $PCI(LJF) = PC(L) \times PC(LIG) \times PC(FIG) \times PC(JF)$ (Eqn. 4-10)

Rupture Jet or Pool Fire: $PCI(RJF) = PC(R) \times PC(RIG) \times PC(FIG) \times PC(JF)$ (Eqn. 4-11)

Leak Flash Fire: $PCI(LFF) = PC(L) \times PC(LIG) \times PC(FIG) \times PC(FF)$ (Eqn. 4-12)

Rupture Flash Fire: $PCI(RFF) = PC(R) \times PC(RIG) \times PC(FIG) \times PC(FF)$ (Eqn. 4-13)

Leak Explosion: $PCI(LEX) = PC(L) \times PC(LIG) \times PC(EIG)$ (Eqn. 4-14)

Rupture Explosion: $PCI(REX) = PC(R) \times PC(RIG) \times PC(EIG)$ (Eqn. 4-15)

Protocol default conditional probabilities for use in these equations are listed in Table 4-4.

Table 4-4. Conditional Probabilities

Conditional Probability of Occurrence Associated with a Product Release	Variable Designation	Gas Pipeline Value	Crude Oil Pipeline Value	Petroleum Product Pipeline Value
Probability of leak	PC(L)	0.8	0.8	0.8
Probability of rupture	PC(R)	0.2	0.2	0.2
Probability of ignition from leak	PC(LIG)	0.3	0.09	0.09 (gasoline) 0.03 (other liquids)
Probability of ignition from rupture	PC(RIG)	0.45	0.03	0.09 (gasoline) 0.03 (other liquids)
Probability of fire from ignition	PC(FIG)	0.99	0.95	0.95
Probability of explosion from ignition	PC(EIG)	0.01	0.05	0.05
Probability of flash fire from ignition	PC(FF)	0.01	0.05	0.05
Probability of jet fire (gas pipelines) or pool fire (liquid pipelines)	PC(JF)	0.98	0.95	0.95
Probability of occupancy	PC(OCC)	0.16	0.16	0.16
Probability of outdoor exposure	PC(OUT)	0.25	0.25	0.25

Source: See Volume 2.

[a] User may substitute other values for default values, if desired, along with supporting documentation. Data sources do not relate values to release orientation for gas releases, so by default, the same values are used for both.

4.5.2.7 Conditional Probability of Individual Exposure

An individual can be affected only if that person is present at the impact location when an incident occurs. The probability of exposure is given as:

$$PC(EXPO) = PC(OCC) \times P(OUT) \qquad \text{(Eqn. 4-16)}$$

Where,

PC(OCC) = the probability of occupancy at the campus in a given year;

P(OUT) = the probability of being outdoors during occupancy in a given year.

This is estimated for an individual campus for the average individual. Default values for this Protocol are based on occupancy for 180 days per year, 8 hours per day to yield:

PC(OCC) = 180 days/year x 8 hours/day / 8760 hours/year = 0.16

PC(OUT) is assumed to be 2 hours per day so the probability of being outdoors during an 8-hour day is 2/8 = 0.25. The default PC(EXPO) = 0.16 x 0.25 = 0.04.

4.5.2.8 Hazard Conditional Probability and IR Calculations

The final step in the analysis is calculation of the individual hazard conditional probabilities and PC(X), the hazard impacts and the fatality probabilities PF(X), and the individual hazard Individual Risks IR(X), and the Total IR.

The individual hazard conditional probabilities are given by the following equations:

Leak Jet or Pool Fire: PC(LJF) = PA(LJF) x PCI(LJF) x PC(EXPO) (Eqn. 4-17)

Rupture Jet or Pool Fire: PC(RJF) = PA(RJF) x PCI(RJF) x PC(EXPO) (Eqn. 4-18)

Leak Flash Fire: PC(LFF) = PA(LFF) x PCI(LFF) x PC(EXPO) (Eqn. 4-19)

Rupture Flash Fire: PC(RFF) = PA(RFF) x PCI(RFF) x PF(EXPO) (Eqn. 4-20)

Leak Explosion: PC(LEX) = PA(LEX) x PCI(LEX) x PC(EXPO) (Eqn. 4-21)

Rupture Explosion: PC(REX) = PA(REX) x PCI(REX) x PC(EXPO) (Eqn. 4-22)

The individual hazard IRs are given by the following equations:

Leak Jet or Pool Fire IR: IR(LJF) = PC(LJF) x PF(LJF) (Eqn. 4-23)

Rupture Jet or Pool Fire IR: IR(RJF) = PC(RJF) x PF(RJF) (Eqn. 4-24)

Leak Flash Fire IR: IR(LFF) = PA(LFF) x PCI(LFF) (Eqn. 4-25)

Rupture Flash Fire IR: IR(RFF) = PA(RFF) x PCI(RFF) (Eqn. 4-26)

Leak Explosion IR: IR(LEX) = PA(LEX) x PCI(LEX) (Eqn. 4-27)

Rupture Explosion IR: IR(REX) = PA(REX) x PCI(REX) (Eqn. 4-28)

The total IR is the sum of the contributions for the IR for each hazard.

TIR = IR(LJF) + IR(RJF) + IR(LFF) + IR(RFF) + IR(LEX) + IR(REX) (Egn. 4-29)

This calculated value is compared to the CDE IRC of 1.0E-06. If TIR > IRC, TIR is "significant"; otherwise it is "insignificant".

The foregoing steps in the estimating the IR can be summarized as:

Step 1: Estimate the hazard impact, maximum distance for each Protocol Basis Scenario.

Step 2: Estimate the hazard segment length, XSEG, for each hazard scenario.

Step 3: Estimate the base release frequency (F0), the base annual release probability per mile of pipeline (P0), and the adjusted base probability PA using the probability adjustment factor, PAF. Determine the base annual probability for each hazard scenario for the estimated hazard segment length.

Step 4: Estimate the conditional probability of impact for each hazard scenario, PCI(X).

Step 5: Estimate the conditional probability of individual exposure, PC(EXPO).

Step 6: Estimate the hazard impact severity at the receptor location, the mortality, and fatality probability if exposed to the impact for each hazard scenario, PF(X).

Step 7: Estimate the hazard conditional probability at the receptor location PC(X).

Step 8. Estimate the individual risk contribution IR(X) of each hazard (X) scenario.

Step 9: Estimate the total individual risk (TIR).

The Total Individual Risk requires a repeat of the above steps of each of the other five hazard scenarios and IR(X). The TIR is then computed. This value is included in a risk analysis report to CDE as discussed in Section 5.

The following numerical example illustrates the process for a natural gas pipeline.