HAZARDOUS MATERIALS COMMODITY FLOW STUDY WITH SPECIAL FOCUS ON SEA LEVEL RISE AND FLOOD RISK

CONTRA COSTA COUNTY CALIFORNIA

Contra Costa Health Services
Hazardous Materials Programs

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APPENDICES

1.0 Introduction

The project consisted of the completion of an initial Hazardous Materials Commodities Flow Study (Flow Study), the results of which were utilized to prepare a Community Risk Assessment for Hazardous Materials (CRA) for Contra Costa Health Services, Hazardous Materials Programs (CCHSHMP). The project was restricted to the coastal areas of the Contra Costa County in areas affected by rising tides.

1.1 Project Objectives

The proposed overall structure for the completion of the project covered two (2) distinct areas of focus. An initial Flow Study was completed, and the results of the Flow Study were utilized to prepare a CRA for the coastal areas of Contra Costa County. The objective of the Flow Study portion of this project was to determine the potential effects/consequences of a chemical spill on critical and vulnerable populations and facilities in the coastal cities of Contra Costa County. The primary focus of the Flow Study was to look at this with respect to rail transport of hazardous chemicals through the County, and particularly within areas of the county where the rail lines may be susceptible to rising tides and flooding risks from changes in our climate. Chemical data from industries in the County helped to determine what types of hazardous chemicals were being transported through the County via rail. Three chemicals of concern (COCs) were determined from the railroad data, and these chemicals (ammonia/anhydrous ammonia, propane, and sulfuric acid) were used in the plume analysis in the CRA portion of this report.

Utilization of this information allowed for the study to focus on and determine a series of vulnerable points (“pinch points”), primarily along the rail lines. Additional information used to locate the pinch points consisted of a review potential flooding due to rising tides, with information available from the Adapting to Rising Tides Program, locations of critical facilities and vulnerable populations, areas of high probability of liquefaction resulting from earthquakes, and specific arterial roads that could be affected by disruption of rail transport of hazardous materials. Once specific pinch points were located, a comprehensive CRA was performed to assess worst-case scenarios related to a COCs incident at these locations. The pinch points were not industry specific, as the focus was on the existing transportation infrastructure.

The objective of the CRA portion of the project was to utilize the data obtained from the Flow Study to determine the potential impacts of a hazardous materials accident/incident to the most vulnerable populations and critical facilities (vulnerability zones) within the hazardous materials transportation corridors in Contra Costa County. The data from the Flow Study and the CRA were somewhat overlapping and have been combined herein within a single comprehensive report with conclusions regarding projected trends in the transportation of hazardous materials through the county relative to projected sea level rise and flood risk, as well as provide guidance to the CCHSHMP and Region II LEPC with respect to equipment and training to allow emergency responders to proactively respond to a hazardous materials accident/incident/disaster within coastal Contra Costa County.

1.2 Project Background

In November 2016, a two-year project sponsored by San Francisco Bay Conservation and Development Commission titled Adapting to Rising Tides (ART) was completed. The ART Program conducted a climate adaptation planning effort in Contra Costa County, which built understanding of projected risk due to sea level rise and developed planning objectives for the diverse challenges and opportunities presented by adapting to sea level rise in the County. This project included areas of the county that interface with the San Francisco Bay, which include areas extending from Richmond to Bay Point.

After the completion of the initial Contra Costa County Adapting to Rising Tides program, it was clear that the County must act to identify risks that exist within the shoreline, specifically in regard to hazardous materials. This project, titled Hazardous Materials Commodity Flow Study with Special Focus on Sea Level Rise and Flood Risk, was needed to foster a greater understanding on how major hazardous materials transportation, such as our rail system, can be impacted by sea level rise/flooding and how that can increase our risk for hazardous materials incidents that can affect the health and safety of our community. Understanding how transportation disruptions can impact the County-wide system will benefit hazardous materials emergency response planning and overall shoreline planning as the actions from the ART project are implemented.

This project will interface with the overall goals of the County's Hazardous Materials Programs. The CAER (Community Awareness Emergency Response) organization will be engaged to obtain collaboration with our Industry partners in the County to get needed input and data regarding their current transportation contingency planning for flooding. This also will maximize the benefit of the project as well as maximize cooperation with needed resources. CCHSHMP is currently participating in the Bay Area Wide Adapting to Rising Tides program, as a hazardous materials representative, along with Michael Kent the Hazardous Materials Ombudsman, as well as the East Contra Costa County program, which is slated to conclude at the end of 2019. With the conclusion of these additional ART programs, all areas of Contra Costa County will be addressed. Data from these additional programs, while not fully completed at the time of the Flow Study competition, have been utilized as part of the project analysis.

Goals of the project include identifying risks from hazardous materials release due to possible disruption of transportation due to sea level rise/flooding as predicted by the Adapting to Rising Tides program. Identifying these issues will help the County to better address and plan for hazardous materials releases in order to protect and promote health, safety, and wellbeing of Contra Costa residents.

The final project report will be published and made available for hazardous materials emergency planning as well as the Bay Area wide Adapting to Rising Tides program and other applicable transportation related planning.

2.0 Historical Information

Background historical information used in preparing both the Flow Study and CRA portions of this project was obtained from the following sources:

- Hazardous Materials Transportation Study for Contra Costa County, 2005; and
- Highway flow study data from Marin and Solano Counties.

2.1 Hazardous Materials Transportation Study 2005

A Hazardous Materials Transportation Study was performed on the County in 2004 and 2005. The reference for the study is as follows:

> Contra Costa Health Services, Hazardous Materials Programs and California Department of Health Services, Environmental Health Investigations Branch, 2005, *Hazardous Materials Transportation Study for Contra Costa County, CA*, 71 p.

The study was a two-part investigation, which included a railroad transportation survey, and a highway transportation survey. Details of these surveys are outlined in the sections below.

2.1.1 Railroad Data

Two railroads are the primary transportation railroads in Contra Costa County, Union Pacific Railroad (UP), and Burlington Northern and Santa Fe Railway (BNSF). Railway data from UP covered the period from January through December 2004, and the data from BNSF covered the period from April 1, 2004 through March 31, 2005. Most of the hazardous materials loads were carried on the following rail segments:

- UP
  - Martinez-Davis
  - Martinez-Tracy
  - Oakland-Martinez

- BNSF
  - Richmond-Port Chicago
  - Port Chicago-Pittsburg
  - Pittsburg-Stockton

The data covering the maximum loads via any Contra Costa rail shipment is contained in Table 14 of the study, and is listed under the Standard Transportation Commodity Code (STCC), which is specific to rail transportation, and is shown below.

Table 14: Hazardous Materials by STCC number – Maximum Loads - any Contra Costa Rail Segment *

STCC #	Description	Max Loads	STCC #	Description	Max Loads
4950130	FAK-HAZARDOUS MATERIALS	10773	4910102	ALCOHOLIC BEVERAGES	72
4905752	PETROLEUM GASES,LIQUEFIED	5539	4901110	CARTRIDGES FOR WEAPONS	71
4950150	FAK-HAZARDOUS MATERIALS	3797	4907270	VINYL ACETATE, STABILIZED	68
4909152	ALCOHOLS, N.O.S.	2956	4935605	2-(2-AMINOETHOXY) ETHANOL	67
4930040	SULFURIC ACID	2329	4932376	BISULFITES, AQ. SOL'N, N.O.S.	66
4901807	CARTRIDGES FOR WEAPONS	1570	4914251	PAINT	65
4920523	CHLORINE	850	4908177	GASOLINE	61
4905423	BUTANE	794	4936653	CORROSIVE LIQUIDS, N.O.S.	59
4961605	ELEVATED TEMP. LIQUID-N.O.S.	790	4910535	FLAMMABLE LIQUIDS, N.O.S.	57
4901271	PROJECTILES	747	4905417	LIQUEFIED PETROLEUM GAS	53
4935240	SODIUM HYDROXIDE SOLUTION	701	4930248	PHOSPHORIC ACID, LIQUID	52
4905421	PROPANE	663	4914256	PETROLEUM DISTILLATES- N.O.S.	49
4930228	HYDROCHLORIC ACID	634	4936556	BATTERIES, WET, FILLED WITH ACID	49
4904509	CARBON DIOXIDE- REFRIG. LIQUID	347	4909184	PICOLINES	46
4909230	METHANOL	345	4921598	PHENOL, MOLTEN	46
4909105	ETHYL ALCOHOL	322	4918335	HYDROGEN PEROXIDE, STABILIZED	45
4930042	SULFURIC ACID- SPENT	307	4912296	FLAMMABLE LIQUIDS- N.O.S.	44
4932342	FERRIC CHLORIDE, SOLUTION	263	4930026	FLUOROSILICIC ACID	44
4902423	CHARGES, PROPELLING, FOR CANNON	208	4930039	SULFURIC ACID	42
4907265	STYRENE MONOMER- INHIBITED	183	4950110	FAK-HAZARDOUS MATERIALS	42
4912215	BUTYL ACRYLATES, STABILIZED	177	4902530	ROCKET MOTORS	41
4901223	BOMBS	174	4909205	ISOPROPANOL	40
4904210	AMMONIA- ANHYDROUS	173	4930223	NITRIC ACID	40
4960107	ENV. HAZ. SUBSTANCES- SOLID- N.O.S.	171	4950168	MIXED LOADS MILTARY IMPEDIMENTA	40
4907250	METHYL METHACRYLATE, STABIL.	156	4902147	AMMUNITION, ILLUMINATING	38
4810560	WASTE FLAMMABLE LIQUIDS, N.O.S.	145	4907219	DICYCLOPENTADIENE	36
4901174	ROCKETS	132	4909363	ALCOHOLS- N.O.S.	36
4807419	WASTE FLAMMABLE LIQ., TOXIC, N.O.S	120	4915473	COMBUSTIBLE LIQUID-N.O.S.	36
4908255	PENTANES	117	4921056	PESTICIDES, LIQUID, TOXIC, FLAM.	35
4930247	PHOSPHORIC ACID, LIQUID	116	4930024	HYDROGEN FLUORIDE, ANHYDROUS	34
4905430	ISOBUTANE	114	4910256	PETROLEUM DISTILLATES, N.O.S.	33
4905704	BUTADIENES, STABILIZED	112	4920508	SULFUR DIOXIDE	33
4909381	METHANOL	98	4916408	CALCIUM CARBIDE	30
4909159	ETHYL ALCOHOL	97	4936545	CORROSIVE SOLIDS, N.O.S.	29
4905424	BUTANE	96	4915389	COMBUSTIBLE LIQUID,N.O.S.	27
4904503	ARGON- REFRIGERATED LIQUID	94	4932329	FERROUS CHLORIDE,SOLUTION	27
4931461	CORROSIVE SOLID, ACIDIC, INORG.	90	4935601	AMINES, LIQUID, CORROSIVE, N.O.S.	27
4901560	CHARGES, DEMOLITION	87	4860132	HAZARDOUS WASTE, LIQUID,N.O.S.	24
4908105	ACETONE	86	4915185	COMBUSTIBLE LIQUID,N.O.S.	24
4960148	ELEVATED TEMP. LIQUID- N.O.S.	81	4920518	METHYL BROMIDE	24
4935230	POTASSIUM HYDROXIDE SOL'N	75	4908290	TETRAHYDROFURAN	23

Table 14, continued

STCC #	Description	Max Loads	STCC #	Description	Max Loads
4921414	CHLOROPICRIN	23	4912298	PETROLEUM DISTILLATES, N.O.S.	12
4906420	ACRYLONITRILE- INHIBITED	22	4918775	HYDROGEN PEROXIDE, AQ. SOL'N	12
4903170	CARTRIDGES FOR WEAPONS	21	4925123	ACRYLAMIDE	12
4921575	TOLUENE DIISOCYANATE	21	4935258	CORROSIVE LIQUID, BASIC, INORGANIC,	12
4909179	PICOLINES	20	4935665	ETHANOLAMINE	12
4918311	AMMONIUM NITRATE	20	4941144	POLYMERIC BEADS, EXPANDABLE	12
4901801	AMMUNITION, ILLUMINATING	19	4961166	ENGINES, INTERNAL COMBUSTION	12
4908183	HEXANES	19	4901319	CHARGES, PROPELLING, FOR CANNON	11
4936540	CORROSIVE LIQUIDS, N.O.S.	19	4909382	PETROLEUM DISTILLATES- N.O.S.	11
4901833	FUSES, DETONATING	18	4835240	WASTE SODIUM HYDROXIDE SOLUTION	10
4905428	BUTYLENE	18	4914108	COMBUSTIBLE LIQUID,N.O.S.	10
4918761	OXIDIZING SOLID, N.O.S.	18	4931303	ACETIC ACID SOLUTION	10
4905753	ISOBUTANE	17			
4910240	ETHANOL	17			
4907829	FLAMMABLE LIQUIDS, CORROSIVE, N.O.S	16			
4908178	GASOLINE (AVIATION GASOLINE, LEADED	16			
4909380	METHANOL	16			
4912604	ADHESIVES	16			
4961102	FUMIGATED UNIT	16			
4966109	OTHER REGULATED SUBSTANCE, LIQUID	16			
4908285	TETRAHYDROFURAN	15			
4902132	AMMUNITION, SMOKE	14			
4903520	FIREWORKS	14			
4909255	DICHLOROPROPENES	14			
4904318	PENTAFLUOROETHANE	13			
4909243	ETHYL METHYL KETONE	13			
4910185	FLAMMABLE LIQUIDS, N.O.S.	13			
4999999	MATERIAL NOT CLASSIFIABLE	13			
4901811	CARTRIDGES FOR WEAPONS	12			
4905784	PROPYLENE	12			
4909219	FLAMMABLE LIQUIDS, N.O.S.	12			

STCC – Standard Transportation Commodity Code (specific to rail transportation)
"Max loads" – The maximum number of loads for each material (each STCC code) carried on any one rail segment in Contra Costa County over a 12 month period (2004-2005). Note: This method avoids duplicate counting of loads carried from one rail segment to the other (a common occurrence) but probably underestimates the total number of loads transported in the county in a year.
"N.O.S." – not otherwise specified.
Note: Material descriptions were provided by the railroads as the 'one-liners' shown above. In some cases worded descriptions are the same although the STCC codes are different. These are different types of the generic material(s) that could not be described on one text line. More information on STCC codes is available at URL: https://www.steelroads.com/index.jsp (click on "product codes").

In addition to the above total shipping data for hazardous materials via the railroad in this study, information concerning "Toxic by Inhalation" Rail Hazardous Materials, is contained within Table 16 of the survey. Those data are shown below.

Table 16: "Toxic by Inhalation" Rail Hazardous Materials

Max Loads - Any Rail Segment	STCC #	UN #	"TIH" Materials
850	4920523	1017	Chlorine
173	4904210	1005	Ammonia, Anhydrous
34	4930024	1052	Hydrogen Fluoride, Anhydrous
33	4920508	1079	Sulfur Dioxide
24	4920518	1062	Methyl Bromide
23	4921414	1580	Chloropicrin
3	4916323	1295	Trichlorosilane *
2	4921405	1595	Dimethyl Sulfate
2	4920369	1955	Liquified Gas, Toxic, N.O.S.
1	4916305	1397	Aluminum Phosphide *
1	4920346	1082	Trifluorochloroethylene, inhibited
1	4921475	2810	Toxic Liquids, Organic, N.O.S.
1	4925275	2810	Toxic Liquids, Organic, N.O.S.

1. "Toxic by Inhalation (TIH)" – 2004 Emergency Response Guidebook (DOT, 2004).
2. "Max loads – any rail segment": The maximum number of loads of the material on any rail segment in Contra Costa County over a 12 month period (2004-2005). Note: This method avoids duplicate counting of loads carried from one rail segment to the other (a common occurrence) but probably underestimates the total number of loads transported in the county in a year.
3. STCC #: Standard Transportation Commodity Code number (railway).
4. UN #: United Nations corresponding four-digit hazardous material number.
5. * Dangerous water-reactive material - produces toxic gas on contact with water 2004 Emergency Response Guidebook (DOT, 2004).
6. N.O.S. – "not otherwise specified."

Additional railroad data are contained within the 2005 report.

2.1.2 Highway Data

Highway placard survey data was collected for the 2005 report from both the fall of 2004 and summer of 2005. The data were collected from the following survey locations:

- Highway 580-Richmond/San Rafael toll bridge plaza;
- Highway 160-Antioch toll bridge plaza;
- Highway 4-Oakley Street intersection;
- Highway 680-Walnut Creek weigh station;
- Highway 80-Carquinez toll bridge plaza;
- Highway 4-Pittsburg train Bay Area Rapid Transit (BART) station; and
- Highway 580-Livermore weigh station.

Data from the highway placard survey is compiled in the report in various tables. Table 4 shows all of the United Nations (UN) chemical identification numbers from all data from the highway placard survey and is shown below.

Table 4: All UN Numbers Recorded from Hazardous Material Trucks during Entire Survey *

UN number	Material	Frequency	Percent
1203	Gasoline	1,094	33.92
3257	Elevated temp. liquid, nos	336	10.42
1075	Liquified petroleum gas, e.g., propane, butane,	274	8.50
1993	Combustible liquid, nos	256	7.94
2448	Sulfur, molten	189	5.86
1791	Hypochlorite solution	116	3.60
2187	Carbon dioxide, refrig liquid	104	3.22
1977	Nitrogen, refrig. liquid	100	3.10
1824	Sodium hydroxide solution	97	3.01
3264	Corrosive liquid, acidic, inorganic nos	58	1.80
1073	Oxygen, refrig. liquid	55	1.71
1987	Alcohols, nos	40	1.24
1830	Sulfuric acid	35	1.09
3082	Environ. hazardous liquid or haz. waste, liquid nos	32	0.99
1263	Paint/related material	26	0.81
1951	Argon, refrig. liquid	25	0.78
2672	Ammonia/ammonium hydroxide solution	25	0.78
2693	Bisulfites, aqueous solution	23	0.71
1789	Hydrochloric acid	21	0.65
1863	Fuel, aviation	21	0.65
No ID	(UN number not identified)	20	0.62
3077	Environ. hazardous solid or haz. waste, solid, nos	15	0.47
1760	Corrosive liquid, nos	14	0.43
2582	Ferric chloride solution	11	0.34
1017	Chlorine	10	0.31
3266	Corrosive liquid, basic, inorganic nos	10	0.31
1005	Ammonia, anhydrous	9	0.28
1049	Hydrogen	9	0.28
1805	Phosphoric acid	8	0.25
2031	Nitric acid	8	0.25
2796	Battery fluid, sulfuric acid	8	0.25
1046	Helium	7	0.22
1866	Resin solution	7	0.22
2426	Ammonium nitrate, hot concentrated solution	7	0.22
3267	Corrosive liquid, basic, organic, nos	7	0.22
partial ID	("corrosive" placard)	7	0.22
1090	Acetone	6	0.19

2014	Hydrogen peroxide, aqueous solution (20-60%)	6	0.19
1701	Xylyl bromide	5	0.16
1778	Fluorosilicic acid	5	0.16
2209	Formaldehyde solutions	5	0.16
2683	Ammonium sulfide solution	5	0.16
2191	Sulfuryl fluoride	4	0.12
2348	Butyl acrylate(s)	4	0.12
3065	Alcoholic beverages	4	0.12
1030	Difluoroethane	3	0.09
1079	Sulfur dioxide	3	0.09
1170	Ethanol	3	0.09
1219	Isopropanol	3	0.09
1287	Rubber solution	3	0.09
1814	Caustic potash / potassium hydroxide solution	3	0.09
3265	Corrosive liquid, acidic, organic, nos	3	0.09
1172	Ethylene glycol monoethyl ether acetate	2	0.06
1230	Methanol	2	0.06
1267	Petroleum crude oil	2	0.06
1268	Petroleum distillates/products, nos	2	0.06
1270	Petroleum oil	2	0.06
1276	n-Propyl acetate	2	0.06
1307	Xylenes	2	0.06
1328	Hexamethylenetetramine	2	0.06
1719	Caustic alkali liquid, nos	2	0.06
1731	Antimony pentachloride, solution	2	0.06
1790	Hydrofluoric acid	2	0.06
1942	Ammonium nitrate	2	0.06
1972	Liquified natural gas or methane, refrig. liquid	2	0.06
1999	Asphalt or liquid tars	2	0.06
3109	Organic peroxide type F, liquid	2	0.06
3190	Self-heating solid, inorganic, nos	2	0.06
partial ID	("miscellaneous" placard)	2	0.06
1072	Oxygen	1	0.03
1193	Methyl ethyl ketone	1	0.03
1197	Extracts, flavoring, liquid	1	0.03
1202	Fuel oil, e.g, diesel	1	0.03
1234	Methylal	1	0.03
1264	Paraldehyde	1	0.03
1294	Toluene	1	0.03
1325	Flammable solid, nos	1	0.03

1648	Acetonitrile	1	0.03
1708	Toluidines	1	0.03
1741	Boron trichloride	1	0.03
1759	Corrosive solid, nos	1	0.03
1803	Phenolsulfonic acid, liquid	1	0.03
1831	Sulfuric acid, fuming	1	0.03
1832	Sulfuric acid, spent	1	0.03
1886	benzylidene chloride	1	0.03
1906	Acid sludge	1	0.03
1907	Soda lime	1	0.03
1908	Chlorite solution	1	0.03
1966	Hydrogen, refrig. liquid	1	0.03
1978	Propane	1	0.03
1992	Flammable liquid, toxic, nos	1	0.03
2055	Styrene monomer, stabilized	1	0.03
2078	Toluene diisocyanate	1	0.03
2201	Nitrous oxide, refrig liquid	1	0.03
2272	n-Ethylaniline	1	0.03
2315	Polychlorinated biphenyls	1	0.03
2491	Ethanolamine	1	0.03
2502	Valeryl chloride	1	0.03
2505	Ammonium fluoride	1	0.03
2734	Alkyl/poly/amines, liquid, corrosive, flammable	1	0.03
2794	Batteries, wet, filled with acid	1	0.03
2795	Batteries, wet, filled with alkali	1	0.03
2810	Poisonous/toxic liquid	1	0.03
2862	Vanadium pentoxide	1	0.03
2922	Corrosive liquid, toxic or sodium hydrosulfide solution	1	0.03
2924	Flammable liquid corrosive, nos	1	0.03
3095	Corrosive solid, self-heating, nos	1	0.03
3139	Oxidizing liquid, nos	1	0.03
3291	Medical waste, nos	1	0.03
3295	Hydrocarbons, liquid, nos	1	0.03
partial ID	("flammable" placard)	1	0.03

*All survey locations, all times
nos – not otherwise specified
Frequency is for UN numbers (bulk loads), rather than trucks. (Some trucks carry more than one load/UN number.)

Additional tables from the 2005 report show the most common UN numbers from the highway placard survey (Table 5), the frequency of hazardous materials worded placards (Table 6), and the "Toxic by Inhalation" trucked materials (Table 12). These three (3) tables are reproduced below.

Table 5: Comparison of Most Common UN numbers from Fall 2004 and Summer 2005 Truck Surveys*

Hazardous Material	UN number	Fall 2004	Summer 2005
Gasoline	1203	35%	27%**
Hot liquid	3257	12%	15%
Liquified petroleum gases	1075	6%	10%
Molten sulfur	2448	7%	5%
Combustible liquid nos (diesel)	1993	8%	5%
Hypochorite solution	1791	2%	4%
Carbon dioxide, refrigerated liquid	2187	2%	4%
Sodium hydroxide	1824	3%	4%
Nitrogen, refrigerated liquid	1977	3%	4%
Acidic corrosive liquid, inorganic, nos	3264	2%	2%
Oxygen, refrigerated liquid	1073	2%	2%
total		**84%**	**82%**

*Same counting locations (Figure 1 locations 3-5: Hwy 680, Hwy 80, Hwy 4 BART), day of the week (Monday, Wednesday, Thursday) and hours (8:00-11:00am)
** Statistically significant difference between fall and summer truck frequencies for this chemical (p=0.0215, Chi square test for difference)
nos = not otherwise specified

Table 6: Frequency of Hazardous Material Worded Placards* for All Trucks Counted in Fall 2004 and Summer 2005 Surveys

Hazard Type	Hazard division number	Frequency	Percent
Flammable/Combustible			
gases	2.1	90	11
liquids	3	114	14
solids	4.1, 4.2	4	1
partial identification		17	2
Inhalation Hazard			
gases, poisons	2.3, 6.1	29	4
Poison (except inhalation)			
toxic or infectious materials	6, 6.2	19	2
Oxidizer			
oxidizing substances	5.1	31	4
organic peroxides	5.2	9	1
Nonflammable gases			
oxygen	2.2	23	3
other nonflammable gases	2.2	216	27
Other hazardous materials			
explosives	1.4	1	0
dangerous when wet	4.3	7	1
radioactive	7	2	0
corrosive	8	159	20
miscellaneous	9	9	1
dangerous**	D	52	7
Missing identification		18	2
TOTAL		**800**	**100**

*Worded placards signify smaller loads than placards with a UN number.
**A vehicle containing nonbulk packaging with two or more types of hazardous materials may use one "dangerous" placard if each material load weighs less than 2,205 lbs.

Table 12: "Toxic by Inhalation" (TIH) Trucked Materials

Total Loads	UN #	TIH Materials
10	1017	Chlorine
9	1005	Ammonia, anhydrous
4	2191	Sulfuryl fluoride
3	1079	Sulfur dioxide
1	1741	Boron trichloride
1	1831	Sulfuric acid, fuming
1	2810	Poisonous/Toxic liquid

"Toxic by Inhalation (TIH)" – 2004 Emergency Response Guidebook (DOT, 2004)

Additional highway placard data are contained in the 2005 report.

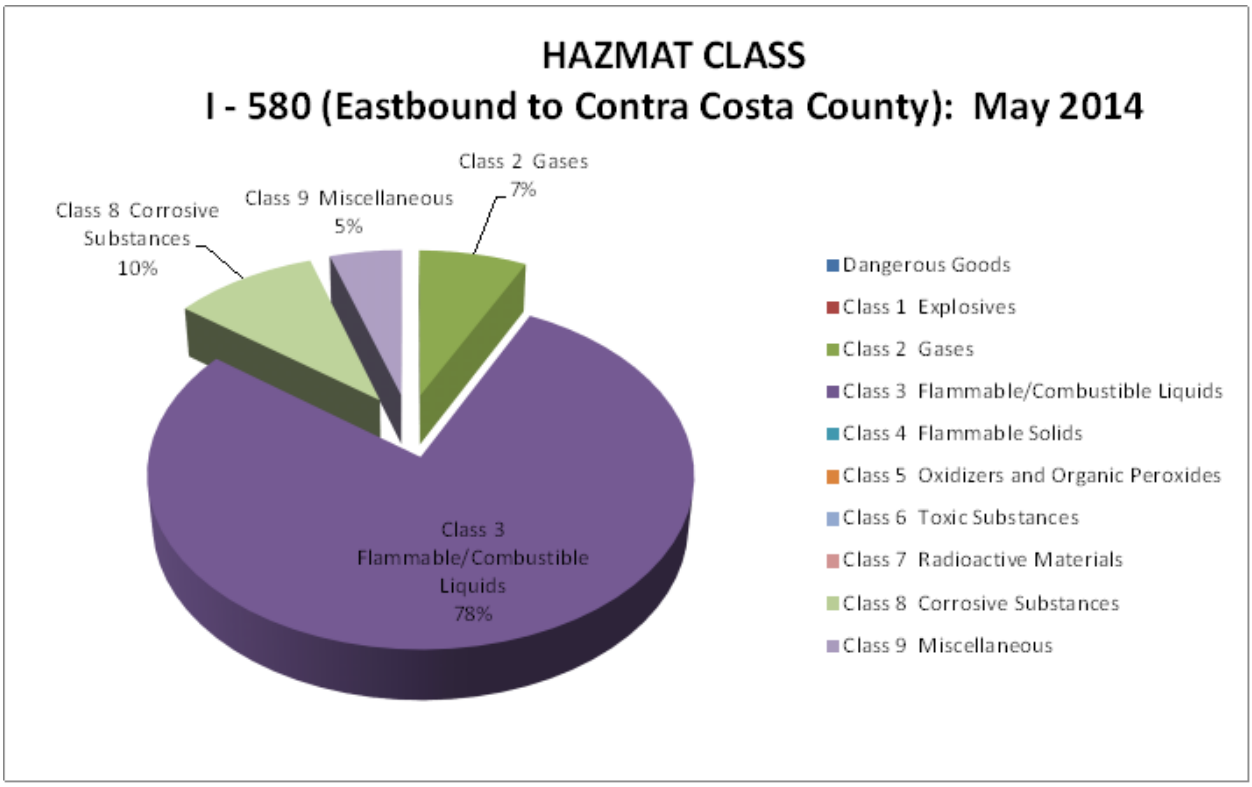
2.2 Highway Flow Study Data from Marin and Solano Counties

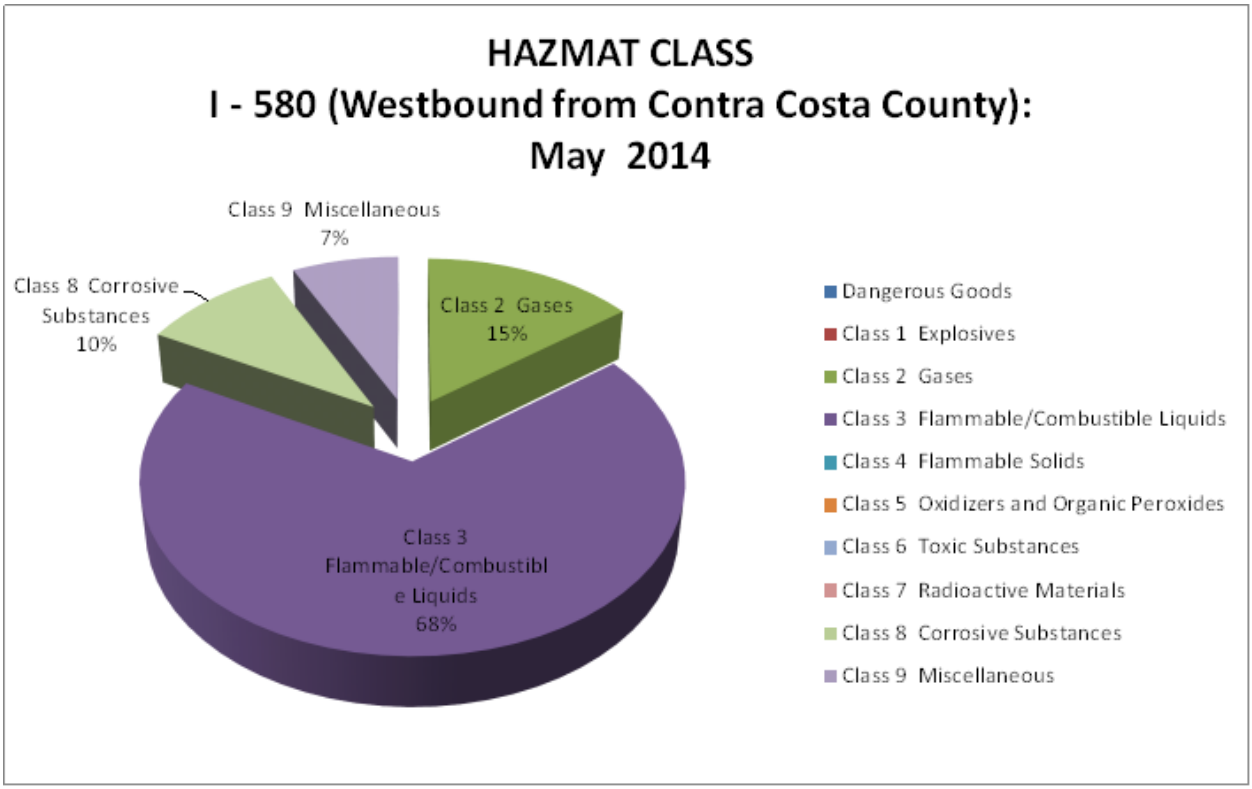
Hazardous Materials Commodity Flow Study reports were prepared for the Marin County Department of Public Works in September 2014, and for the Solano County Department of Resource Management, Environmental Health Division in May 2016. Both the Marin County and Solano County agencies were contacted to request the use of the highway placard data from those reports as it applies to the current Contra Costa County Flow Study. The relevant data includes highway transportation of hazardous materials at the locations where it enters Contra Costa County. The data from Marin and Solano County are detailed in the following sections.

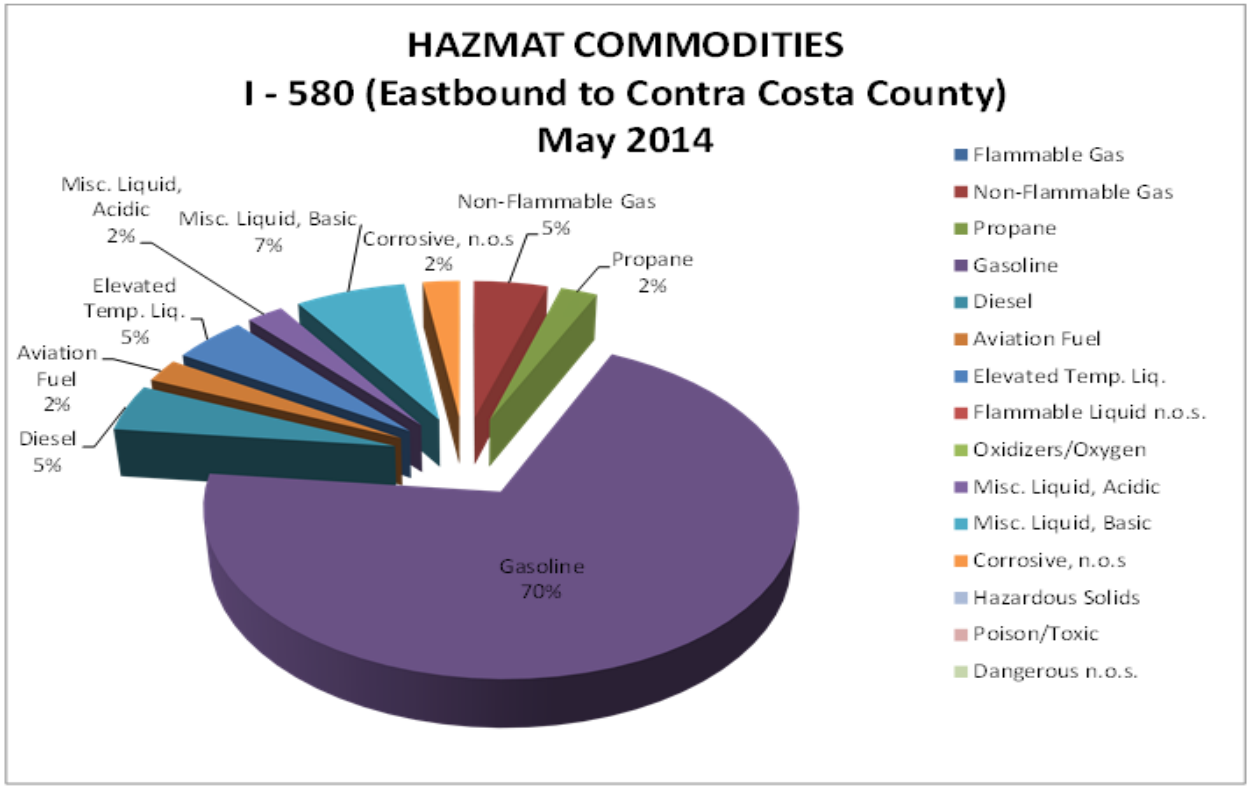
2.2.1 Marin County Flow Study Data 2014

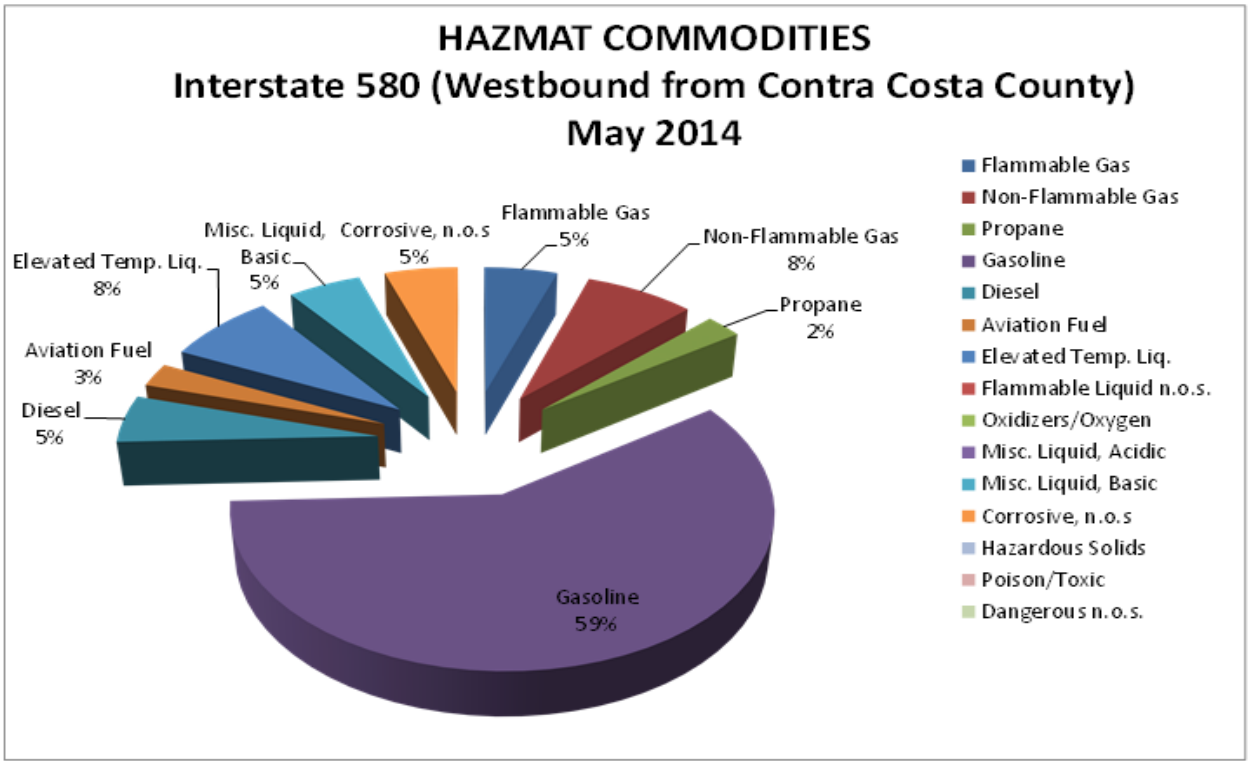
Highway placard survey data from the Marin County Flow Study was obtained for Interstate-580 where it flows in both north and south directions through the Richmond-San Rafael Bridge. The results of that study are presented below.

MARIN COUNTY: HIGHWAY PLACARD SURVEY DATA COMPILATION TABLE				
	May 2014			
Survey Location	Placard Class	Placard No.	Common Name	No. of Trucks
I-580 (Eastbound: inbound to Contra Costa County via Richmond-San Rafael Bridge)				
	2.1	1075	Propane	1
	2.2	N/A	Non Flammable Gas	2
	3	1203	Gasoline	29
	3	1863	Aviation Fuel	1
	3	1993	Diesel Fuel	2
	8	1760	Corrosive Liquid n.o.s.	1
	8	1791	Hypochlorite Solutions	1
	8	2582	Ferric Chloride	0.5
	8	1814	Potassium Hydroxide	0.5
	8	1824	Sodium Hydroxide	1
	9	3257	Elevated Temperature Liquid	2
	Subtotal Placarded Trucks			**41**
	Subtotal Trucks Not Placarded			**815**
	TOTAL TRUCKS			**856**
I-580 (Westbound: outbound from Contra Costa County via Richmond-San Rafael Bridge)				
	2.1	1075	Propane	1
	2.2	2187	Carbon Dioxide	1
	2.1	N/A	Flammable Gas	2
	2.2	N/A	Non Flammable Gas	2
	3	1203	Gasoline	25
	3	1863	Aviation Fuel	1
	3	1993	Diesel Fuel	2
	8	1791	Hypochlorite Solutions	1
	8	1824	Sodium Hydroxide	1
	8	N/A	Corrosive	2
	9	3257	Elevated Temperature Liquid	3
	Subtotal Placarded Trucks			**41**
	Subtotal Trucks Not Placarded			**945**
	TOTAL TRUCKS			**986**
All Sites	**Subtotal Placarded Trucks**			**82**
	Subtotal Trucks Not Placarded			**1760**
	TOTAL TRUCKS			**1842**


HAZMAT CLASS
I - 580 (Eastbound to Contra Costa County): May 2014
Class 2 Gases 7%
Class 9 Miscellaneous 5%
Class 8 Corrosive Substances 10%
Class 3 Flammable/Combustible Liquids 78%
Dangerous Goods
Class 1 Explosives
Class 2 Gases
Class 3 Flammable/Combustible Liquids
Class 4 Flammable Solids
Class 5 Oxidizers and Organic Peroxides
Class 6 Toxic Substances
Class 7 Radioactive Materials
Class 8 Corrosive Substances
Class 9 Miscellaneous


HAZMAT CLASS
I - 580 (Westbound from Contra Costa County): May 2014
Class 9 Miscellaneous 7%
Class 8 Corrosive Substances 10%
Class 2 Gases 15%
Class 3 Flammable/Combustible Liquids 68%
Dangerous Goods
Class 1 Explosives
Class 2 Gases
Class 3 Flammable/Combustible Liquids
Class 4 Flammable Solids
Class 5 Oxidizers and Organic Peroxides
Class 6 Toxic Substances
Class 7 Radioactive Materials
Class 8 Corrosive Substances
Class 9 Miscellaneous


HAZMAT COMMODITIES
I - 580 (Eastbound to Contra Costa County)
May 2014
Misc. Liquid, Acidic 2%
Misc. Liquid, Basic 7%
Corrosive, n.o.s 2%
Non-Flammable Gas 5%
Propane 2%
Elevated Temp. Liq. 5%
Aviation Fuel 2%
Diesel 5%
Gasoline 70%
Flammable Gas
Non-Flammable Gas
Propane
Gasoline
Diesel
Aviation Fuel
Elevated Temp. Liq.
Flammable Liquid n.o.s.
Oxidizers/Oxygen
Misc. Liquid, Acidic
Misc. Liquid, Basic
Corrosive, n.o.s
Hazardous Solids
Poison/Toxic
Dangerous n.o.s.


HAZMAT COMMODITIES
Interstate 580 (Westbound from Contra Costa County)
May 2014
Misc. Liquid, Basic 5%
Corrosive, n.o.s 5%
Flammable Gas 5%
Non-Flammable Gas 8%
Elevated Temp. Liq. 8%
Propane 2%
Aviation Fuel 3%
Diesel 5%
Gasoline 59%
Flammable Gas
Non-Flammable Gas
Propane
Gasoline
Diesel
Aviation Fuel
Elevated Temp. Liq.
Flammable Liquid n.o.s.
Oxidizers/Oxygen
Misc. Liquid, Acidic
Misc. Liquid, Basic
Corrosive, n.o.s
Hazardous Solids
Poison/Toxic
Dangerous n.o.s.

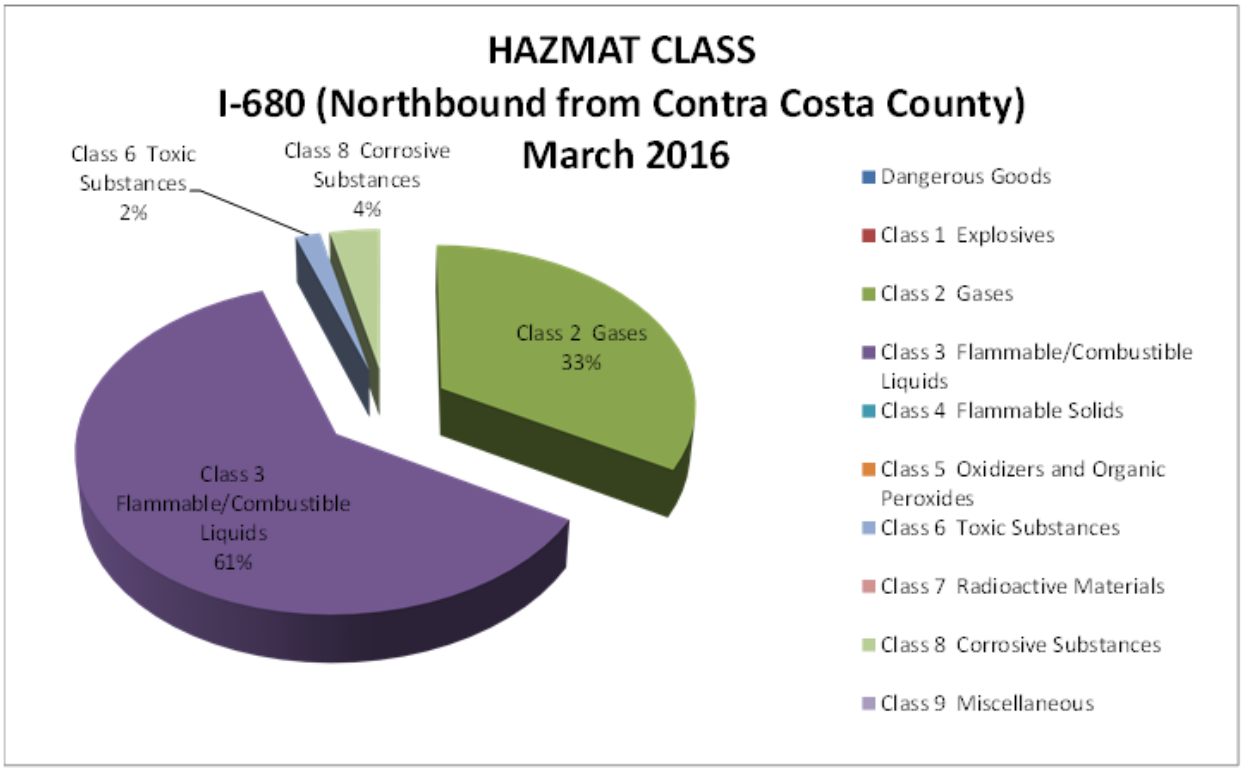
2.2.2 Solano County Flow Study Data 2016

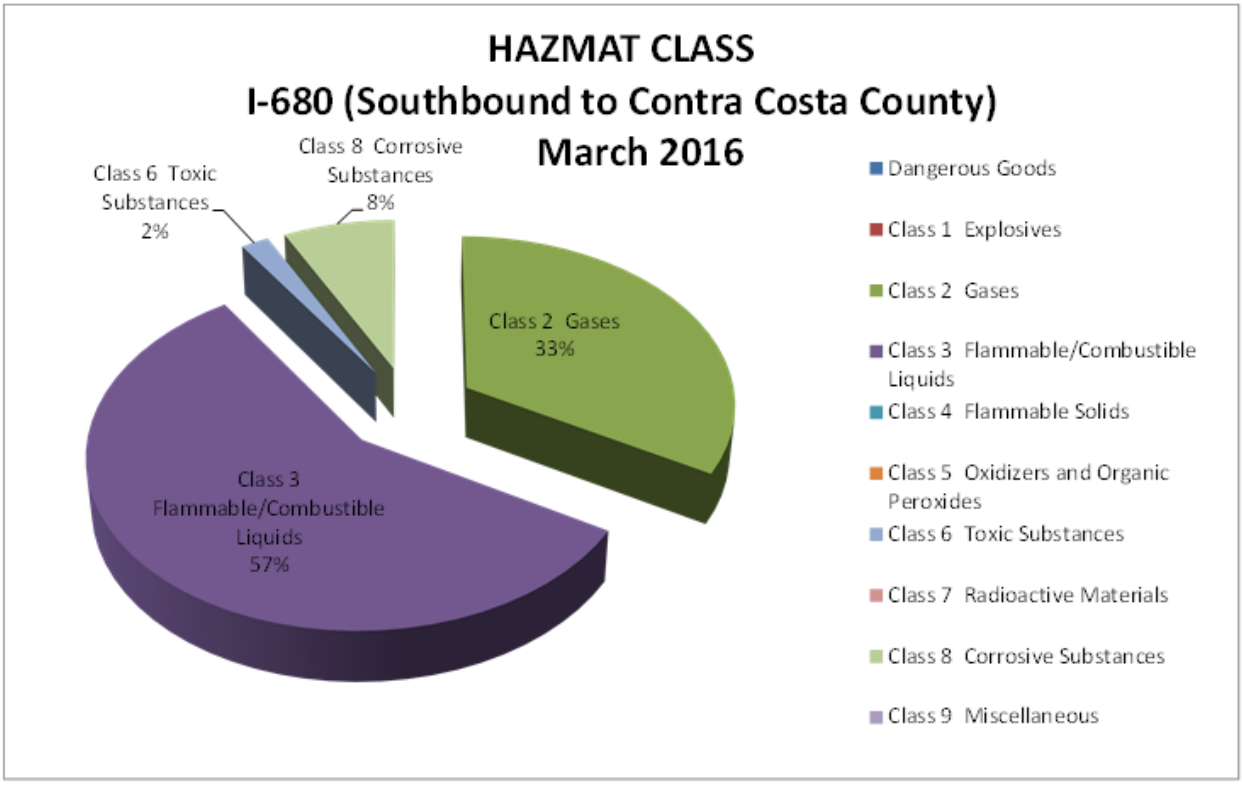
Highway placard survey data from the Marin County Flow Study was obtained for Interstate 580 where it flows in both directions through the following points:

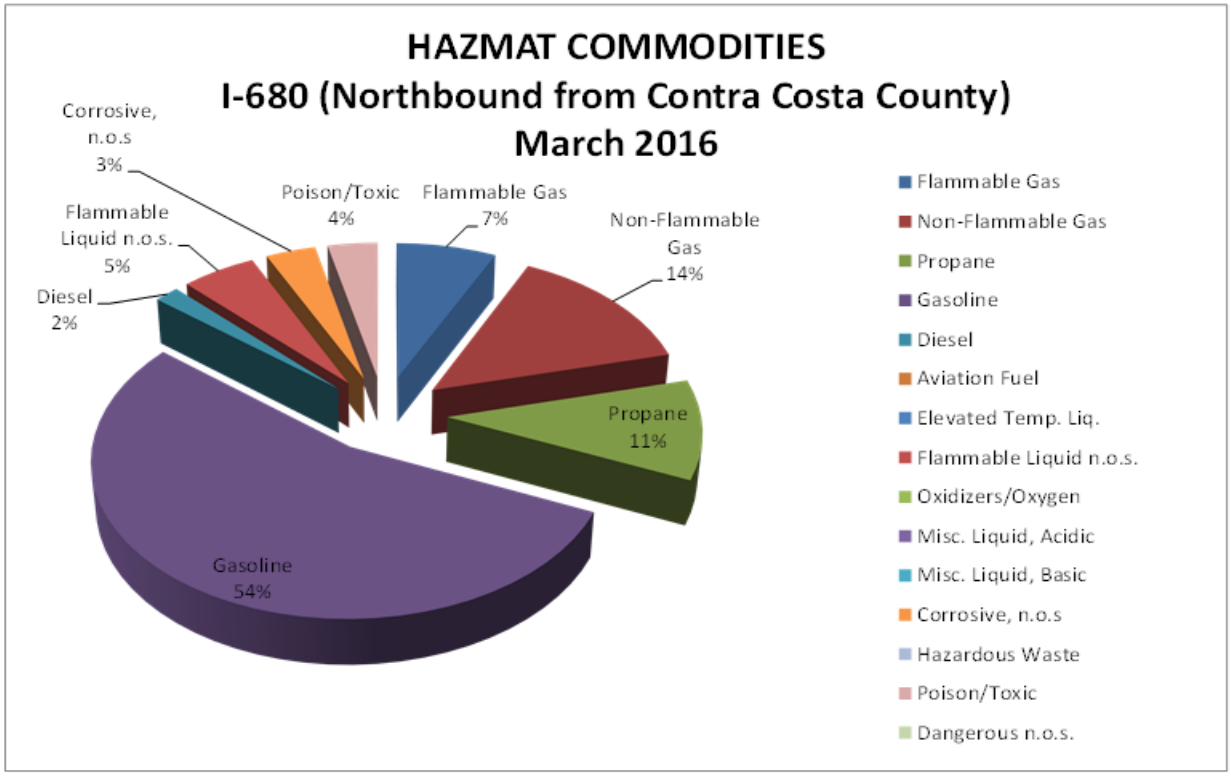
- Interstate 80 at the Carquinez Bridge
- Interstate 680 at the Benicia-Martinez Bridge

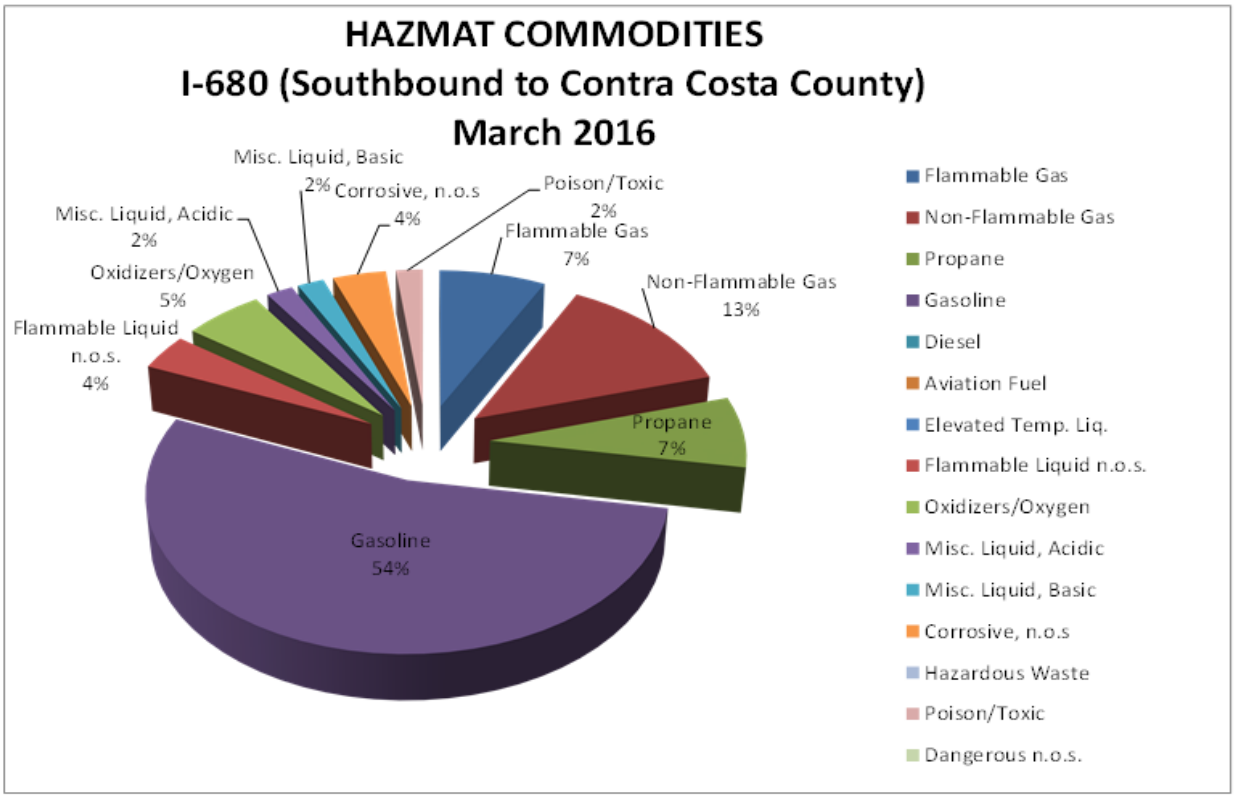
The results of that study are presented below.

SOLANO COUNTY: HIGHWAY PLACARD SURVEY DATA COMPILATION TABLE				
	March 2016			
Survey Location	Placard Class	Placard No.	Common Name	No. of Trucks
I-680 Northbound: outbound from Contra Costa County via Benecia-Martinez Bridge				
	2.1	N/A	Flammable Gas	4
	2.2	N/A	Non Flammable Gas	3
	2.3	1023	Coal Gas	1
	2.1	1075	Propane	6
	2.2	1977	Liquid Nitrogen	3
	2.2	2187	Carbon Dioxide	2
	3	1203	Gasoline	31
	3	1987	Alcohol, n.o.s.	2
	3	1992	Flammable Liquids, toxic, n.o.s.	1
	3	1993	Diesel Fuel	1
	6.1	1897	Perchloroethylene/Tetrachlorethylene	1
	8	N/A	Corrosive	2
	Subtotal Placarded Trucks			**57**
	Subtotal Trucks Not Placarded			**591**
	TOTAL TRUCKS			**648**
I-680 Southbound: inbound to Contra Costa County via Benecia-Martinez Bridge				
	2.1	N/A	Flammable Gas	3
	2.2	N/A	Non Flammable Gas	5
	2.2	1073	Oxygen, refrigerated liquid	3
	2.1	1075	Propane	4
	2.2	2187	Carbon Dioxide	2
	2.1	1049	Hydrogen, compressed	1
	3	1203	Gasoline	29
	3	1268	Petroleum Distillates	2
	6.1	2810	Toxic, liquids, organic, n.o.s.	1
	8	N/A	Corrosive	2
	8	1824	Sodium Hydroxide	1
	8	3264	Corrosive Liquid, acidic, inorganic, n.o.s.	1
	Subtotal Placarded Trucks			**54**
	Subtotal Trucks Not Placarded			**681**
	TOTAL TRUCKS			**735**

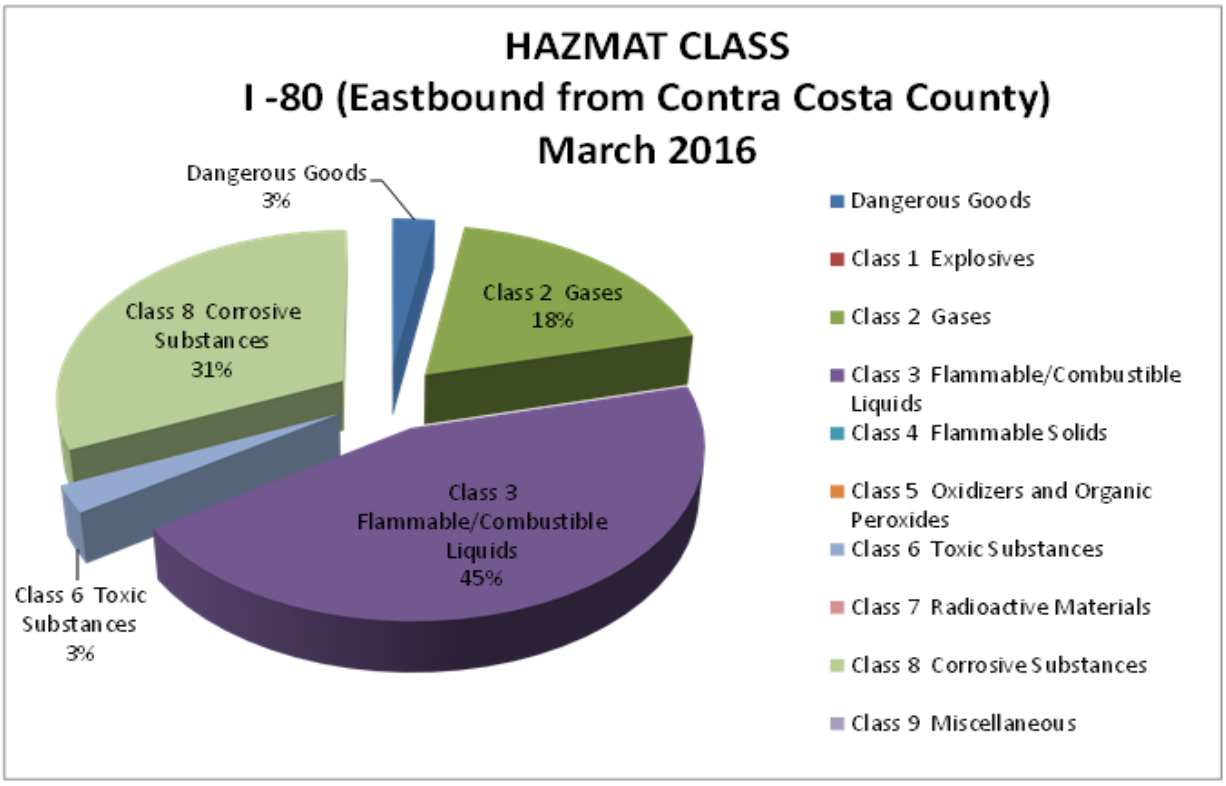

HAZMAT CLASS
I-680 (Northbound from Contra Costa County)
March 2016
Class 6 Toxic Substances 2%
Class 8 Corrosive Substances 4%
Class 2 Gases 33%
Class 3 Flammable/Combustible Liquids 61%
Dangerous Goods
Class 1 Explosives
Class 2 Gases
Class 3 Flammable/Combustible Liquids
Class 4 Flammable Solids
Class 5 Oxidizers and Organic Peroxides
Class 6 Toxic Substances
Class 7 Radioactive Materials
Class 8 Corrosive Substances
Class 9 Miscellaneous

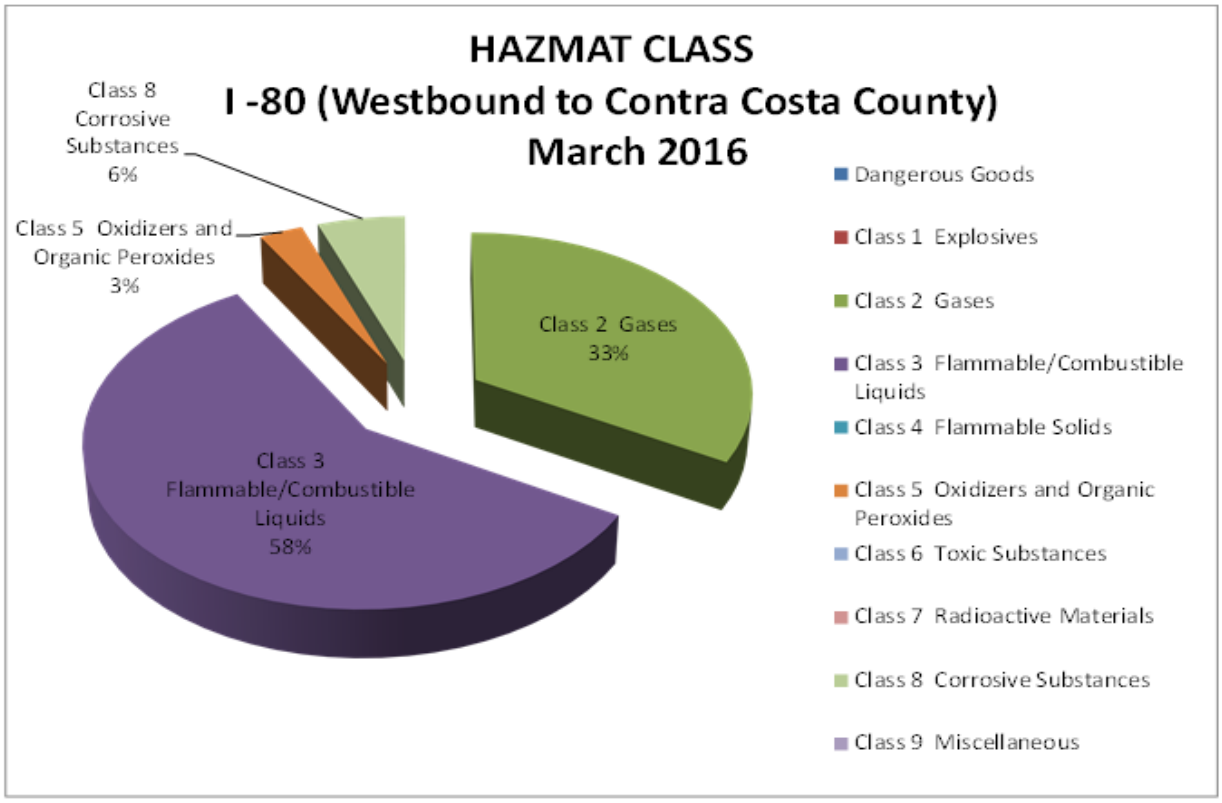

HAZMAT CLASS
I-680 (Southbound to Contra Costa County)
March 2016
Class 6 Toxic Substances 2%
Class 8 Corrosive Substances 8%
Class 2 Gases 33%
Class 3 Flammable/Combustible Liquids 57%
Dangerous Goods
Class 1 Explosives
Class 2 Gases
Class 3 Flammable/Combustible Liquids
Class 4 Flammable Solids
Class 5 Oxidizers and Organic Peroxides
Class 6 Toxic Substances
Class 7 Radioactive Materials
Class 8 Corrosive Substances
Class 9 Miscellaneous

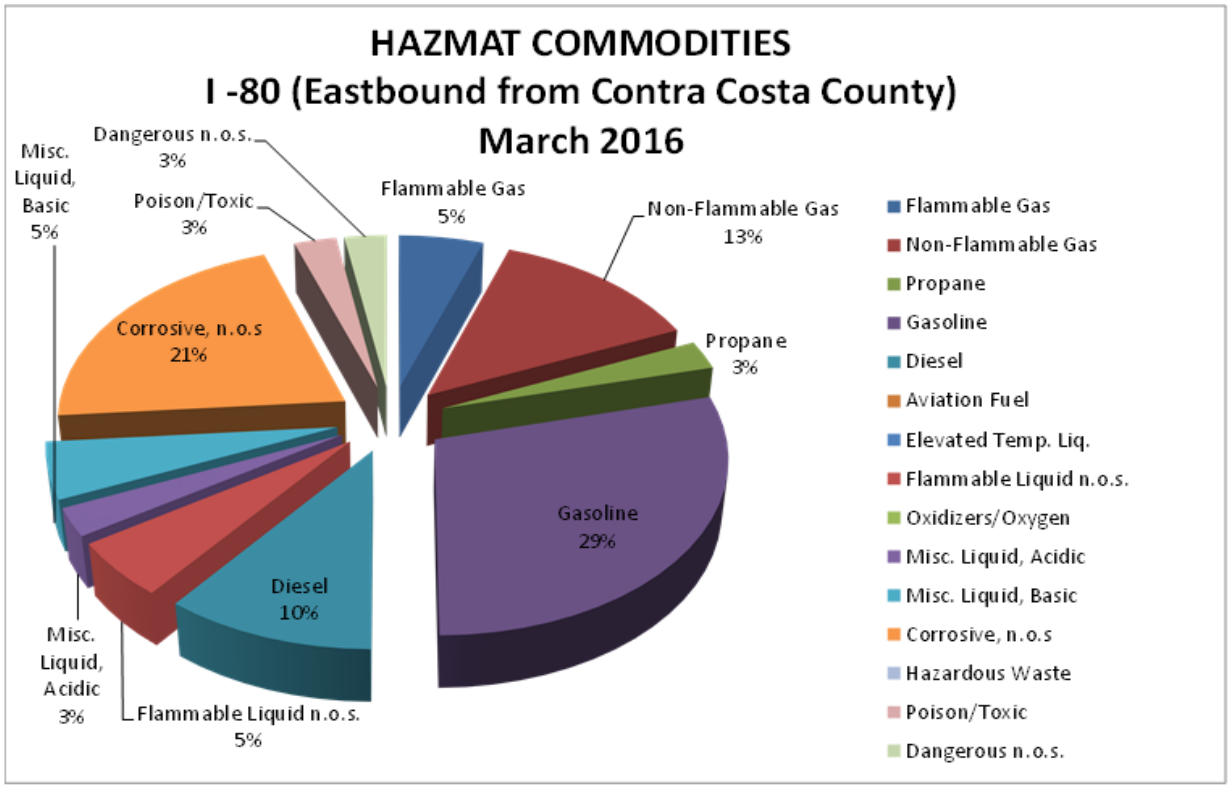

HAZMAT COMMODITIES
I-680 (Northbound from Contra Costa County)
March 2016
Corrosive, n.o.s 3%
Poison/Toxic 4%
Flammable Gas 7%
Non-Flammable Gas 14%
Flammable Liquid n.o.s. 5%
Diesel 2%
Propane 11%
Gasoline 54%
Flammable Gas
Non-Flammable Gas
Propane
Gasoline
Diesel
Aviation Fuel
Elevated Temp. Liq.
Flammable Liquid n.o.s.
Oxidizers/Oxygen
Misc. Liquid, Acidic
Misc. Liquid, Basic
Corrosive, n.o.s
Hazardous Waste
Poison/Toxic
Dangerous n.o.s.

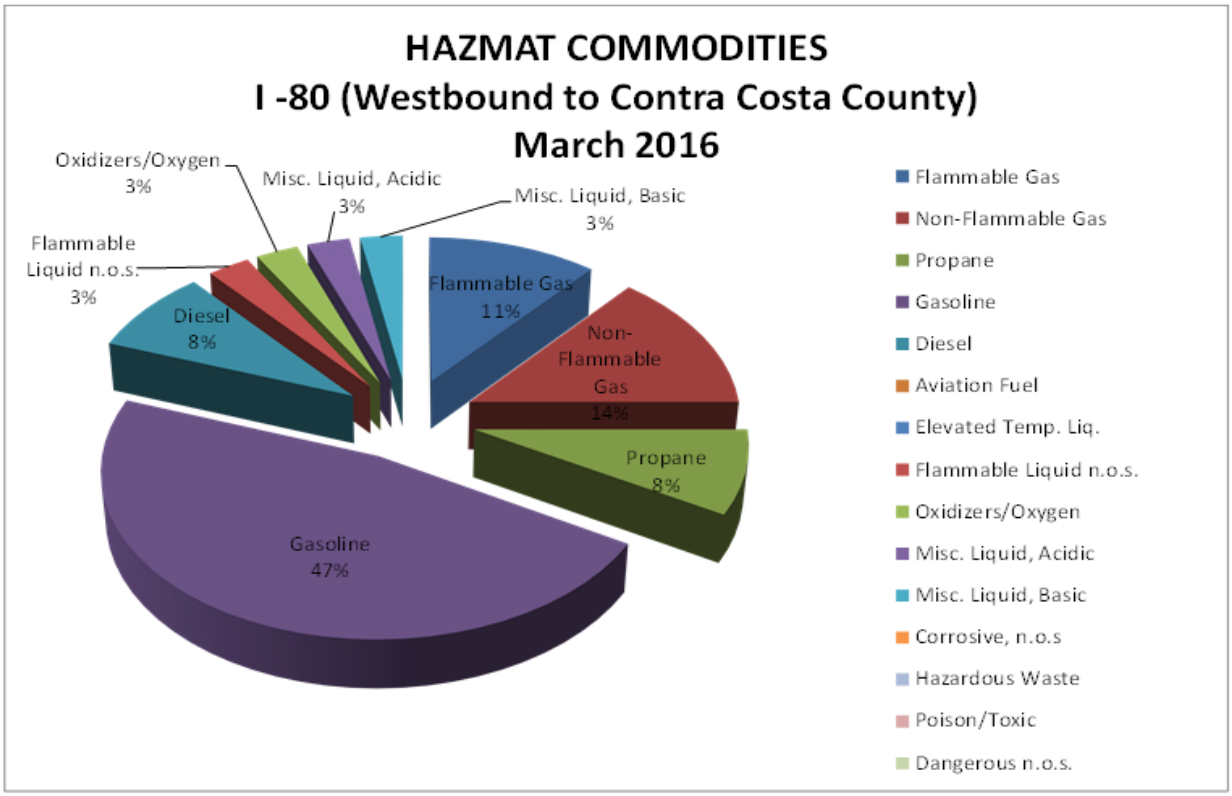

HAZMAT COMMODITIES
I-680 (Southbound to Contra Costa County)
March 2016
Misc. Liquid, Basic 2%
Corrosive, n.o.s 4%
Poison/Toxic 2%
Misc. Liquid, Acidic 2%
Flammable Gas 7%
Oxidizers/Oxygen 5%
Non-Flammable Gas 13%
Flammable Liquid n.o.s. 4%
Propane 7%
Gasoline 54%
Flammable Gas
Non-Flammable Gas
Propane
Gasoline
Diesel
Aviation Fuel
Elevated Temp. Liq.
Flammable Liquid n.o.s.
Oxidizers/Oxygen
Misc. Liquid, Acidic
Misc. Liquid, Basic
Corrosive, n.o.s
Hazardous Waste
Poison/Toxic
Dangerous n.o.s.

SOLANO COUNTY: HIGHWAY PLACARD SURVEY DATA COMPILATION TABLE				
	March 2016			
Survey Location	Placard Class	Placard No.	Common Name	No. of Trucks
I-80 Eastbound: outbound from Contra Costa County via Carquinez Bridge				
	2.1	N/A	Flammable Gas	2
	2.2	N/A	Non Flammable Gas	1
	2.2	1066	Nitrogen, compressed	1
	2.1	1075	Propane	1
	2.2	2187	Carbon Dioxide	2
	3	1203	Gasoline	11
	3	1987	Alcohol, n.o.s.	2
	3	1993	Diesel Fuel	4
	6.1	N/A	Poison	1
	8	N/A	Corrosive	4
	8	1724	Allyltrichlorosilane, stabilized	1
	8	1778	Fluorosilicic Acid	1
	8	1791	Hypochlorite Solution	1
	8	1824	Sodium Hydroxide	1
	8	2693	Bisulfites	3
	8	3260	Corrosive solid, acidic, inorganic, n.o.s.	1
	N/A	N/A	Dangerous	1
	Subtotal Placarded Trucks			**38**
	Subtotal Trucks Not Placarded			**996**
	TOTAL TRUCKS			**1034**
I-80 Westbound: inbound to Contra Costa County via Carquinez Bridge				
	2.1	N/A	Flammable Gas	4
	2.2	N/A	Non Flammable Gas	1
	2.1	1075	Propane	3
	2.2	1973	Chlorodifluoromethane and chloropentafluorethane mixture	1
	2.2	1977	Liquid Nitrogen	2
	2.2	2187	Carbon Dioxide	1
	3	1203	Gasoline	17
	3	1268	Petroleum Distillates	1
	3	1993	Diesel	3
	5.1	2426	Ammonium nitrate, liquid	1
	8	1791	Hypochlorite Solution	1
	8	1830	Sulfuric Acid with more than 51% acid	1
	Subtotal Placarded Trucks			**36**
	Subtotal Trucks Not Placarded			**930**
	TOTAL TRUCKS			**966**
All Sites	**Subtotal Placarded Trucks**			**185**
	Subtotal Trucks Not Placarded			**3198**
	TOTAL TRUCKS			**3383**


HAZMAT CLASS
I -80 (Eastbound from Contra Costa County)
March 2016
Dangerous Goods 3%
Class 2 Gases 18%
Class 8 Corrosive Substances 31%
Class 3 Flammable/Combustible Liquids 45%
Class 6 Toxic Substances 3%
Dangerous Goods
Class 1 Explosives
Class 2 Gases
Class 3 Flammable/Combustible Liquids
Class 4 Flammable Solids
Class 5 Oxidizers and Organic Peroxides
Class 6 Toxic Substances
Class 7 Radioactive Materials
Class 8 Corrosive Substances
Class 9 Miscellaneous


HAZMAT CLASS
I -80 (Westbound to Contra Costa County)
March 2016
Class 8 Corrosive Substances 6%
Class 5 Oxidizers and Organic Peroxides 3%
Class 2 Gases 33%
Class 3 Flammable/Combustible Liquids 58%
Dangerous Goods
Class 1 Explosives
Class 2 Gases
Class 3 Flammable/Combustible Liquids
Class 4 Flammable Solids
Class 5 Oxidizers and Organic Peroxides
Class 6 Toxic Substances
Class 7 Radioactive Materials
Class 8 Corrosive Substances
Class 9 Miscellaneous


HAZMAT COMMODITIES
I -80 (Eastbound from Contra Costa County)
March 2016
Misc. Liquid, Basic 5%
Dangerous n.o.s. 3%
Poison/Toxic 3%
Flammable Gas 5%
Non-Flammable Gas 13%
Propane 3%
Corrosive, n.o.s 21%
Gasoline 29%
Diesel 10%
Misc. Liquid, Acidic 3%
Flammable Liquid n.o.s. 5%
Flammable Gas
Non-Flammable Gas
Propane
Gasoline
Diesel
Aviation Fuel
Elevated Temp. Liq.
Flammable Liquid n.o.s.
Oxidizers/Oxygen
Misc. Liquid, Acidic
Misc. Liquid, Basic
Corrosive, n.o.s
Hazardous Waste
Poison/Toxic
Dangerous n.o.s.


HAZMAT COMMODITIES
I -80 (Westbound to Contra Costa County)
March 2016
Oxidizers/Oxygen 3%
Misc. Liquid, Acidic 3%
Misc. Liquid, Basic 3%
Flammable Liquid n.o.s. 3%
Diesel 8%
Flammable Gas 11%
Non-Flammable Gas 14%
Propane 8%
Gasoline 47%
Flammable Gas
Non-Flammable Gas
Propane
Gasoline
Diesel
Aviation Fuel
Elevated Temp. Liq.
Flammable Liquid n.o.s.
Oxidizers/Oxygen
Misc. Liquid, Acidic
Misc. Liquid, Basic
Corrosive, n.o.s
Hazardous Waste
Poison/Toxic
Dangerous n.o.s.

3.0 Commodity Flow Study

The data for the commodities Flow Study was obtained from the UP and BNSF Railroads and from industry chemical data. Data from hazardous materials transport via pipeline are included in this section. Historical data concerning rail, roadway, and pipeline hazardous materials incidents is also contained in this section. Utilization of Google Earth and Google Maps for base maps to portray the various data occur throughout this section and the remainder of the report.

3.1 Railroad Data

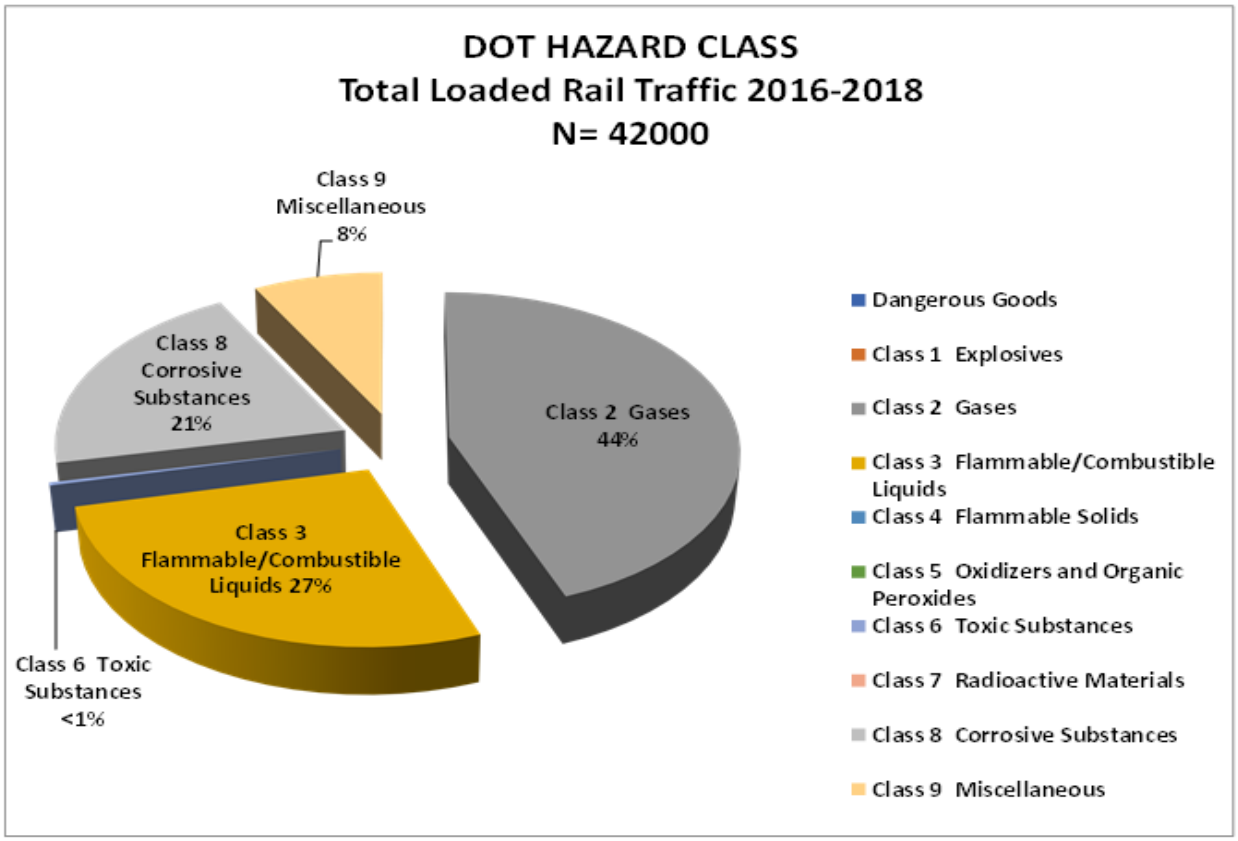
Railroad commodity data was obtained and managed by CCHSHMP from both UP and BNSF from the years 2016-2018. Obtained data is used solely for and by a bona fide emergency planning and response organization for the expressed purpose of emergency and contingency planning. All Sensitive Security Information was managed as such by CCHSHMP and detailed information regarding obtained rail data is not included as part of this report.

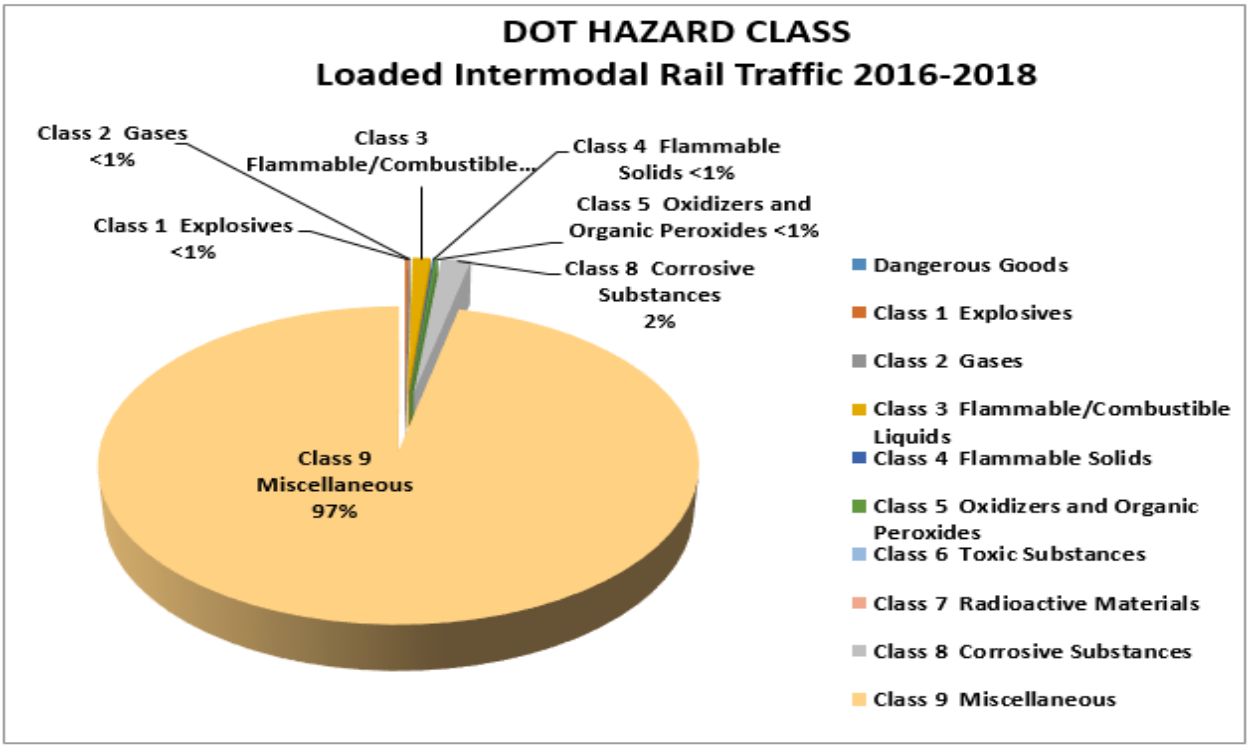
The following collection of data provides a comprehensive overview of the total rail traffic through Contra Costa County during the years analyzed. Charts in the following sections summarize the overall data with respect to the following:

- Total loaded rail traffic;
- Loaded intermodal rail traffic; and
- High movement of materials and materials of concern.

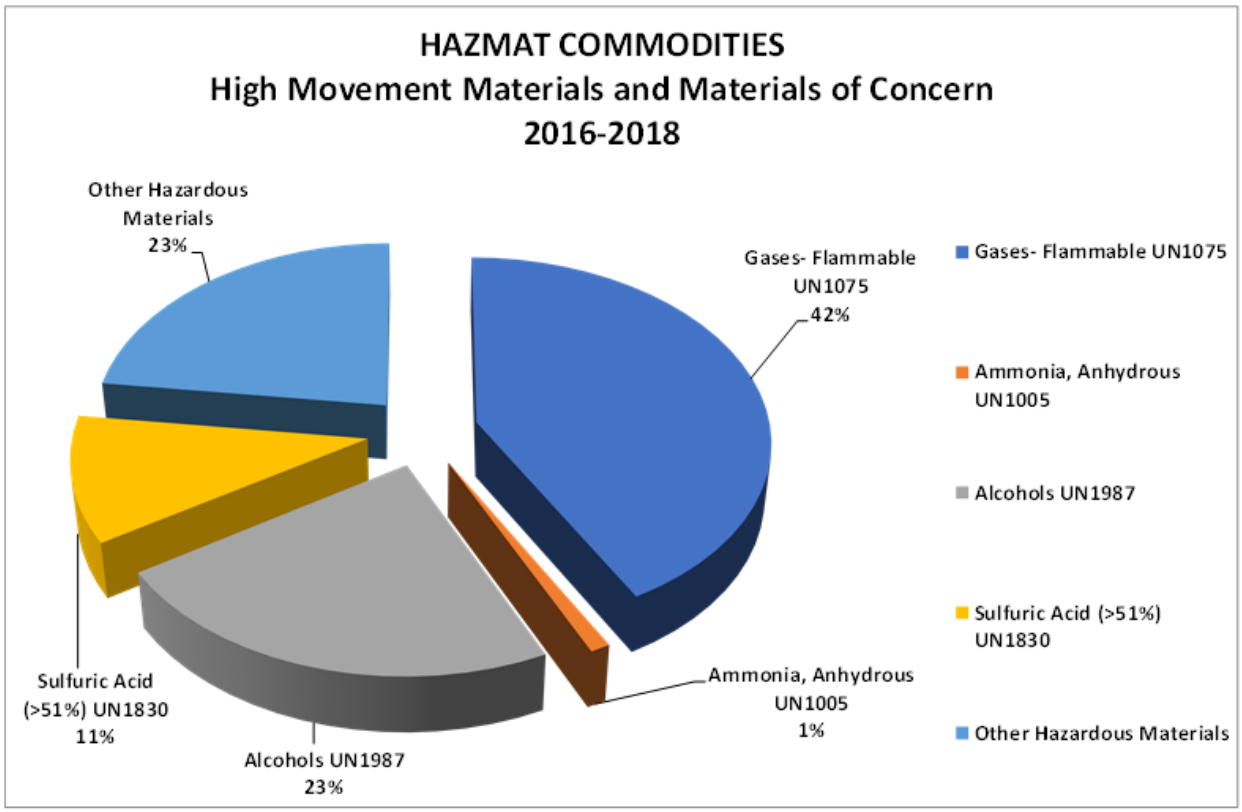
The Total loaded rail traffic consisted primarily of gases, flammable and combustible liquids, and corrosive substances, with lesser amounts of toxic substances and miscellaneous hazardous materials.

Loaded intermodal rail traffic was predominantly miscellaneous hazardous materials with less than 3% explosives, gases, flammable/combustible liquids, flammable solids, oxidizers and organic peroxides, and corrosive substances.


DOT HAZARD CLASS
Total Loaded Rail Traffic 2016-2018
N= 42000
Class 9 Miscellaneous 8%
Class 8 Corrosive Substances 21%
Class 2 Gases 44%
Class 3 Flammable/Combustible Liquids 27%
Class 6 Toxic Substances <1%
Dangerous Goods
Class 1 Explosives
Class 2 Gases
Class 3 Flammable/Combustible Liquids
Class 4 Flammable Solids
Class 5 Oxidizers and Organic Peroxides
Class 6 Toxic Substances
Class 7 Radioactive Materials
Class 8 Corrosive Substances
Class 9 Miscellaneous


DOT HAZARD CLASS
Loaded Intermodal Rail Traffic 2016-2018
Class 2 Gases <1%
Class 3 Flammable/Combustible...
Class 4 Flammable Solids <1%
Class 5 Oxidizers and Organic Peroxides <1%
Class 1 Explosives <1%
Class 8 Corrosive Substances 2%
Class 9 Miscellaneous 97%
Dangerous Goods
Class 1 Explosives
Class 2 Gases
Class 3 Flammable/Combustible Liquids
Class 4 Flammable Solids
Class 5 Oxidizers and Organic Peroxides
Class 6 Toxic Substances
Class 7 Radioactive Materials
Class 8 Corrosive Substances
Class 9 Miscellaneous

Based on the data, it was determined that the major materials of concern were Propane (UN1075), Sulfuric Acid (UN1830), and Anhydrous Ammonia (UN1005).



3.2 Industry Chemical Data

CCHSHMP gained support from the Community Awareness Emergency Response (CAER) group as an emergency response agency and as a leader in community health and safety. The mission of CAER is to actively enhance public health and safety. CAER leadership believes this Flow Study supports this mission and identifies emerging threats in our community. Following the results of the Adapting to Rising Tides program, which is supported by both the Hazardous Materials Commission and the Contra Costa County Board of Supervisors, a gap in understanding of the impacts of hazardous materials transportation was identified. CAER believes that this Flow Study will help to fill the gap in understanding and address planning needs for sea level rise and flooding issues that are predicted to occur in the San Francisco Bay Area.

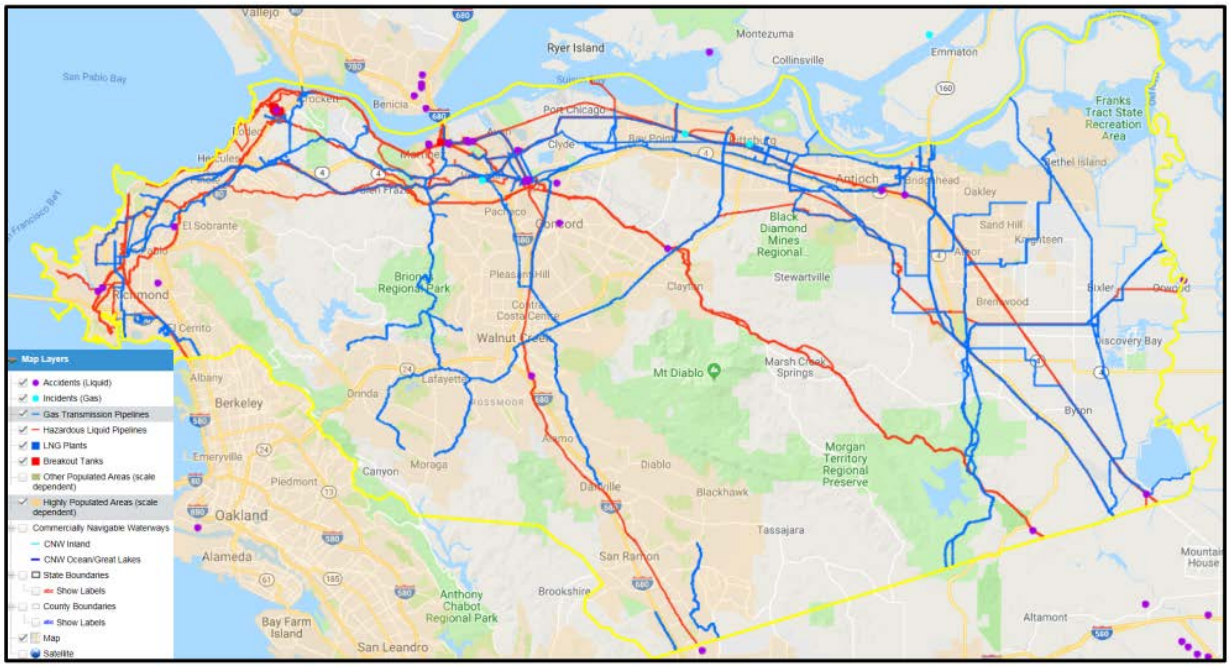
CAER holds representation from a majority of the large industrial facilities located in Contra Costa County. In order to further validate and identify chemicals of concerns, as determined from railroad data, an Industry Questionnaire was developed and distributed to the members of CAER. This questionnaire addressed hazardous materials transported to and from the facilities, approximate volumes, issues with flooding and other disruptions, as well as alternative arrangements made to ship hazardous materials. The hope was to gain a better

understanding of what impacts would be possible directly relating from industry due to a disruption of rail transportation.

Unfortunately, the results of the Industry Questionnaire were not obtained as part of this project.

3.3 Pipeline Data

Information concerning underground pipelines in Costa Mesa County was obtained from the website of the National Pipeline Mapping System (NPMS) at https://www.npms.phmsa.dot.gov/. A map showing the pipelines in Contra Costa County is shown below. Most of the pipelines in the County are located in the coastal areas, and in many locations, they are co-located with the railroad lines.

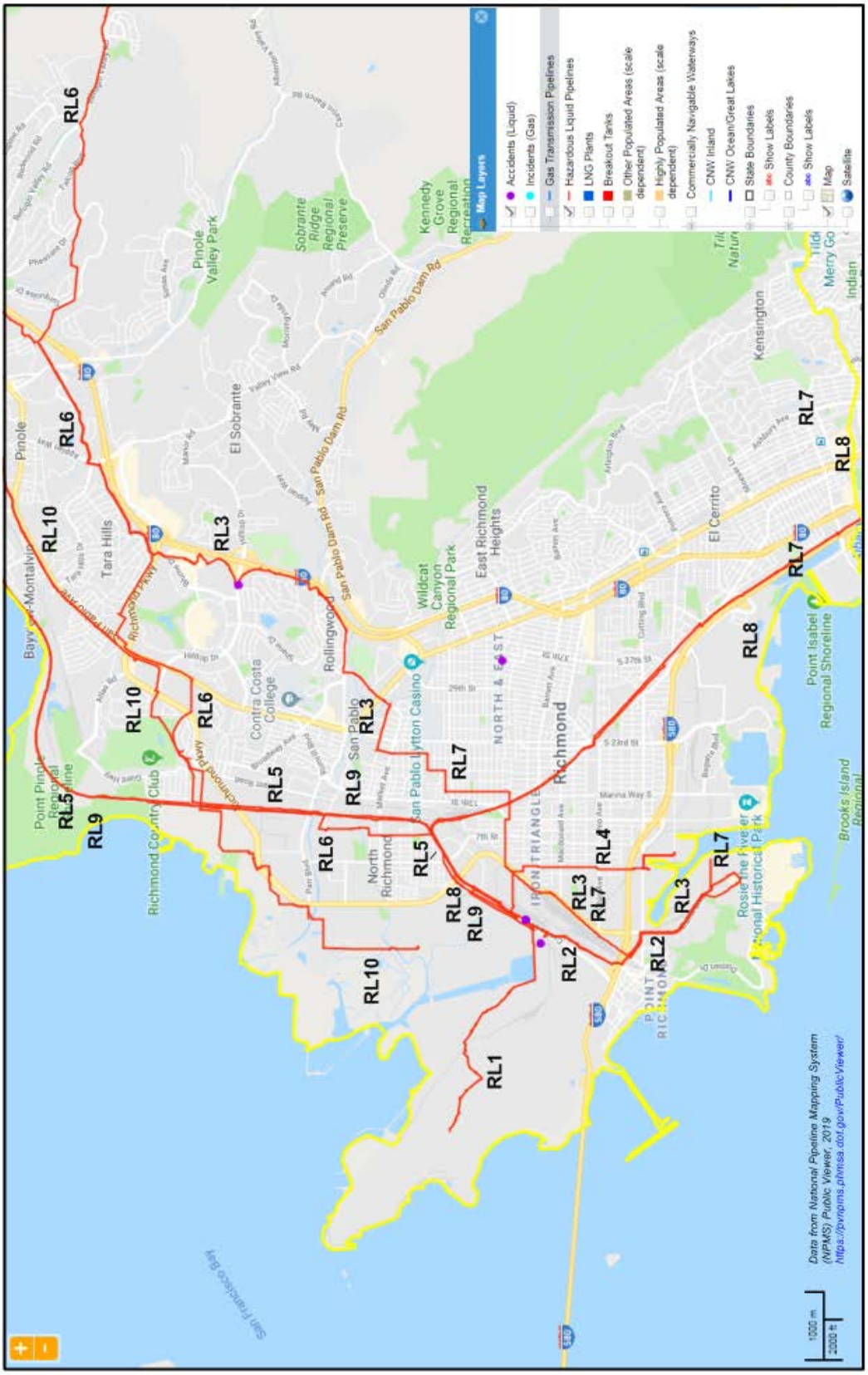


Due to the large number of pipelines in the County, the coastal part of the County was subdivided into four (4) areas. Detailed maps showing the hazardous liquid pipelines and gas transmission lines in these areas are shown in the following sections. Details concerning the hazardous liquid pipelines are contained in Appendix A. The numbers on the hazardous liquid pipeline maps refer to the detailed pipeline data listed in Appendix A.

Maps showing the gas transmission lines are also shown, but the various pipelines have not been detailed. The primary constituent of the gas transmission lines is natural gas.

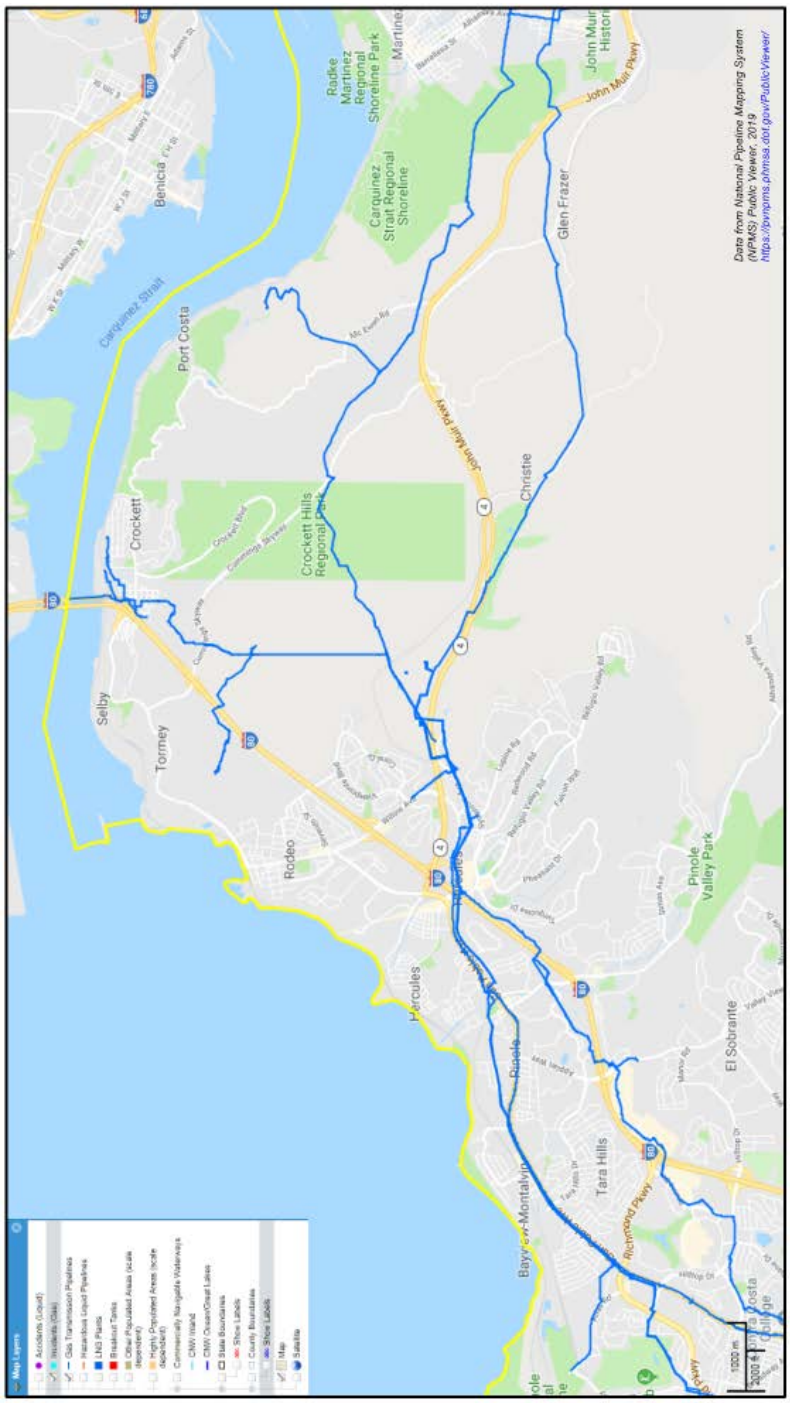
3.3.1 Richmond Area Pipeline Data

The gas transmission pipelines and hazardous liquid pipelines for the Richmond area are shown in the following maps. Details for the hazardous liquid pipelines are contained in Appendix A-1.


RL1
RL2
RL3
RL4
RL5
RL6
RL7
RL8
RL9
RL10
Richmond
San Pablo
North Richmond
El Sobrante
Pinole
Kensington
El Cerrito
Contra Costa College
Point Pinole Regional Shoreline
Point Isabel Regional Shoreline
Brooks Island Regional
Wildcat Canyon Regional Park
Kennedy Grove Regional Recreation
Sobrante Ridge Regional Preserve
Pinole Valley Park
Tara Hills
East Richmond Heights
Rollingwood
Richmond Country Club
San Pablo Lytton Casino
Rosie the Riveter National Historical Park
San Pablo Dam Rd
Richmond Pkwy
Map Layers
Accidents (Liquid)
Incidents (Gas)
Gas Transmission Pipelines
Hazardous Liquid Pipelines
LNG Plants
Breakout Tanks
Other Populated Areas (scale dependent)
Highly Populated Areas (scale dependent)
Commercially Navigable Waterways
CNW Inland
CNW Ocean/Great Lakes
State Boundaries
Show Labels
County Boundaries
Show Labels
Map
Satellite
Data from National Pipeline Mapping System (NPMS) Public Viewer, 2019
https://pvnpms.phmsa.dot.gov/PublicViewer/
1000 m
2000 ft

3.3.2 Crockett Area Pipeline Data

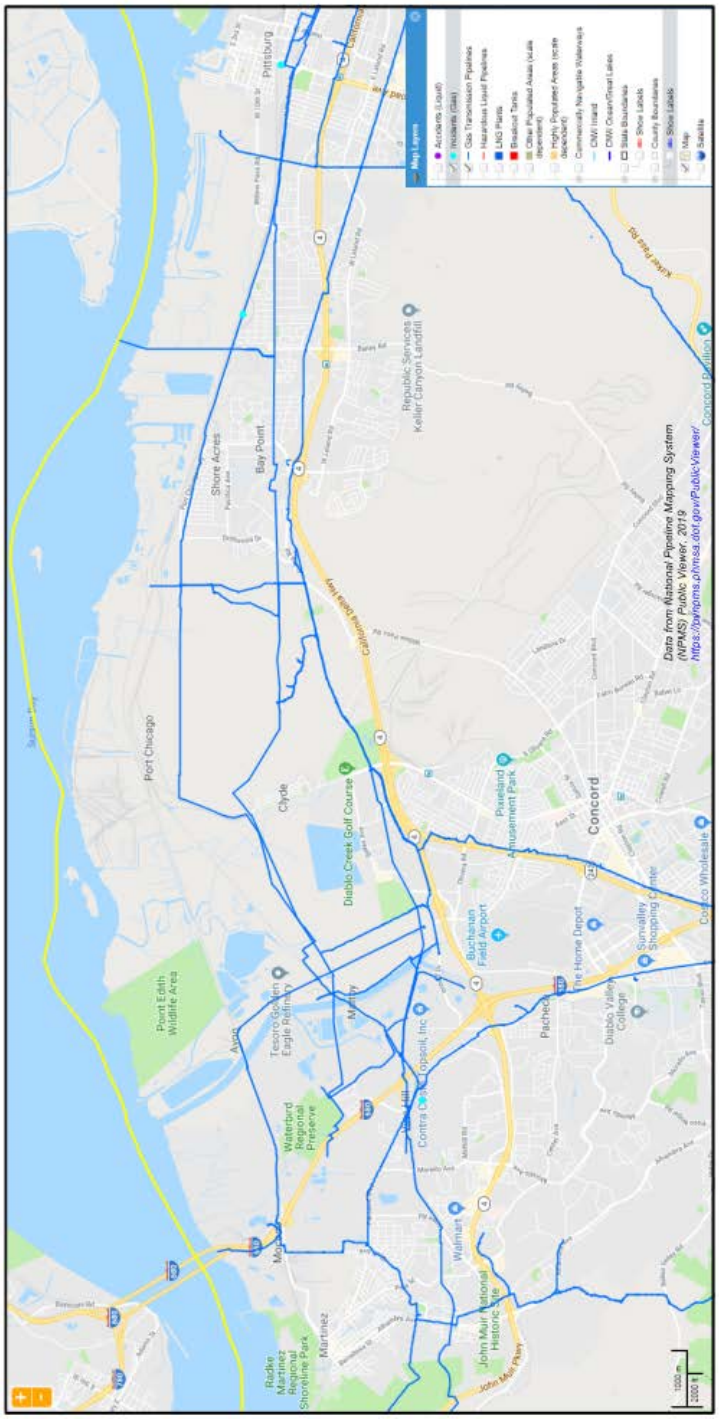
The gas transmission pipelines and hazardous liquid pipelines for the Crockett area are shown in the following maps. Details for the hazardous liquid pipelines are contained in Appendix A-2.




CL1
CL2
CL3
CL4
CL5
CL6
CL7
CL8
CL9
CL10
Map Layers
Accidents (Liquid)
Incidents (Gas)
Gas Transmission Pipelines
Hazardous Liquid Pipelines
LNG Plants
Breakout Tanks
Other Populated Areas (scale dependent)
Highly Populated Areas (scale dependent)
Commercially Navigable Waterways
CNW Inland
CNW Ocean/Great Lakes
State Boundaries
Show Labels
County Boundaries
Show Labels
Map
Satellite
Carquinez Strait
Benicia
Port Costa
Crockett
Rodeo
Hercules
Pinole
Tara Hills
El Sobrante
Pinole Valley Park
Crockett Hills Regional Park
Radke Martinez Regional Shoreline
Carquinez Strait Regional Shoreline
Glen Frazer
Christie
Bayview-Montalvin
Contra Costa College
Data from National Pipeline Mapping System (NPMS) Public Viewer, 2019
https://bvnpms.phmsa.dot.gov/PublicViewer/

3.3.3 Martinez Area Pipeline Data

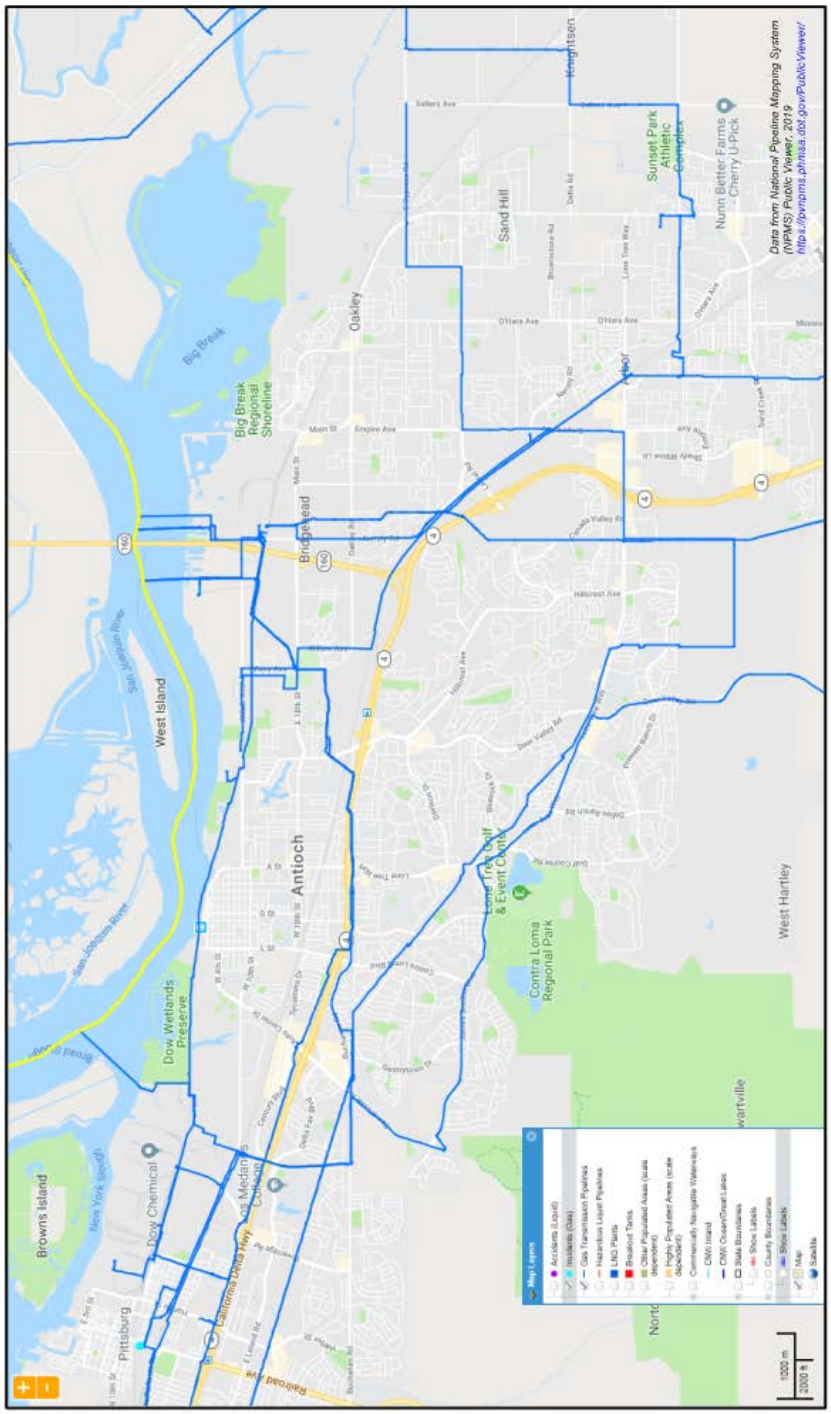
The gas transmission pipelines and hazardous liquid pipelines for the Martinez area are shown in the following maps. Details for the hazardous liquid pipelines are contained in Appendix A-3.

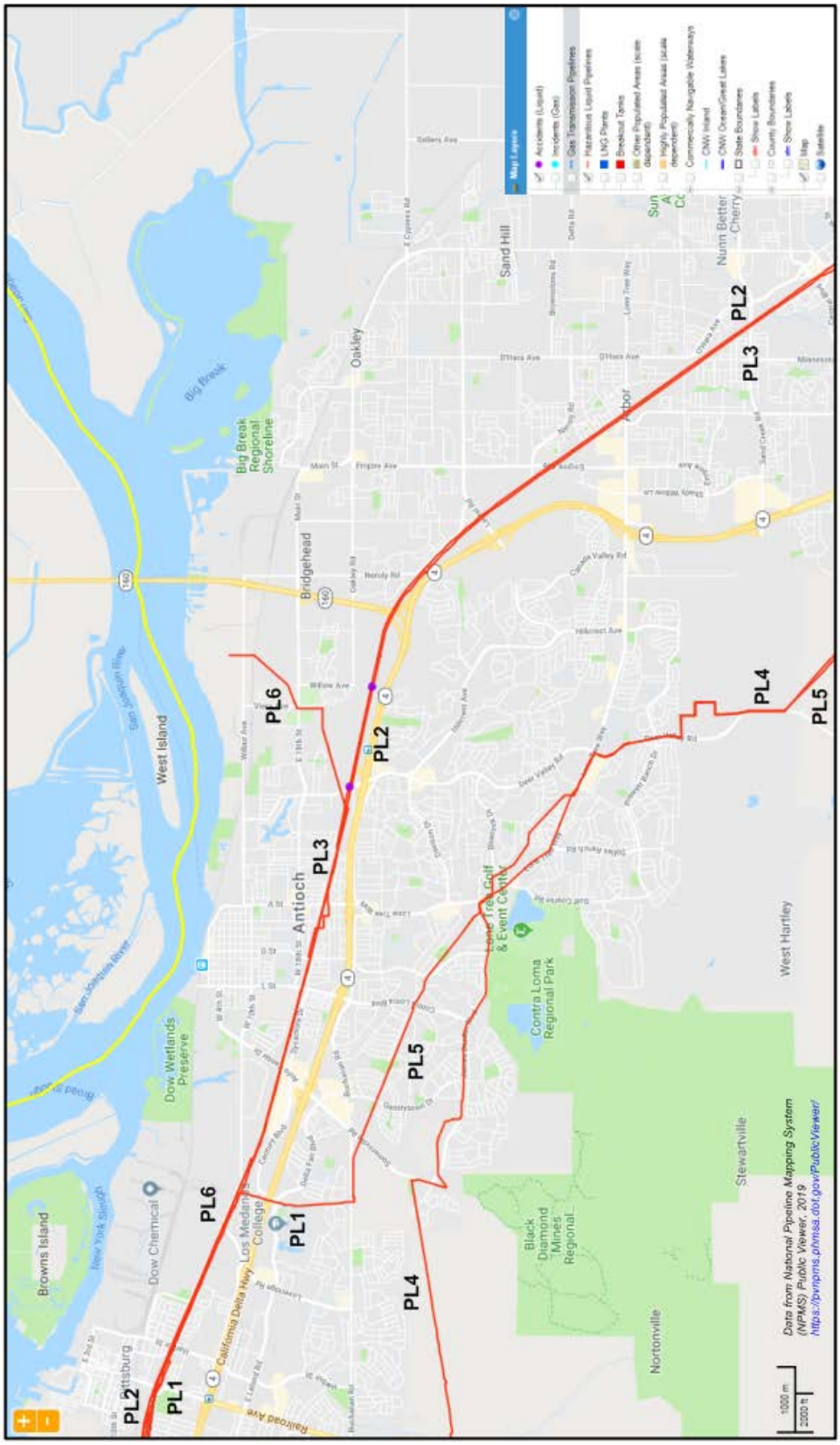



ML1
ML2
ML3
ML4
ML5
ML6
ML7
ML8
ML9
ML10
ML11
ML12
ML13
ML14
ML15, 16, 17, 18
ML19
ML20
ML20, 21, 22, 23, 24
ML21, 22, 24
ML23
ML25
ML26
ML27
ML28
ML29
ML30
ML31
ML32
ML33
ML34, 35
Bay Point
Port Chicago
Clyde
Pittsburg
Concord
Pacheco
Data from National Pipeline Mapping System (NPMS) Public Viewer, 2019
https://pvnpms.phmsa.dot.gov/PublicViewer/

3.3.4 Pittsburg-Antioch Area Pipeline Data

The gas transmission pipelines and hazardous liquid pipelines for the Pittsburg-Antioch area are shown in the following maps. Details for the hazardous liquid pipelines are contained in Appendix A-4.




PL1
PL2
PL3
PL4
PL5
PL6
Antioch
Oakley
Bridgehead
West Island
Browns Island
Dow Chemical
Dow Wetlands Preserve
Big Break
Big Break Regional Shoreline
Sand Hill
Nunn Better Cherry
West Hartley
Stewartville
Nortonville
Black Diamond Mines Regional
Contra Loma Regional Park
Los Medanos College
Data from National Pipeline Mapping System (NPMS) Public Viewer, 2019
https://pvnpms.phmsa.dot.gov/PublicViewer/

3.4 Hazardous Materials Incidents

Data involving hazardous materials transportation incidents were reviewed from available sources, generally publicly available resources. Hazardous Materials incident data were available for rail and roadway transportation through the County. In addition, pipeline incidents involving both hazardous liquids and gases in the Coastal areas of the County are also discussed.

3.4.1 Railroad Incidents

Data concerning hazardous materials incidents involving the railroads in Contra Costa County were obtained from the following sources:

Federal Railroad Administration, on line at https://fragis.fra.dot.gov/gisfrasafety/

Federal Railroad Administration, Office of Safety Analysis, on line at https://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/AccidentByStateRailroad.aspx

Contra Costa County Railroad Accident Timeline, on line at http://www.mapreport.com/na/west/ba/news/citysubtopics/contra_costa_county-d-r.html

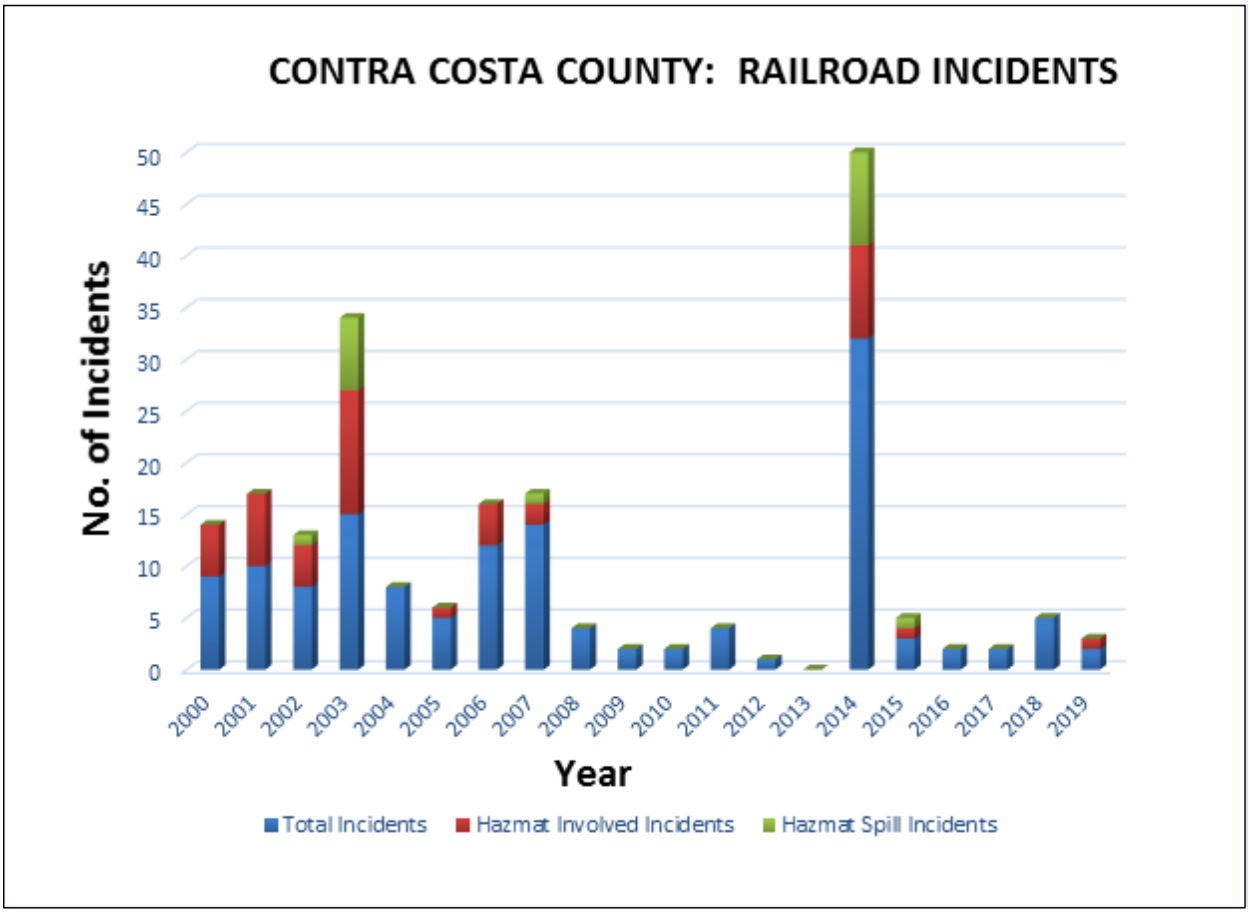
In addition, information was utilized from California Office of Emergency Services (CalOES), as well as various on-line news articles related to rail incidents.

Rail incident data from 2000 through 2019 were used for this report. It should be noted that some of the rail incidents may include release of hazardous materials from other than a rail car, particularly in the event of a train accident with a vehicle carrying hazardous materials. These have not been differentiated in the data.

Three general categories were reviewed and they are as follows:

- Total number of railroad incidents (140);
- Number of railroad incidents where hazardous materials were involved (46); and
- Number of railroad incidents where hazardous materials were spilled (19).

A summary table of the railroad incidents in Contra Costa County over the period of 2000 through 2019 is as follows.



A large number of rail incidents, including a somewhat higher percentage of rail incidents involving hazardous materials occurred between 2000 and 2007, with a major spike in 2014. With the exception of the number of incidents in 2014, the number of incidents in the last 10 years has generally declined from the early 2000s.

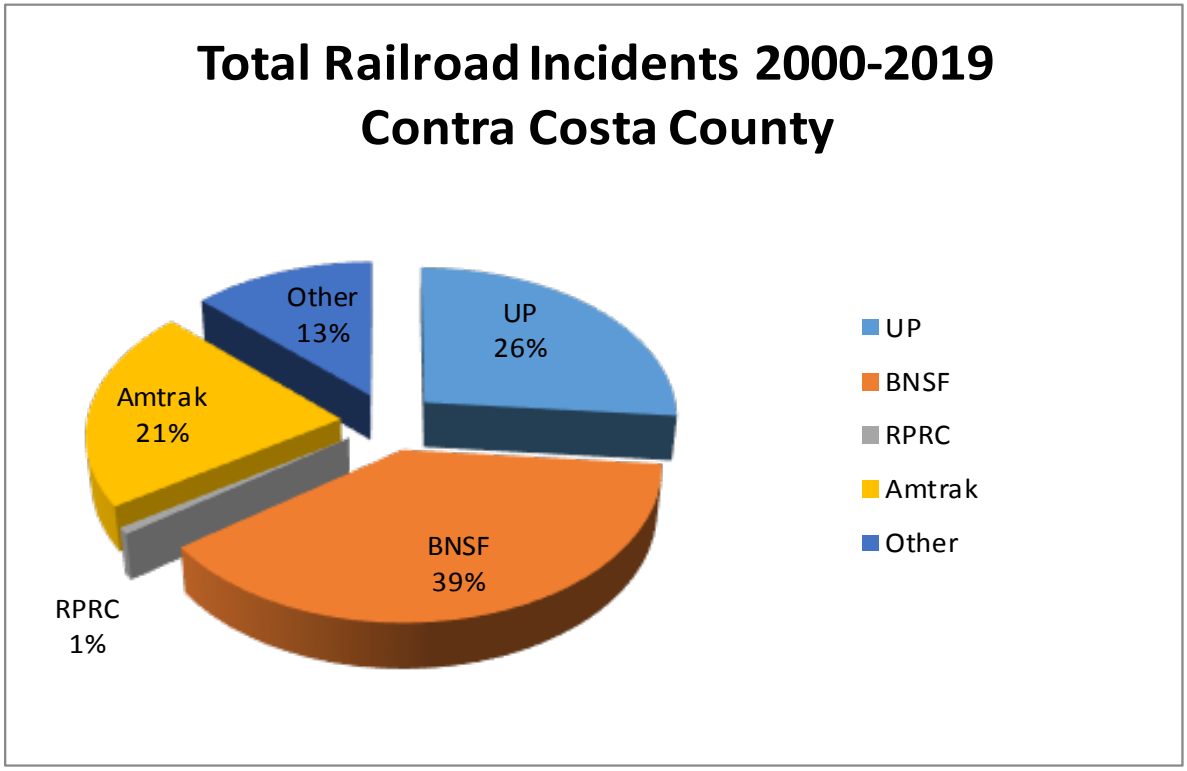
Chemicals involved in the railroad incidents are listed in the following chart. Three of these chemicals, anhydrous ammonia, propane, and sulfuric acid were used as the chemicals of concern for plume analysis in the CRA portion of this report.

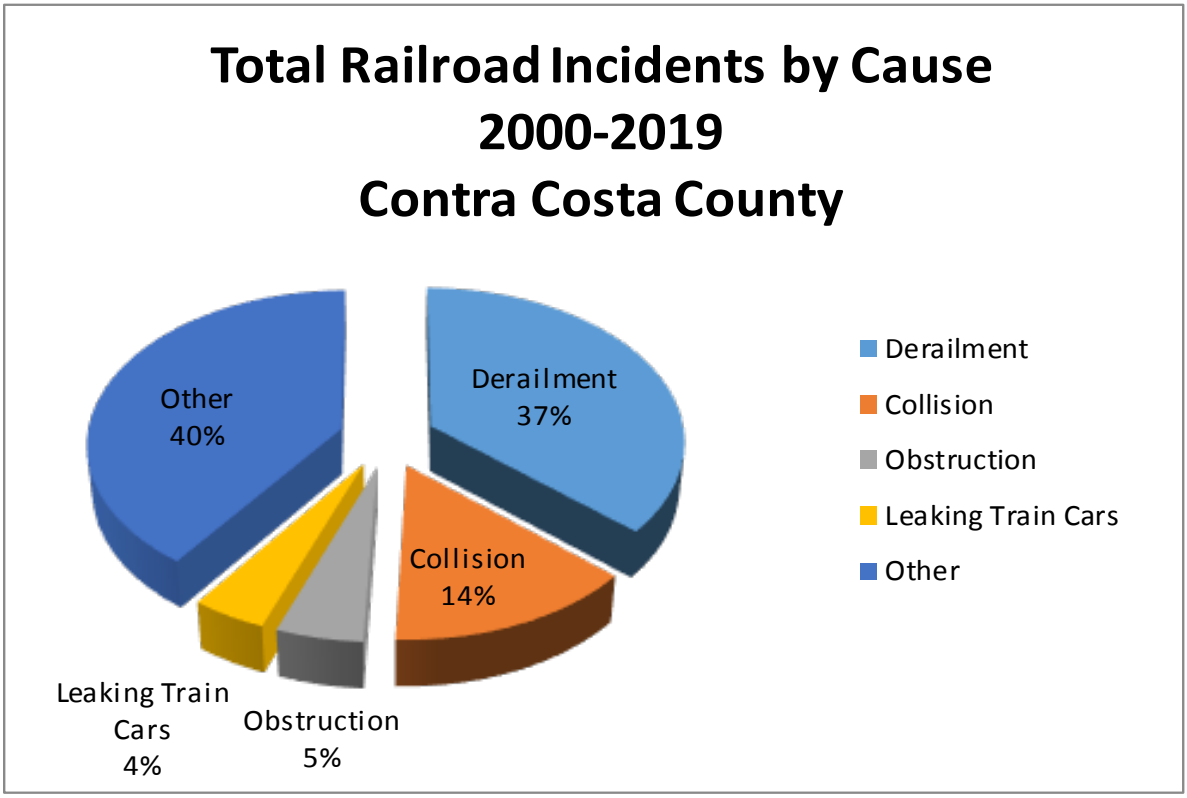
Chemicals Involved in Incidents	Number of Incidents
Anhydrous Ammonia	1
Propane	1
Sulfuric Acid	2
Hydrochloric Acid	1
Diesel/Gasoline	6
Ethanol	1
Oils/Sludge	3
Herbicide	1
Powdered Aluminum	1
Bleach	2
Total	19

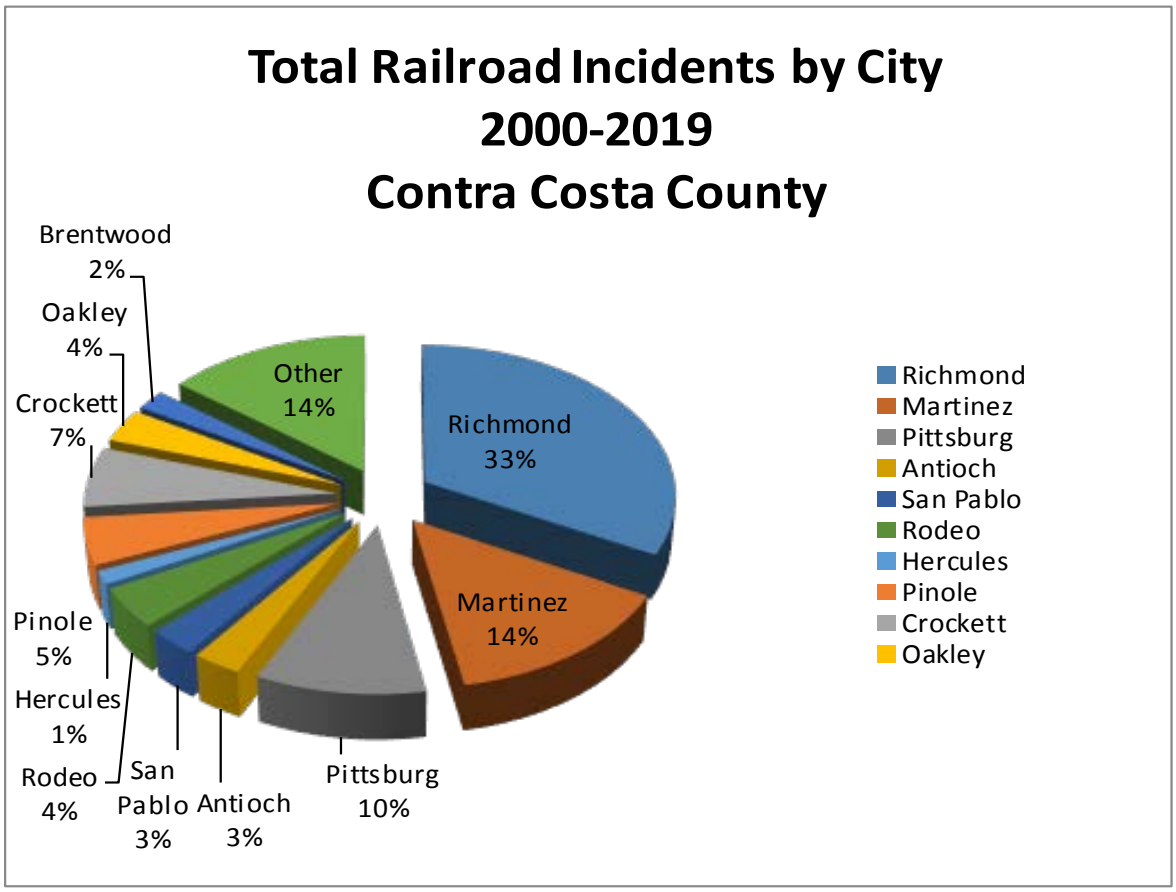
Each of the above three general categories was further subdivided into the following subcategories:

- Number of incidents by railroad company;
- Number of incidents by cause of incident; and
- Number of incidents by city.

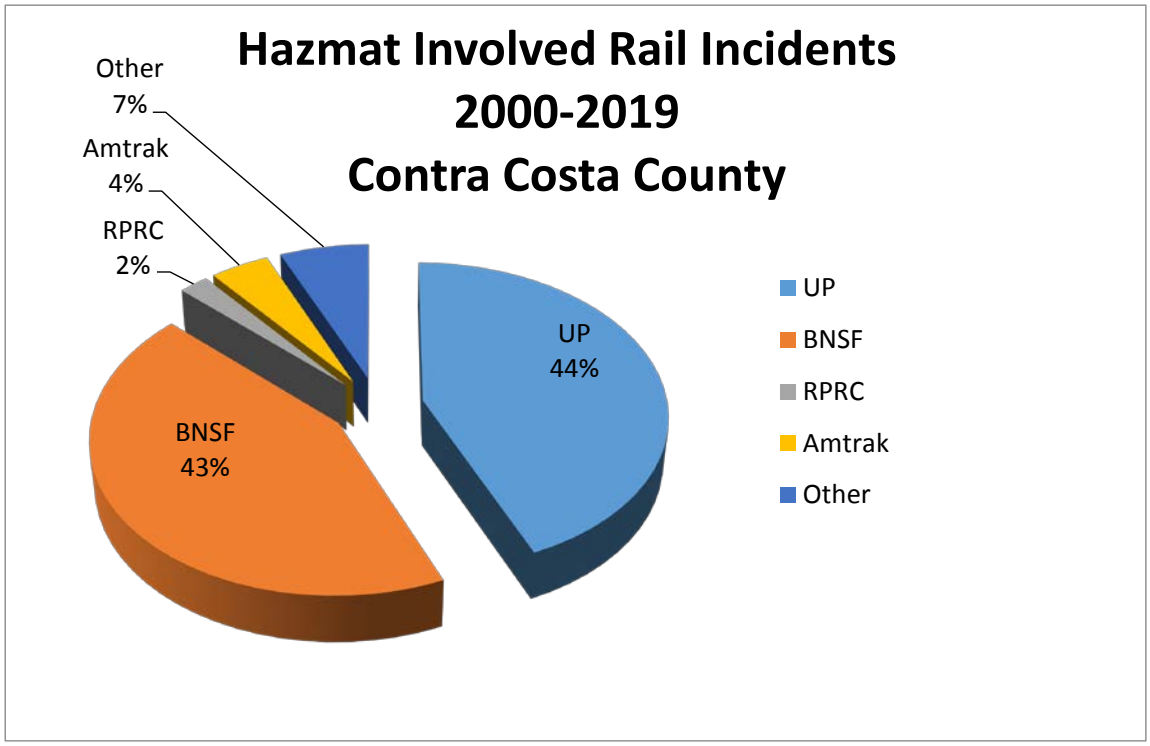
The total number of incidents (140), both hazardous and non-hazardous, occurring on the railroads in Contra Costa County from the period from 2000 through 2019 are illustrated in the following charts.

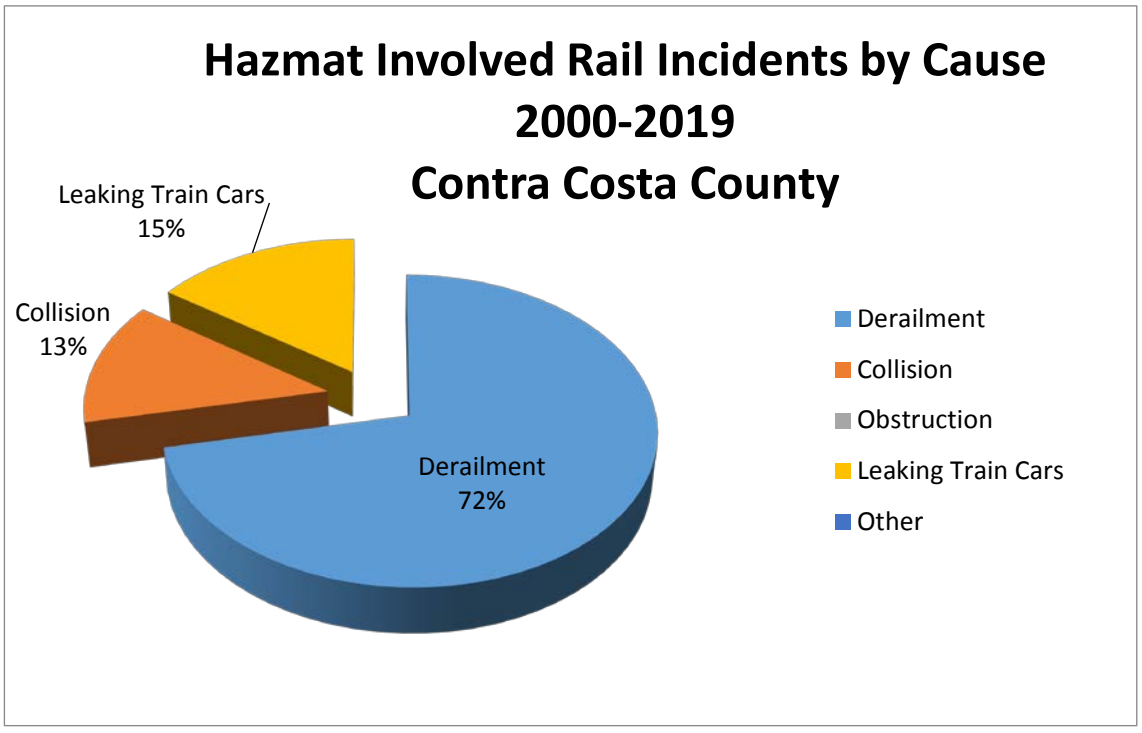

Total Railroad Incidents 2000-2019
Contra Costa County
Other 13%
UP 26%
Amtrak 21%
BNSF 39%
RPRC 1%
UP
BNSF
RPRC
Amtrak
Other

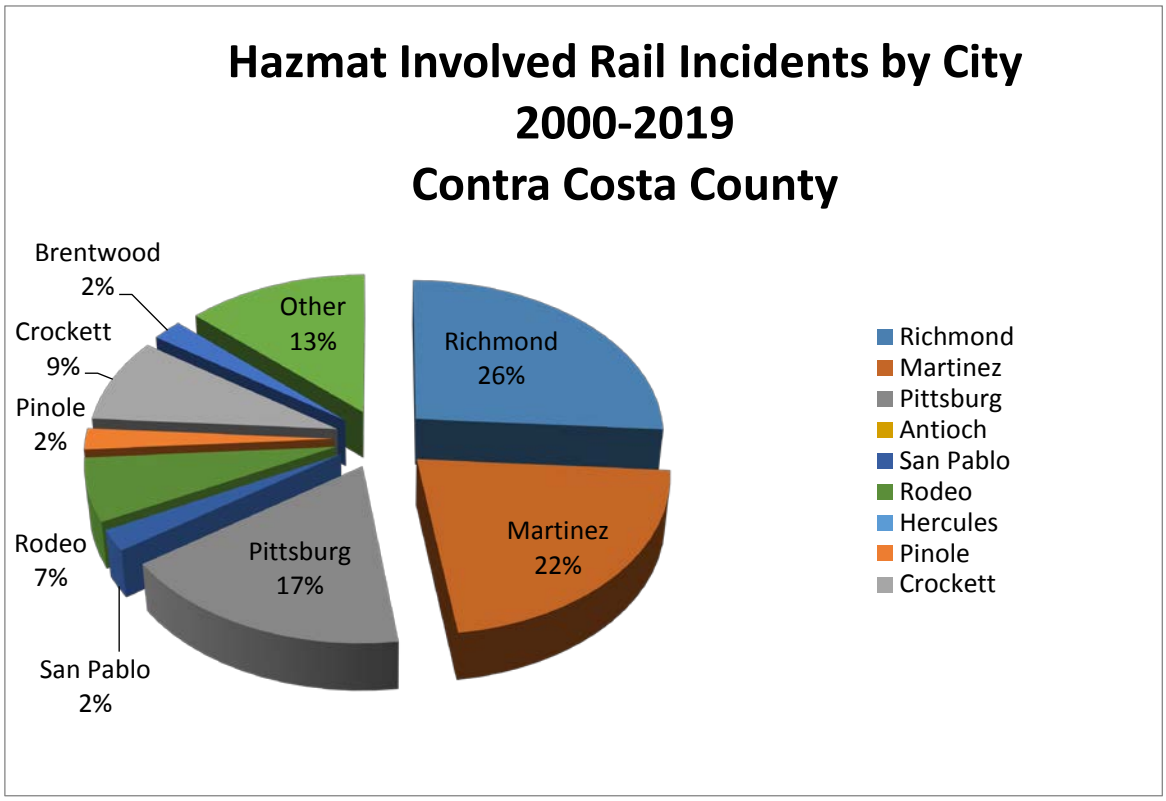

Total Railroad Incidents by Cause
2000-2019
Contra Costa County
Other 40%
Derailment 37%
Collision 14%
Leaking Train Cars 4%
Obstruction 5%
Derailment
Collision
Obstruction
Leaking Train Cars
Other


Total Railroad Incidents by City
2000-2019
Contra Costa County
Brentwood 2%
Oakley 4%
Crockett 7%
Other 14%
Richmond 33%
Martinez 14%
Pittsburg 10%
Antioch 3%
San Pablo 3%
Rodeo 4%
Hercules 1%
Pinole 5%
Richmond
Martinez
Pittsburg
Antioch
San Pablo
Rodeo
Hercules
Pinole
Crockett
Oakley

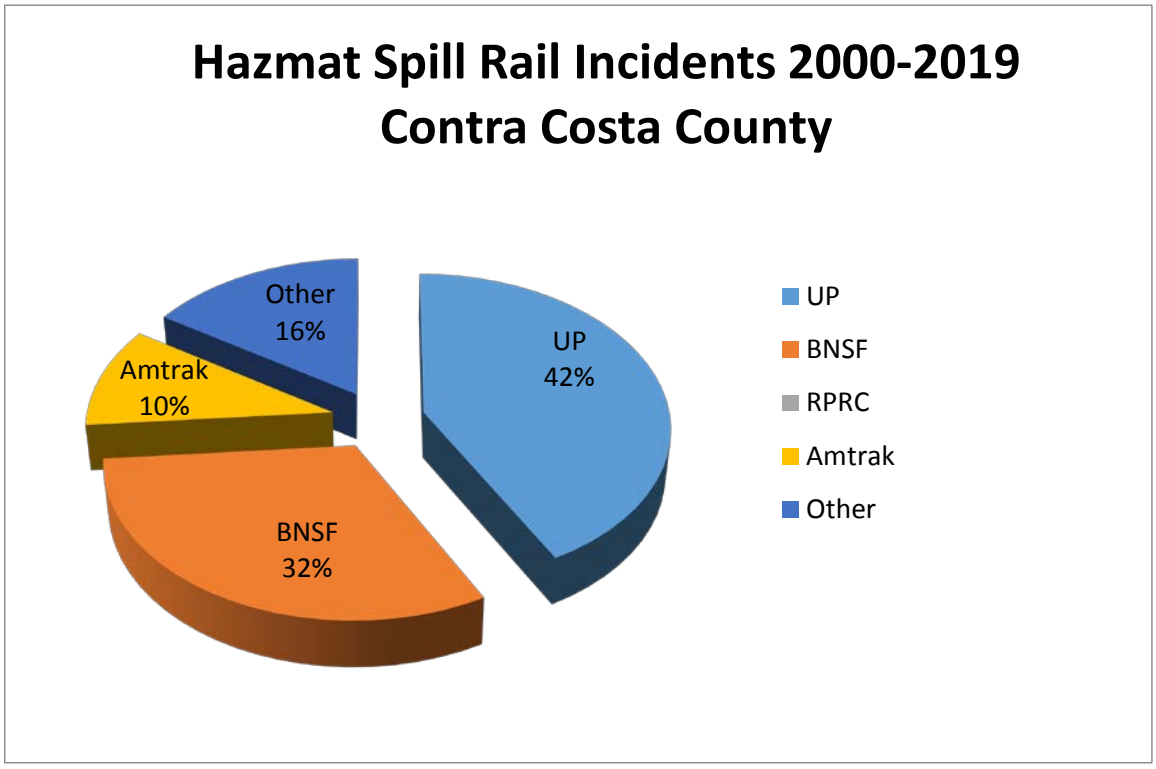
The number of railroad incidents involving hazardous materials (46 incidents) occurring in Contra Costa County from the period from 2000 through 2019 are illustrated in the following charts.

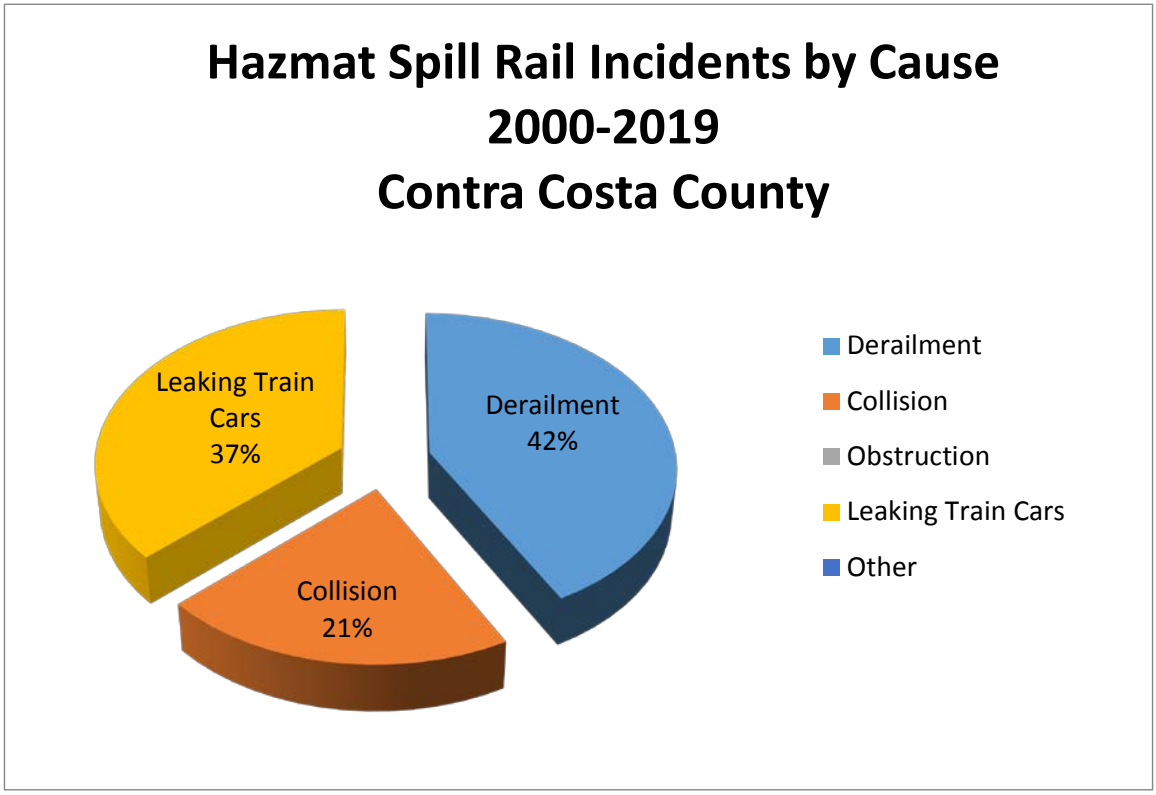


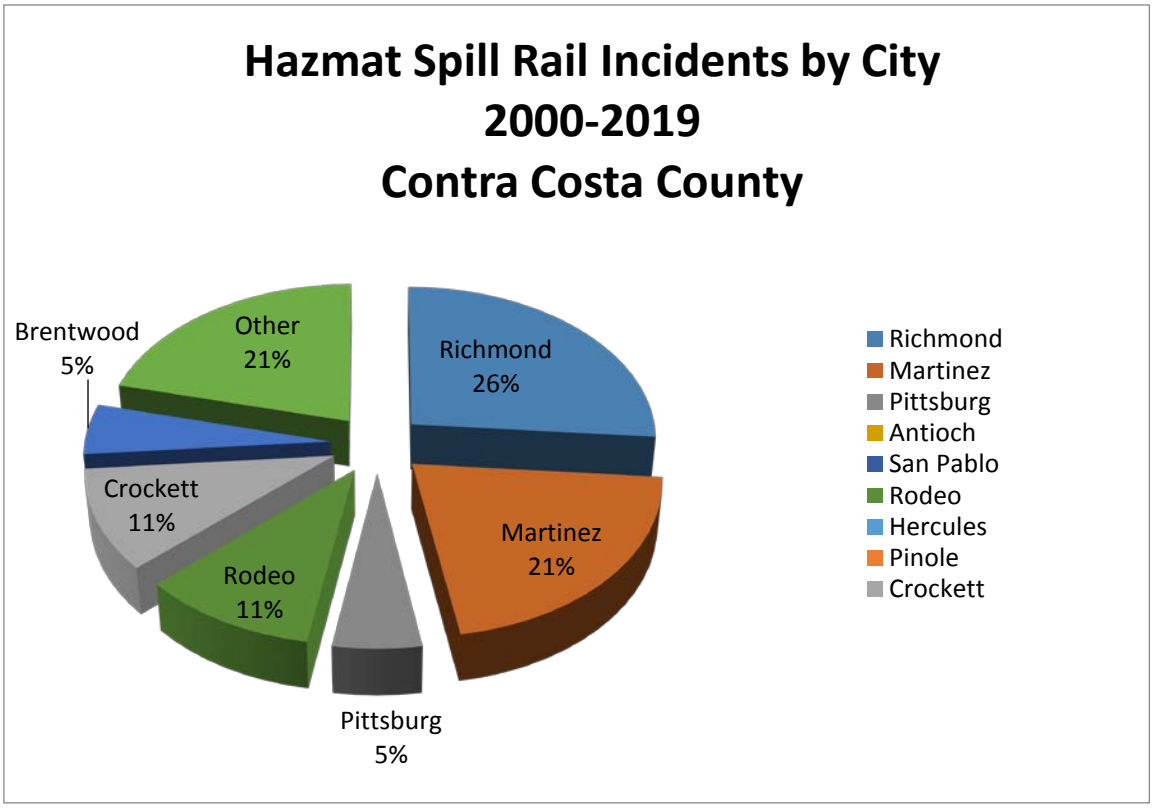



Hazmat Involved Rail Incidents by City
2000-2019
Contra Costa County
Brentwood 2%
Crockett 9%
Pinole 2%
Rodeo 7%
San Pablo 2%
Other 13%
Richmond 26%
Martinez 22%
Pittsburg 17%
Richmond
Martinez
Pittsburg
Antioch
San Pablo
Rodeo
Hercules
Pinole
Crockett

The number of railroad incidents resulting in hazardous materials spills (19 incidents) occurring in Contra Costa County from the period from 2000 through 2019 are illustrated in the following charts.




Hazmat Spill Rail Incidents by Cause
2000-2019
Contra Costa County
Leaking Train Cars 37%
Derailment 42%
Collision 21%
Derailment
Collision
Obstruction
Leaking Train Cars
Other


Hazmat Spill Rail Incidents by City
2000-2019
Contra Costa County
Brentwood 5%
Other 21%
Richmond 26%
Crockett 11%
Martinez 21%
Rodeo 11%
Pittsburg 5%
Richmond
Martinez
Pittsburg
Antioch
San Pablo
Rodeo
Hercules
Pinole
Crockett

A review of the above data indicates the following trends:

- Major cause of total rail incidents is derailment;
- Major causes of hazardous materials spill incidents are derailment, leaking train cars, and collision;
- Both UP and BNSF lines contained the major portion of the total rail incidents, as these are the major rail lines in the area;
- UP had a higher percentage of hazardous materials spill incidents than BNSF;
- Total rail incidents were located primarily in the cities of Richmond, Martinez, Pittsburg, Rodeo, and Crockett; and.
- Hazardous materials spill incidents were located primarily in Richmond, Martinez, Rodeo, and Crockett.

3.4.2 Highway Incidents

Data concerning hazardous materials incidents involving the highway and roadways in Contra Costa County were obtained from the following sources:

California Highway Patrol (CHP).

PHMSA Data Mart Hazardous Materials, on line at https://portal.phmsa.dot.gov/analyticsSOAP/saw.dll?Dashboard.

The California Highway Patrol provided general data for the years 2016 through 2018.

CHP DATA	Hazardous Materials Count of collisions		
	Fatal	Injury	PDO
Collision Year			
2016	10	309	376
2017	9	287	377
2018	7	278	450
TOTALS	26	874	1203

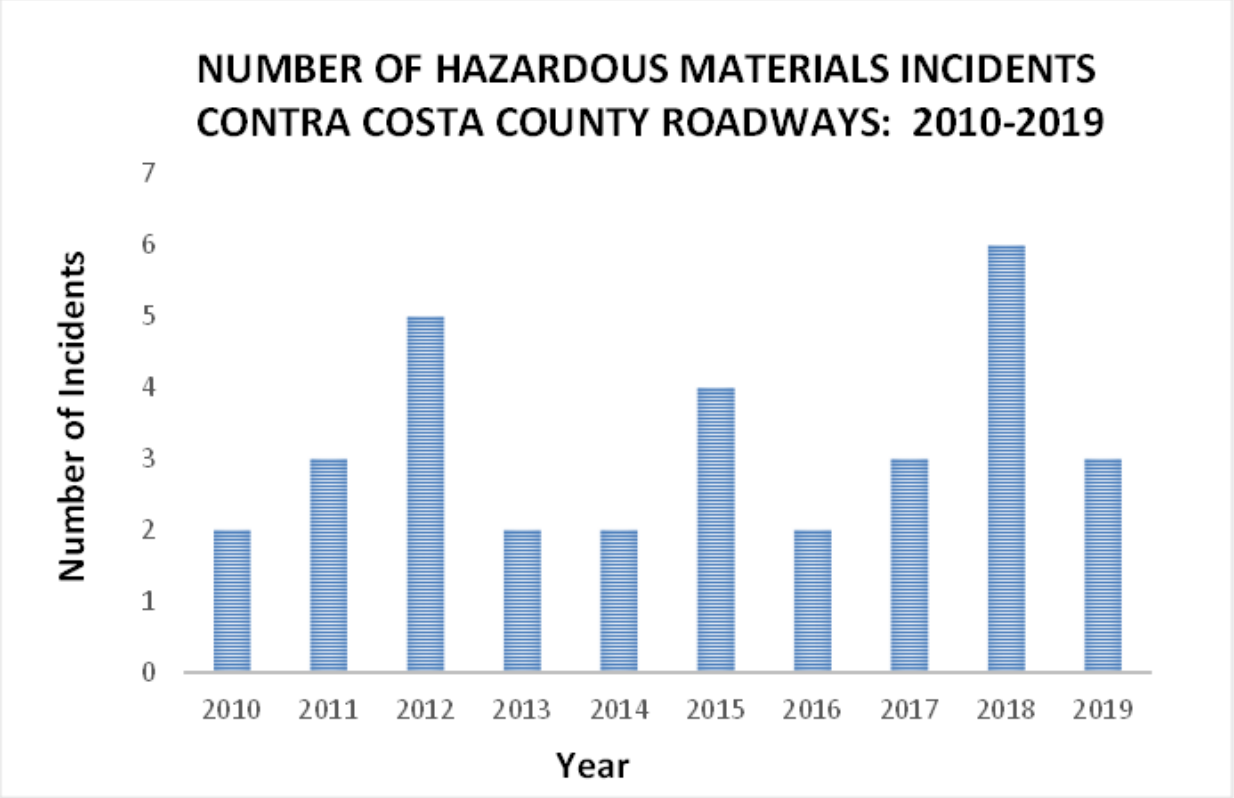
Data from PHMSA were obtained for the years 2010 through 2019. Many of the hazardous materials incidents in the PHMSA data involved small quantities of released materials. The data are summarized in the following table.

HAZARDOUS MATERIALS HIGHWAY AND ROADWAY RELEASES IN CONTRA COSTA COUNTY: 2010-2019

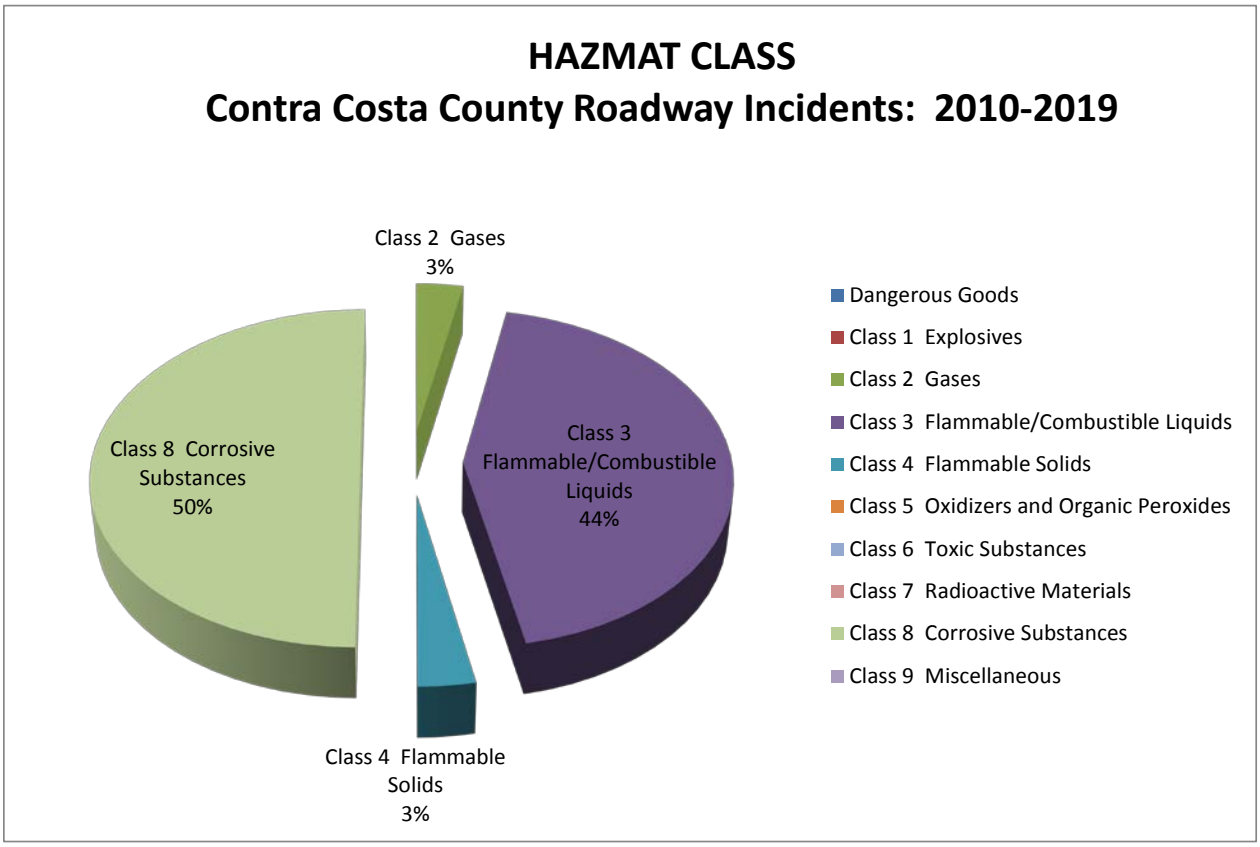
Incident Street Address	City	Date	Carrier	Chemical Name	UN ID#	Hazmat Class	Quantity Released (gallons)	Vehicle Type	Cause of Release
1601 Atlas Road	San Pablo	5/26/2010	United Parcel Service, Inc.	Petroleum Distillates	1268	3	0	N/A	Packaging failure
1601 Atlas Road	San Pablo	7/17/2010	United Parcel Service, Inc.	Isopropanol	1219	3	0.26418	N/A	Human Error
East Bay MUD	El Sorbante	8/26/2011	Quality Carriers, Inc.	Caustic Soda	1824	8	0.015625	Cargo Tank Motor Vehicle	Human Error
1601 Atlas Road	Richmond	10/26/2011	United Parcel Service, Inc.	Chloroform	1888	8	0.26418	Non-bulk	Human Error
Unknown	Pittsburg	12/21/2011	Quality Carriers, Inc.	Sodium Hypochlorite, Solution	1791	8	40	Cargo Tank Motor Vehicle	Human Error
950 Loveridge Road	Pittsburg	2/21/2012	Quality Carriers, Inc.	Hypochlorite Solutions with 16% or more	1791	8	10	Cargo Tank Motor Vehicle	N/A
John Muir Parkway	Crockett	3/12/2012	Chemical Transfer Company, Inc.	Combustible Liquid N.O.S.	1993	3	2	Cargo Tank Motor Vehicle	Human Error
East Bay MUD	El Sorbante	5/11/2012	Quality Carriers, Inc.	Caustic Soda	1824	8	0.023438	Cargo Tank Motor Vehicle	Human Error
Chevron	Richmond	6/28/2012	QSI Services, Inc.	Ethanolamine or Ethanolamine Solutions	2491	8	10	Cargo Tank Motor Vehicle	Human Error
Unknown	Pittsburg	11/2/2012	Quality Carriers, Inc.	Hypochlorite Solutions	1791	8	0.0625	Cargo Tank Motor Vehicle	Human Error
1140 Canal Blvd.	Richmond	5/2/2013	Quality Carriers, Inc.	Sodium Hydroxide, Solution	1824	8	20	Cargo Tank Motor Vehicle	Human error
901 Loveridge Road	Pittsburg	7/31/2013	Quality Carriers, Inc.	Flammable Liquids, N.O.S.	1993	3	20	Cargo Tank Motor Vehicle	Human error
950 Loveridge Road	Pittsburg	9/30/2014	Quality Carriers, Inc.	Hypochlorite Solutions	1791	8	N/A	Cargo Tank Motor Vehicle	Human Error
1601 Atlas Road	San Pablo	10/1/2014	United Parcel Service, Inc.	Matches, Safety	1944	4.1	N/A	In bulk	N/A
611 Solano Way	Martinez	1/31/2015	KAG West, LLC	Gasoline	1203	3	15	Cargo Tank Motor Vehicle	Vehicular Crash or Accident Damage
105 Brookside Avenue	Richmond	4/23/2015	Quality Carriers, Inc.	Sodium Hypochlorite, Solution	1791	8	0.03125	Cargo Tank Motor Vehicle	Deterioration or Aging
Unknown	Richmond	4/27/2015	Quality Carriers, Inc.	Bisulfites, Aqueous Solutions, N.O.S.	2693	8	0.007812	Cargo Tank Motor Vehicle	Deterioration or Aging
1601 Atlas Road	San Pablo	7/12/2015	United Parcel Service, Inc.	Corrosive Liquids, N.O.S.	1760	8	0.09375	Non-Bulk	Human Error
1601 Atlas Road	San Pablo	1/6/2016	United Parcel Service, Inc.	Corrosive Liquid, Acidic, Inorganic, N.O.S.	3264	8	4	Non-Bulk	Improper Preparation for Transportation
1601 Atlas Road	San Pablo	6/13/2016	United Parcel Service, Inc.	Corrosive Liquid, Basic, Inorganic, N.O.S.	3266	8	0.1875	Non-Bulk	Human Error
1601 Atlas Road	San Pablo	8/16/2017	United Parcel Service, Inc.	Aerosols, Flammable	1950	2.2	0.15625	Non-Bulk	Inadequate Preparation for Transportation
4500 Norris Canyon Road	San Ramon	9/8/2017	United Parcel Service, Inc.	Acetone	1090	3	0.007812	Non-Bulk	Human Error
300 Olympia Drive	Pittsburg	11/30/2017	Quality Carriers, Inc.	Sodium Hydroxide, Solution	1824	8	3	Cargo Tank Motor Vehicle	Inadequate Preparation for Transportation
1601 Atlas Road	San Pablo	1/16/2018	United Parcel Service, Inc.	Hypochlorite Solutions	1791	3	0.1875	Non-Bulk	Dropped

HAZARDOUS MATERIALS HIGHWAY AND ROADWAY RELEASES IN CONTRA COSTA COUNTY: 2010-2019									
Incident Street Address	City	Date	Carrier	Chemical Name	UN ID#	Hazmat Class	Quantity Released (gallons)	Vehicle Type	Cause of Release
1601 Atlas Road	San Pablo	1/16/2018	United Parcel Service, Inc.	Hypochlorite Solutions	1791	3	0.1875	Non-Bulk	Dropped
1601 Atlas Road	San Pablo	9/17/2018	United Parcel Service, Inc.	Flammable Liquids, N.O.S.	1993	3	1	Non-Bulk	Abrasion
1601 Atlas Road	San Pablo	11/6/2018	United Parcel Service, Inc.	Hexanes	1208	3	0.66045	Non-Bulk	Human Error
1601 Atlas Road	San Pablo	11/16/2018	United Parcel Service, Inc.	Corrosive Liquid, Acidic, Inorganic, N.O.S.	3264	3	0.023438	Non-Bulk	Conveyer or Material Handling Equipment Mishap
1601 Atlas Road	San Pablo	11/16/2018	United Parcel Service, Inc.	Corrosive Liquid, Acidic, Inorganic, N.O.S.	3264	3	0.007813	Non-Bulk	Conveyer or Material Handling Equipment Mishap
4500 Norris Canyon Road	San Ramon	1/4/2019	United Parcel Service, Inc.	Acetone	1090	3	0.039063	Non-Bulk	Dropped
4500 Norris Canyon Road	San Ramon	2/21/2019	United Parcel Service, Inc.	Flammable Liquid, N.O.S.	1993	3	0.0625	Non-Bulk	Inadequate Preparation for Transportation
Richmond Pkwy. & San Pablo Ave.	Richmond	2/21/2019	Univar, Inc.	Sodium Bisulfite, Solution	2693	8	50	Cargo Tank Motor Vehicle	Human Error

Based on the data shown above, the incident rate per year (2019 not yet completed) is shown in the following chart.



Several different hazardous materials classes are represented in the releases as shown in the following chart.



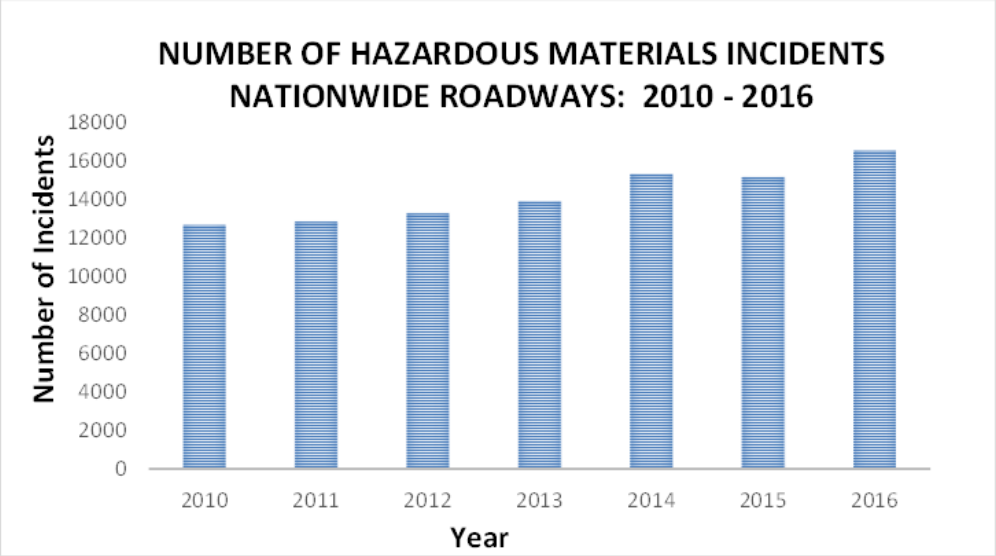
Information concerning hazardous materials incidents on a nationwide basis was available from the following publications:

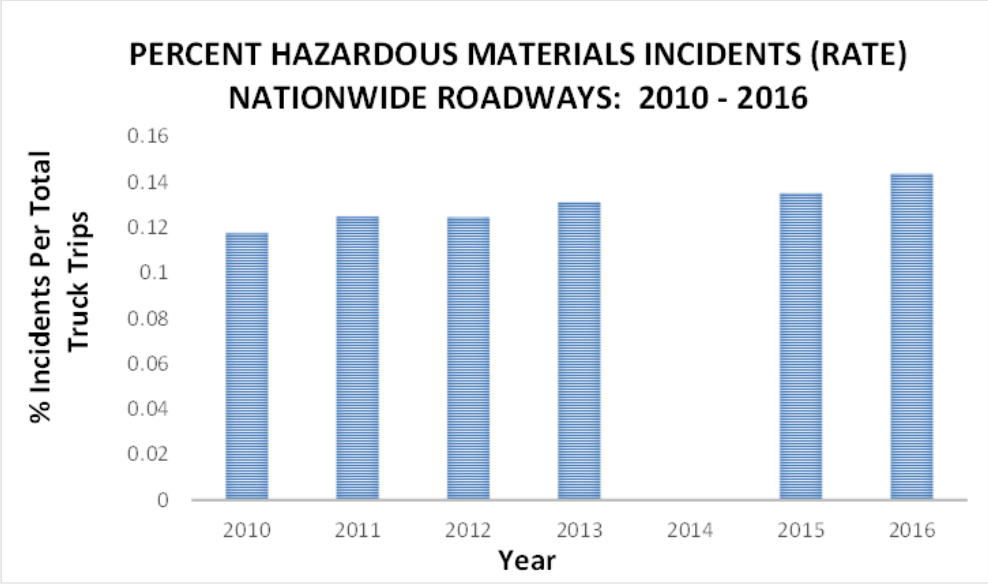
U.S. Department of Transportation, Bureau of Transportation Statistics, March 15, 2018, Facts and Figures 2017.

U.S. Department of Transportation, Bureau of Transportation Statistics, January 1, 2015, Facts and Figures 2015.

Information from the Bureau of Transportation Statistics (BTS) included data concerning total truck trips and total truck hazardous materials incidents for the years from 2010 through 2016. The information is summarized in the following table and charts.

Nationwide Hazardous Materials Trucking Incidents: 2010-2016				
Year	Total Truck Traffic Trips on Highways	Truck Traffic as % of Total Highway Traffic	Hazardous Materials Trucking Incidents	Hazardous Materials Trucking Incidents as % of Total Truck Traffic
2010	10,770,054	4.3	12,651	0.1175%
2011	10,270,693	4.1	12,812	0.1247%
2012	10,659,380	4.2	13,255	0.1244%
2013	10,597,356	4.1	13,882	0.1310%
2014	N/A	N/A	15,284	N/A
2015	11,203,184	4.2	15,120	0.1350%
2016	11,498,561	4.3	16,501	0.1435%





The above data indicate that throughout the period from 2010 through 2016, the number of nationwide incidents resulting from highway transportation of hazardous materials cargo has increased from 2010 through 2016. In addition, the rate of the hazardous materials incidents has also increased. In general, the number of hazardous materials incidents occurs in about 12 to 14 times per 10,000 total truck trips. These numbers can be extrapolated to Contra Costa County, although there may be an increase in the frequency/rate of the incidents due to the following:

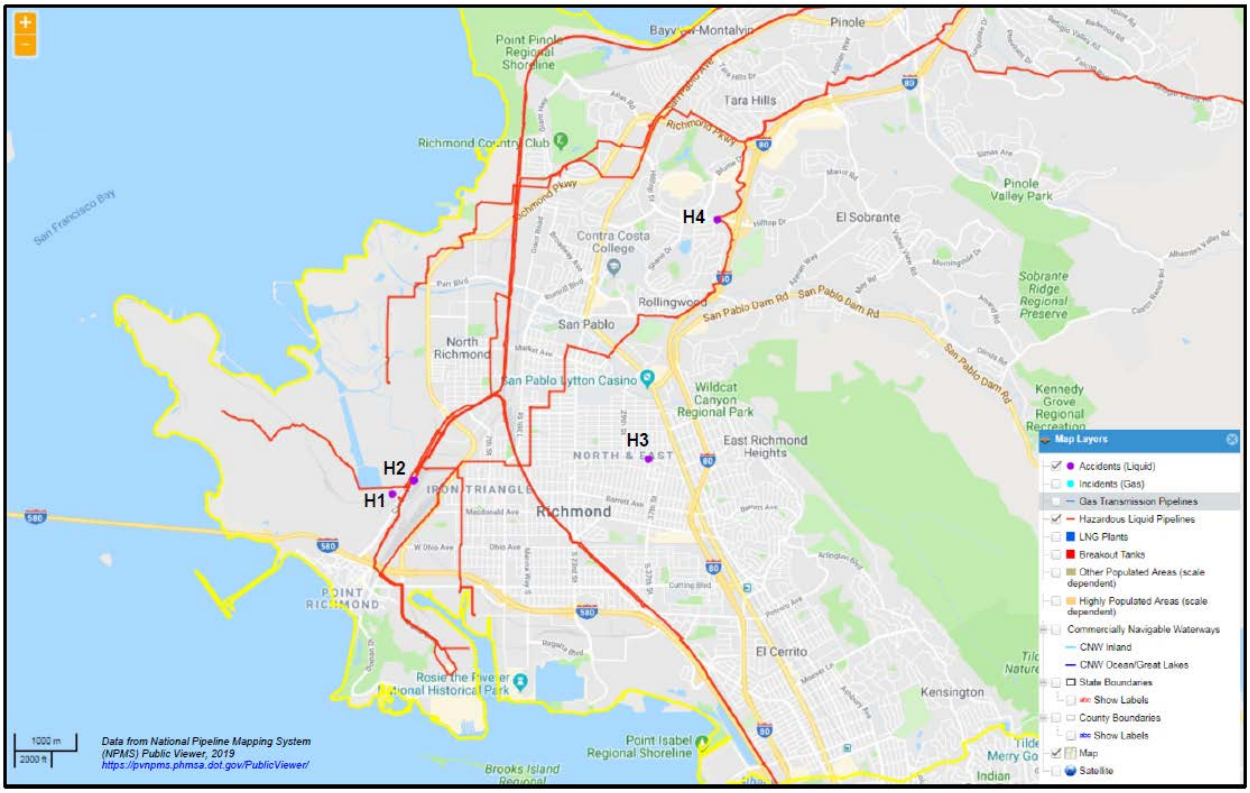
- High traffic volumes in a heavily populated urban area;
- Increased frequency of transportation of hazardous materials along arterial roadways; and
- Increased number of incidents because of flooding due to rising tides.

3.4.2 Pipeline Incidents

Release incidents can occur along pipelines that can endanger populations located adjacent to the pipelines, as well as those in downstream areas from the pipelines. This is particularly true with the natural gas pipelines, and was evidenced in the 2010 San Bruno PG&E natural gas pipeline explosion and fires. In order to mitigate any negative results due to a release incident along the pipelines, Contra Costa County should coordinate with the pipeline operators to immediately isolate the affected lines. Isolation will ensure that a minimal amount of the population is affected by the incident. In addition, evacuation procedures should be in place to quickly and efficiently remove the affected populations from the areas impacted by the incident.

Most of the data available from the National Pipeline Mapping System (NPMS) at https://www.npms.phmsa.dot.gov/ covered releases from hazardous liquid pipelines with few releases listed from the gas transmission lines. Maps showing the locations of the pipeline incidents in the coastal area of Contra Costa County and accompanying details of the incidents are shown below for the Richmond, Crockett, Martinez, and Pittsburg-Antioch areas.

Hazardous liquid pipeline data for the Richmond area are shown in the following map and table. There was no information available for gas transmission line incidents in the Richmond area.

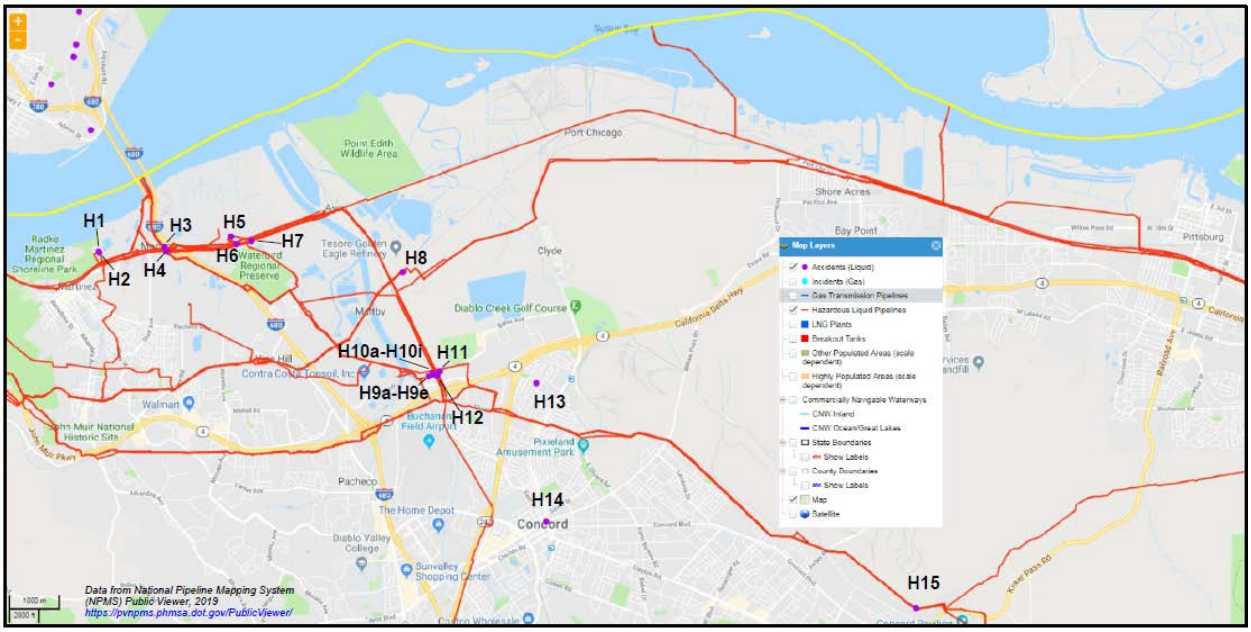


Richmond Area: Hazardous Liquid Pipeline Incident Data						
Location	**Date**	**Pipeline Operator**	**Commodity Released**	**Loss (bbls)**	**Recovered (bbls)**	**Cause**
H1	5/23/2008	SFPP,LP	Gasoline	4.0	1.0	Corrosion
H2	1/12/2015	SFPP,LP	Refined and/or Petroleum Products	58.9	58.9	Material/weld/equipment failure
H3	12/7/2002	SFPP,LP	Gasoline/diesel	4.0	0.0	Material/weld/equipment failure
H4	9/17/2014	Phillips 66 Pipeline, LLC	Refined and/or Petroleum Products	2.1	2.1	Material/weld/equipment failure

Hazardous liquid pipeline data for the Crockett area are shown in the following map and table. There was no information available for gas transmission line incidents in the Crockett area.

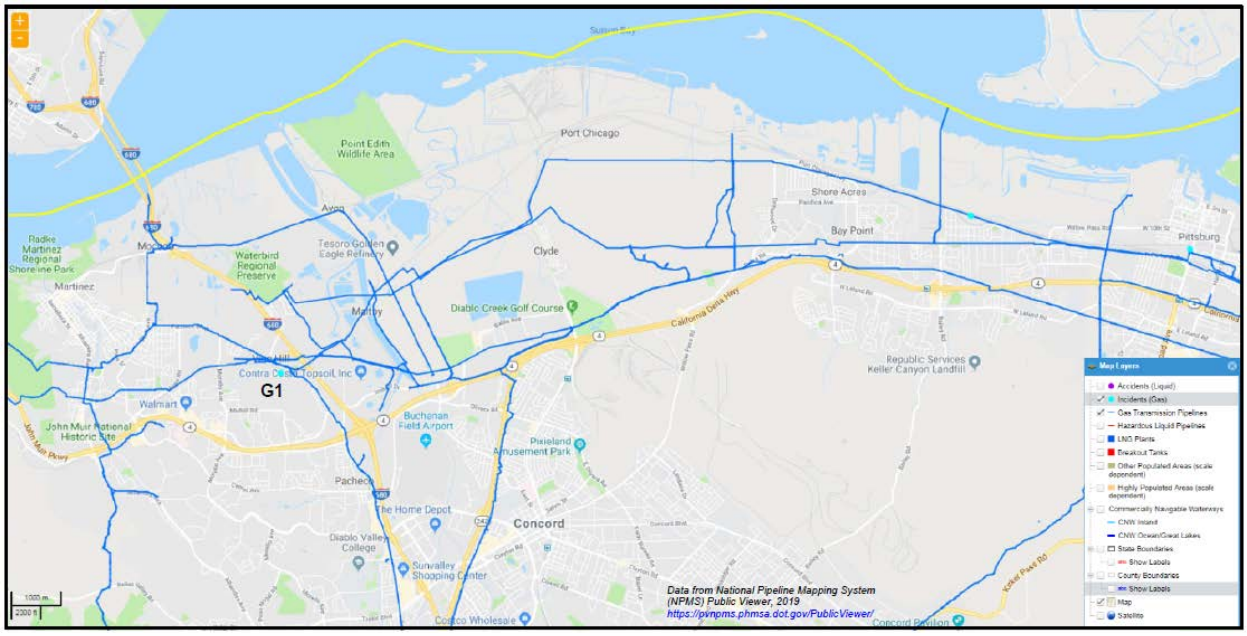
Crockett Area: Hazardous Liquid Pipeline Incident Data						
Location	**Date**	**Pipeline Operator**	**Commodity Released**	**Loss (bbls)**	**Recovered (bbls)**	**Cause**
H1	9/17/2014	Phillips 66 Pipeline, LLC	Refined and/or Petroleum Products	2.1	2.1	Material/weld/equipment failure
H2	6/21/2004	Nustar Terminals Operations	Refined and/or Petroleum Products	37.0	37.0	Incorrect Operation

Hazardous liquid pipeline data for the Martinez area are shown in the following map and table. Information was also available for gas transmission line incidents in the Martinez area.



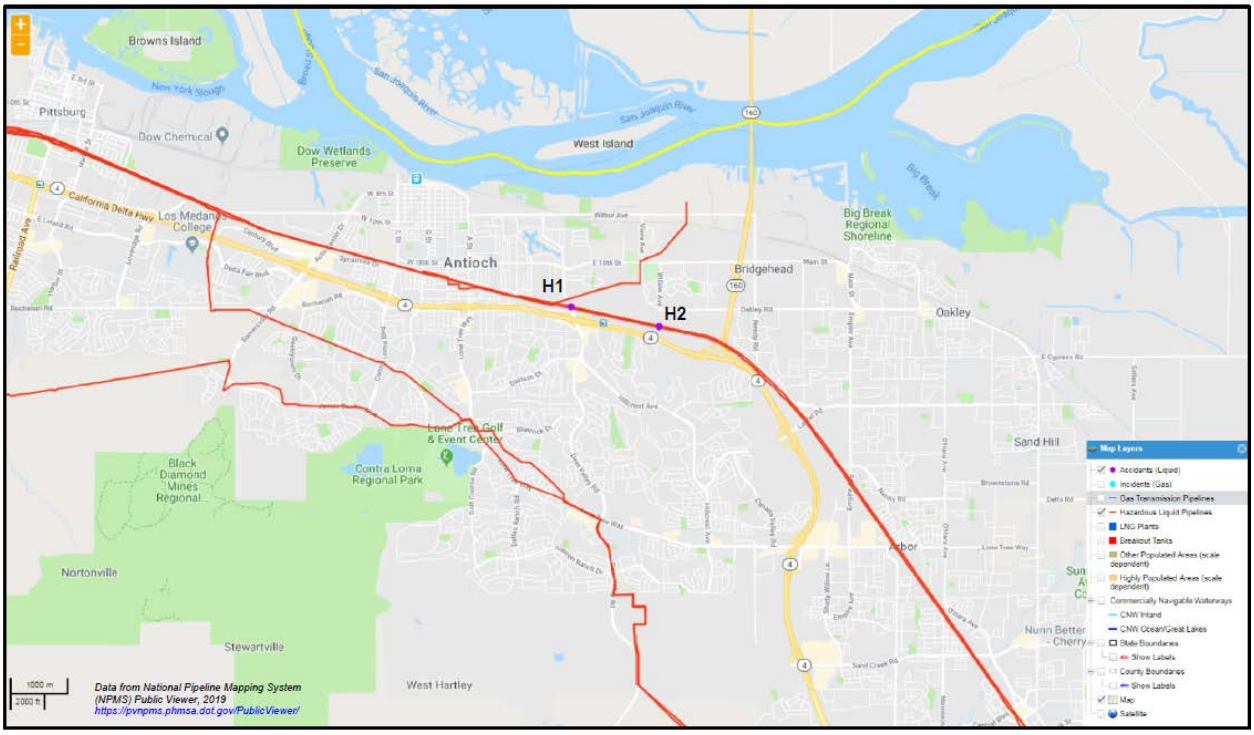
Martinez Area: Hazardous Liquid Pipeline Incident Data

Location	Date	Pipeline Operator	Commodity Released	Loss (bbls)	Recovered (bbls)	Cause
H1	7/3/2012	Shell Pipeline Co., LP	Refined and/or Petroleum Products	13.0	13.0	Material/weld/equipment failure
H2	12/15/2015	Shell Pipeline Co., LP	Refined and/or Petroleum Products	0.95	0.48	Incorrect Operation
H3	11/7/2004	SFPP,LP	Jet Fuel JP-8	299.0	203.0	Excavation Damage
H4	6/24/2008	Pacific Atlantic Terminals, LLC	Hydrotest Water/Oil Mixture	0.5	0.0	Material/weld/equipment failure
H5	9/8/2007	Pacific Atlantic Terminals, LLC	Gasoline/Reformate	168.0	123.0	Incorrect Operation
H6	4/5/2016	Tesoro Logistics Operations	Refined and/or Petroleum Products	1.5	1.5	Incorrect Operation
H7	11/5/2009	Plains Marketing, LP	Diesel	4.0	0.0	Corrosion
H8	4/19/2019	Chevron Pipeline Co.	Refined and/or Petroleum Products	15.5	15.5	Material/weld/equipment failure
H9a	8/8/2013	SFPP,LP	Refined and/or Petroleum Products	1.4	1.4	Material/weld/equipment failure
H9b	12/9/2014	SFPP,LP	Refined and/or Petroleum Products	0.01	0.01	All Other Causes
H9c	6/21/2014	SFPP,LP	Refined and/or Petroleum Products	7.2	7.0	Incorrect Operation
H9d	9/14/2014	SFPP,LP	Refined and/or Petroleum Products	12.8	12.8	Incorrect Operation
H9e	9/21/2018	SFPP,LP	Refined and/or Petroleum Products	0.4	0.4	Material/weld/equipment failure
H10a	11/20/2017	SFPP,LP	Refined and/or Petroleum Products	0.35	0.35	Material/weld/equipment failure
H10b	9/28/2004	SFPP,LP	Gasoline/Distillate Mixture	3.0	0.0	Material/weld/equipment failure
H10c	5/30/2003	SFPP,LP	Gasoline	1.43	0.71	Incorrect Operation
H10d	4/30/2006	SFPP,LP	Gasoline	77.0	77.0	Material/weld/equipment failure
H10e	3/29/2003	SFPP,LP	Turbine Fuel	0.48	0.00	Material/weld/equipment failure
H10f	9/8/2003	SFPP,LP	Turbine Fuel	0.48	0.00	Incorrect Operation
H10g	4/14/2003	SFPP,LP	Transmix	725.0	485.0	Corrosion
H10h	3/23/2016	SFPP,LP	Refined and/or Petroleum Products	2.19	2.19	Corrosion
H10i	4/1/2013	SFPP,LP	Gasoline	530.0	486.0	Material/weld/equipment failure
H11	4/21/2002	SFPP,LP	Diesel	13.0	0.0	Incorrect Operation
H12	1/8/2002	SFPP,LP	Gasoline	4.0	0.0	All Other Causes
H13	8/14/2002	SFPP,LP	Gasoline/Diesel	3.0	0.0	Material/weld/equipment failure
H14	7/4/2002	Equilon Pipeline Co., LLC	Crude Oil	0.24	0.00	Material/weld/equipment failure
H15	11/7/2011	Conoco Phillips	Crude Oil	45.0	0.0	Corrosion



Martinez Area: Gas Transmission Pipeline Incident Data						
Location	**Date**	**Pipeline Operator**	**Commodity Released**	**Loss (bbls)**	**Recovered (bbls)**	**Cause**
G1	3/8/2012	Standard Pacific Gas Line, Inc.	Natural Gas	N/A	N/A	Excavation Damage

Hazardous liquid pipeline data for the Pittsburg-Antioch area are shown in the following map and table. There was no information available for gas transmission line incidents in the Pittsburg-Antioch area.



Pittsburg-Antioch Area: Hazardous Liquid Pipeline Incident Data						
Location	**Date**	**Pipeline Operator**	**Commodity Released**	**Loss (bbls)**	**Recovered (bbls)**	**Cause**
H1	8/5/2018	SFPP, LP	Refined and/or Petroleum Products	72.0	72.0	Material/weld/equipment failure
H2	10/22/2018	SFPP, LP	Refined and/or Petroleum Products	12.02	12.02	Material/weld/equipment failure

4.0 Community Risk Assessment for Hazardous Materials

This Community Risk Assessment for Hazardous Materials (CRA) is developed to further refine and define the areas of increased risk within the coastal area of Contra Costa County that are vulnerable to a significant hazardous materials release from railroad, roadway, or pipeline incident. Data from the Flow Study outlined above in Section 3 of this report was used to aid in the identification of major toxic chemicals or COCs that could present a danger to vulnerable areas of the County during a release incident. In addition, the Flow Study data aided in the determination of the pinch points or the locations most susceptible to a hazardous materials incident as well as vulnerable populations and critical facilities affected by an incident. This analysis and determination of pinch points will be aided by available data from the Adapting to Rising tides program. The CRA presented herein will allow for first responders to plan the incident response in advance of the incident, and to provide additional information toward the planning needs of Contra Costa County.

Potential hazardous materials incidents within Contra Costa County can be generally classified as follows:

- Spill or Release: Exposure to toxic vapors, gases, liquids, and solids, requiring County residents and business to undertake protective actions, such as evacuation or shelter-in-place. Secondary risk to the environment is possible including contamination of subsurface drinking water sources, soil contamination, and danger to the health of wildlife.

- Fire: Toxic chemicals may be produced when hazardous materials burn creating inhalation and skin adsorption issues from toxic clouds and plumes, and it may require County residents and business to undertake protective actions such as evacuation or shelter in place. Fires related to hazardous materials tend to be focused around industrial areas and transportation corridors.

- Explosion: Explosions can occur with fires at hazardous materials sites, and represent a physical hazards as well as a chemical hazard. As with fires related to hazardous materials, explosions tend to occur in industrial areas and along transportation corridors. Boiling Liquid Expanding Vapor Explosions (BLEVEs and may also pose an immediate threat to County residents and businesses.

The following are examples of the critical facilities that could be impacted by a hazardous materials incident:

- City, County, State, and Federal Buildings, including public safety and public works buildings;
- Fire Stations;
- Hospitals, Emergency Care, and other Medical Facilities;
- Nursing and Convalescent Homes;
- Community Centers and Shelters; and
- Colleges, Schools, and Preschools.

Other general assets that could be affected by a hazardous materials incident are:

- Vulnerable Populations; and
- Residential Building Stock.

Vulnerable populations are often present in close proximity to major transportation corridors. Many of these areas are relatively high-density residential areas, and from a demographic standpoint, they tend to be lower-income areas.

The scope of work for the completion of the CRA was focused on the following areas:

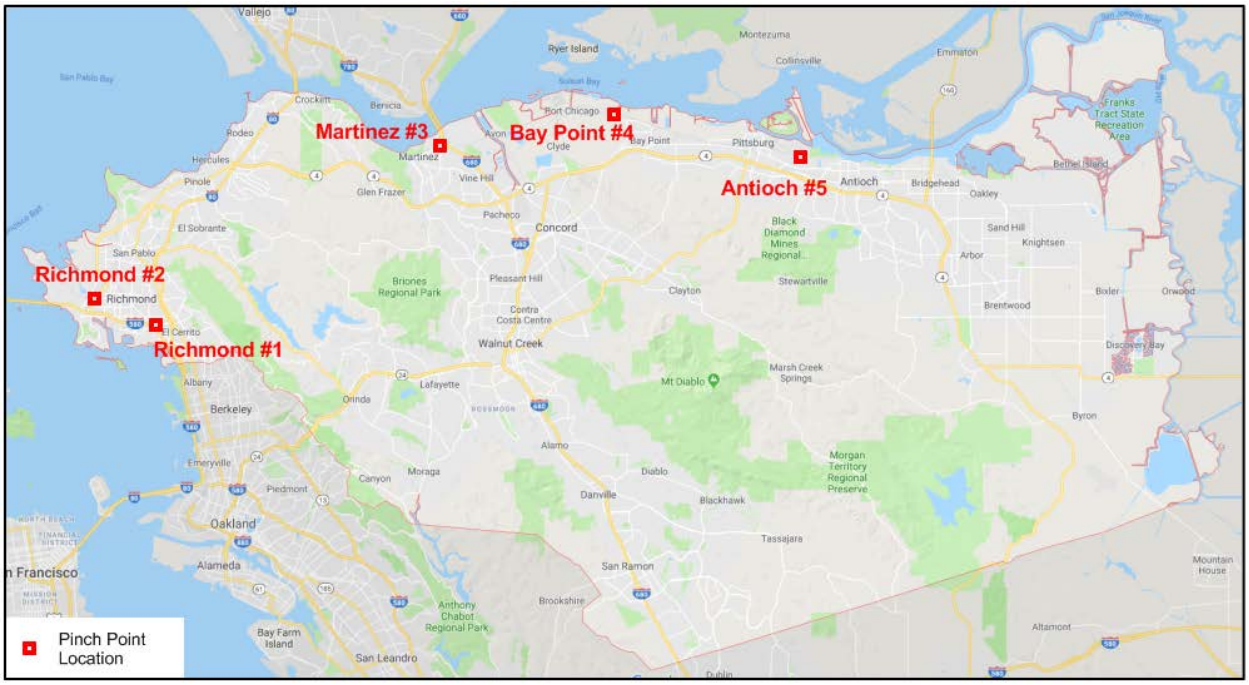
- Hazardous materials producers/users/transporters located within the coastal areas of Contra Costa County;
- Transportation routes of hazardous materials along the UP and BNSF Railroads in the coastal and near-coastal areas of Contra Costa County;
- Evaluation and determination of the five (5) pinch points based on the locations where a hazardous incident is more likely to occur and the effects on critical facilities and vulnerable populations is at higher risk;
- Land use in high-risk areas (commercial, industrial, residential);
- Demographics;
- Utilization of CalARP data for Contra Costa County;
- Incorporation of ALOHA/CAMEO/MARPLOT data and ERG data into the CRA for high-risk areas;
- Potential impacts in high-risk areas; and
- Evaluation of the vulnerability of specific areas.

4.1 Determination of Pinch Points

Five pinch points were determined during this study for extended analysis in the event that a hazardous materials incident/accident occurred at these locations. The pinch points were located as follows:

Richmond #1:	I-580 at Meade Street
Richmond #2:	Richmond Parkway South of MacDonald Avenue
Martinez #3:	Shell Avenue and Marina Vista Avenue
Bay Point #4:	Nichols Road North of Port Chicago Highway
Antioch #5:	End of Arcy Lane

The locations of the 5 pinch points are shown on the map below.



The determination of the pinch points was dependent in part on the following parameters, which were used to perform the CRA:

- Rising Tides data and areas most susceptible to rising tides and sea level rise;
- California Healthy Places Index indicating vulnerable populations;
- Liquefaction Susceptibility data;
- Location of CalARP Facilities;
- Locations of Critical Facilities;
- Chemicals of Concern;
- Weather data;
- Railroad Locations; and
- Critical Arterial Road Locations.

These parameters are described in detail in the following sections and are tabulated in the various parts of Section 5 of this report.

4.1.1 Rising Tides Data

A critical aspect of the determination of pinch points is an analysis of flooding due to rising tides and sea level rise, including king tides and storm surges. These critical aspects will be summarized in this section based on the data available from the following sources:

Contra Costa County ART Project, March 14, 2017, *Adapting to Rising Tides: Contra Costa County Assessment and Adaption Project*, 188 p.

Adapting to Rising Tides Bay Shoreline Flood Explorer, 2019, San Francisco Bay Conservation and Development Commission's Adapting to Rising Tides Program, on line at https://explorer.adaptingtorisingtides.org/home.

Adapting to Rising Tides East Contra Costa Shoreline Flood Explorer, 2019, San Francisco Bay Conservation and Development Commission's Adapting to Rising Tides Program.

Flooding due to rising tides and sea level rise can have a significant impact on the ground transportation of goods, including hazardous chemicals, as well as commuters, and the ability of first responders to respond to emergency situations. Impacted transportation routes include railroads, roadways, and pipelines.

Two major rail lines are located in the coastal areas of Contra Costa County. Union Pacific Railroad (UP) operates along the shoreline area of the County from Richmond to past I-680 through Martinez, where it is directed easterly toward Pittsburg, and then southeasterly toward Tracy. Burlington Northern and Santa Fe Railroad (BNSF) operates from Richmond along the coast to Pinole where it heads inland to Martinez where it joins the UP line. BNSF is directed easterly toward Pittsburg, and then on to Stockton. Richmond Pacific Railroad Company (RPRC) leases about 11 miles of UP track in the western part of Richmond. The UP rail line is also used by passenger/commuter trains.

The effect of rising tides on the rail lines can be summarized as follows:

- Rail lines located along the shorelines serve as a first line of defense against inland flooding, also known as ad hoc flood protection;
- Disruption of rail line transportation can have significant impacts on the movement of goods through Contra Costa County, particularly alternate transportation along roadways;
- In the event of flooding, the stability of the rail lines in some areas (ballast and track bed materials) may be at risk of becoming structurally unsound;
- Groundwater table rise due to climate change could also result in the instability of the rail lines due to the potential damage to track bed and ballast materials; and
- Certain areas of the rail lines are in areas at risk of high to very high liquefaction in the event of an earthquake.

In Contra Costa County, a total of 14 miles of rail is within the 100-year floodplain, including the coastal floodplain and the tidal creeks and channels. The information contained in the ART report includes only the area of the County from Richmond to Bay Point. Data from the East County ART was not available at the time of the completion of the Flow Study. This is shown in the following chart which is noted as Table 29 in the Contra Costa County ART Project document referenced above and is reproduced below.

Table 29. Miles of rail that could be exposed to sea level rise.

Rail Owner	Miles in the Current 100-year Floodplain	Miles exposed to Sea Level Rise					
		1'	2'	3'	4'	5'	6'
BNSF	2	2	2	2	4	5	7
Union Pacific	9	3	6	7	12	18	22
Unknown	2	2	3	4	5	8	10
Total	14	7	10	13	20	31	40

Roadways utilized in the transportation of hazardous chemicals in the coastal areas of Contra Costa County consist of Interstate highways, freeways or expressways, principal arterial roads, and major collector roads. Of the roadways evaluated in the coastal area of the County, 27.5 miles are within the 100-year floodplain, and 16.3 miles are potentially exposed to sea level rise. All 3 Interstate highways (I-580, I-80, and I-680) in the County carry high volumes of truck traffic throughout the area. The miles of roadways located within the current 100-year floodplain is shown in the following chart which is noted as Table 31 in the Contra Costa County ART Project document referenced above and is reproduced below.

Table 31. Roadways in the current 100-year floodplane and roadways that could be exposed to sea level rise.

Type of Road*	Total miles in project area	Miles in the current 100-year Flood	Miles exposed to Sea Level Rise					
			1'	2'	3'	4'	5'	6'
Interstate	22.7	3.3	1.3	1.3	1.4	1.4	1.6	2.2
Freeway or Expressway	33.7	2.2	0.1	0.1	0.1	3.1	3.5	3.5
Principal Arterial	20.3	2.1	0.0	0.1	0.1	0.1	0.2	0.2
Major Collector	124.9	19.9	0.8	1.1	1.4	1.9	6.9	10.4

*Note: there are no minor arterials in the project area

Table 32 from the same document shows the local streets and roads at risk of current or future flooding and is reproduced below.

Table 32. Local streets and roads at risk of current or future flooding.

Local Streets and Roads at Risk of Flooding*	
Richmond	San Pablo
Richmond Parkway	Rumrill Boulevard
Castro Street	23rd Street
Rydin Road at Central Avenue	San Pablo Avenue at San Pablo Creek
Pierce Street	Giant Road and Brookside Drive and numerous
San Mateo Street at Belmont Avenue	local streets around Wildcat Creek and San Pablo
Santa Clara Avenue at Yosemite Avenue	Creek
Carlson Boulevard and Jacuzzi Street between the county line and Central Avenue	
Bayview Avenue and South 51st Street between E. Montgomery Avenue and I-580	
Hercules	Pinole
Railroad Avenue at Santa Fe	Orleans Drive
Bayfront Boulevard	Railroad Avenue
Sanderling Drive	Tennent Avenue
Martinez	Unincorporated County Areas
Embarcadero Street	San Pablo Avenue, Parr Boulevard and Garden
Joe DiMaggio Drive	Tract Road (North Richmond)
North Court Street	San Pablo Avenue (Bayview-Montalvin)
Marina Vista Avenue between Pine Street and	San Pablo and Parker Avenue (Rodeo)
Alhambra Avenue	Dowrelio Drive, Loring Avenue and Rolph Avenue
Alhambra Avenue from HWY 4 to Marina Vista	(Crockett)
Avenue, including adjacent local streets	Canyon Lake Drive (Port Costa)
Pine Street at Escobar, and between Pacheco	Waterfront Road (from Martinez to Bay Point)
Boulevard and Green	Solano and Monsanto Way
Waterfront Road near I-680 to the county line	Main Street (Bay Point)
Service Road and Waterbird Way	

*this is by no means exhaustive.

As with the railroads, portions of the freeways are susceptible to damage due to sea level rise or an elevation of the groundwater table. Also, in the event of disruption of transportation of commercial goods along the rail lines, significant stress will be placed on the roadways to move cargo and people through the area.

Numerous pipelines carry hazardous chemicals through the coastal areas of Contra Costa County. According to the Contra Costa County ART Project document, approximately pipelines carry 11% of transported goods, primarily liquid petroleum products through the County. Many of the pipelines are collocated with the rail lines, and issues due to rising tides and sea level rise could equally affect the pipelines, resulting in major chemical spills from the pipelines.

Using the Adapting to Rising Tides Bay Shoreline Flood Explorer, the project compiled data for three different scenarios:

- 12-Inch Sea Level Rise, Equivalent to King Tide with no Sea Level Rise;
- 24-inch Sea Level Rise, Equivalent to 5-Year Storm Surge with no Sea Level Rise; and
- 36-Inch Sea Level Rise, Equivalent to 50-Year Storm Surge with no Sea Level Rise.

The above flooding scenarios were chosen due to various factors including likelihood of that flood event occurring. 12-Inch Sea Level Rise, for example, is equivalent to a King Tide, which is the highest predicted high tide of the year. A 5-Year Storm Surge has a one-in-five chance (20% chance) of occurring on any given year, and a 50-Year Storm Surge has a 2% chance.

Also, sea level rise probability predictions were considered. According to the State of California Sea Level Rise Guidance 2018 Update, sea level rise in the San Francisco area is predicted to be between six (6) to 10 inches by 2030 and 13 to 23 inches by 2050.

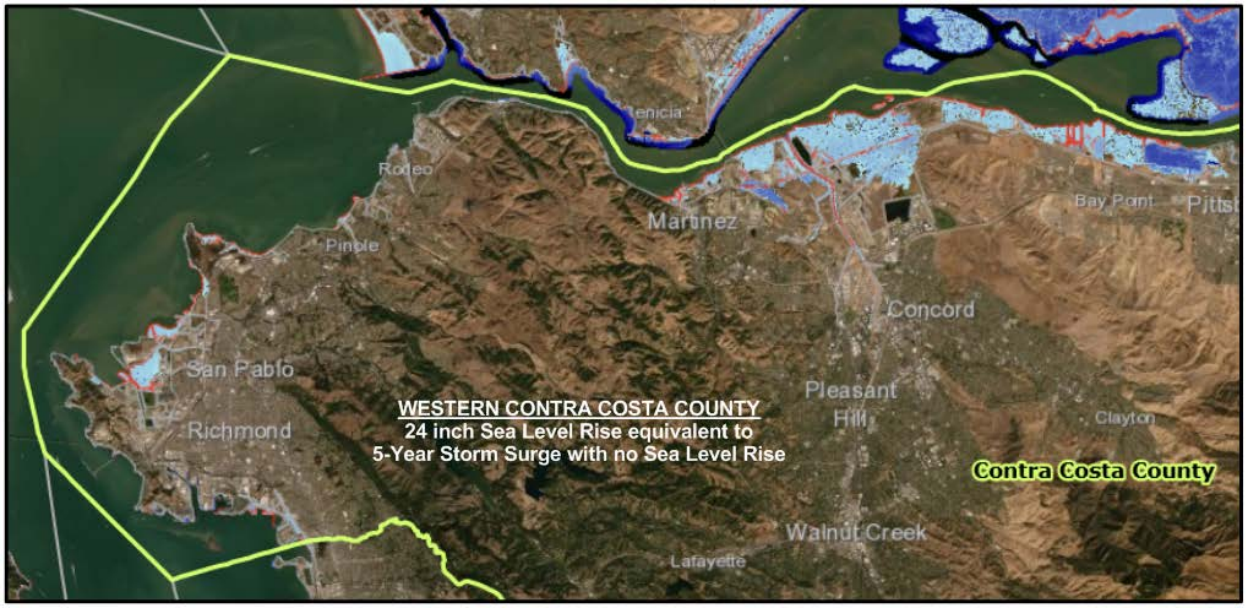
		Probabilistic Projections (in feet) (based on Kopp et al. 2014)					H++ scenario (Sweet et al. 2017) *Single scenario
		MEDIAN	LIKELY RANGE		1-IN-20 CHANCE	1-IN-200 CHANCE	
		50% probability sea-level rise meets or exceeds...	66% probability sea-level rise is between...		5% probability sea-level rise meets or exceeds...	0.5% probability sea-level rise meets or exceeds...	
				Low Risk Aversion		Medium - High Risk Aversion	Extreme Risk Aversion
High emissions	2030	0.4	0.3 -	0.5	0.6	0.8	1.0
	2040	0.6	0.5 -	0.8	1.0	1.3	1.8
	2050	0.9	0.6 -	1.1	1.4	1.9	2.7
Low emissions	2060	1.0	0.6 -	1.3	1.6	2.4	
High emissions	2060	1.1	0.8 -	1.5	1.8	2.6	3.9
Low emissions	2070	1.1	0.8 -	1.5	1.9	3.1	
High emissions	2070	1.4	1.0 -	1.9	2.4	3.5	5.2
Low emissions	2080	1.3	0.9 -	1.8	2.3	3.9	
High emissions	2080	1.7	1.2 -	2.4	3.0	4.5	6.6
Low emissions	2090	1.4	1.0 -	2.1	2.8	4.7	
High emissions	2090	2.1	1.4 -	2.9	3.6	5.6	8.3
Low emissions	2100	1.6	1.0 -	2.4	3.2	5.7	
High emissions	2100	2.5	1.6 -	3.4	4.4	6.9	10.2

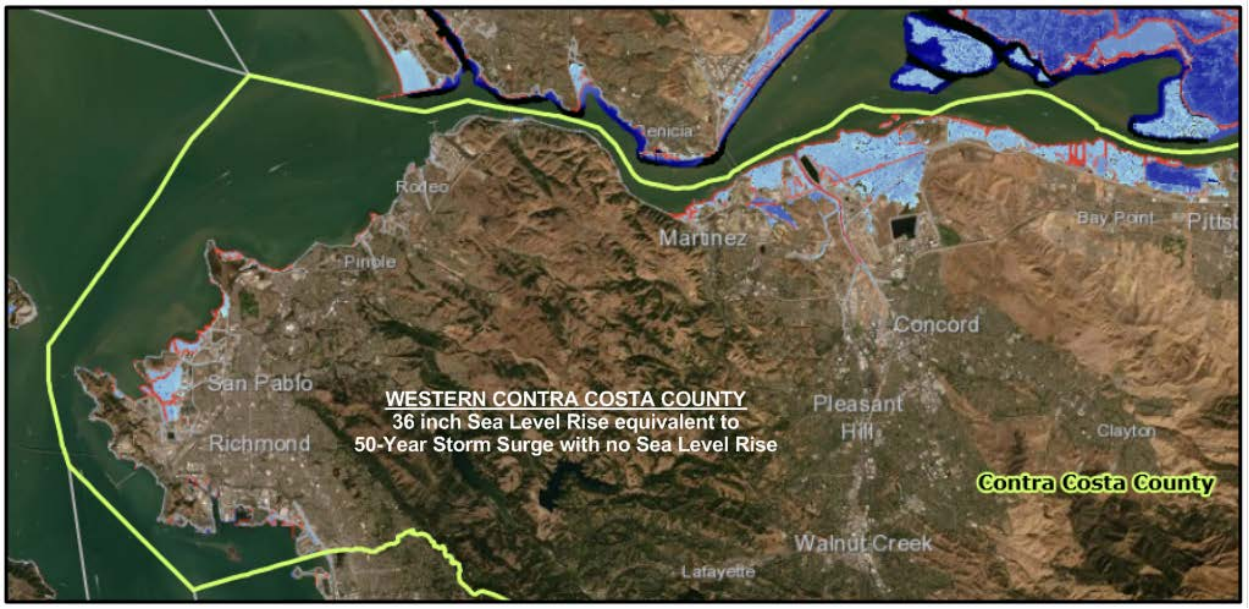
For more information regarding probabilistic prediction, please see:
http://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

For purposes of the CRA, only the 12-inch Sea Level Rise, equivalent to a King Tide with no Sea Level Rise will be used in the Chemical Plume analysis section of this report (Section 5).

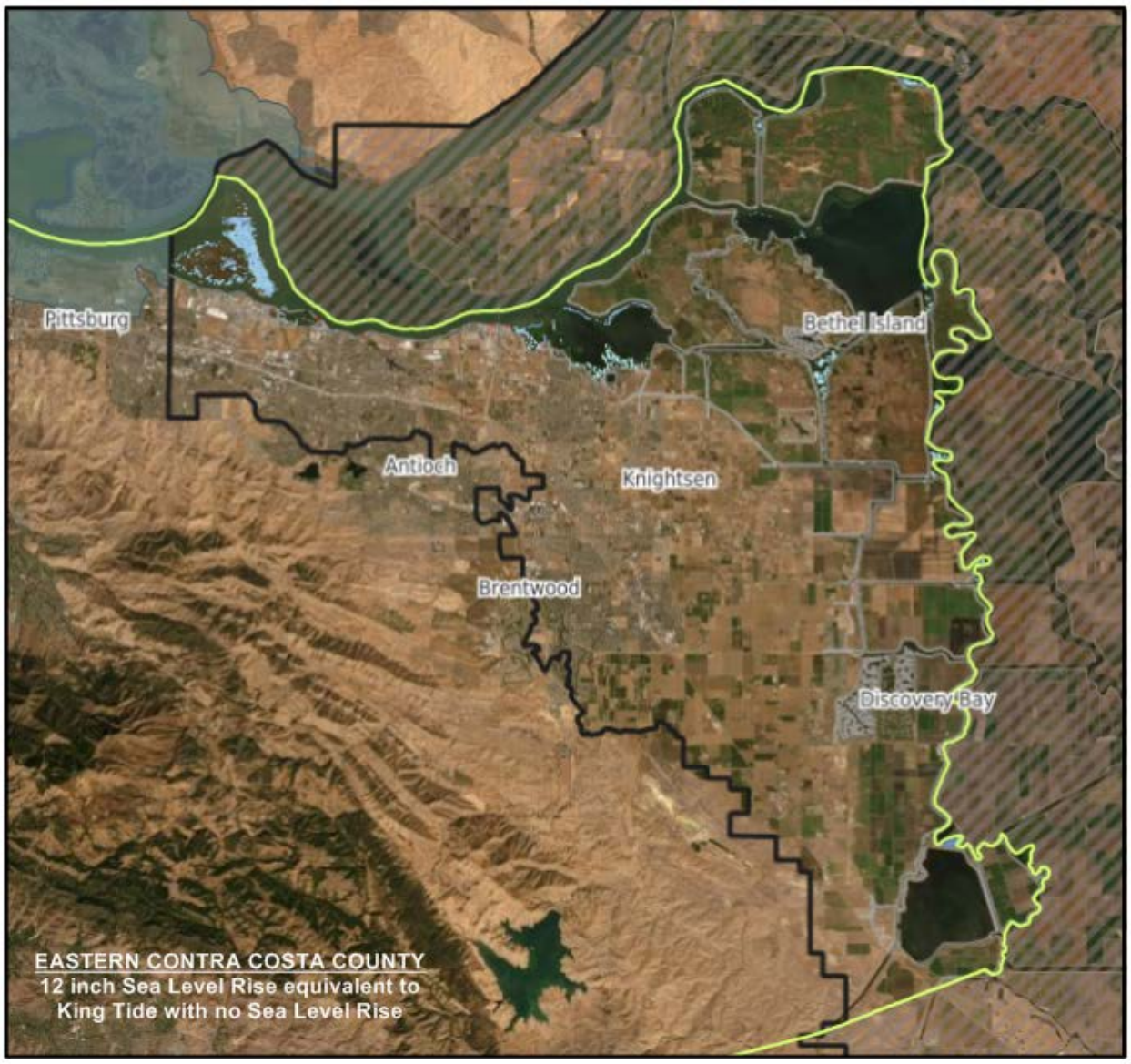
These three scenarios for Richmond and Martinez areas of Contra Costa County are shown in the following three maps. Detailed maps covering the 12-inch Sea Level Rise,

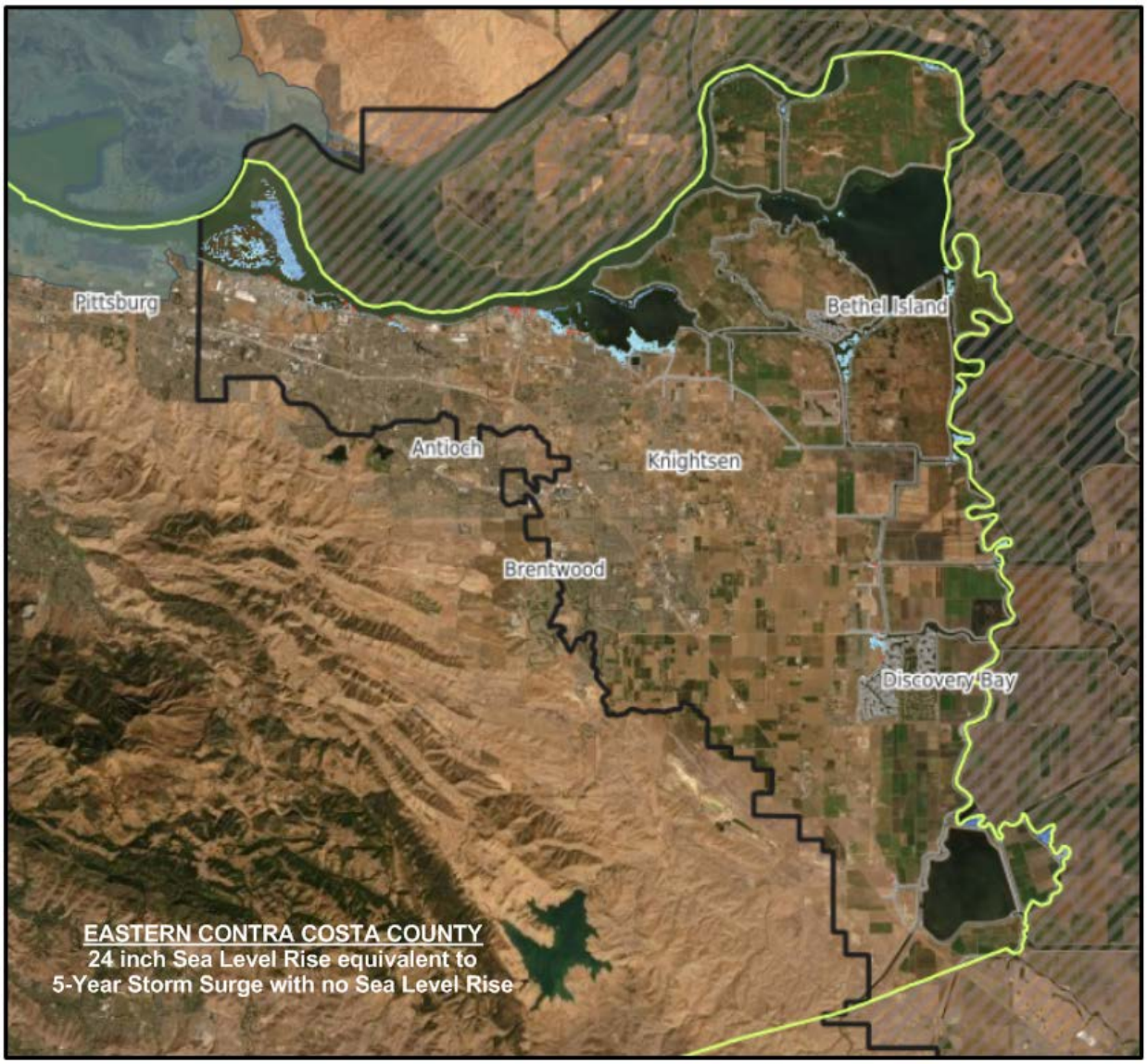
equivalent to a King Tide with no Sea level Rise will be provided with the various pinch point locations discussed in Section 5.

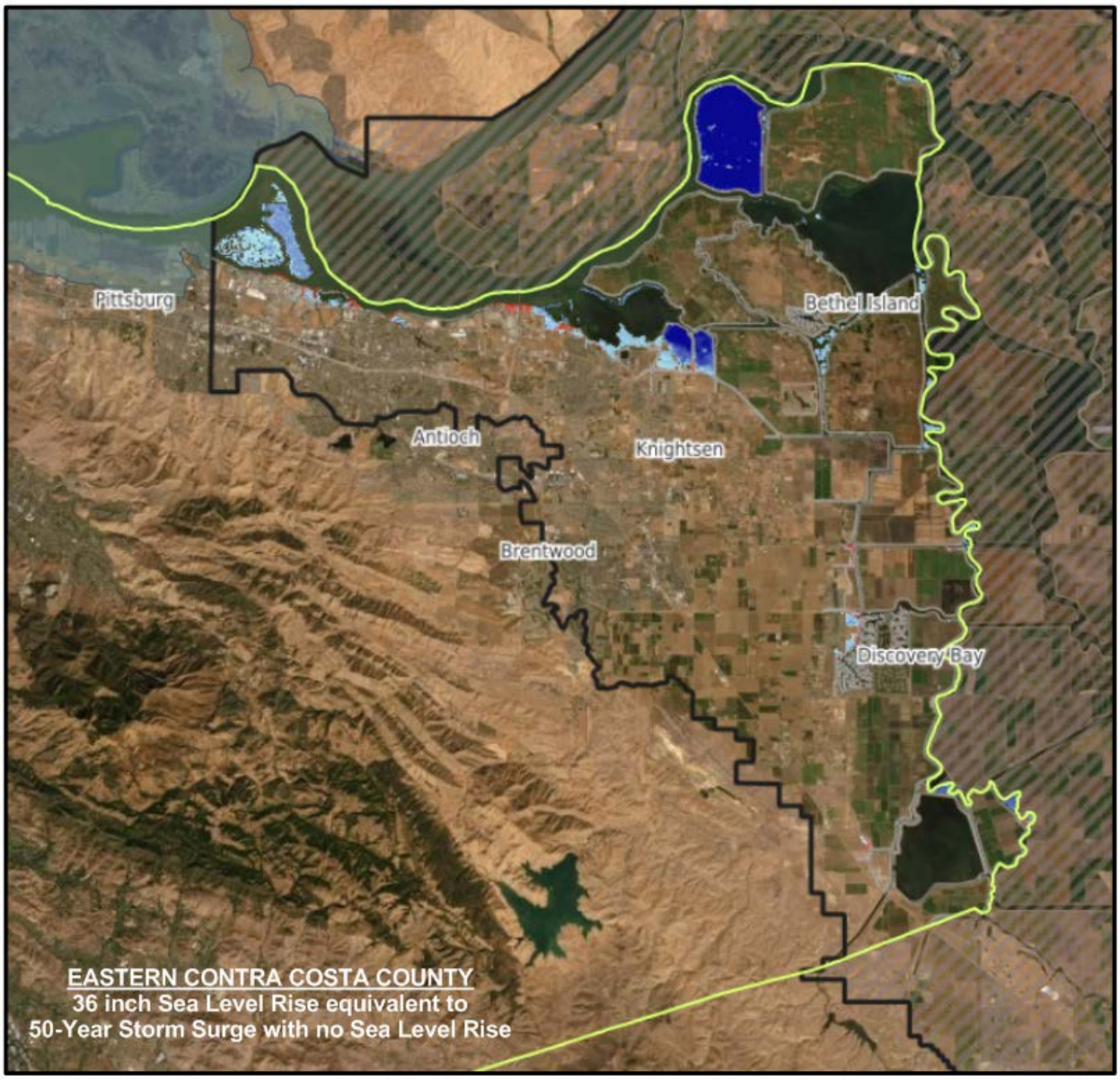



Rodeo
Martinez
Pinole
Bay Point
Concord
San Pablo
Richmond
Pleasant Hill
Clayton
Walnut Creek
Lafayette
WESTERN CONTRA COSTA COUNTY
36 inch Sea Level Rise equivalent to
50-Year Storm Surge with no Sea Level Rise
Contra Costa County

These three scenarios for the eastern portion of Contra Costa County were obtained from the Adapting to Rising Tides Eastern Contra Costa Shoreline Flood Explorer, and they are compiled in the following three maps. Detailed maps covering the 12-inch Sea Level Rise, equivalent to a King Tide with no Sea level Rise will be provided with the various pinch point locations discussed in Section 5.




Pittsburg
Bethel Island
Antioch
Knightsen
Brentwood
Discovery Bay
EASTERN CONTRA COSTA COUNTY
24 inch Sea Level Rise equivalent to
5-Year Storm Surge with no Sea Level Rise


Pittsburg
Bethel Island
Antioch
Knightsen
Brentwood
Discovery Bay
EASTERN CONTRA COSTA COUNTY
36 inch Sea Level Rise equivalent to
50-Year Storm Surge with no Sea Level Rise

4.1.2 California Healthy Places Index

The California Healthy Places Index (HPI) was used as an aid to determine more vulnerable populations for the CRA, including areas of lower income residential development. The HPI is available on line at https://map.healthyplacesindex.org/. The HPI indicators were developed using the following data:

- Economic;
- Education;
- Transportation;
- Social;
- Clean Environment;
- Housing; and
- Healthcare Access.

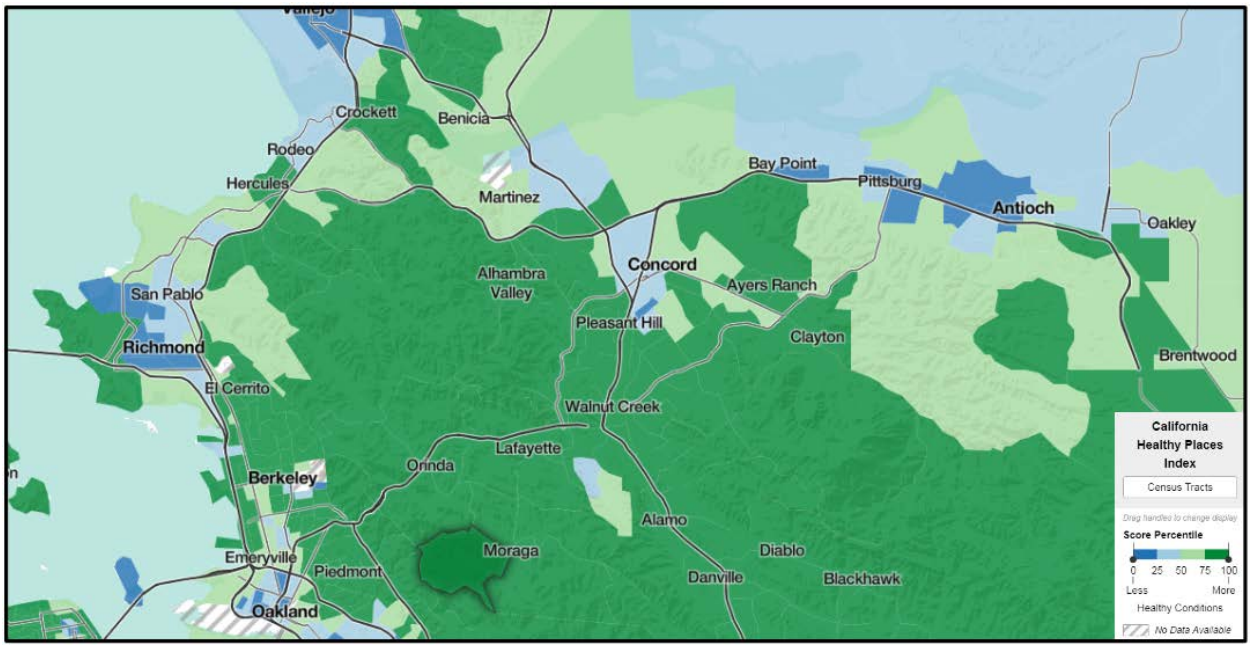
The HPI indicators are supported by a number of Decision Support Layers as follows:

- Health Outcomes;
- Health Risk Behaviors;
- Climate Change-Exposures;
- Climate Change-Social Vulnerability;
- Climate Change-Adaptive Capacity;
- Other Indices of Disadvantage;
- Other Decision Support Layers; and
- Race/Ethnicity.

Based on the above data, each area is given a percentile score which fall within the following parameters from “less” to “more” healthy conditions as follows:

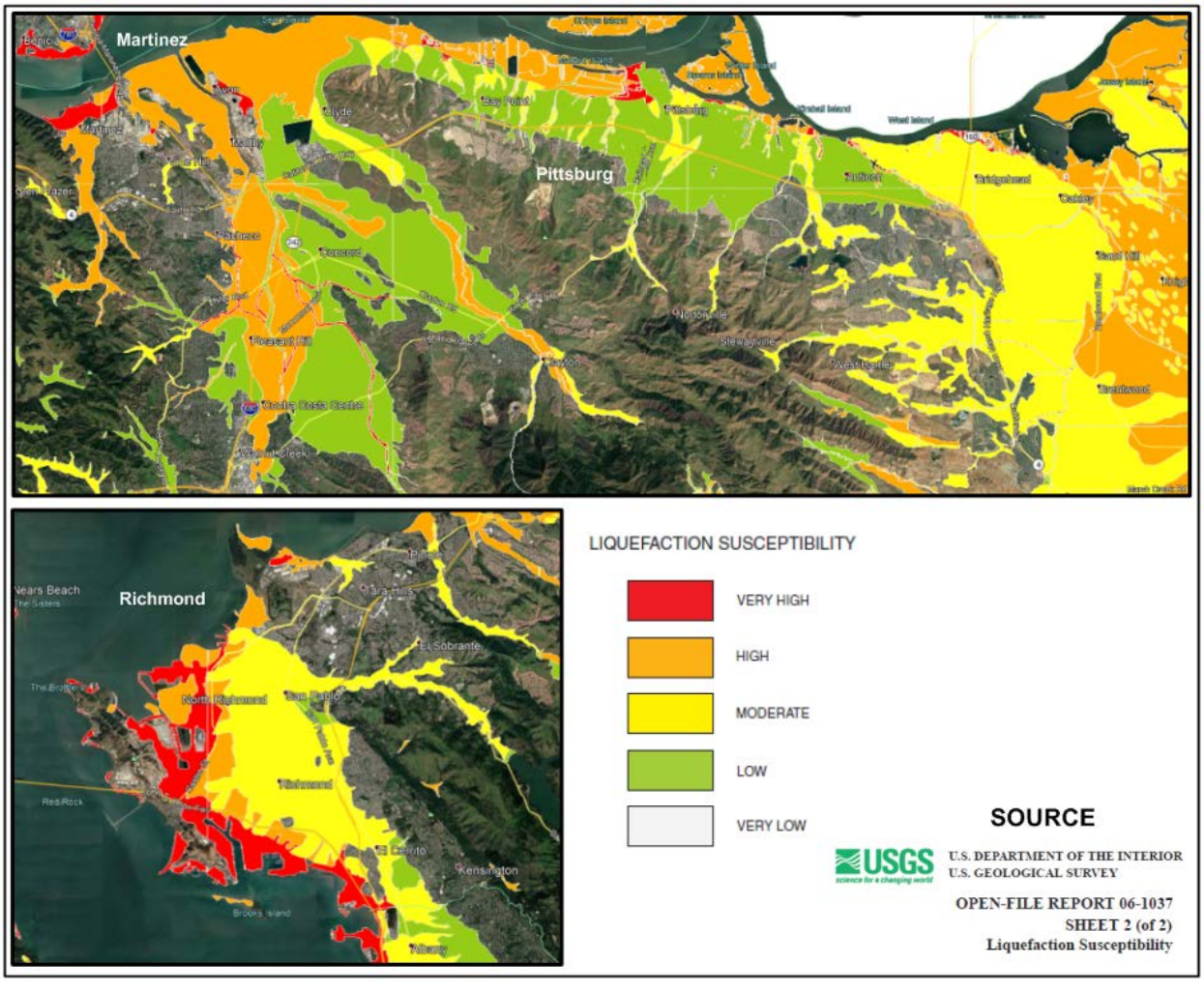
- 0-25 (least);
- 25-50;
- 50-75; or
- 75-100 (most).

A generalized map of Contra Costa County is shown below. Detailed maps will be provided with the various pinch point locations.


Crockett
Benicia
Rodeo
Hercules
Martinez
Bay Point
Pittsburg
Antioch
Oakley
Concord
Alhambra Valley
Ayers Ranch
San Pablo
Pleasant Hill
Clayton
Richmond
Brentwood
El Cerrito
Walnut Creek
Lafayette
Orinda
Berkeley
Alamo
Moraga
Diablo
Emeryville
Piedmont
Danville
Blackhawk
Oakland
California Healthy Places Index
Census Tracts
Drag handles to change display
Score Percentile
0 25 50 75 100
Less More
Healthy Conditions
No Data Available

4.1.3 Liquefaction Susceptibility

Large areas of high to very high susceptibility to liquefaction during a seismic event are located in the coastal areas of Contra Costa County. Liquefaction occurs where saturated sand and silt assume the characteristics of a liquid during an intense shaking during an earthquake. These areas are considered to be vulnerable to disruption of rail and road traffic, as a result of an incident during an earthquake. Information on liquefaction susceptibility in Contra Costa County was obtained from the US. Geological Survey on line data at https://earthquake.usgs.gov/learn/topics/geologicmaps/liquefaction.php. A generalized map of high to very high liquefaction susceptibility in the County is shown below. Detailed maps will be provided with the various pinch point locations.



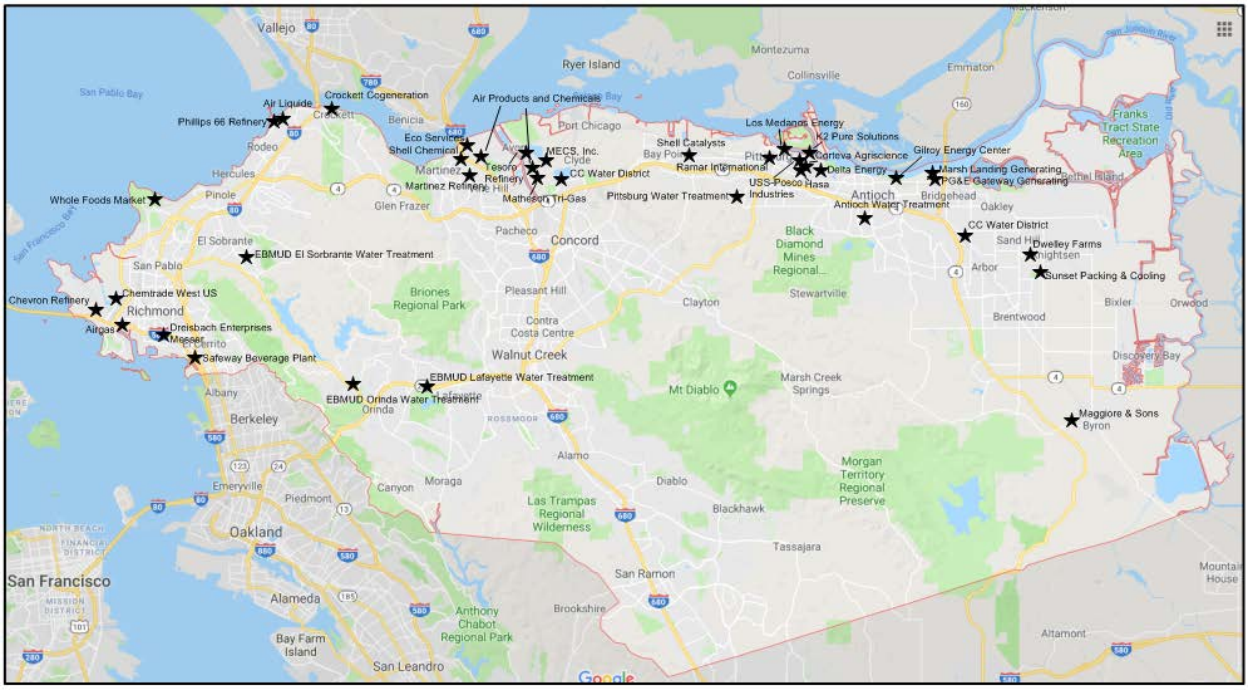
4.1.4 CalARP Facilities

Contra Costa Health Services provides an on-line listing of sites that are part of the California Accidental Release Prevention (CalARP) Program at https://cchealth.org/hazmat/rmp/. Locations of CalARP facilities aided in the determination of the pinch points, as hazardous chemical from some of the CalARP sites were transported through the area along the railroads and roadways. Some of the CalARP facilities are considered to be critical operating facilities, as they include water treatment and energy generation /transfer facilities, as well as large economic centers.

In the event of rail incident resulting from derailment or other cause due to rising tides and subsequent flooding, major rail transport of manufactured goods, including hazardous materials via rail may be seriously disrupted for unspecified periods of time. Alternate shipping routes, including other rail lines, arterial roadways, and ports will be subjected to increased volumes of traffic, potentially resulting in increased transportation-related incidents along all transportation lines.

Currently, a Hazardous Materials Commodity Flow Study is being undertaken for 11 California deep water ports, including the Port of Richmond by Dr. George Lane of the Center for Catastrophic Risk Management of the University of California at Berkeley. This study is being funded by CalOES, and the results are separate from this project.

A map locating the CalARP facilities in the coastal areas of Contra Costa County is shown below.



4.1.5 Critical Facilities and Vulnerable Populations

The locations of critical facilities were used as an aid in determining the locations of the pinch points. Critical facilities located in the coastal areas of Contra Costa County can be summarized as follows:

- City, County, Federal Buildings
  - City Hall
  - Civic Centers
  - City Administrative Buildings
  - Local Police Departments
  - Public Libraries
  - Public Works
  - County Administrative Buildings
  - Sheriff Departments
  - Animal Shelters

- Fire Stations

- Hospitals and Emergency Medical Care
  - Hospitals
  - Clinics
  - Urgent Care
  - Surgical Services

- Nursing and Convalescent Homes
  - Nursing Homes
  - Residential Care
  - Assisted Living Centers

- Community Centers/Shelters
  - Community Centers
  - Rescue Missions
  - Homeless Shelters

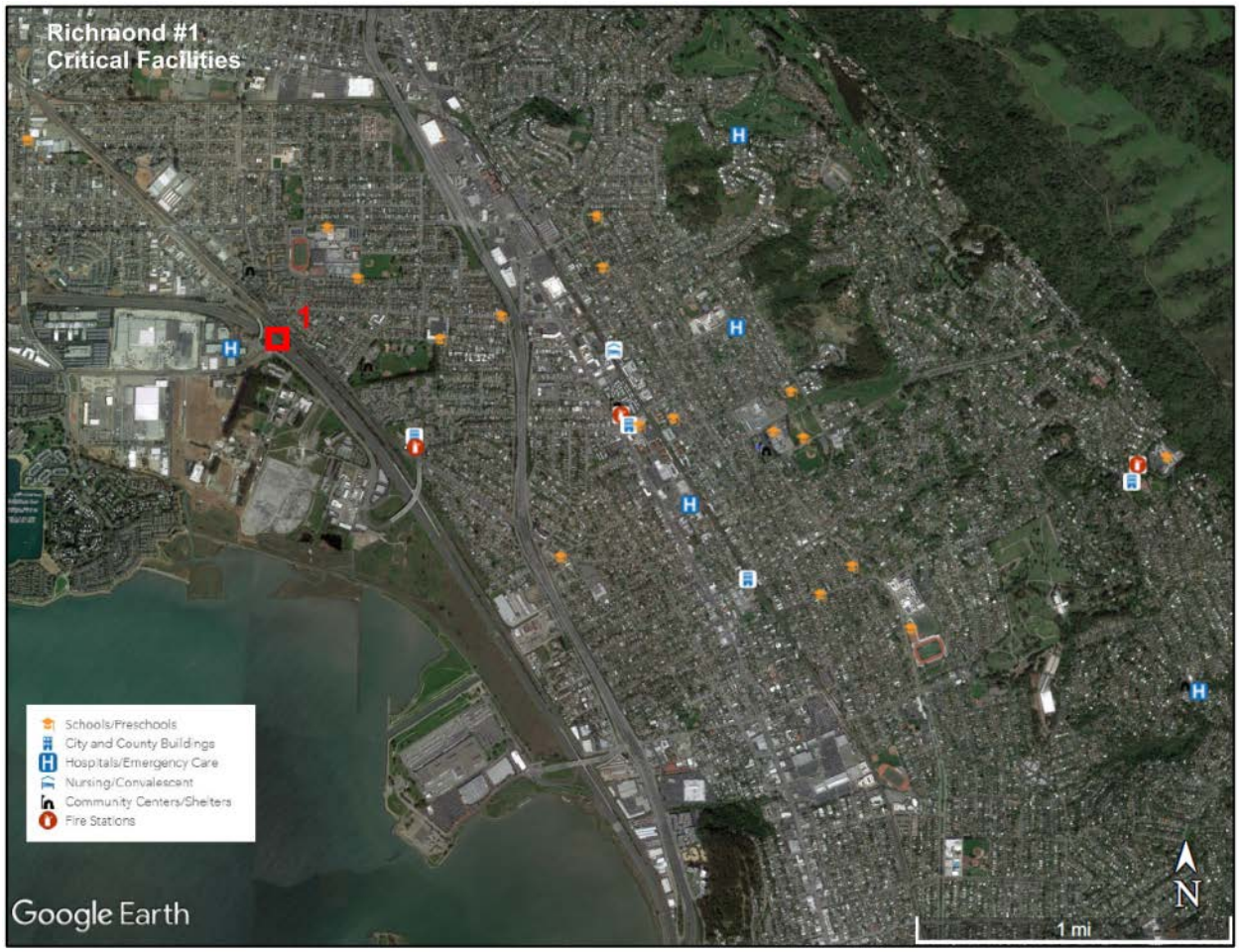
- Schools
  - Colleges
  - High Schools
  - Middle Schools
  - Elementary Schools
  - Specialty Schools
  - Preschools

Many of these facilities are relevant to other hazards than the release of hazardous materials. As a result, and for the purposes of this CRA, critical facilities will refer to facilities that may contain vulnerable or essential emergency populations that will require mitigation/evacuation in the event of a hazardous materials release.

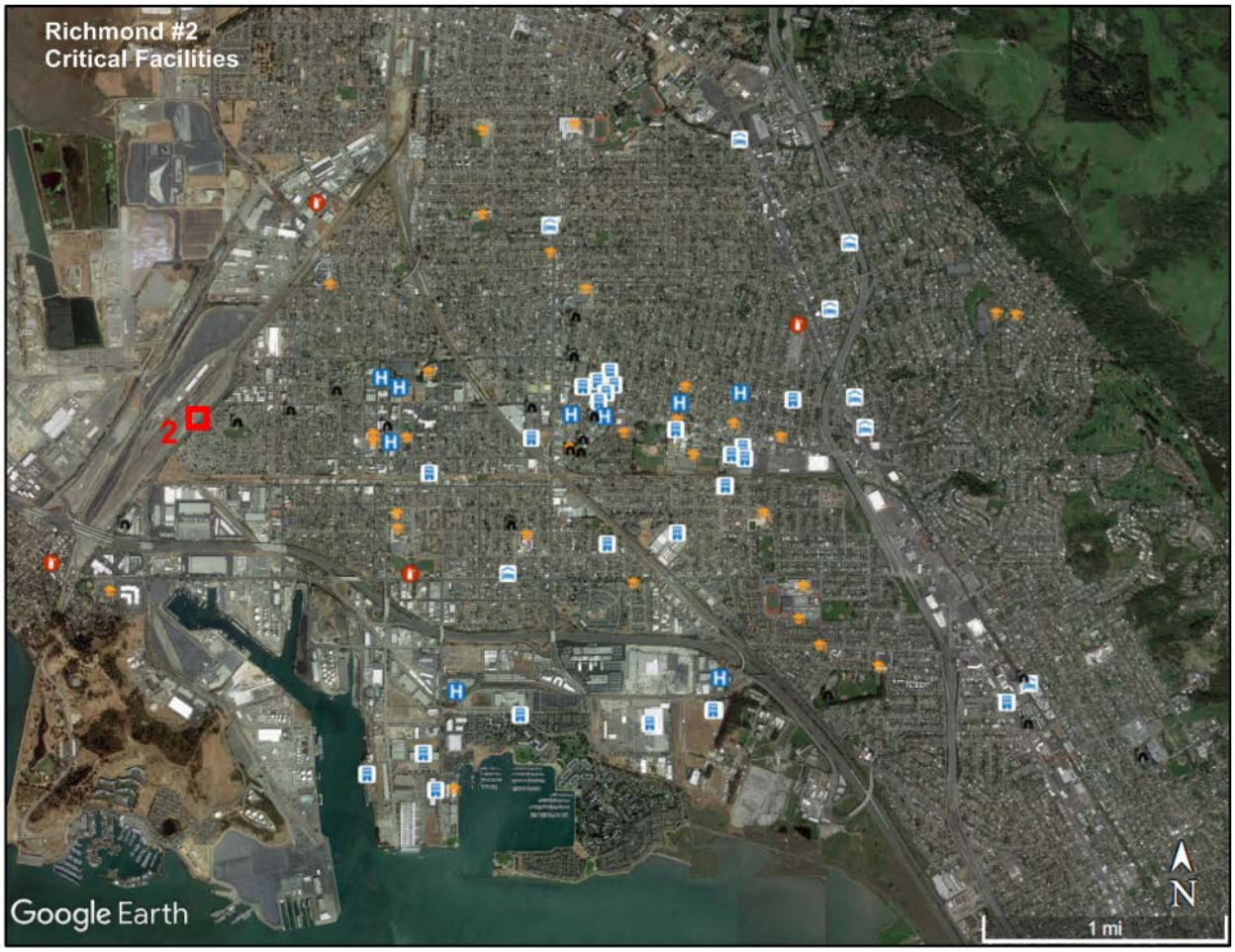
A list of these critical facilities, which are located within one to two miles of the pinch points is contained in Appendix B. Maps showing the critical facilities listed above are contained in the following pages.

The locations of critical facilities in relation to the identified pinch points was of primary concern. Other factors including location of railroads and arterial roadways, liquefaction potential, rising tides issues, and California Healthy Places also played a cumulative role in the determination of each of the pinch points.

Pinch Point Richmond #1 is located along a major north-south rail corridor in the city of Richmond. Most of the cirtical facilities for Pinch Point Richmond #1 are located east of the pinch point, which is equivalent to the prevailing downwind direction. Much of this area is in commercial and residential land use. Most of the area west and southwest of the pinch point is industrial.



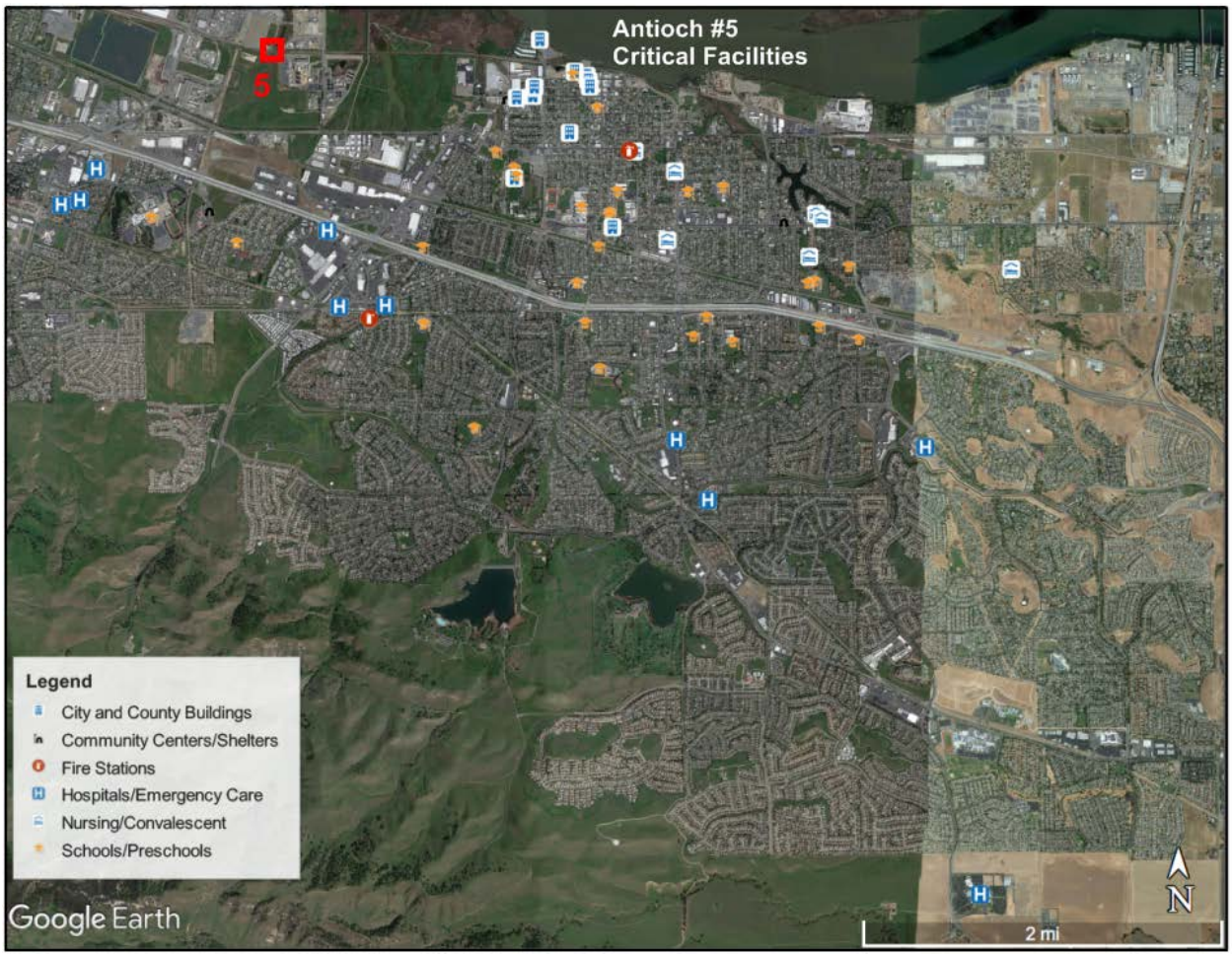
Pinch Point Richmond #2 is located along a major north-south rail corridor and rail siding in the city of Richmond. Most of the cirtical facilities for Pinch Point Richmond #2 are located east of the pinch point, which is equivalent to the prevailing downwind direction. Much of this area is in commercial and residential land use. Downtown Richmond is located directly east of the pinch point. Most of the area west of the pinch point is industrial.



Pinch Point Martinez #3 is located along the major UP rail line entering the Martinez area from the coast to the west. Most of the cirtical facilities for Pinch Point Martinez #3 are located southwest and south of the pinch point. Much of the area southwest of the pinch point is in commercial and residential land use and downtown Matinez is located in this direction. Most of the area to the south of the pinch point is residential. Industrial areas, including oil refineries, are located east of the pinch point, which is equivalent to the downwind direction. Industrial areas are also located north and west of the pinch point.

Pinch Point Bay Point #4 is located at the intersection of the major UP and BNSF rail lines heading east from Martinez. Most of the cirtical facilities for Pinch Point Bay Point #4 are located east-southeast of the pinch point. The major portion of the cities of Bay Point and Pittsburg, including the commercial, residentia,l and downtown areas of these cities. These cities are partially downwind of the prevaiing wind direction. The area directly west of the pinch point are primarily industrial and natural coastal areas.

Pinch Point Antioch #5 is along the BNSF rail heading east from Martinez. Most of the cirtical facilities for Pinch Point Antioch #5 are located east and east-southeast (downwind) of the pinch point and includes a major portion of the city of Antioch, including the commercial, residential, and downtown areas of the city. The area surrounding the pinch point are primarily industrial and natural coastal areas.



4.1.6 Chemicals of Concern

Based on the Flow Study from the railroads, it was determined that the following 3 chemicals of concern would be used in the CRA portion of this study to cover worst-case scenario situations at the pinch points in the event of a hazardous materials incident/accident :

- Ammonia/anhydrous ammonia: highly toxic;
- Propane: highly explosive and commonly transported along the railroads in Contra Costa County; and
- Sulfuric acid: commonly transported along the railroads in Contra Costa County.

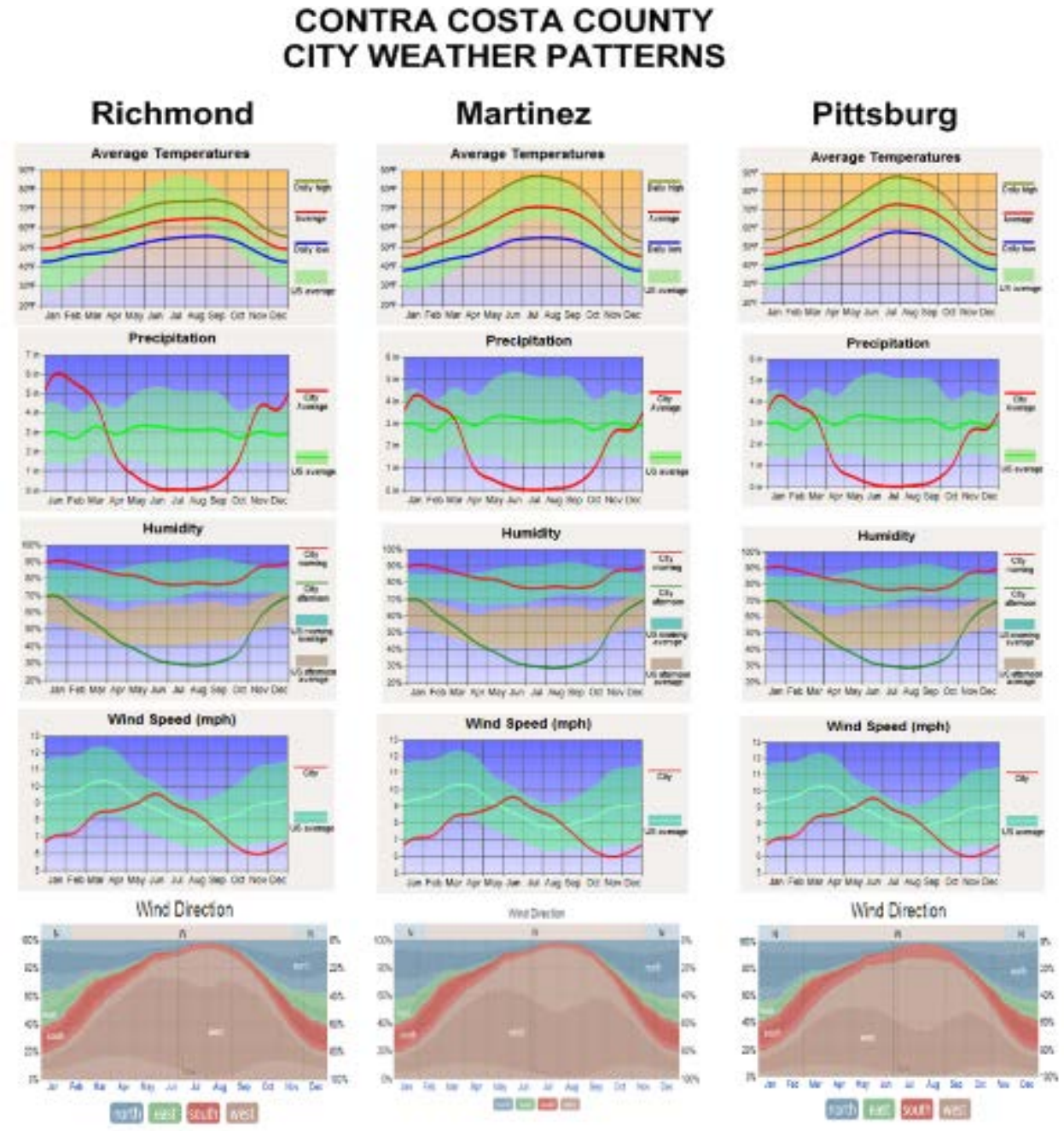
These chemicals are discussed in detail in subsequent sections of this report.

4.1.7 Background Weather Data

Background weather data for use in the plume diagrams were obtained from the following websites:

- Weather data for the city of Martinez was obtained from http://www.city-data.com/
- Detailed wind data were obtained from https://weatherspark.com

Weather for the coastal regions of Contra Costa County was available for several cities within the County. For the most part, weather patterns for the coastal cities are very similar, as shown by the weather data below. This information was used as the basis of the weather patterns for this study. Wind direction is a critical component of toxic plume analysis, as it determines the direction which the plume will travel over the land surface.



The wind data for each of the 3 above cities is very similar and can be considered as representative of the coastal area of Contra Costa County as a whole. Based on the wind data, the major wind directions for the County are from the west during the period from February through November, and from the north from November through February.

Based on the weather data above, it was determined that in that the major wind direction from the west occurred throughout most of the year. As a result, the plume analysis utilized in this report will cover an incident occurring in July.

4.1.8 Railroads

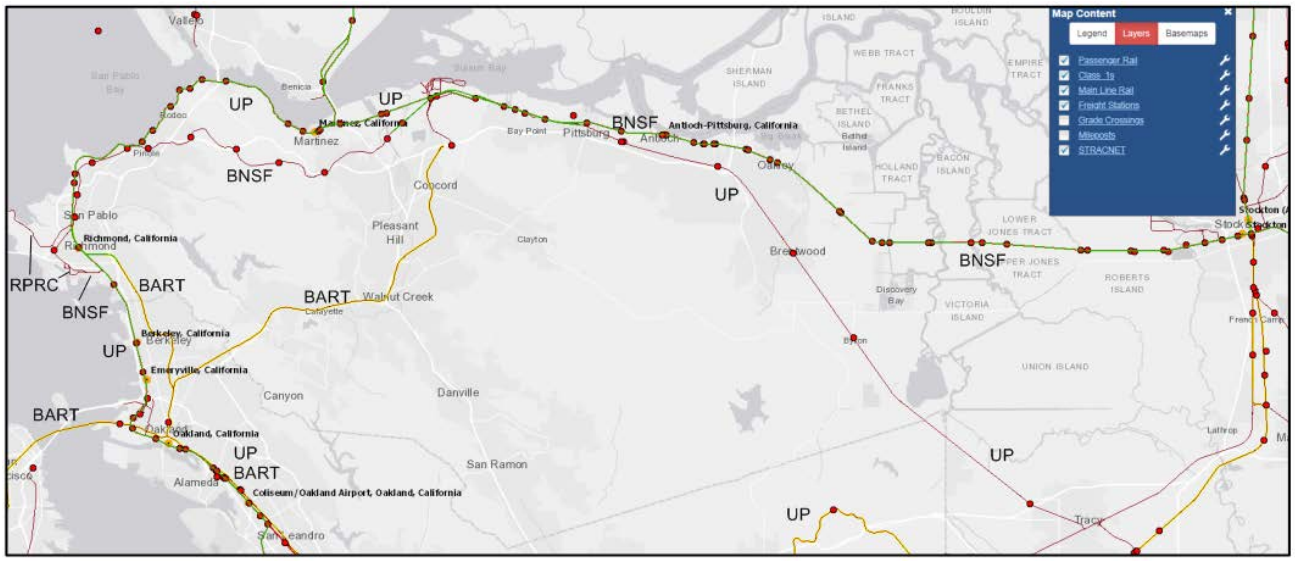
Railroads in Contra Costa County primarily of the following railroad lines:

- Union Pacific Railroad (UP);
- Burlington Northern and Santa Fe Railroad (BNSF);
- Richmond Pacific Railroad Company (RPRC); and
- Bay Area Rapid Transit (BART).

Detailed information on the railroads in Contra Costa County can be obtained from the following source:

> U.S. Department of Transportation, Federal Railroad Administration, on line at https://fragis.fra.dot.gov/gisfrasafety/

A generalized map showing the rail lines and freight stations for Contra Costa County was compiled from the above source and is shown below.



Two major rail lines are located in the coastal areas of Contra Costa County. UP operates along the shoreline area of the County from Richmond to past I-680 through Martinez, where it is directed easterly toward Pittsburg, and then southeasterly toward Tracy. BNSF operates from Richmond along the coast to Pinole where it heads inland to Martinez where it joins the UP line. BNSF is directed easterly toward Pittsburg, and then on to Stockton. RPRC leases about 11 miles of UP track in the western part of Richmond. The UP rail line is also used by passenger/commuter trains.

Many of the rail lines are co-located with underground pipelines, particularly along the coastal areas. Portions of the rail lines are located in areas of 12-inch (and greater) sea level rise, as well as in some areas of high to very high liquefaction which could be caused by earthquake events. Rail lines in these areas could become compromised, resulting in

potential hazardous materials incidents due to derailment or other causes. In addition, disruption of commercial rail traffic could result in significant increases in commodity flow along major arterial roadways and highways throughout the coastal areas of Contra Costa County. It is also important to note that the rail lines that act as ad hoc flood protection could result in more significant flooding in surrounding areas due to overtopping effects.

Each of the pinch points discussed in the CRA are located along or adjacent to railroad lines. These locations are considered to be higher risk, due to one or more factors discussed above in Sections 4.1.1 through 4.1.7.

4.1.9 Roadways

As discussed above in Section 4.1.8, disruption of commercial rail traffic could result in increased commodity flow via trucks along various arterial roads and highways in the vicinity of the pinch points. This also results in a higher risk of a hazardous materials incident occurring along the roadways. In addition, inundation of the areas of the pinch points by water, due to rising tides or disruption of rail traffic due to seismic events could also affect the ability to move commercial goods via roadways.

In consideration of transporting hazardous materials via rail, primarily within rail tanker cars, it should be noted that one tanker car can generally contain 2 to 3 times the amount of commodity than one tanker truck. This will put significant pressure on trucking commodities through neighborhoods of vulnerable populations and critical facilities. It is also possible that highway transport may not be a viable option in areas of flooding, as the roadways themselves may also be closed.

Any increase in trucking of hazardous materials though vulnerable neighborhoods will increase the potential for hazardous materials incidents to occur. Due to the stress placed on the roadways, and the potential for less-than-ideal road conditions during flooding activities, the increase in highway related hazardous materials transportation incidents may be additionally increased.

Based on the comparison of the amount of trucks that would be required to transport specific hazardous materials, such as sulfuric acid, which would normally be transported by rail would be dependent on the amount of rail cars that would be disrupted on a time-dependent basis. Unless, materials can be transported on still-operating rail lines or through the ports, then the additional stress in highway transport will be significant. In the event of a large rail incident scenario, a major disruption of commerce through the County could result in a cessation of manufacturing operations for an unspecified amount of time.

The major arterial roads and highways, which could be subject to increased truck traffic, including increased hazardous materials transport for each of the pinch points are as follows:

ARTERIAL ROADS AND HIGHWAYS	
PINCH POINT LOCATION	**ARTERIAL ROADS AND HIGHWAYS**
Richmond #1	I-580
	Carlson Blvd.
	Potrero Ave.
	Regatta Blvd.
Richmond #2	I-580
	Richmond Parkway
	Barrett Ave.
	McDonald Ave.
	W. Ohio Ave.
Martinez #3	I-680
	Marina Vista Ave
	Shell Ave
	Pacheco Blvd
	CA-4
Bay Point #4	CA-4
	Kinney Blvd.
	Port Chicago Highway
Antioch #5	CA-4
	W. 10th Street

4.2 Release Plume Analysis

Plume diagrams for release of hazardous materials from the pinch points are contained in this section. The plume diagrams are determined using the CAMEO suite of programs created by the U.S. Environmental Protection Agency (EPA). The CAMEO suite consists of CAMEO chemicals, ALOHA plume modeling through various release scenarios, and MARPLOT, which assists in plotting the information onto various map bases, such as Google Earth.

The plume diagrams are utilized in determining the extent of threat zones based on the release of a particular chemical. Three threat zones are mapped for each chemical release:

- Red zone: Highest threat level
- Orange Zone: Moderate threat level
- Yellow Zone: Low threat level

The following information was also utilized in the preparation of the plume maps:

- Assumed weather conditions at the time of release;
- Identity and amount of chemical released;
- The amount of the chemical entering the vapor phase (air);
- Location of the release; and
- Time and date of release.

4.2.1 Background Plume Analysis Parameters

The following information was obtained from the National Oceanic and Atmospheric Administration (NOAA), Office of Response and Restoration guidelines concerning Levels of Concern (LOCs), which are available on line at:

https://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/resources/levels-concern.html

A Toxic LOC will determine what level (threshold concentration) of inhalation exposure to a chemical would be injurious if inhaled over a defined length of time (exposure duration). In general, the lower the Toxic LOC value, the more toxic the substance is by inhalation.

ALOHA (Areal Locations of Hazardous Atmospheres) is used for emergency response or planning situations to assess the threat posed to the general public by a chemical release. ALOHA utilizes public exposure guidelines to predict how members of the general public would be affected if they are exposed to a particular hazardous chemical in an emergency response scenario.

ALOHA preferentially uses Acute Exposure Guideline Levels (AEGLs), as they are considered to be the best public exposure Toxic LOCs. As of mid-2016, AEGLs had been finalized for about 175 chemicals. ALOHA uses only the AEGL values for a 60-minute exposure duration.

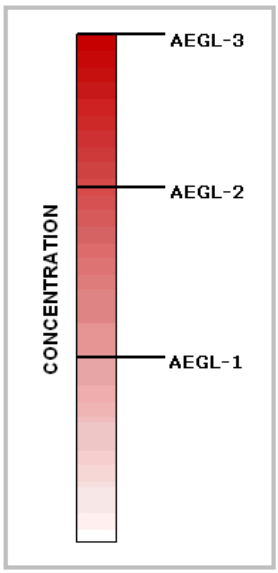
AEGLs are subdivided into 3 tiers which correspond to specific health effects. The AEGL tiers and their corresponding threat levels are as follows:

- AEGL-3: Red Threat Zone Level
- AEGL-2: Orange Threat Zone Level
- AEGL-1: Yellow Threat Zone Level

A more detailed discussion of the AEGLs is copied from the NOAA data at https://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/resources/acute-exposure-guideline-levels-aegls.html as follows.

What are AEGLs? • top

AEGLs estimate the concentrations at which most people—including sensitive individuals such as old, sick, or very young people—will begin to experience health effects if they are exposed to a hazardous chemical for a specific length of time (duration). For a given exposure duration, a chemical may have up to three AEGL values, each of which corresponds to a specific tier of health effects.



The three AEGL tiers are defined as follows:

- **AEGL-3** is the airborne concentration, expressed as parts per million (ppm) or milligrams per cubic meter (mg/m^3), of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.
- **AEGL-2** is the airborne concentration (expressed as ppm or mg/m^3) 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-1** is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

All three tiers (AEGL-1, AEGL-2, and AEGL-3) are developed for five exposure periods: 10 minutes, 30 minutes, 60 minutes, 4 hours, and 8 hours. The table below shows how the chlorine AEGL values vary with exposure duration.

Final AEGLs for chlorine (in parts per million)

	10 minutes	30 minutes	60 minutes	4 hours	8 hours
AEGL-1	0.50	0.50	0.50	0.50	0.50
AEGL-2	2.8	2.8	2.0	1.0	0.71
AEGL-3	50	28	20	10	7.1

Typically, the AEGL values will be different for each exposure duration (such as the AEGL-3 values in the table above). This is because the physical effects are typically related to dose (that is, concentration over exposure duration). However, in some cases, the AEGL values will be the same for all durations. This situation usually occurs at the AEGL-1 level (as in the table above), because it is a threshold for non-disabling effects; some effects (for example, whether people will be able to smell the chemical) depend only on concentration—not on the length of time people are exposed.

4.2.2 Chemicals of Concern for Plume Analysis

Based on the information contained in the Flow Study, the 3 most common chemicals defined as an inhalation hazard that were observed travelling through Contra Costa County via rail and highway that were of major concern from a release incident standpoint were anhydrous ammonia (UN ID #1005, STCC ID #4904210), propane (UN ID #1075, STCC ID #2912111), and sulfuric Acid (UN ID #1830, STCC ID #2819314). In the event of a release of these chemicals, isolation and protective distances from the release point will need to be employed as outlined in the 2016 Emergency Response

Guide (ERG), which was published by the U.S. Department of Transportation (DOT), Pipeline and Hazardous Materials Safety Administration (PHMSA).

Data from the ERG concerning isolation and protective distances for anhydrous ammonia is shown below:

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TABLE 1 - INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES

			SMALL SPILLS (From a small package or small leak from a large package)						LARGE SPILLS (From a large package or from many small packages)					
			First ISOLATE in all Directions		Then PROTECT persons Downwind during				First ISOLATE in all Directions		Then PROTECT persons Downwind during			
					DAY		NIGHT				DAY		NIGHT	
ID No.	Guide	NAME OF MATERIAL	Meters	(Feet)	Kilometers	(Miles)	Kilometers	(Miles)	Meters	(Feet)	Kilometers	(Miles)	Kilometers	(Miles)
1005	125	Ammonia, anhydrous	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	Refer to table 3					
1005	125	Anhydrous ammonia												
1008	125	Boron trifluoride	30 m	(100 ft)	0.1 km	(0.1 mi)	0.7 km	(0.4 mi)	400 m	(1250 ft)	2.2 km	(1.4 mi)	4.8 km	(3.0 mi)
1008	125	Boron trifluoride, compressed												
1016	119	Carbon monoxide	30 m	(100 ft)	0.1 km	(0.1 mi)	0.2 km	(0.1 mi)	200 m	(600 ft)	1.2 km	(0.7 mi)	4.4 km	(2.8 mi)
1016	119	Carbon monoxide, compressed												
1017	124	Chlorine	60 m	(200 ft)	0.3 km	(0.2 mi)	1.1 km	(0.7 mi)	Refer to table 3					

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TABLE 3 - INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES FOR LARGE SPILLS FOR DIFFERENT QUANTITIES OF SIX COMMON TIH (PIH in the US) GASES

	First ISOLATE in all Directions		Then PROTECT persons Downwind during											
			DAY						NIGHT					
			Low wind (< 6 mph = < 10 km/h)		Moderate wind (6-12 mph = 10 - 20 km/h)		High wind (> 12 mph = > 20 km/h)		Low wind (< 6 mph = < 10 km/h)		Moderate wind (6-12 mph = 10 - 20 km/h)		High wind (> 12 mph = > 20 km/h)	
	Meters	(Feet)	km	(Miles)	km	(Miles)	km	(Miles)	km	(Miles)	km	(Miles)	km	(Miles)
TRANSPORT CONTAINER	UN1005 Ammonia, anhydrous: Large Spills													
Rail tank car	300	(1000)	1.7	(1.1)	1.3	(0.8)	1.0	(0.6)	4.3	(2.7)	2.3	(1.4)	1.3	(0.8)
Highway tank truck or trailer	150	(500)	0.9	(0.6)	0.5	(0.3)	0.4	(0.3)	2.0	(1.3)	0.8	(0.5)	0.6	(0.4)
Agricultural nurse tank	60	(200)	0.5	(0.3)	0.3	(0.2)	0.3	(0.2)	1.3	(0.8)	0.3	(0.2)	0.3	(0.2)
Multiple small cylinders	30	(100)	0.3	(0.2)	0.2	(0.1)	0.1	(0.1)	0.7	(0.5)	0.3	(0.2)	0.2	(0.1)
TRANSPORT CONTAINER	UN1017 Chlorine: Large Spills													
Rail tank car	1000	(3000)	9.9	(6.2)	5.4	(4.0)	5.1	(3.2)	11+	(7+)	9.0	(5.6)	6.7	(4.2)
Highway tank truck or trailer	600	(2000)	5.8	(3.6)	3.4	(2.1)	2.9	(1.8)	6.7	(4.3)	5.0	(3.1)	4.1	(2.5)
Multiple ton cylinders	300	(1000)	2.1	(1.3)	1.3	(0.8)	1.0	(0.6)	4.0	(2.5)	2.4	(1.5)	1.3	(0.8)
Multiple small cylinders or single ton cylinder	150	(500)	1.5	(0.9)	0.8	(0.5)	0.5	(0.3)	2.9	(1.8)	1.3	(0.8)	0.5	(0.4)

"+" means distance can be larger in certain atmospheric conditions

AEGLs for ammonia, propane, and sulfuric acid as determined by the NOAA are as follows.

Ammonia 7664-41-7 (Final)

	10 min	30 min	60 min	4 hr	8 hr
ppm					
AEGL 1	30	30	30	30	30
AEGL 2	220	220	160	110	110
AEGL 3	2,700	1,600	1,100	550	390

Propane 74-98-6 (Final)

	10 min	30 min	60 min	4 hr	8 hr
ppm					
AEGL 1	10,000*	6,900*	5,500*	5,500*	5,500*
AEGL 2	**	**	**	**	**
AEGL 3	***	***	***	***	***

Lower Explosive Limit (LEL) = 23,000 ppm
* = >10% LEL; ** = >50% LEL; *** = >100% LEL
AEGL 2 - 10 min/30 min/60 min/4 hr/8 hr = ** 17,000 ppm
AEGL 3 - 10 min/30 min/60 min/4 hr/8 hr = *** 33,000 ppm
For values denoted as * safety considerations against the hazard(s) of explosion(s) must be taken into account.
For values denoted as ** and *** extreme safety considerations against the hazard(s) of explosion(s) must be taken into account.

Sulfuric acid 7664-93-9 (Interim)

	10 min	30 min	60 min	4 hr	8 hr
(mg/m^3) 11/30/06					
AEGL 1	0.20 mg/m^3	0.20 mg/m^3	0.20 mg/m^3	0.20 mg/m^3	0.20 mg/m^3
AEGL 2	8.7 mg/m^3	8.7 mg/m^3	8.7 mg/m^3	8.7 mg/m^3	8.7 mg/m^3
AEGL 3	270 mg/m^3	200 mg/m^3	160 mg/m^3	110 mg/m^3	93 mg/m^3

NOTE THAT VALUES ARE IN **mg/m^3**, NOT ppm.

IMPORTANT NOTE: Interim AEGLs are established following review and consideration by the National Advisory Committee for AEGLs (NAC/AEGL) of public comments on Proposed AEGLs. Interim AEGLs are available for use by organizations while awaiting NRC/NAS peer review and publication of Final AEGLs. **Changes to Interim values and Technical Support Documents may occur prior to publication of Final AEGL values**. In some cases, revised Interim values may be posted on this Web site, but the revised Interim Technical Support Document for the chemical may be subject to change. (Further information is available through AEGL Process).

4.2.3 Basis for Plume Analysis

The plume analysis diagrams contained in Section 4 are based on the following parameters:

- Weather Conditions: Both January and July data represent 2 separate endpoints of weather conditions in Contra Costa County, and the following weather parameters are included in the analysis:
  - Differing wind directions
  - Wind speed
  - Temperature extremes. (The average high temperatures for January and July are used in the analysis)
  - Cloud cover

- COCs: Utilization of ammonia/anhydrous ammonia, propane, and sulfuric acid as the COCs.

- Worst-Case Scenario: Assumption that a worst-case scenario situation where a maximum amount of the COCs from railroad tanker car are released to the environment. By utilizing the worst-case scenario default situation, the plume analysis diagrams will allow for a more significant area of impact than may be encountered in a realistic scenario.

4.3 Ammonia Gas Summary

The release scenarios outlined above in Section 4.2 are considered to be a worst-case scenario in the case of a rail tank car holding 34,397 gallons of ammonia that has ruptured due to derailment due to flooding along the railroad or other cause. This has resulted in the release of a toxic cloud of liquefied ammonia from the pressurized tanks directly to the atmosphere. The ammonia quickly combines with moisture in the air, vaporizes, and forms a toxic cloud migrating downwind from the source.

Information concerning the characteristics of ammonia and anhydrous ammonia and the migration of an ammonia gas cloud is well represented in the literature, and the general information summarized here was obtained from the following references:

Centers for Disease Control and Prevention (CDC), Ammonia *Solution (UN3318); Ammonia, Anhydrous (UN1005): Lung Damaging Agent*, on line at https://www.cdc.gov/niosh/ershdb/emergencyresponsecard_29750013.html.

United States Department of Labor, 2018, Ammonia *Refrigeration Emergency Response*, on line at https://www.osha.gov/SLTC/etools/ammonia_refrigeration/emergency/index.html.

United States Department of Labor, 2018, Ammonia *Refrigeration Properties of Ammonia*, on line at https://www.osha.gov/SLTC/etools/ammonia_refrigeration/ammonia/index.html.

Illinois Fertilizer and Chemical Association, 2018, *Fertilizer's Role in Agriculture,* on line at https://www.ifca.com/media/files/27_3.pdf.

Transcaer, Section 4, Anhydrous Ammonia Response, on line at https://www.transcaer.com/docs/AATour/Transcaer_Ammonia_Training_2011Response_IG_rev14.pdf.

Airgas, February 15, 2018, Ammonia Safety Data Sheet, on line at https://www.airgas.com/msds/001003.pdf.

Ammonia/anhydrous ammonia is one of the highest production chemicals in the United States. It is used in manufacturing, refrigeration, and as an agricultural fertilizer, and is common in household chemicals. Ammonia can be absorbed into the body by inhalation, ingestion, and by skin and eye contact. A poisonous and visible vapor cloud is produced when ammonia comes in contact with water. Ammonia is extremely corrosive, and when it mixes with air it forms an explosive mixture. Although anhydrous ammonia is classified by the U.S Department of Transportation (USDOT) as nonflammable, ammonia vapor is flammable at concentrations of 15% to 28% by volume of air.

The odor threshold for ammonia is between 5 and 50 parts per million (ppm) of air, and the permissible exposure limit (PEL) is 50 ppm over an 8-hour time period. The USDOT summarizes the properties of ammonia as follows:

Summary of properties:

Boiling Point	-28°F
Weight per gallon of liquid at -28°F	5.69 pounds
Weight per gallon of liquid at 60°F	5.15 pounds
Specific gravity of the liquid (water=1)	0.619
Specific gravity of the gas (air=1)	0.588
Flammable limits in air	16-25%
Ignition temperature	1204°F
Vapor pressure at 0°F	16 psi
Vapor pressure at 68°F	110 psi
Vapor pressure at 100°F	198 psi
One cubic foot of liquid at 60°F expands to	850 cubic foot of gas

Ammonia can be absorbed into the body by inhalation, ingestion, and by skin and eye contact. According to the CDC exposure to dangerous concentrations of ammonia may result in the following symptoms:

- Rapid eye irritation and burning sensation, and possible severe corrosive eye injury;
- Upon ingestion, nausea, vomiting abdominal pain and corrosive burns to the mouth, esophagus, and stomach;
- Skin inflammation, including blistering, tissue death, and deep penetrating burns; and
- Exposure to liquefied ammonia gas may lead to severe frostbite and burns.

Characteristics of ammonia/anhydrous ammonia are contained on an Airgas Safety Data Sheet (Appendix C).

Ammonia is generally transported via highway in high-pressure nurse tanks on trailers pulled by trucks, or truck cargo tankers. Each truck cargo and carry 20 tons of ammonia. Ammonia can be transported in pressurized rail cars containing 80 tons of ammonia. The majority of ammonia is transported by rail. Fixed facilities that use ammonia for refrigeration purposes may contain pressurized tanks of ammonia.

Ammonia gas is lighter than air, and when it comes in contact with moisture in the air, it will form an ammonia fog. Once it forms a fog, however, the fog is heavier than air and is likely to remain low to the ground. This fog or cloud is white in color. The ammonia fog can travel along the ground aided by wind in the direction of the prevailing wind. Higher temperatures will cause the ammonia cloud to move and disperse more rapidly than colder temperatures.

Emergency response to an ammonia release is covered in detail in the above-referenced CDC document and is summarized below:

- Red Zone: (generally corresponds to Red Zone of ALOHA plume designation): Personal Protective Equipment (PPE) in Level A or Level B should be used. In this zone, the exposure to chemical hazards, is above IDLH or greater than AEGL-2.

- Yellow Zone (generally corresponds to Orange Zone of ALOHA plume designation): PPE in Level C, with canister-type gas mask for ammonia levels in air above AEGL-2, and particulate cartridge/filter combination or a continuous flow respirator for ammonia levels in air above AEGL-1.

- Green Zone (Generally corresponds to Yellow Zone of ALOHA plume designation): Level D when exposure limit is less than AEGL-1.

In addition, the CDC recommends the following initial isolation and protective action distances:

- **When UN 1005 (anhydrous, liquefied), UN 2073 (35% to 50%), or UN 3318 (> 50%)** is involved in a tank, rail car, or tank truck fire:
  - Isolate it for 1 mi (1600 m) in all directions; also, consider initial evacuation for 1 mi (1600 m) in all directions.

- **When UN 1005 (anhydrous, liquefied) or UN 3318 (> 50%)** is involved in small spills (involving the release of approximately 52.83 gallons (200 liters) or less):
  - First isolate in all directions: 100 ft (30 m).
  - Then protect persons downwind during the day: 0.1 mi (0.1 km).
  - Then protect persons downwind during the night: 0.1 mi (0.1 km).

- **When UN 1005 (anhydrous, liquefied) or UN 3318 (> 50%)** is involved in large spills (involving quantities greater than 52.83 gallons (200 liters)):
  - First isolate in all directions: 200 ft (60 m).
  - Then protect persons downwind during the day: 0.4 mi (0.6 km).
  - Then protect persons downwind during the night: 1.4 mi (2.2 km).

4.4 Propane Summary

The release scenarios outlined above in Section 4.2 are considered to be a worst-case scenario in the case of a rail tank car holding 34,397 gallons of liquefied petroleum gas (propane) that has ruptured due to derailment due to flooding along the railroad or other cause. This has resulted in the release of the contents of the tank car to the environment.

Information concerning the characteristics of propane and the mitigation of a propane release incident are summarized here, and the data were obtained from the following references:

Alternative Fuels Data Center, Propane Production and Distribution, U.S. Department of Energy, 2019, on line at https://afdc.energy.gov/fuels/propane_production.html.

Linde, Industrial Gases, Propane, 2019, on line at https://www.linde-gas.com/en/products_and_supply/gases_fuel/propane.html.

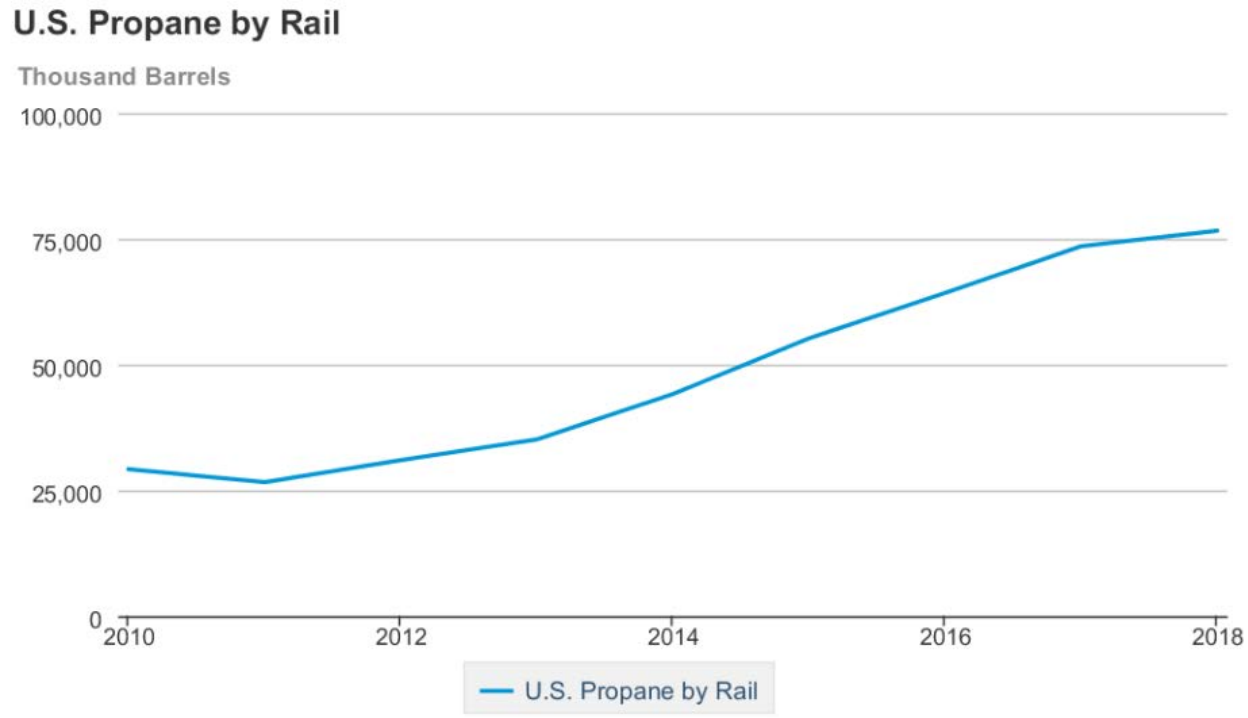
U.S. Energy Information Administration, Petroleum and Other Liquids, 2019, on line at https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=esm_epllpa_rail_nus-nus_mbbl&f=a.

Ferrellgas (Blue Rhino), 2018, Safety Data Sheet, Propane, on line at https://www.ferrellgas.com/media/66083/sds_propane_12_18.pdf.

U. S. Department of Transportation, 2016 Emergency Response Guidebook.

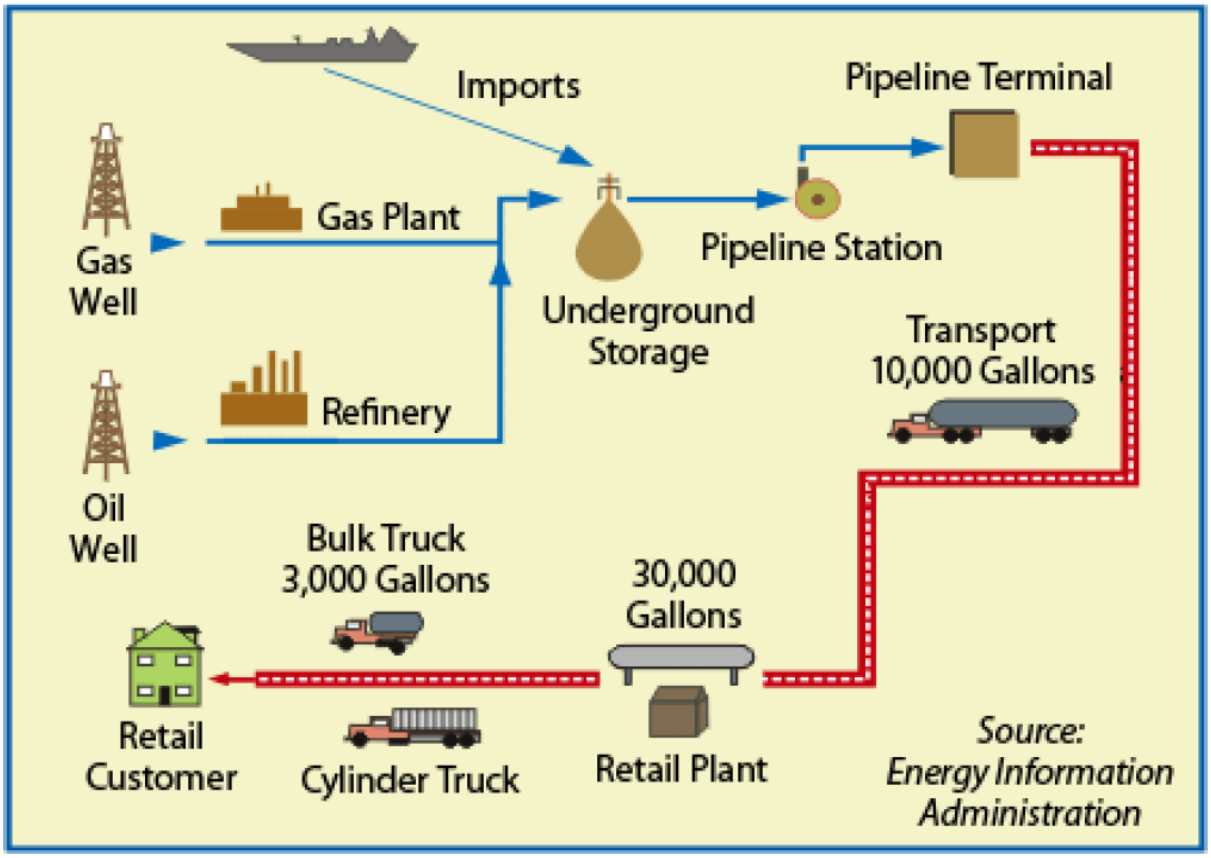
Propane is a by-product of natural gas processing and crude oil refining and is produced from liquid components recovered during natural gas processing. Propane is a colorless, highly flammable liquefied gas and is one of the main components of liquid petroleum gas (LPG). Propane is used as a vehicle fuel, as well as for industrial and domestic heating. It is also a specialty gas employed as a refrigerant and an aerosol propellant.

Propane production has increased over the last several years, and shipments by rail attained more than 75,000 thousand barrels in 2018 as shown below in the U.S. Energy Information Administration data:



eia Source: U.S. Energy Information Administration

A typical propane distribution route from producer to consumer is contained in the Alternative Fuels Data Center information, and is shown as follows:



Schematic of a typical propane distribution route (Source: EIA (https://www.eia.gov/))

Propane is heavier than air and is identified under United Nations (UN) Guide in the Department of Transport Emergency Response Guidebook (ERG) as No. 1075. The details concerning transportation information from the Ferrellgas (Blue Rhino) Safety Data Sheet (SDS) are shown below:

U.S. Department of Transportation (DOT)
UN Number: 1978 or 1075
UN proper shipping name: Propane,
Transport hazard class(es): 2.1
Packing Group: None
Environmental Hazards: This product does not meet the DOT/UN/IMDG/IMO criteria of a marine pollutant
Special precautions for user: ***For domestic transportation only, UN1075 may be substituted for the UN number shown as long as the substitution is consistent on package markings, shipping papers, and emergency response information. See 49 CFR 172.102 Special Provision 19.***
Containers of NON-ODORIZED liquefied petroleum gas must be marked either NON-ODORIZED or NOT ODORIZED as of September 30, 2006. [49 CFR 172.301(f), 326(d), 330(c) and 338(e)]
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable

The railroad Standard Transportation Commodity Code (STCC) for propane is 2912111.

The summary of the physical properties of 93% sulfuric acid is reproduced from the Ferrellgas SDS and is as follows:

Appearance: Colorless
Physical Form: Liquefied Gas
Odor: No distinct odor (or skunk, rotten egg or garlic if odorant added)
Odor Threshold: No data
pH: Not applicable
Vapor Density (air=1): >1
Upper Explosive Limits (vol % in air): 9.5
Lower Explosive Limits (vol % in air): 2.1
Evaporation Rate (nBuAc=1): >1
Particle Size: Not applicable
Percent Volatile: 100%
Flammability (solid, gas): Extremely Flammable

Flash Point: -156 °F / -104 °C
Test Method: Tag Closed Cup (TCC), ASTM D56
Initial Boiling Point/Range: -44 °F / -42 °C

Vapor Pressure: 208 psia (Reid VP) @ 100°F / 37.8°C
Partition Coefficient (n-octanol/water) (Kow): No data
Melting/Freezing Point: -309 °F / -189 °C
Auto-ignition Temperature: 842 °F / 450 °C
Decomposition Temperature: No data
Specific Gravity (water=1): 0.50-0.51 @ 60°F (15.6°C)
Bulk Density: No data
Viscosity: No data
Solubility in Water: Negligible

Propane is biodegradable, and will readily evaporate into the environment. Inhalation of propane in minor amounts is not considered toxic; however, large amounts of propane in the air can displace oxygen and act as an asphyxiant. Skin absorption and ingestion of propane is not anticipated, although contact with propane in the liquid phase may result in frostbite.

Propane is highly flammable and explosive, and spillages of large quantities of liquid propane will vaporize to propane gas. Propane vapors can travel considerable distances. An ignition source may cause propane to ignite, flash back, and explode. Propane explosions can result in Boiling Liquid Expanding Vapor Explosion (BLEVE). The U.S. Department of Transport Emergency Response Guidebook (ERG) has determined general evacuation distances to be undertaken in the event of propane-induced BLEVE, and they are outlined below.

WARNING: The data given are approximate and should only be used with extreme caution. These times can vary from situation to situation. LPG tanks have been known to BLEVE within minutes. Therefore, never risk life based on these times.

BLEVE
(USE WITH CAUTION)

Capacity		Diameter		Length		Propane Mass		Minimum time to failure for severe torch	Approximate time to empty for engulfing fire	Fireball radius		Emergency response distance		Minimum evacuation distance		Preferred evacuation distance		Cooling water flow rate	
Litres	(Gallons)	Meters	(Feet)	Meters	(Feet)	Kilograms	(Pounds)	Minutes	Minutes	Meters	(Feet)	Meters	(Feet)	Meters	(Feet)	Meters	(Feet)	Litres/min	USgal/min
100	(26.4)	0.3	(1)	1.5	(4.9)	40	(88)	4	8	10	(33)	90	(295)	154	(505)	307	(1007)	94.6	25
400	(106)	0.61	(2)	1.5	(4.9)	160	(353)	4	12	16	(53)	90	(295)	244	(801)	488	(1601)	189.3	50
2000	(528)	0.96	(3.2)	3	(9.8)	800	(1764)	5	18	28	(92)	111	(364)	417	(1368)	834	(2736)	424	112
4000	(1057)	1	(3.3)	4.9	(16.1)	1600	(3527)	5	20	35	(115)	140	(459)	525	(1722)	1050	(3445)	598	158
8000	(2113)	1.25	(4.1)	6.5	(21.3)	3200	(7055)	6	22	44	(144)	176	(577)	661	(2169)	1323	(4341)	848	224
22000	(5812)	2.1	(6.9)	6.7	(22)	8800	(19400)	7	28	62	(203)	247	(810)	926	(3038)	1852	(6076)	1404	371
42000	(11095)	2.1	(6.9)	11.8	(38.7)	16800	(37037)	7	32	77	(253)	306	(1004)	1149	(3770)	2200	(7218)	1938	512
82000	(21662)	2.75	(9)	13.7	(45)	32800	(72310)	8	40	96	(315)	383	(1257)	1435	(4708)	2200	(7218)	2710	716
140000	(36984)	3.3	(10.8)	17.2	(56.4)	56000	(123457)	9	45	114	(374)	457	(1499)	1715	(5627)	2200	(7218)	3539	935

4.5 Sulfuric Acid Summary

The release scenarios outlined above in Section 4.2 are considered to be a worst-case scenario in the case of a rail tank car holding 13,350 gallons of 93% sulfuric acid that has ruptured, and a release of the contents of the tank car to the environment has occurred following a derailment due to flooding along the railroad or other cause.

Information concerning the characteristics of 93% sulfuric acid and the mitigation of a spill are summarized here, and the data were obtained from the following references:

Sulfuric Acid, The Essential Chemical Industry-online, 2019, on line at http://www.essentialchemicalindustry.org/chemicals/sulfuric-acid.html.

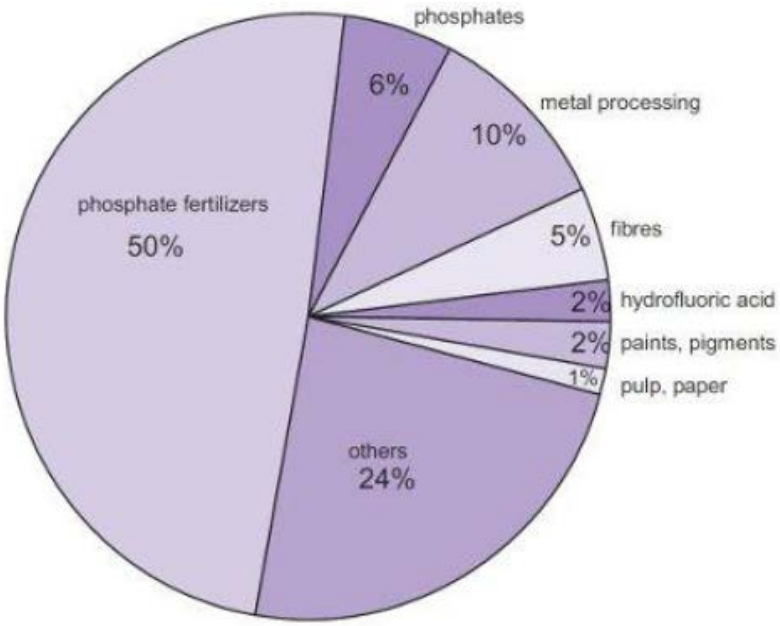
Columbus Chemical Industries, Inc., January 22, 2015, Sulfuric Acid, 93% PC, Safety Data Sheet, on line at https://www.columbuschemical.com/MSDS/SDS/Sulfuric%20Acid,%2093%25%20PC%205665.pdf.

J. R. Simplot, July 28, 2017, Sulfuric Acid 93% Safety Data Sheet, on line at http://sds.simplot.com/datasheets/16020.pdf

Deerpoint Group, Inc., Material Safety Data Sheet, Sulfuric Acid 93%, on line at https://assets.greenbook.net/M122570.pdf

U. S. Department of Transportation, 2016 Emergency Response Guidebook.

Sulfuric acid is one of the most important compounds manufactured by the chemical industry and is used to make hundreds of other compounds needed by other industries. Sulfuric acid is used widely in the manufacture of phosphoric acid in the fertilizer industry,, as well as in the metal processing industry. Annual production of sulfuric acid in the United States is 37,000,000 metric tonnes. Uses of sulfuric acid are shown in the following diagram, which was reproduced from the Essential Chemistry on-line, is as follows:



Sulfuric acid is a highly corrosive material, and is identified under United Nations (UN) Guide in the Department of Transport Emergency Response Guidebook (ERG) as No. 1830. The details from the J.R. Simplot Safety Data Sheet (SDS) are shown below:

Department of Transportation (DOT)

In accordance with DOT

Transport document description	:	UN1830 Sulfuric acid, 8, II
UN-No.(DOT)	:	UN1830
Proper Shipping Name (DOT)	:	Sulfuric acid
Class (DOT)	:	8 - Class 8 - Corrosive material 49 CFR 173.136
Packing group (DOT)	:	II - Medium Danger
Hazard labels (DOT)	:	8 - Corrosive

The railroad Standard Transportation Commodity Code (STCC) for sulfuric acid is 4930040.

The summary of the physical properties of 93% sulfuric acid is reproduced from the Columbus Chemical SDS and is as follows:

Appearance (physical state, color, etc.)	Clear, colorless liquid.
Odor	Odorless.
Odor threshold	Not Available
pH	Not Available
Melting point/freezing point	Not Available
Initial boiling point and boiling range	Not Available
Flash point	Not Flammable
Evaporation rate	Not Available
Flammability (solid, gas)	Not Flammable
Upper/lower flammability or explosive limit	Not Explosive
Vapor pressure	Not Available
Vapor density	Not Available
Density	1.8350 (water = 1)
Solubility (ies)	Soluble in water.
Partition coefficient: n-octanol/water	Not Available
Auto-ignition temperature	Not Available
Decomposition temperature	Not Available

Sulfuric acid is not considered to be harmful to aquatic organisms or to cause long-term effects to the environment. However, exposure to sulfuric acid can cause skin and eye burns, is destructive to the tissues of the upper respiratory tract if inhaled, and is harmful, and may be fatal, if ingested. The American Conference of Governmental Industrial Hygienists (ACGIH) and the Occupational Health and Safety Administration (OSHA) data for 93% sulfuric acid, as noted in the J. R. Simplot SDS is as follows:

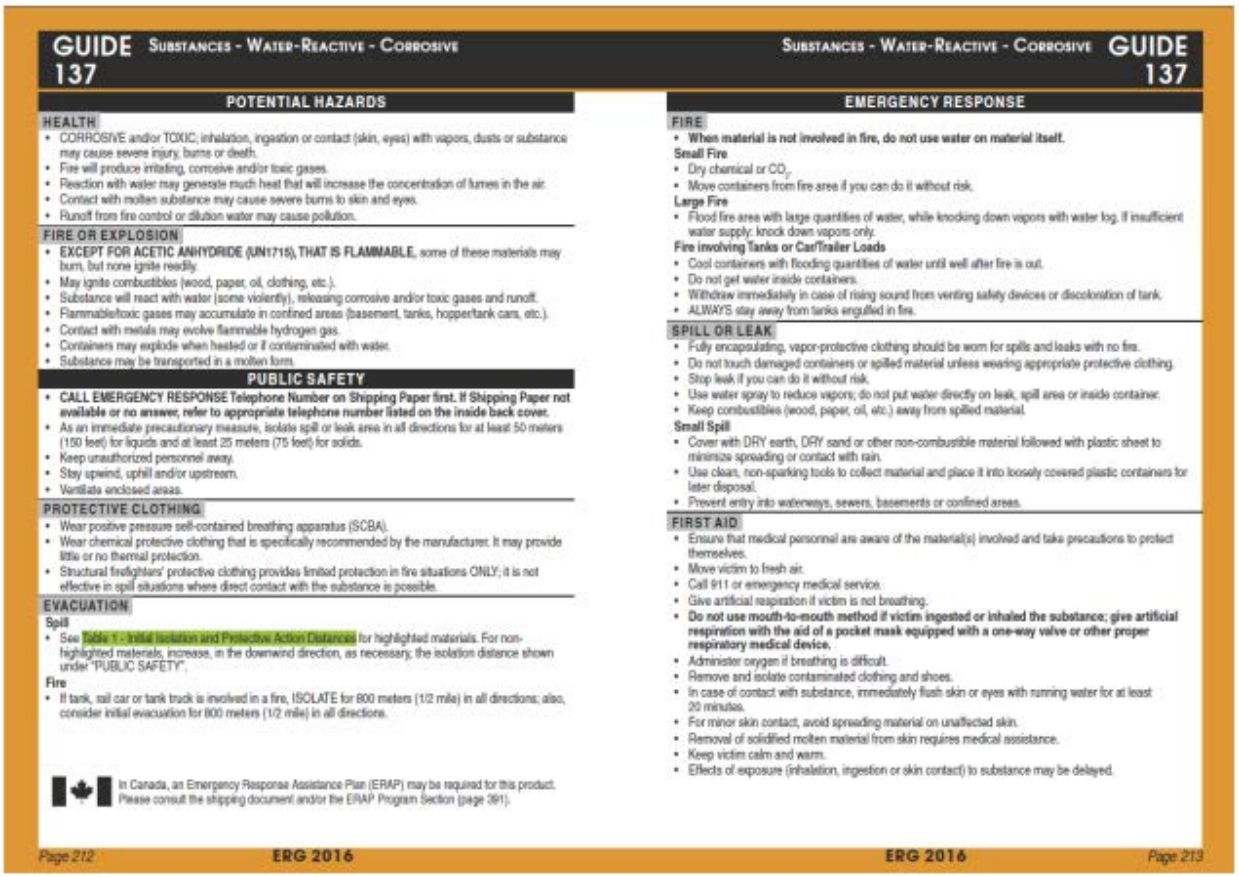
Sulfuric Acid 93%		
ACGIH	ACGIH TWA (mg/m³)	0.2
ACGIH	ACGIH TWA (ppm)	0.0498 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	1
OSHA	OSHA PEL (TWA) (ppm)	0.25

Spill cleanup of large spills of sulfuric acid should be undertaken by isolating the spill area with diking materials, including isolation from waterways. The acid can be treated with soda ash or lime, although neutralization will resolve a release of heat. Sulfuric acid is not flammable, but can be highly reactive with combustible materials.

Sulfuric acid spills are not considered as toxic, but can form a gray cloud. If sulfuric acid is mixed with water, it reacts vigorously forming an exothermic reaction. A vapor cloud of sulfuric acid can mix with water or water vapor to form a white cloud, which, based on the specific gravity is heavier than air.

Evacuation guidelines are contained with the ERG, and the isolation distance in the event that a fire is involved is ½ mile in all directions. The response guidelines in the ERG are shown below. Although there is no stated isolation distance in the event of a sulfuric acid spill, or a

spill into water, the ERG guidelines with respect to fire should be used as a basis for evacuation and mitigation.



GUIDE 137 SUBSTANCES - WATER-REACTIVE - CORROSIVE

POTENTIAL HAZARDS

HEALTH

- CORROSIVE and/or TOXIC; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns or death.
- Fire will produce irritating, corrosive and/or toxic gases.
- Reaction with water may generate much heat that will increase the concentration of fumes in the air.
- Contact with molten substance may cause severe burns to skin and eyes.
- Runoff from fire control or dilution water may cause pollution.

FIRE OR EXPLOSION

- **EXCEPT FOR ACETIC ANHYDRIDE (UN1715), THAT IS FLAMMABLE,** some of these materials may burn, but none ignite readily.
- May ignite combustibles (wood, paper, oil, clothing, etc.).
- Substance will react with water (some violently), releasing corrosive and/or toxic gases and runoff.
- Flammable/toxic gases may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.).
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated or if contaminated with water.
- Substance may be transported in a molten form.

PUBLIC SAFETY

- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.
- Keep unauthorized personnel away.
- Stay upwind, uphill and/or upstream.
- Ventilate enclosed areas.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

EVACUATION

Spill

- See Table 1 - Initial Isolation and Protective Action Distances for highlighted materials. For non-highlighted materials, increase, in the downwind direction, as necessary, the isolation distance shown under "PUBLIC SAFETY".

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping document and/or the ERAP Program Section (page 391).

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SUBSTANCES - WATER-REACTIVE - CORROSIVE GUIDE 137

EMERGENCY RESPONSE

FIRE

- **When material is not involved in fire, do not use water on material itself.**

Small Fire

- Dry chemical or CO_2.
- Move containers from fire area if you can do it without risk.

Large Fire

- Flood fire area with large quantities of water, while knocking down vapors with water fog. If insufficient water supply: knock down vapors only.

Fire involving Tanks or Car/Trailer Loads

- Cool containers with flooding quantities of water until well after fire is out.
- Do not get water inside containers.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.

SPILL OR LEAK

- Fully encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container.
- Keep combustibles (wood, paper, oil, etc.) away from spilled material.

Small Spill

- Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Use clean, non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.
- Prevent entry into waterways, sewers, basements or confined areas.

FIRST AID

- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- **Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.**
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- For minor skin contact, avoid spreading material on unaffected skin.
- Removal of solidified molten material from skin requires medical assistance.
- Keep victim calm and warm.
- Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.

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5.0 Chemical Plume Analysis

This section contains plume analysis for Toxic LOCs for the COCs ammonia, propane, and sulfuric acid based on the input of specific parameters, as outlined above in Section 4.2.2. As noted above, these parameters have been determined to illustrate a worst-case scenario and/or probable scenario with respect to a major release of the COCs within Contra Costa County. As ALOHA data input requires a date input, the arbitrary date of July 18 is used.

The plume diagrams produced using the ALOHA modeling program for the 5 determined pinch points located within coastal area of Contra Costa County, and they are described in the following sections. In each section, the basis of the ALOHA plume maps are presented with the following summary data:

- Text Summary: the text summary describes the parameters under which the plume data were prepared. This includes:
  - Site Data which has been input specifically for the location.
  - Chemical Data for the specific chemical (in this case chlorine or ammonia), including AEGL-1, AEGL-2 and AEGL-3 (60 minutes), other specific chemical characteristics, and the "Immediately Dangerous to Life and Health (IDLH) concentration.
  - Atmospheric Data derived from the weather data for Contra Costa County for July. The prevailing wind direction for 10 months of the year (February through November) is from the west, and this direction will be used in the ALOHA modeling.
  - Source Strength, including quantity spilled/released into the atmosphere and conditions under which it was released.
  - Threat Zone, which defines the red, orange, and yellow threat zones.

- Toxic Threat Zone: This is a schematic of the plume size and shape with a summary of the threat zone.

- Release Rate: This is a graph of the data contained in the text portion under Source Strength.

- Plume Diagram: The plume diagram is superimposed on a Google Earth base. The 3 threat zones (red, orange, and yellow) are shown, as are the critical facilities receptors.

Site-specific parameters were applied to the plume modeling mapping discussed for each of the 5 pinch points in Sections 5.1 through 5.5.

Ammonia/Anhydrous Ammonia: ALOHA model plume mapping of an ammonia/anhydrous ammonia (UN ID# 1005) release is shown in the plume maps. Some of the major parameters used in plume development include:

- Incident occurs in mid-July with an internal tank temperature of 85°F;
- Wind is from the west at nine (9) miles per hour;
- Size of railroad tank care is 34,397 gallons;
- Tank diameter of 10.66 feet; and

- The rupture in the tank car is a 10-inch diameter hole located near the bottom of the tank car.

Detailed parameters are contained in Appendix C. Critical facilities within the plume are also shown on the maps.

Propane: ALOHA model plume mapping for a propane (UN ID# 1075) release is shown in the following maps. The first map in each section shows the extent of a propane plume release. The second map shows the area affected in the event that the tank car explodes in a BLEVE scenario. Some of the major parameters used in plume development include:

- Incident occurs in mid-July with an air temperature of 85^{o}F;
- Wind is from the west at 9 miles per hour;
- Size of railroad tank care is 34,397 gallons;
- Tank diameter of 10.66 feet; and
- The rupture in the tank car is a 10-inch diameter hole located near the bottom of the tank car.

Detailed parameters are contained in Appendix C. Critical facilities within the plume are also shown on the maps.

Sulfuric Acid: Sulfuric acid is not considered a toxic material that will create a toxic vapor plume during a release. Nevertheless, it but can form a gray cloud, and when this cloud mixes with water vapor to form a white cloud, it is heavier than air. The mixing of sulfuric acid with water results in a highly exothermic reaction. A rail spill of sulfuric acid due to derailment caused by a flooding event is a realistic scenario in the coastal areas of Contra Costa County. Sulfuric acid can be neutralized with soda ash or lime.

Evacuation guidelines are contained with the ERG, and the isolation distance in the event that a fire is involved is ½ mile in all directions. Although there is no stated isolation distance in the event of a sulfuric acid spill, or a spill into water, the ERG guidelines with respect to fire should be used as a basis for evacuation and mitigation.

Some of the major parameters used development of the isolation distance map for sulfuric acid at each of the 5 pinch points are as follows:

- Incident occurs in mid-July with an internal tank temperature of 85^{o}F;
- Size of railroad tank care is 13,350 gallons;
- Tank diameter of eight (8) feet; and
- The rupture in the tank car is a 10-inch diameter hole located near the bottom of the tank car.

Critical facilities within the plume are also shown on the maps.

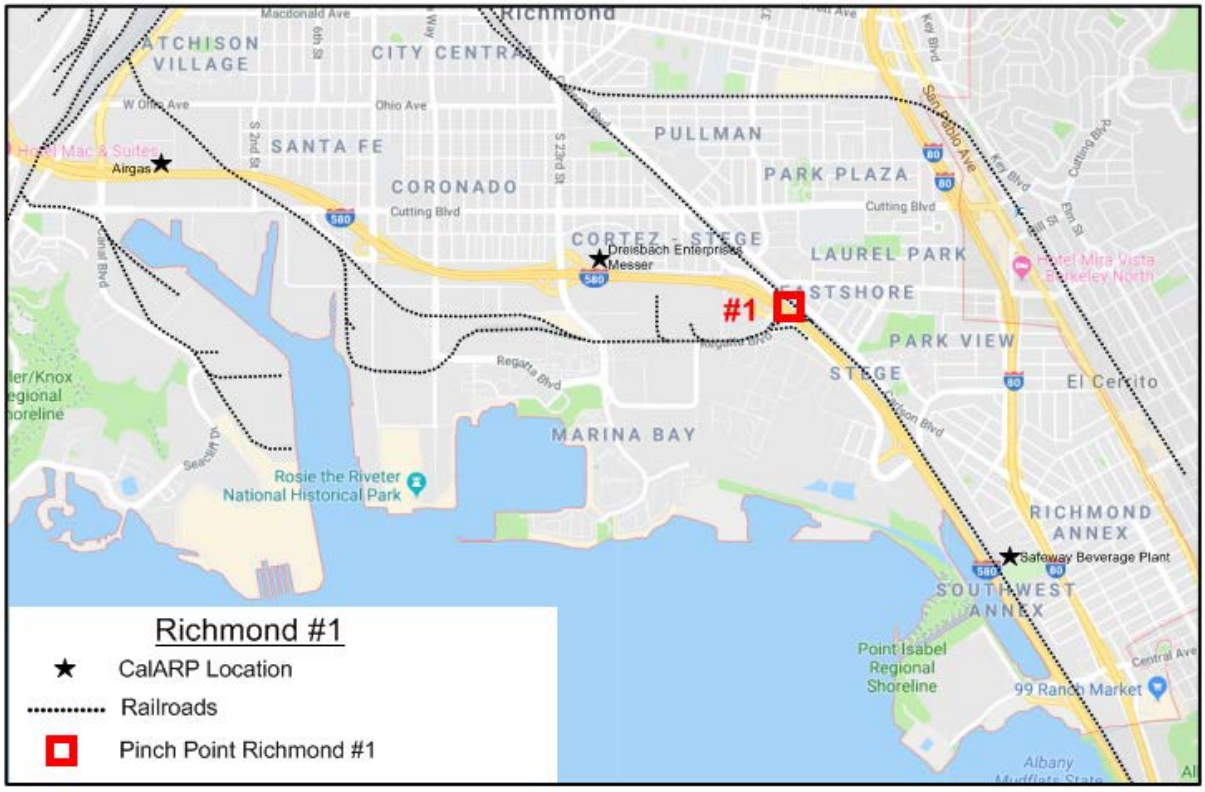
5.1 Pinch Point – Richmond #1

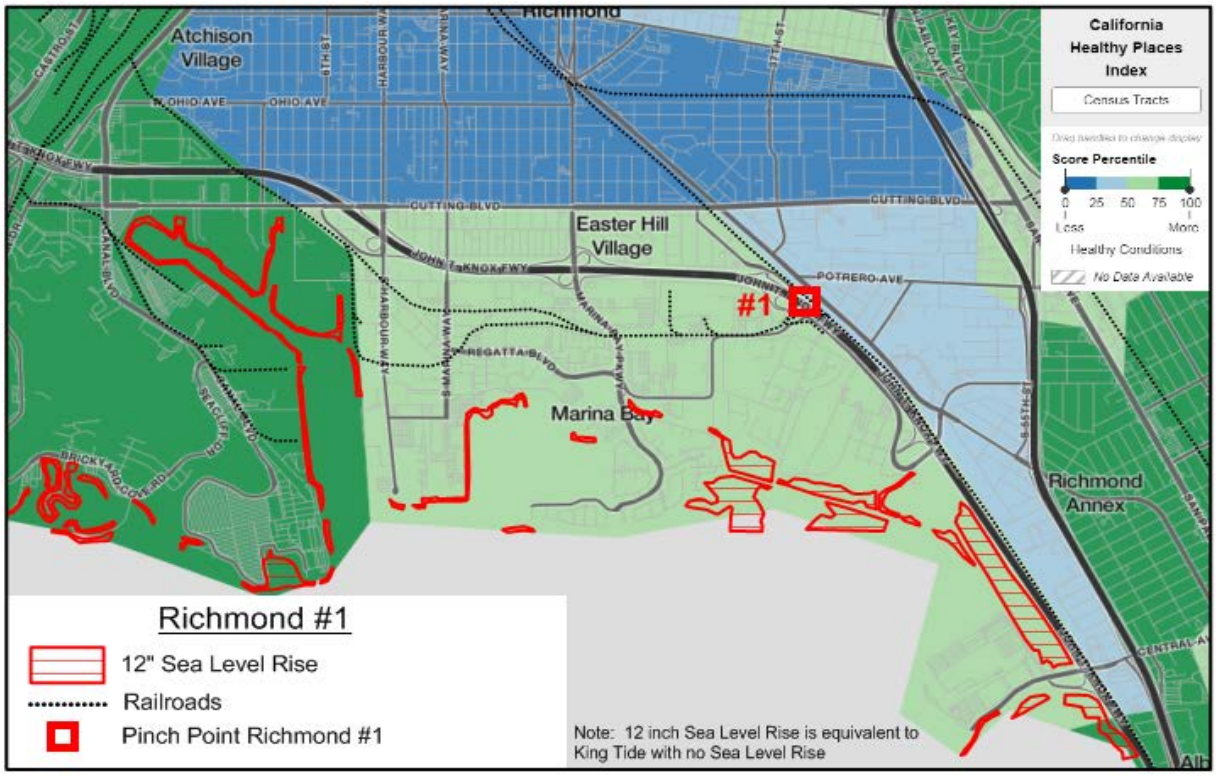
At the Richmond #1 pinch point, it will be assumed that the hazardous materials spill of a COC will result from an incident with a rail tank car holding 34,397 gallons of the ammonia/anhydrous ammonia (worst-case scenario), a rail tank car holding 34,397 gallons of propane as LPG (worst-case scenario), and 13,350 gallons of sulfuric acid (worst-case scenario). The individual details are contained in the sections below.

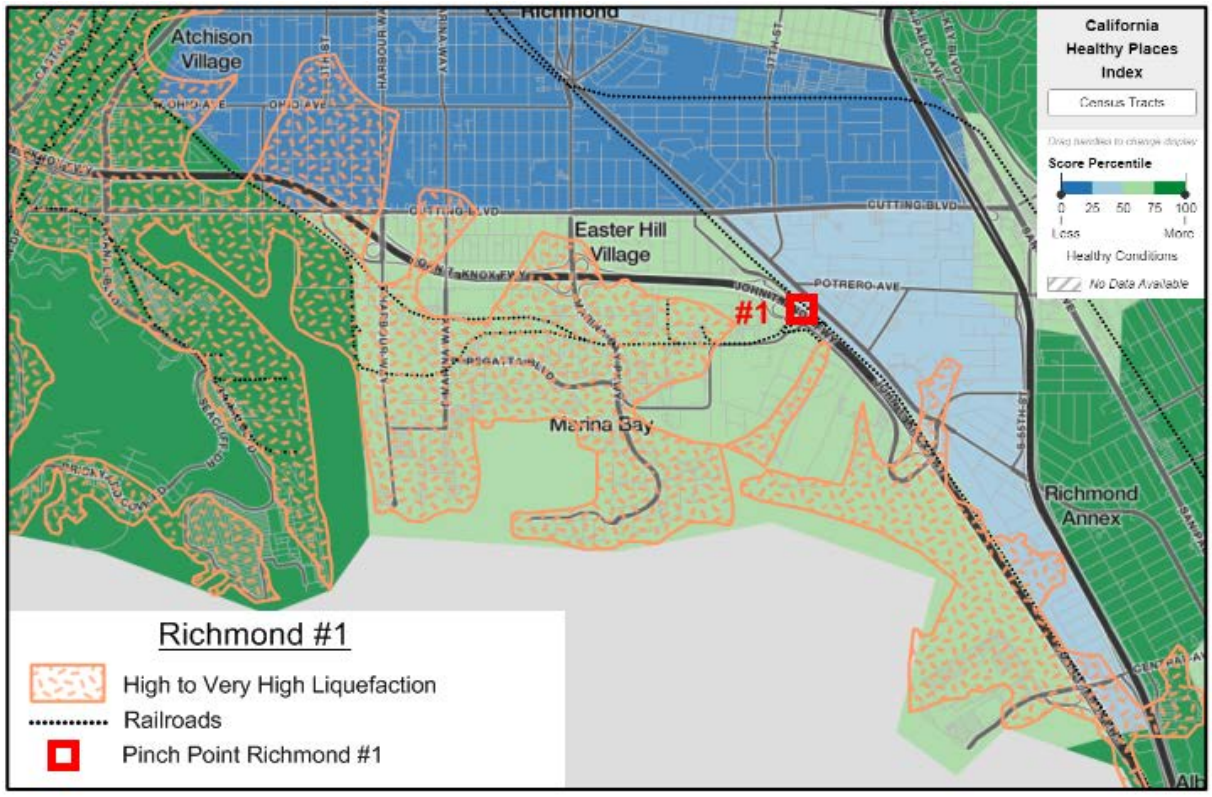
Criteria used in the identification of the pinch point are summarized in the table below. Maps showing some of the criteria used in the determination of the pinch point are shown following the table.

RICHMOND PINCH POINT #1 CRITERIA

CRITERIA	DESCRIPTION	COMMENTS
Location	I-580 at Meade Street	
Elevation (feet above msl)	30	Above 12" rising tide
Latitude	37.919608	
Longitude	-122.332571	
Railroads	UP (pinch point)	Pinch point along major rail line
	RPRC (pinch point and west)	Pinch point along major rail line
Highways & Arterial Roads	I-580	
	Carlson Blvd.	
	Potrero Ave.	
	Regatta Blvd.	
Pipelines	Gas and hazardous liquid at pinch point along UP and RPRC line	Co-located with rail lines at pinch point
Nearby CalARP Facilities	Dreisbach Enterprises, Messer	
	Safeway Beverage Plant	
Surrounding Land Use	N-industrial/residential (low to moderate income)	Vulnerable population
	E-residential (low to moderate income)	Vulnerable population
	S-industrial	
	W-industrial	
Healthy Places Index	25-50 (at pinch point and to east; 27.4 percentile)	Vulnerable population
	0-25 (north of pinch point)	
	50-75 (west and south of pinch point)	
Wind Direction (from)	West (Feb-Nov); North (Nov-Feb)	
Rising Tides 12"	South of pinch point	
Liquefaction (high to very high)	South, southeast, and west of pinch point	

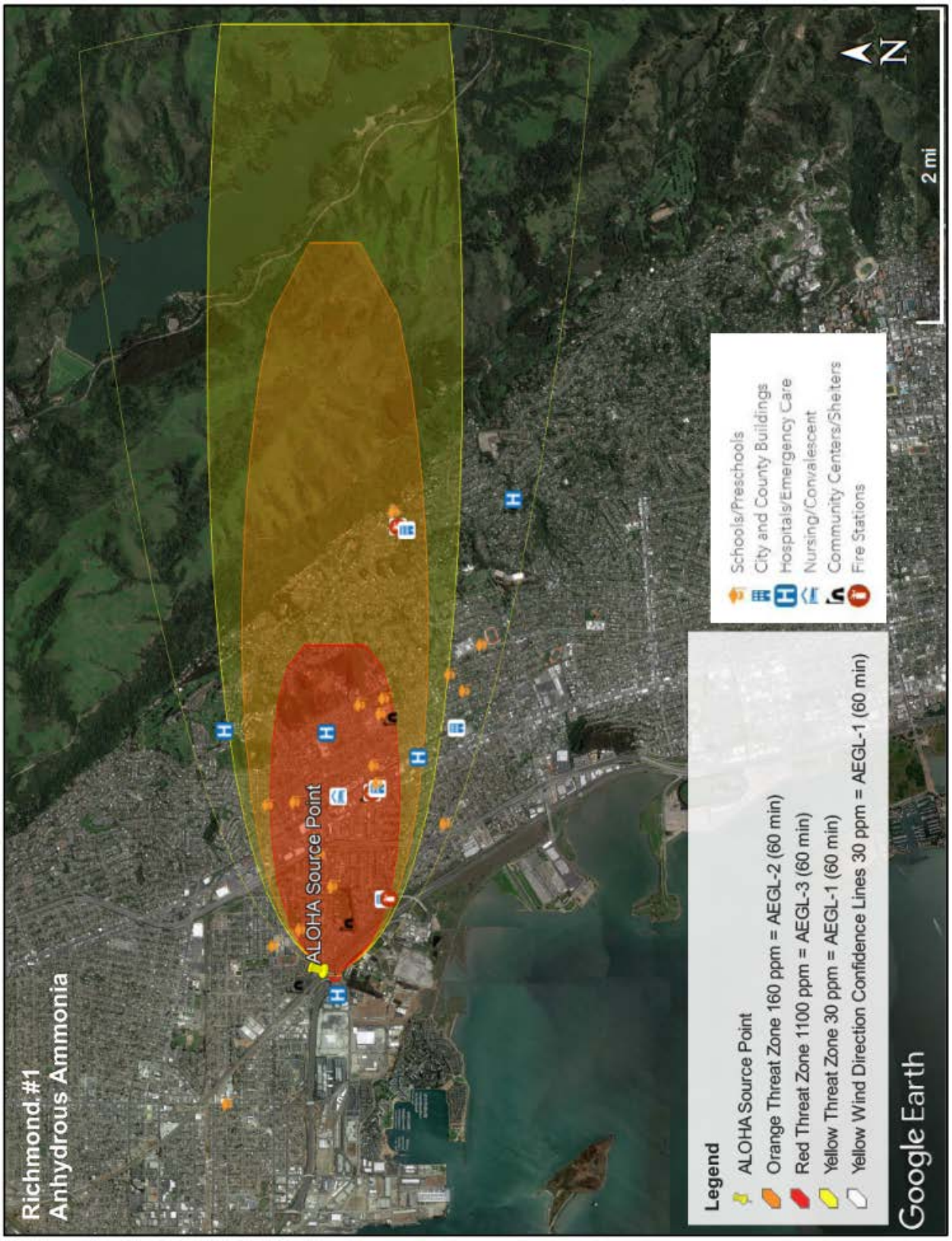

Richmond
ATCHISON VILLAGE
CITY CENTRE
SANTA FE
PULLMAN
PARK PLAZA
CORONADO
CORTEZ - STEGE
LAUREL PARK
EASTSHORE
PARK VIEW
STEGE
El Cerrito
MARINA BAY
RICHMOND ANNEX
SOUTHWEST ANNEX
Airgas
Dreisbach Enterprises
Messer
Safeway Beverage Plant
Rosie the Riveter National Historical Park
Point Isabel Regional Shoreline
99 Ranch Market
#1
Richmond #1
CalARP Location
Railroads
Pinch Point Richmond #1


Richmond
Atchison Village
Easter Hill Village
Marina Bay
Richmond Annex
#1
California Healthy Places Index
Census Tracts
Score Percentile
0 25 50 75 100
Less More
Healthy Conditions
No Data Available
Richmond #1
12" Sea Level Rise
Railroads
Pinch Point Richmond #1
Note: 12 inch Sea Level Rise is equivalent to King Tide with no Sea Level Rise



5.1.1 Scenario 1: Ammonia

ALOHA model plume mapping at Pinch Point Richmond #1 for an ammonia/anhydrous ammonia (UN ID# 1005) release is shown in the following map. The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone is approximately 2 miles long and up to a mile wide and covers a significant portion of the residential and commercial areas of east Richmond and El Cerrito. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are also residential and commercial. Much of the area to the south is either industrial or part of San Francisco Bay.

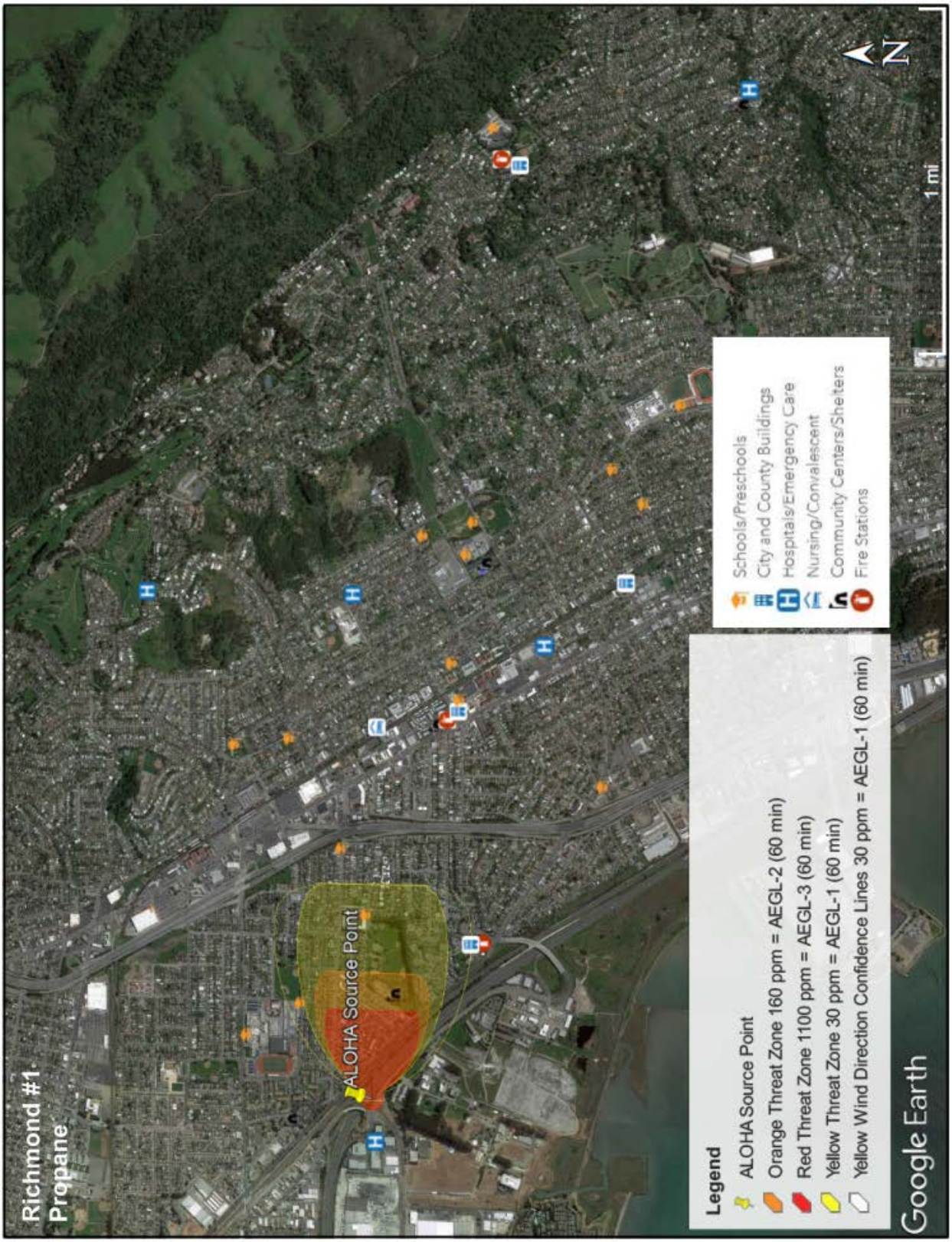

Richmond #1
Anhydrous Ammonia
ALOHA Source Point
N
2 mi
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
Google Earth

5.1.2 Scenario 2: Propane

ALOHA model plume mapping at Pinch Point Richmond #1 for propane (UN ID# 1075) release is shown in the following maps. The first map shows the extent of a propane plume release. The second map shows the area affected in the event that the tank car explodes in a BLEVE scenario.

The propane plume is approximately 1 mile long and up to ½ mile wide. The Red Threat Zone is approximately ½ mile long and up to ¼ mile wide. The entire plume covers a portion of the residential area of east Richmond and El Cerrito. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place a limited area southeast and south at risk from propane incident release. Areas to the southeast are also residential. Much of the area to the south is primarily industrial.

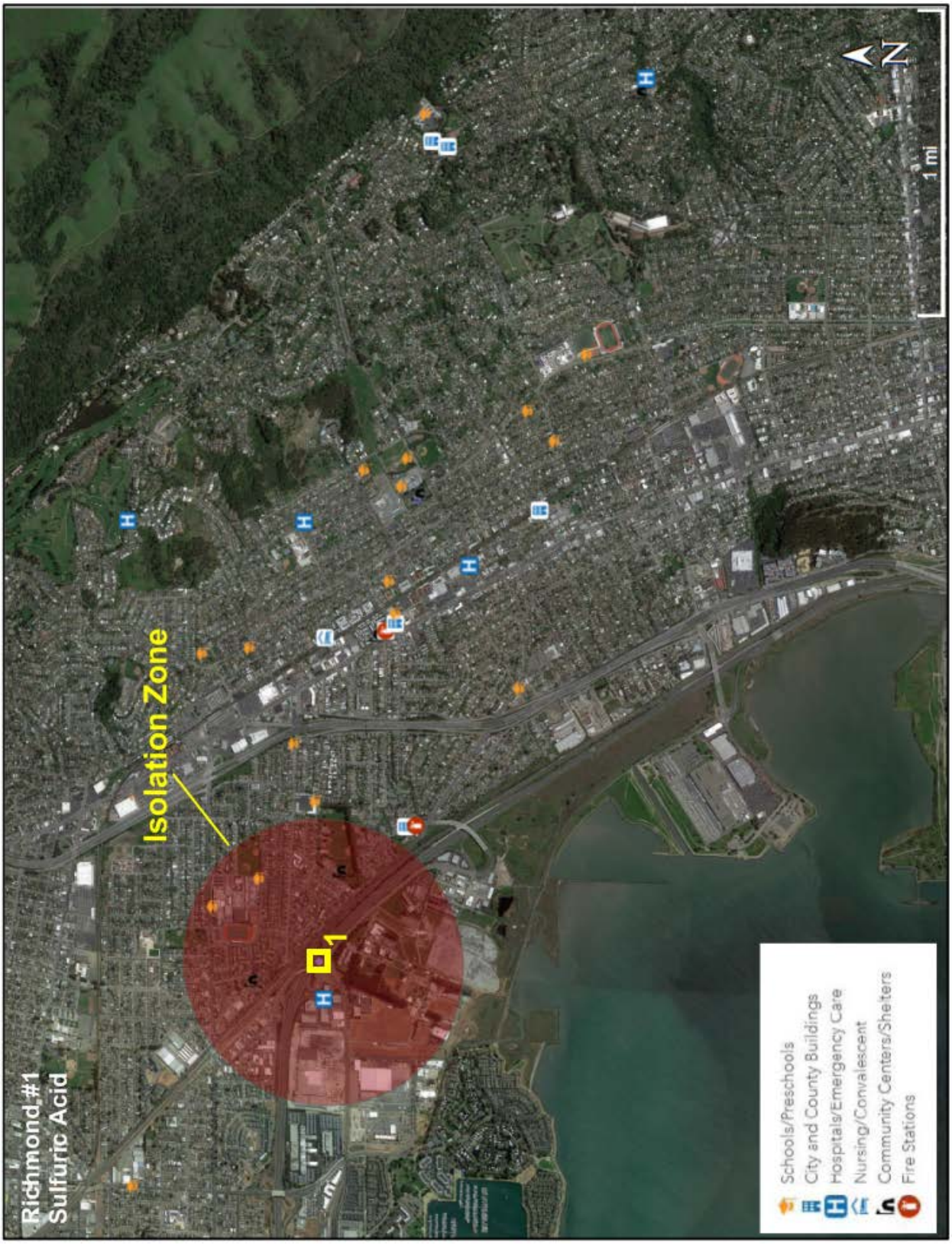
The second map shows the propane BLEVE scenario. In this scenario the area affected is known as the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. In general, areas to the northwest, north, east, and southeast are primarily residential; areas to the west and south are industrial.


Richmond #1
Propane
ALOHA Source Point
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
N
1 mi
Google Earth


Richmond #1
Propane BLEVE
ALOHA Source Point
N
1 mi
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
Google Earth

5.1.3 Scenario 3: Sulfuric Acid

The sulfuric acid (UN ID #1830) release isolation zone at Pinch Point Richmond #1 is shown in the following map. According to ERG guidelines, the isolation distance in the event that a fire is involved is ½ mile in all directions. Although slightly less extensive in area, the isolation zone is similar to the Propane BLEVE scenario. In general, areas to the northwest, north, east, and southeast are primarily residential; areas to the west and south are industrial.

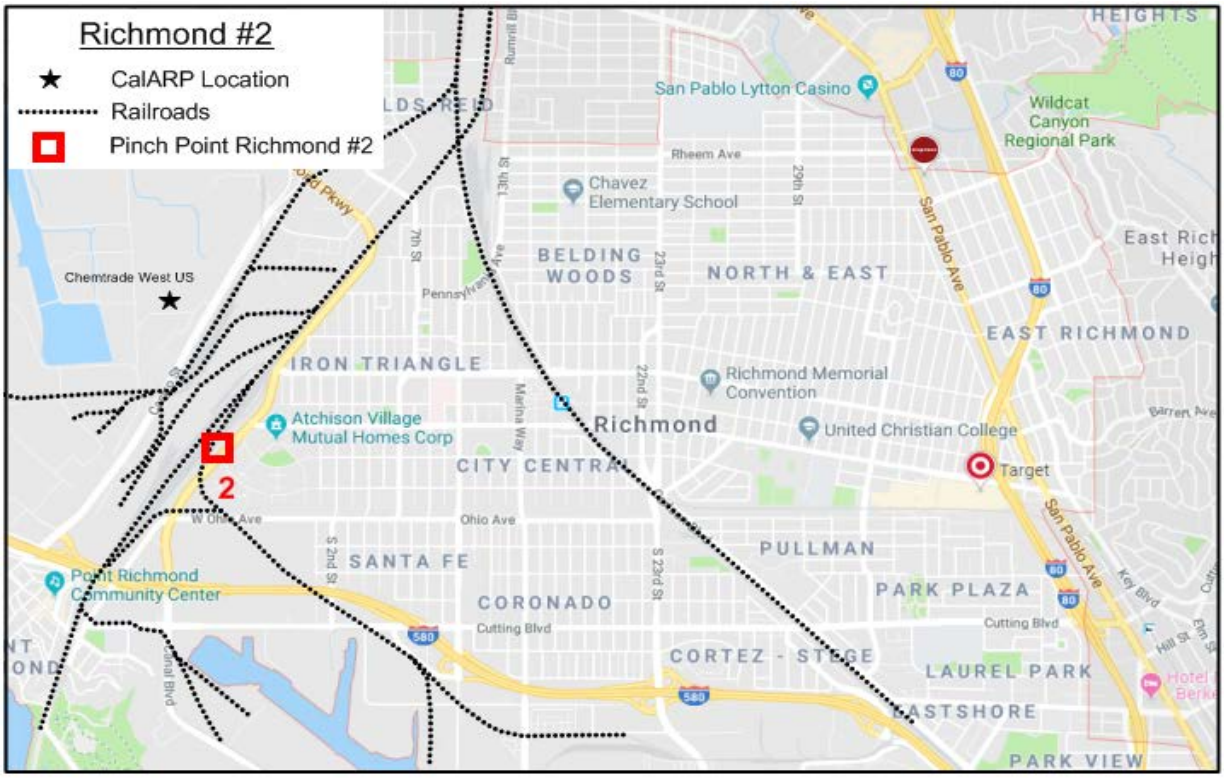

Richmond #1
Sulfuric Acid
Isolation Zone
1
N
1 mi
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations

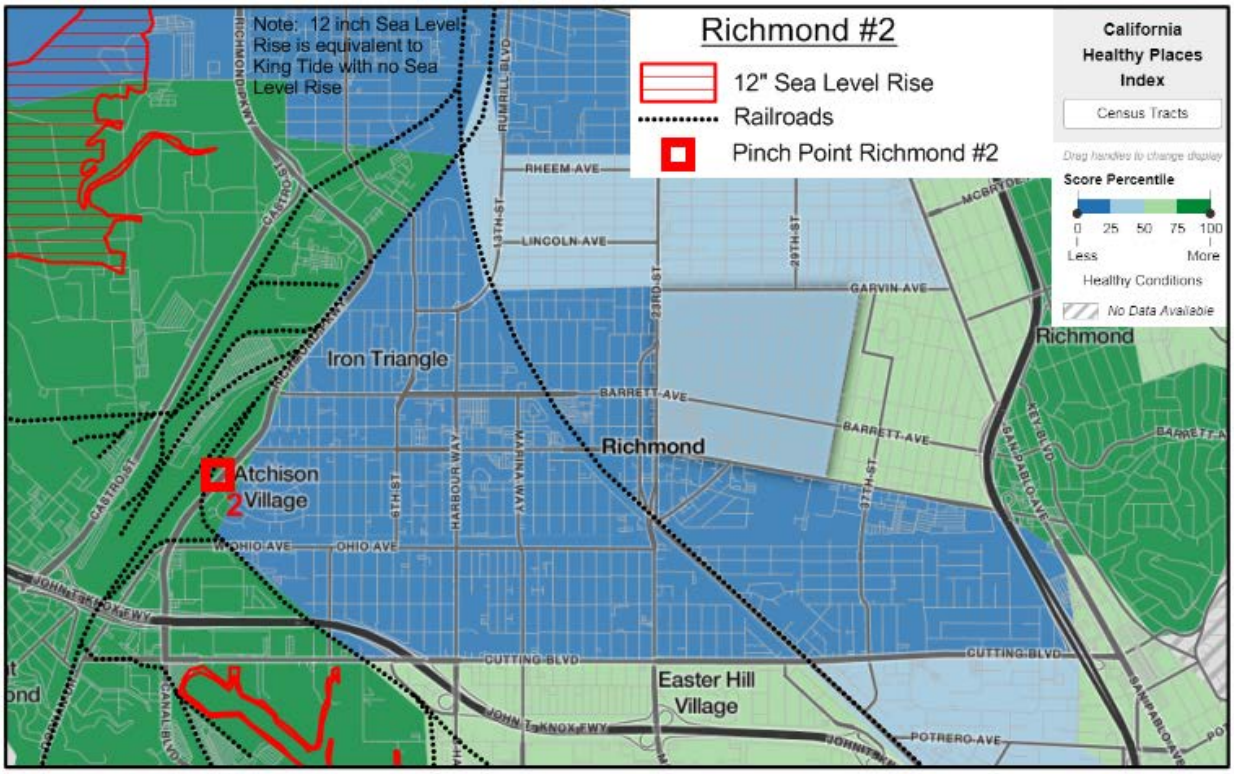
5.2 Pinch Point – Richmond #2

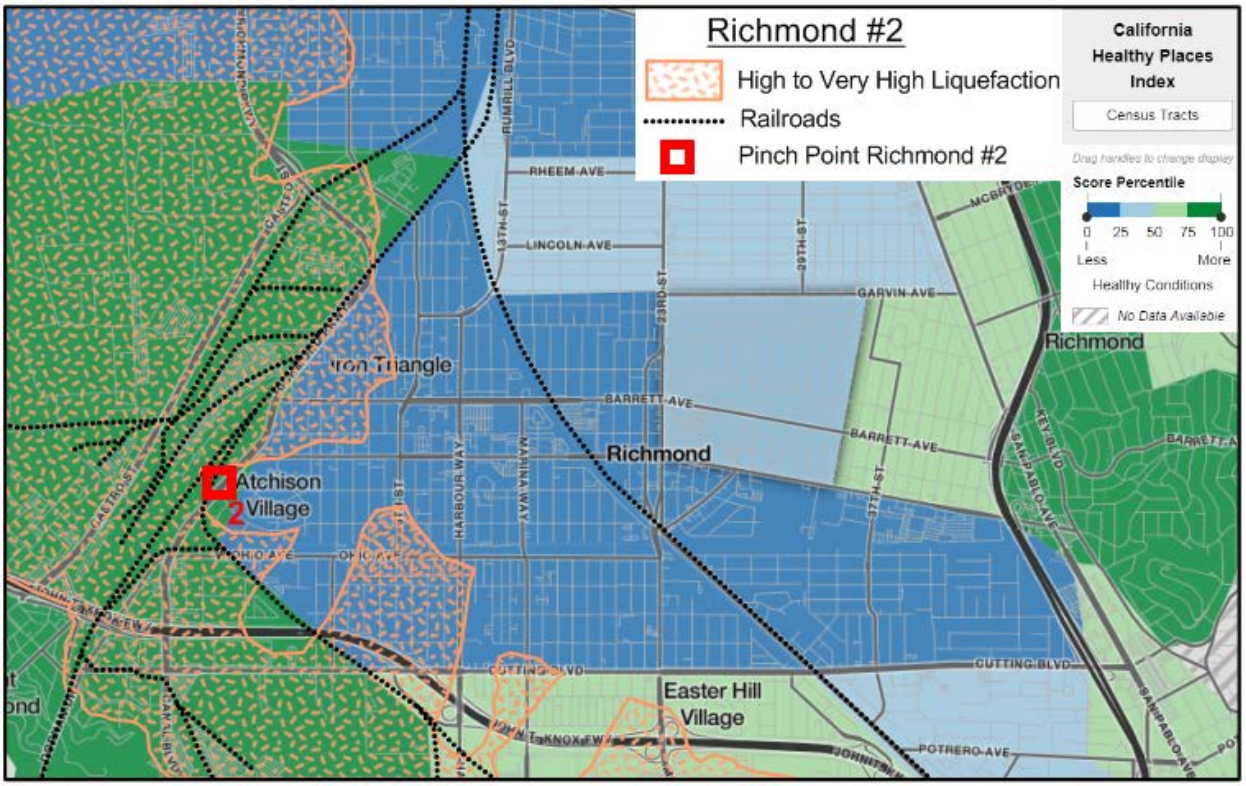
At the Richmond #2 pinch point, it will be assumed that the hazardous materials spill of a COC will result from an incident with a rail tank car holding 34,397 gallons of the ammonia/ anhydrous ammonia (worst-case scenario), a rail tank car holding 34,397 gallons of propane as LPG (worst-case scenario), and 13,350 gallons of sulfuric acid (worst-case scenario). The individual details are contained in the sections below.

Criteria used in the identification of the pinch point are summarized in the table below. Maps showing some of the criteria used in the determination of the pinch point are shown following the table.

RICHMOND PINCH POINT #2 CRITERIA		
CRITERIA	**DESCRIPTION**	**COMMENTS**
Location	Richmond Parkway south of MacDonald Ave.	
Elevation (feet above msl)	14	Above 12" rising tide
Latitude	37.934993	
Longitude	-122.374823	
Railroads	BNSF (pinch point)	Pinch point is at major rail siding
	RPRC (west)	
	UP (east)	
Highways & Arterial Roads	I-580	
	Richmond Parkway	
	Barrett Ave.	
	McDonald Ave.	
	W. Ohio Ave.	
Pipelines	Hazardous liquid pipelines parallel railroad	Co-located with rail lines at pinch point
Nearby CalARP Facilities	Chevron Refinery	
	Chemtrade West US	
Surrounding Land Use	N-industrial	
	E-commercial/residential (low to moderate income)	Vulnerable population; critical facilities
	S-industrial	
	W-industrial	
Healthy Places Index	0-25 (east and southeast; 15.8 and 22.2 percentile)	Vulnerable population; critical facilities
	75-100 (pinch point, north, south, and west)	
Wind Direction (from)	West (Feb-Nov); North (Nov-Feb)	
Rising Tides 12"	North and south of pinch point	
Liquefaction (high to very high)	Pinch point and to north, south, and west	

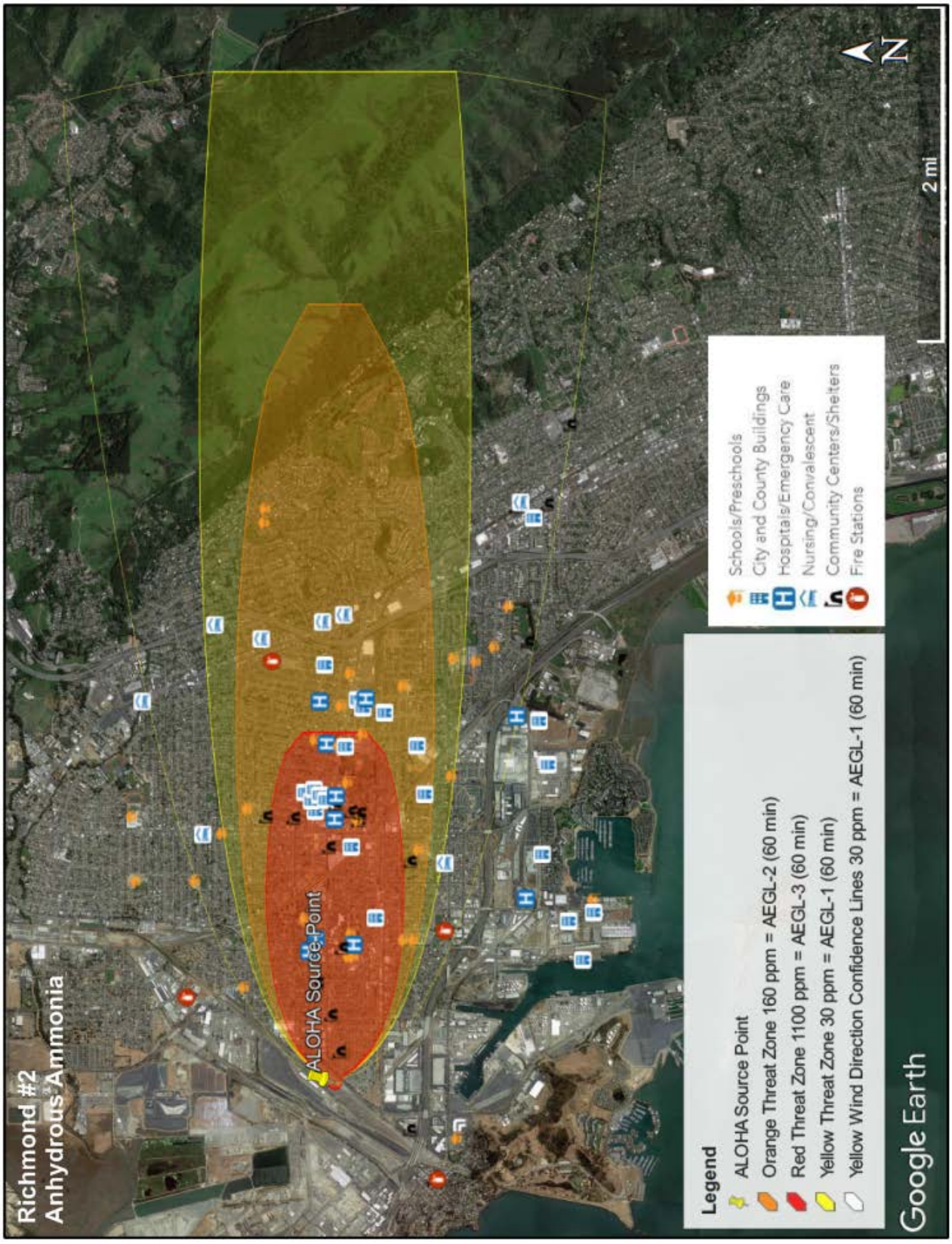

Richmond #2
CalARP Location
Railroads
Pinch Point Richmond #2
San Pablo Lytton Casino
Wildcat Canyon Regional Park
Chavez Elementary School
Rheem Ave
Chemtrade West US
BELDING WOODS
NORTH & EAST
EAST RICHMOND
IRON TRIANGLE
Richmond Memorial Convention
Atchison Village Mutual Homes Corp
Richmond
United Christian College
CITY CENTRA
Target
2
Ohio Ave
SANTA FE
PULLMAN
Point Richmond Community Center
CORONADO
PARK PLAZA
Cutting Blvd
CORTEZ - STEGE
LAUREL PARK
EASTSHORE
PARK VIEW


Note: 12 inch Sea Level Rise is equivalent to King Tide with no Sea Level Rise
Richmond #2
12" Sea Level Rise
Railroads
Pinch Point Richmond #2
California Healthy Places Index
Census Tracts
Score Percentile
0 25 50 75 100
Less
More
Healthy Conditions
No Data Available
Iron Triangle
Richmond
Atchison Village
2
RHEEM-AVE
LINCOLN-AVE
GARVIN-AVE
BARRETT-AVE
OHIO-AVE
CUTTING-BLVD
Easter Hill Village
POTRERO-AVE



5.2.1 Scenario 1: Ammonia

ALOHA model plume mapping at Pinch Point Richmond #2 for an ammonia/anhydrous ammonia (UN ID# 1005) release is shown in the following map. The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone is approximately 2 miles long and up to a mile wide and covers a significant portion of the residential and commercial areas of the central and downtown portion of the city of Richmond. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are also residential and commercial with some industry. Much of the area to the south is either industrial or part of San Francisco Bay.

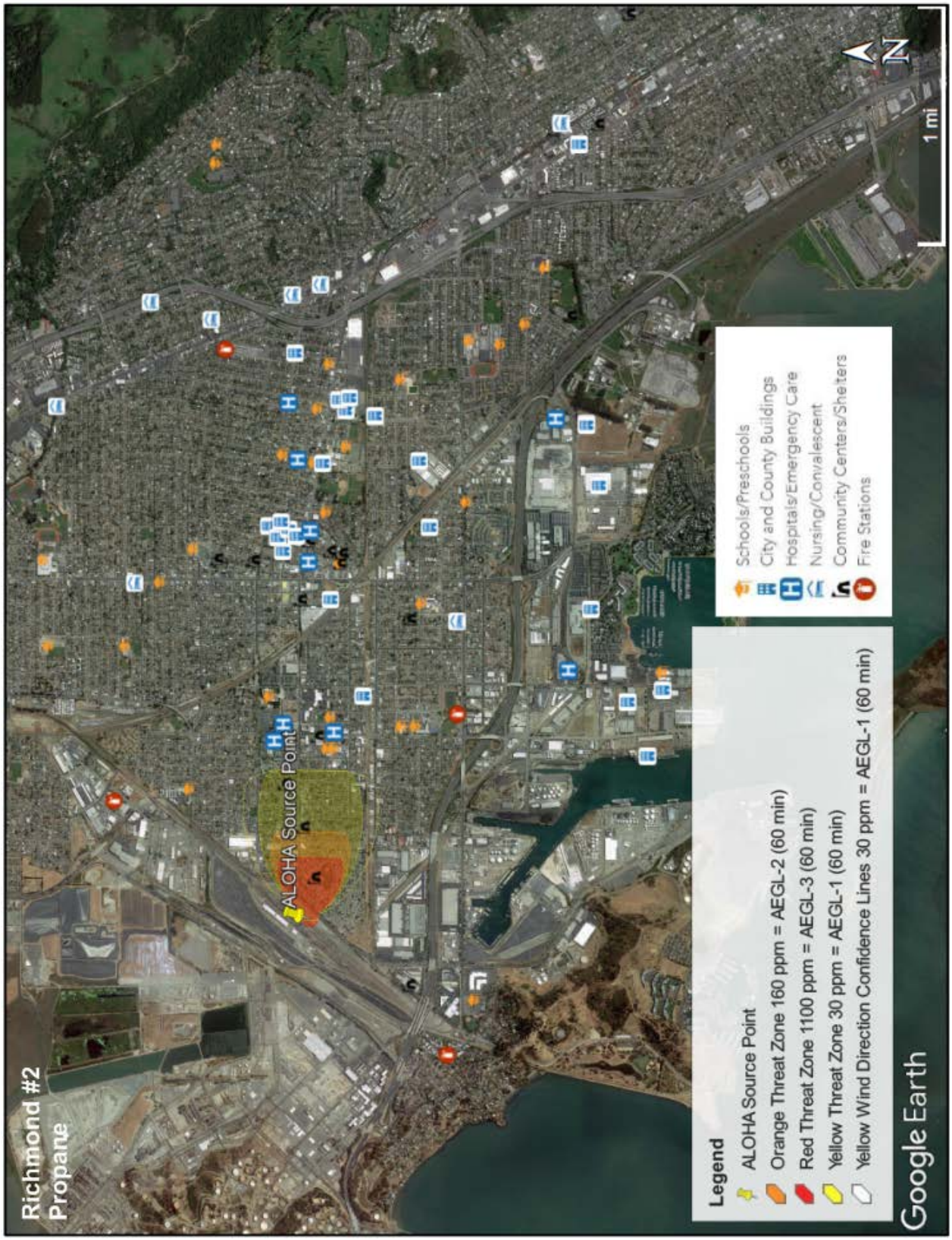

Richmond #2
Anhydrous Ammonia
ALOHA Source Point
N
2 mi
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Google Earth

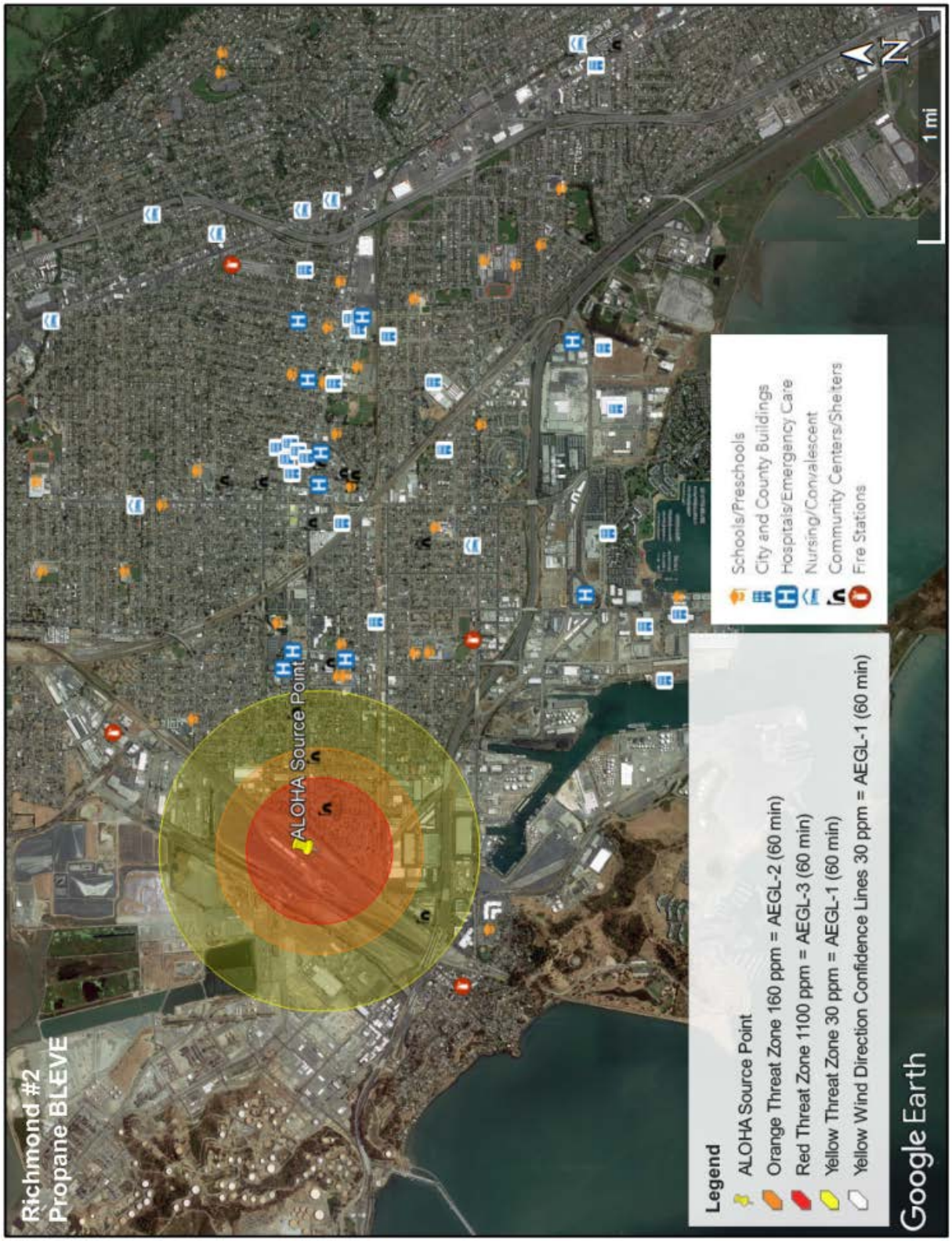
5.2.2 Scenario 2: Propane

ALOHA model plume mapping at Pinch Point Richmond #2 for propane (UN ID# 1075) release is shown in the following maps. The first map shows the extent of a propane plume release. The second map shows the area affected in the event that the tank car explodes in a BLEVE scenario.

The propane plume is approximately 1 mile long and up to ½ mile wide. The Red Threat Zone is approximately ½ mile long and up to ¼ mile wide. The entire plume covers a portion of the commercial and residential area of Richmond, including the downtown area. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place a limited area southeast and south at risk from a propane incident. Areas to the southeast are also residential. Much of the area to the south is primarily industrial.

The second map shows the Propane BLEVE scenario. In this scenario the area affected is known as the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. In general, areas to the northeast, east, and southeast are primarily commercial and residential; areas to the northwest, west, and south are industrial.


Richmond #2
Propane
ALOHA Source Point
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
N
1 mi
Google Earth


Richmond #2
Propane BLEVE
ALOHA Source Point
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
1 mi
N
Google Earth

5.2.3 Scenario 3: Sulfuric Acid

The sulfuric acid (UN ID #1830) release isolation zone at Pinch Point Richmond #2 is shown in the following map. According to ERG guidelines, the isolation distance in the event that a fire is involved is ½ mile in all directions. Although slightly less extensive in area, the isolation zone is similar to the Propane BLEVE scenario. In general, areas to the northeast and east are primarily residential; areas to the west and south are industrial.

.

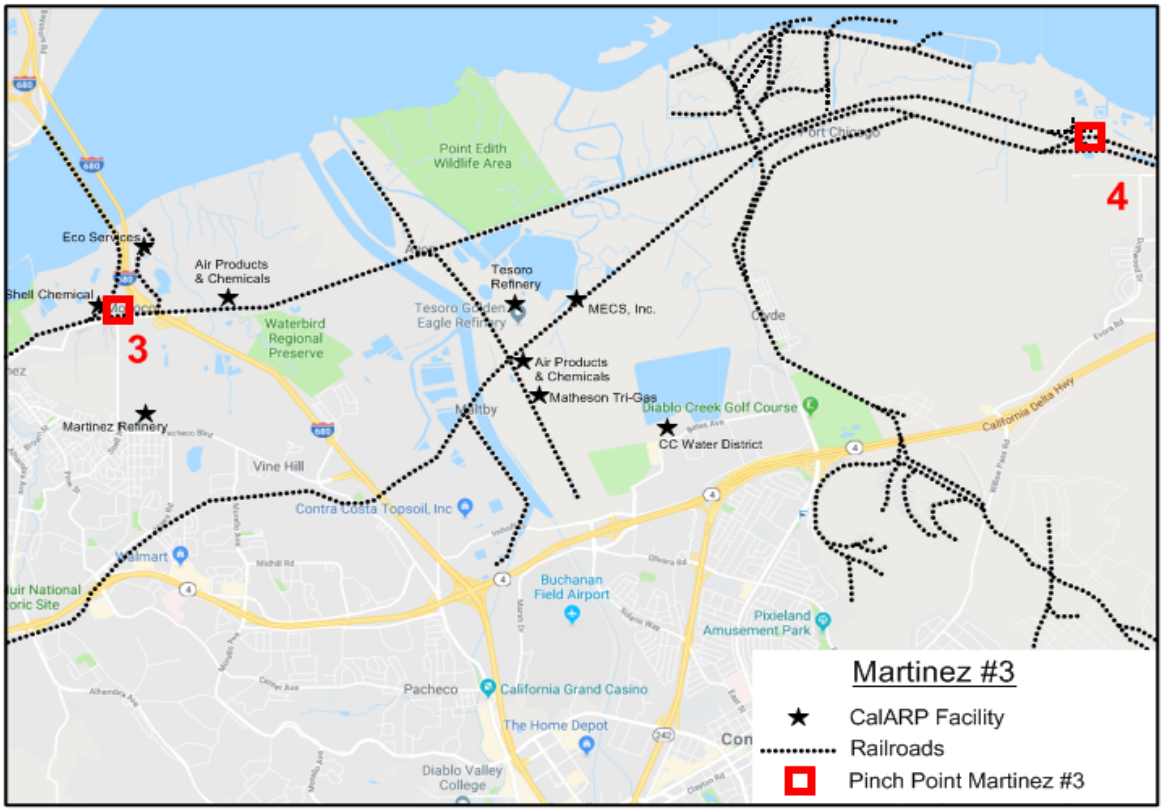

N
1 mi
Isolation Zone
Richmond #2
Sulfuric Acid
2
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations

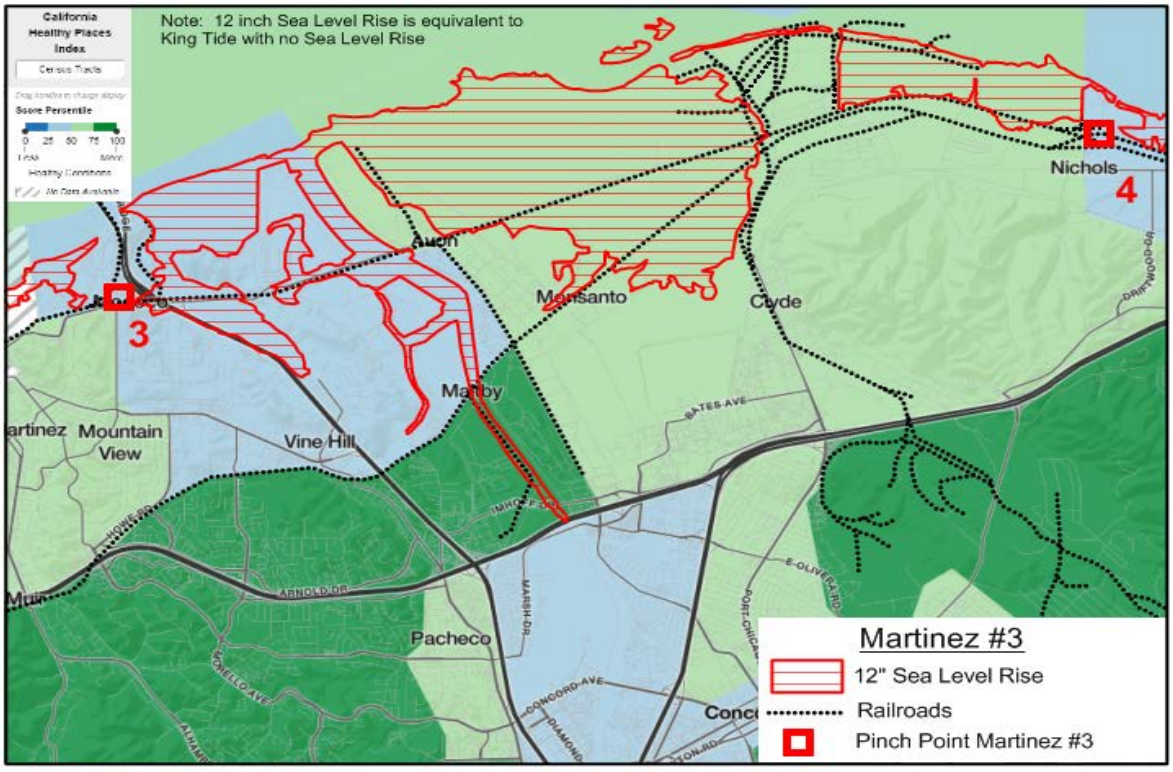
5.3 Pinch Point – Martinez #3

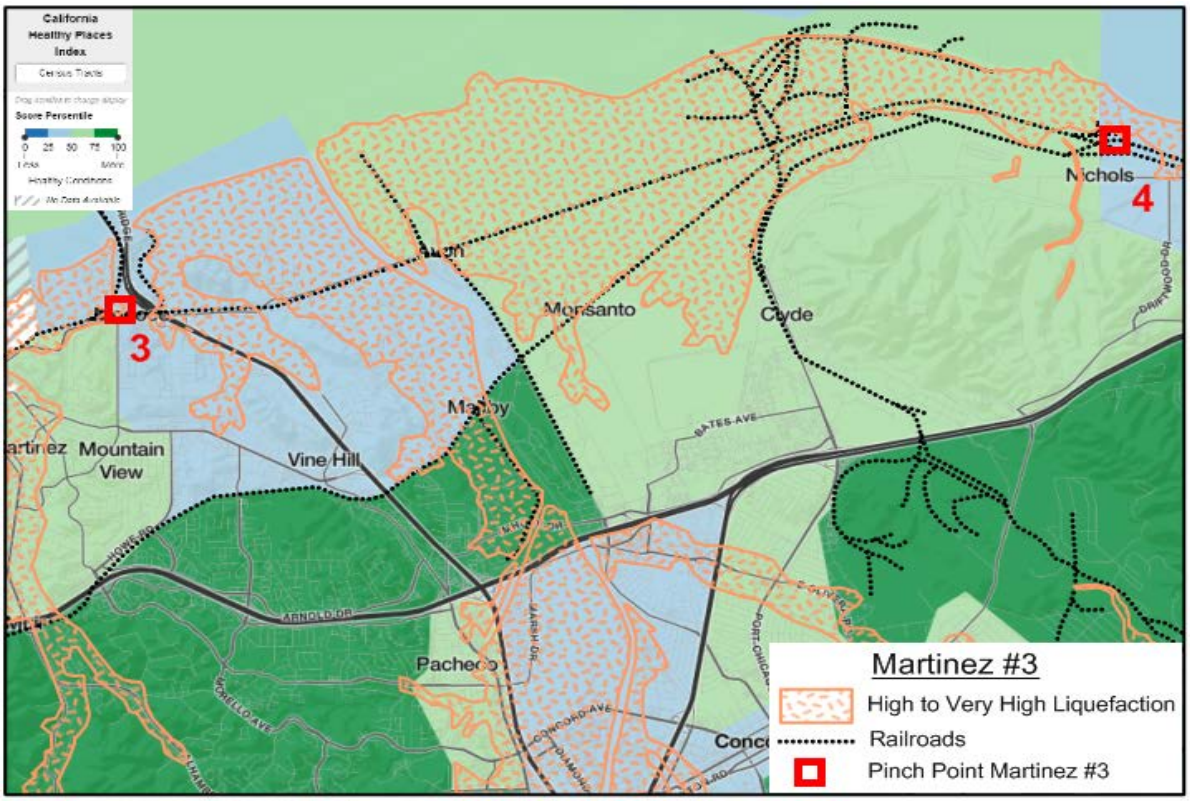
At the Martinez #3 pinch point, it will be assumed that the hazardous materials spill of a COC will result from an incident with a rail tank car holding 34,397gallons of the ammonia/anhydrous ammonia (worst-case scenario), a rail tank car holding 34,397 gallons of propane as LPG (worst-case scenario), and 13,350 gallons of sulfuric acid (worst-case scenario). The individual details are contained in the sections below.

Criteria used in the identification of the pinch point are summarized in the table below. Maps showing some of the criteria used in the determination of the pinch point are shown following the table.

MARTINEZ PINCH POINT #3 CRITERIA		
CRITERIA	**DESCRIPTION**	**COMMENTS**
Location	Shell Ave. and Marina Vista Ave.	
Elevation (feet above msl)	13	Above 12" rising tide
Latitude	38.026135	
Longitude	-122.117939	
Railroads	UP (pinch point)	Pinch point along major rail line
	BNSF (south)	
Highways & Arterial Roads	I-680	
	Marina Vista Ave	
	Shell Ave	
	Pacheco Blvd	
	CA-4	
Pipelines	Numerous crude oil, hazardous liquid, and gas pipelines	Co-located with rail lines at pinch point
Nearby CalARP Facilities	Shell Chemical	Immediate vicinity of pinch point
	Martinez Refinery	Close to pinch point
	Air Products & Chemicals (2 locations)	1 location close to pinch point
	Eco Services	Close to pinch point
	Tesoro Refinery	
	Matheson Tri-Gas	
	CC Water District	
	MECS, Inc.	
Surrounding Land Use	N-industrial	
	E-industrial	
	S-commercial/residential (low to moderate income)	Vulnerable population
	W-commercial (downtown)/residential (moderate income)	Vulnerable population; critical facilities
Healthy Places Index	25-50 (pinch point, N, E, and SE)	
	50-75 (S and W)	
Wind Direction (from)	West (Feb-Nov); North (Nov-Feb)	
Rising Tides 12"	East and west of pinch point	Rail lines in areas 12" rising tide
Liquefaction (high to very high)	At pinch point, east and west of pinch point	Railroads in areas of liquefaction

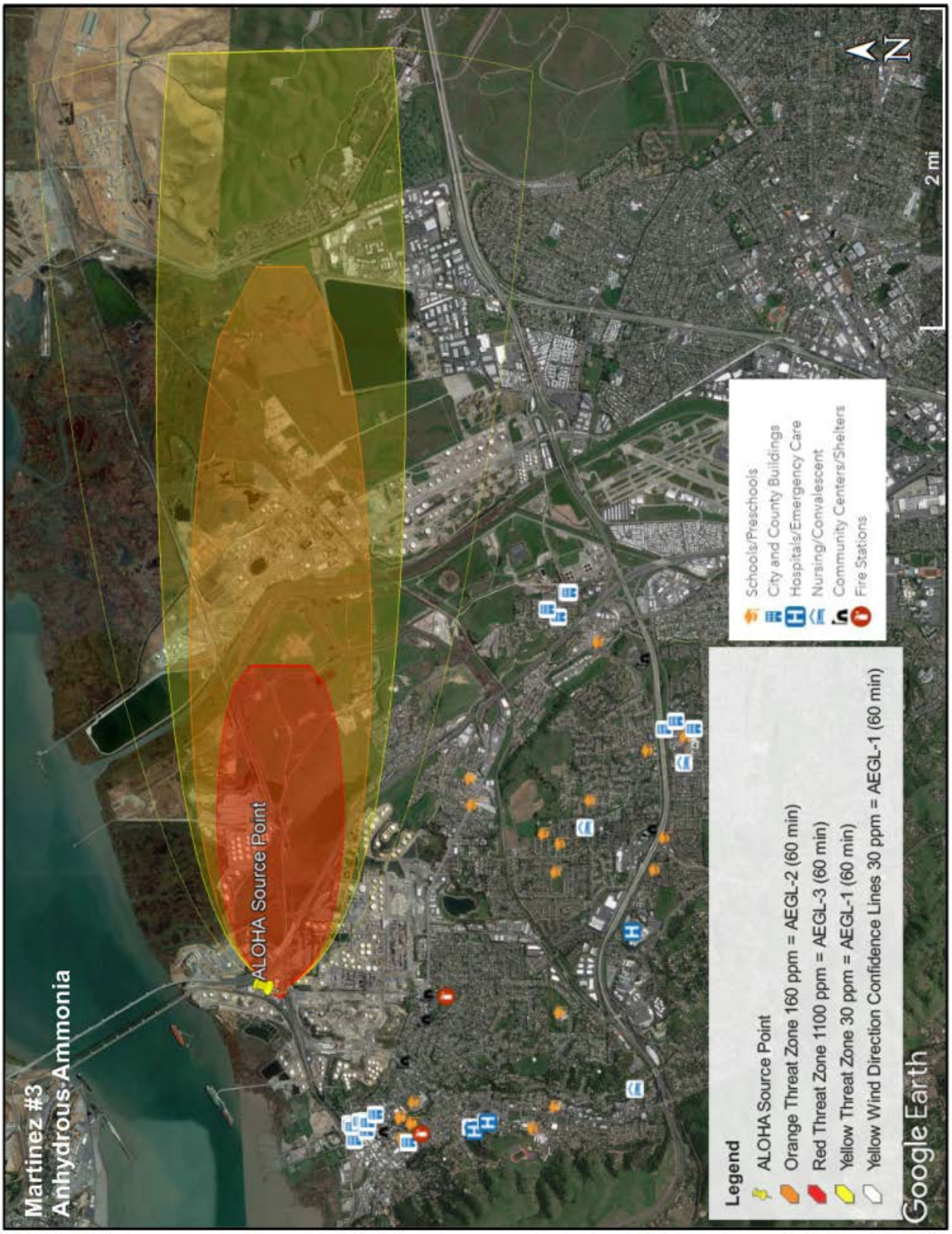

Point Edith Wildlife Area
Eco Services
Air Products & Chemicals
Shell Chemical
Tesoro Refinery
MECS, Inc.
Waterbird Regional Preserve
Air Products & Chemicals
Matheson Tri-Gas
Martinez Refinery
Diablo Creek Golf Course
CC Water District
Vine Hill
Contra Costa Topsoil, Inc
Walmart
Buchanan Field Airport
Pixieland Amusement Park
Pacheco
California Grand Casino
The Home Depot
Diablo Valley College
3
4
Martinez #3
CalARP Facility
Railroads
Pinch Point Martinez #3


California Healthy Places Index
Note: 12 inch Sea Level Rise is equivalent to King Tide with no Sea Level Rise
Nichols
Monsanto
Clyde
Martinez
Mountain View
Vine Hill
Pacheco
3
4
Martinez #3
12" Sea Level Rise
Railroads
Pinch Point Martinez #3



5.3.1 Scenario 1: Ammonia

ALOHA model plume mapping at Pinch Point Martinez #3 for an ammonia/anhydrous ammonia (UN ID# 1005) release is shown in the following map. The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone is approximately 2 miles long and up to a mile wide and covers the industrial area northeast of the city of Martinez, including oil refineries. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are also industrial. Much of the area to the south is partly industrial and partly residential.

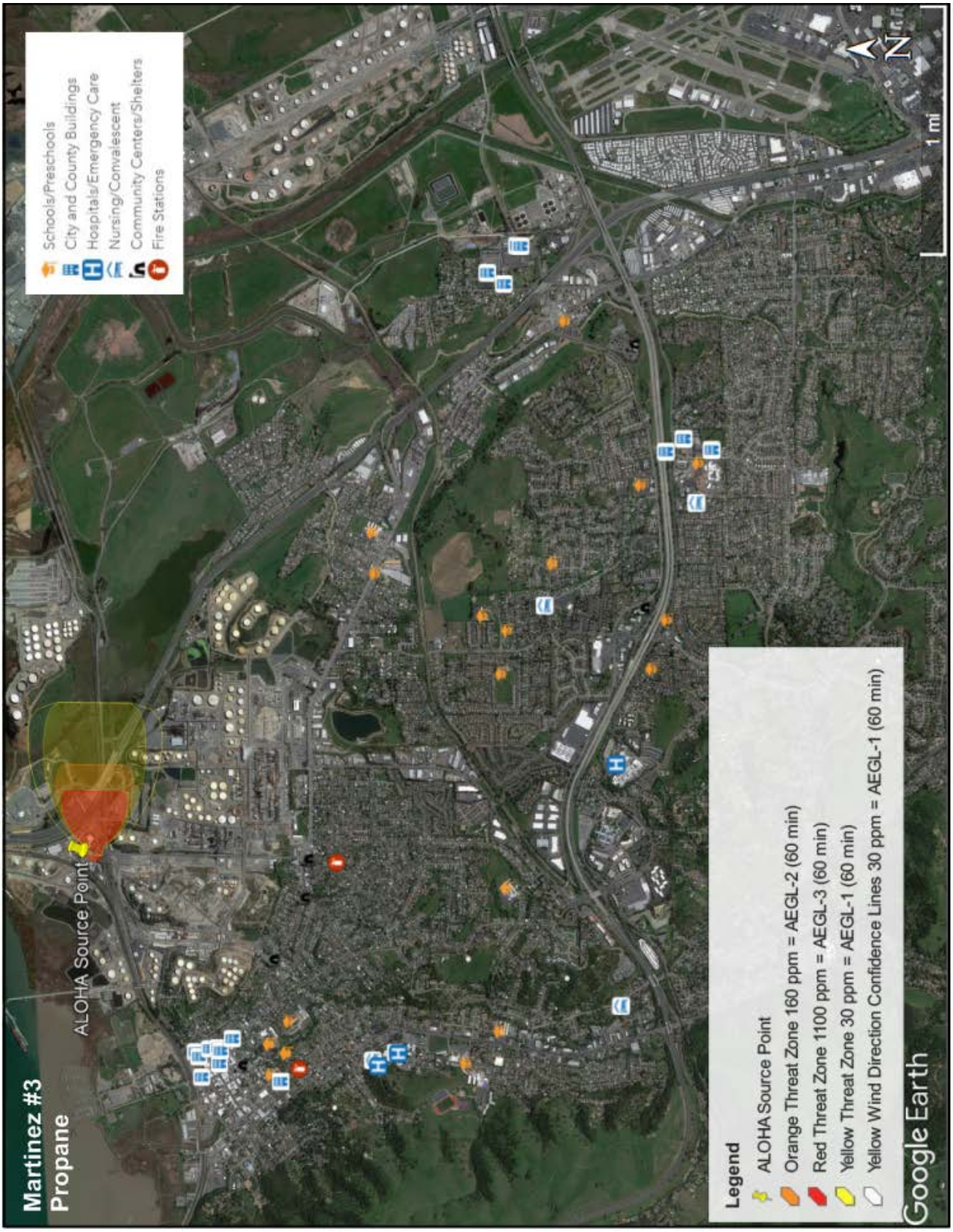

Martinez #3
Anhydrous Ammonia
ALOHA Source Point
N
2 mi
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
Google Earth

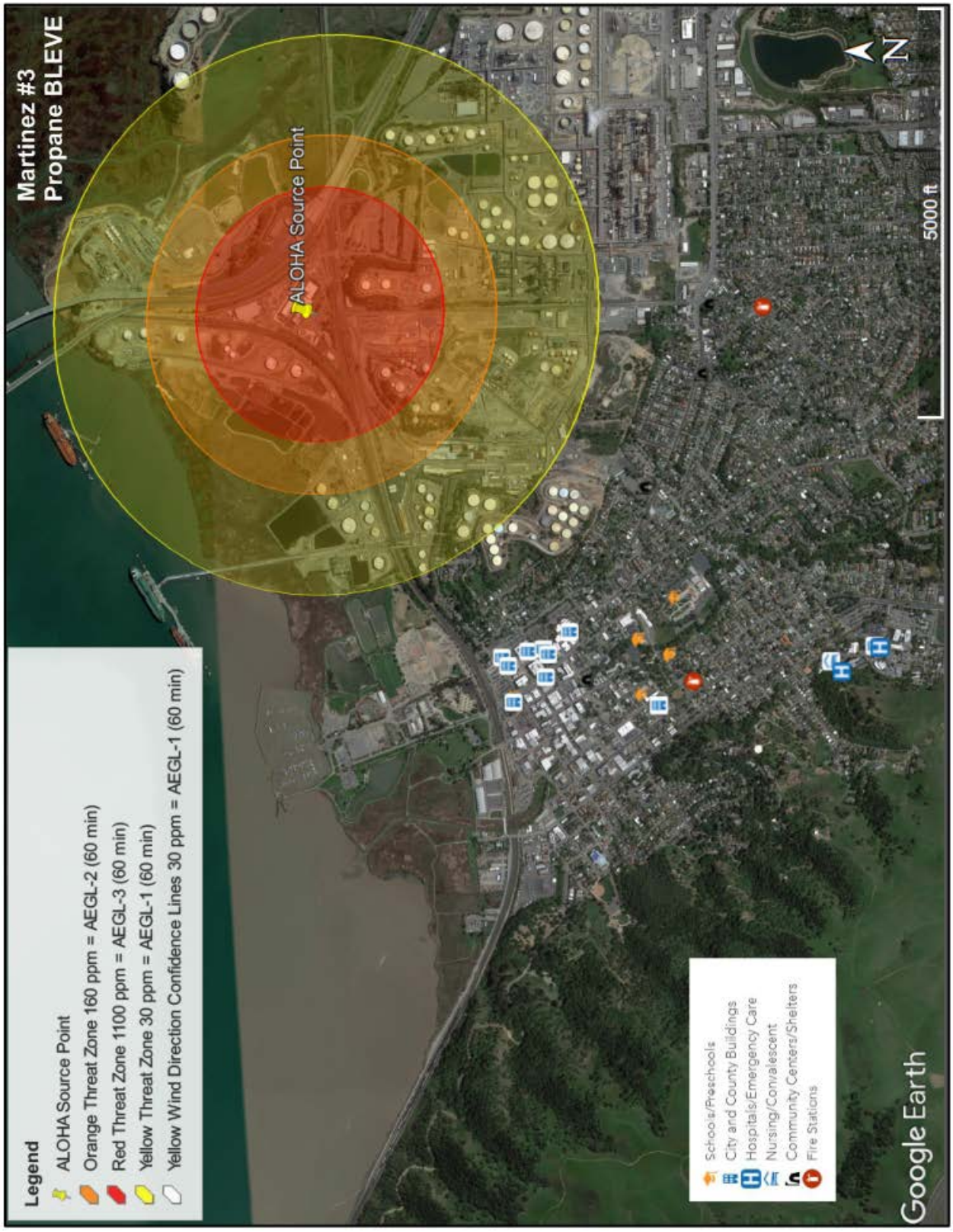
5.3.2 Scenario 2: Propane

ALOHA model plume mapping at Pinch Point Martinez #3 for propane (UN ID# 1075) release is shown in the following maps. The first map shows the extent of a propane plume release. The second map shows the area affected in the event that the tank car explodes in a BLEVE scenario.

The propane plume is approximately 1 mile long and up to ½ mile wide. The Red Threat Zone is approximately ½ mile long and up to ¼ mile wide. The entire plume covers a portion of the industrial area in the northeastern part of Martinez. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place the industrial area south of the pinch point at risk from a propane incident.

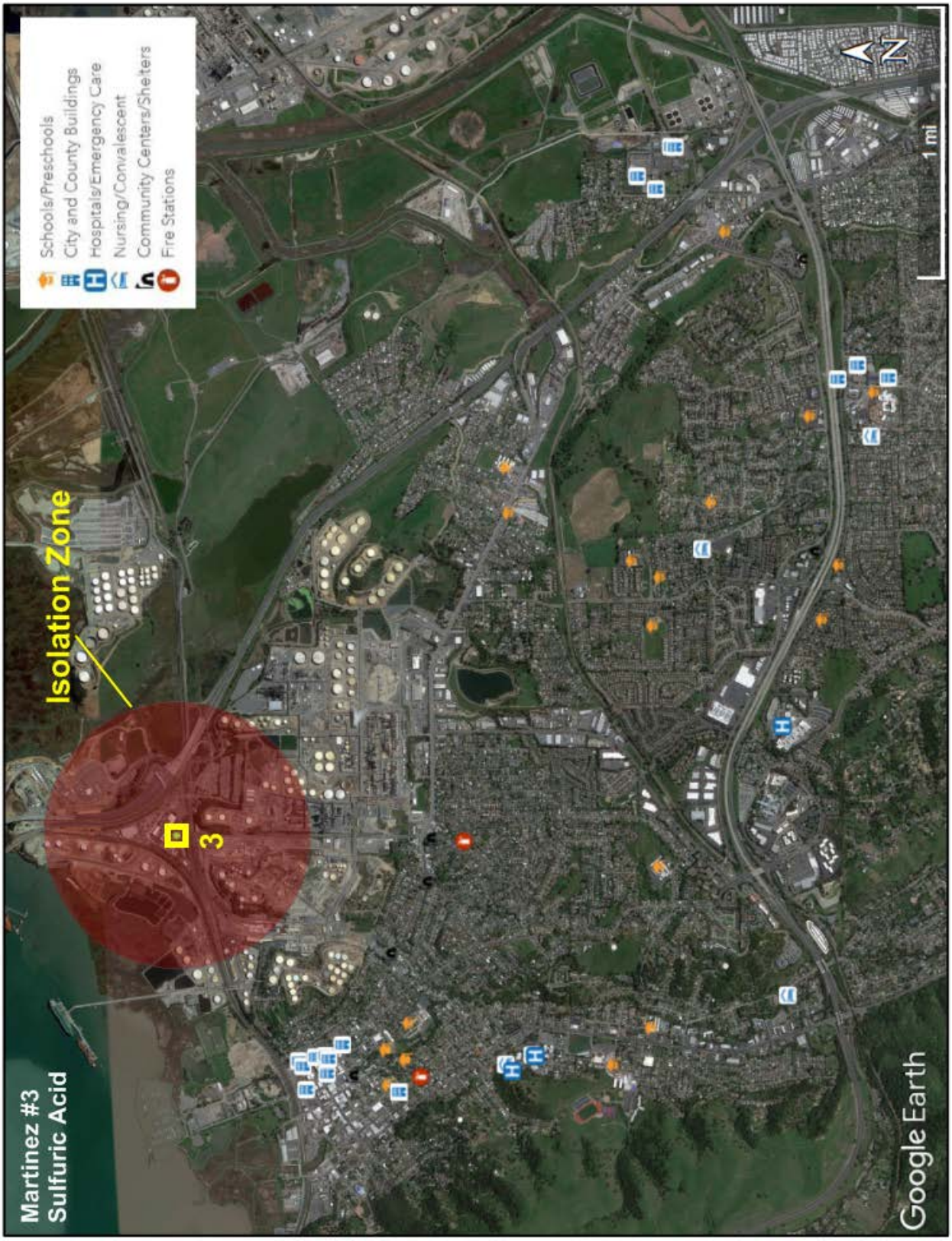
The second map shows the Propane BLEVE scenario. In this scenario the area affected is known as the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. The entire area affected by this scenario is industrial, including oil refineries.


Martinez #3
Propane
ALOHA Source Point
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
N
1 mi
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Google Earth


Martinez #3
Propane BLEVE
ALOHA Source Point
N
5000 ft
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
Google Earth

5.3.3 Scenario 3: Sulfuric Acid

The sulfuric acid (UN ID #1830) release isolation zone at Pinch Point Martinez #3 is shown in the following map. According to ERG guidelines, the isolation distance in the event that a fire is involved is ½ mile in all directions. Although slightly less extensive in area, the isolation zone is similar to the Propane BLEVE scenario. The entire isolation zone is industrial, including oil refineries.

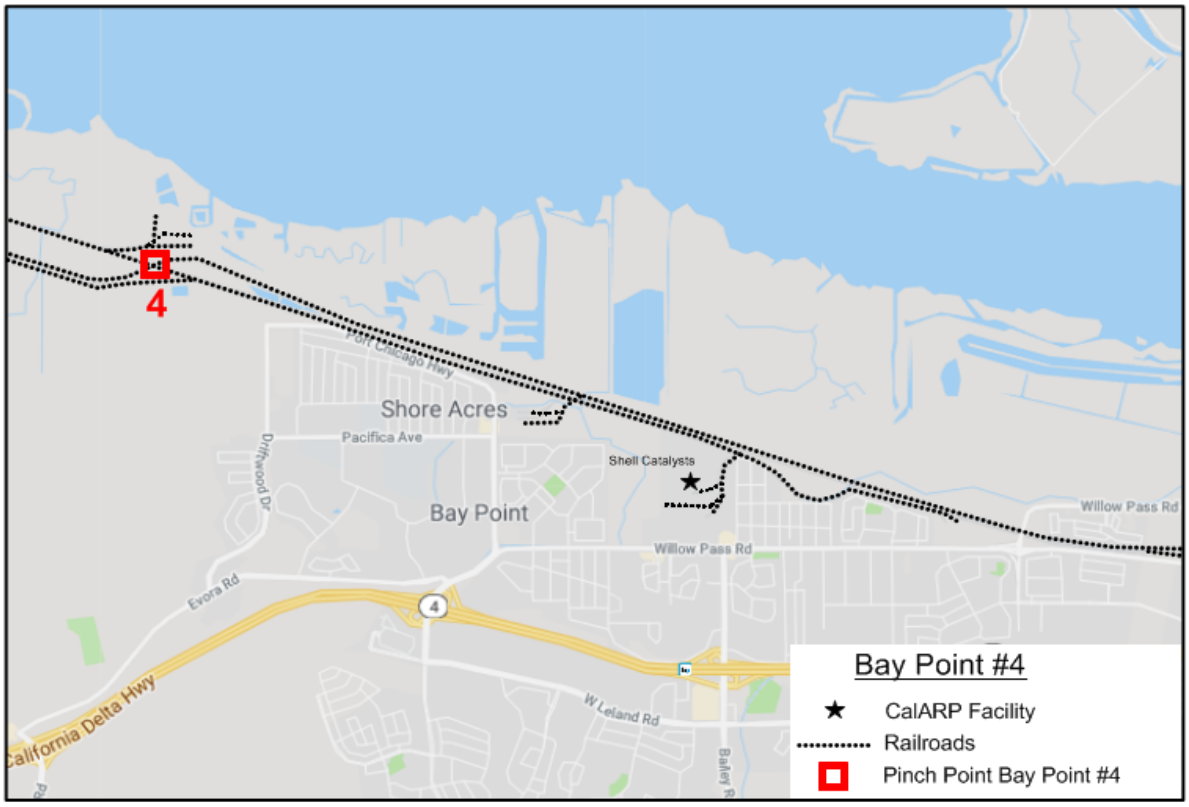

Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
Isolation Zone
3
Martinez #3
Sulfuric Acid
N
1 mi
Google Earth

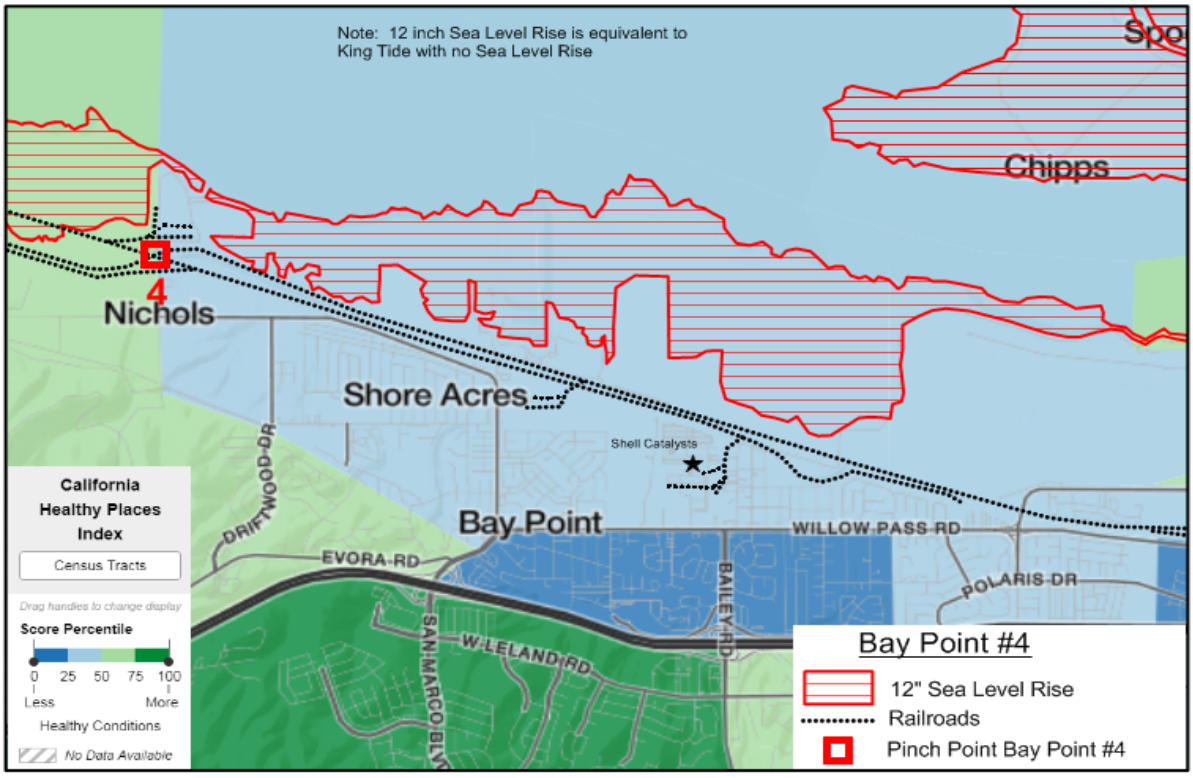
5.4 Pinch Point – Bay Point #4

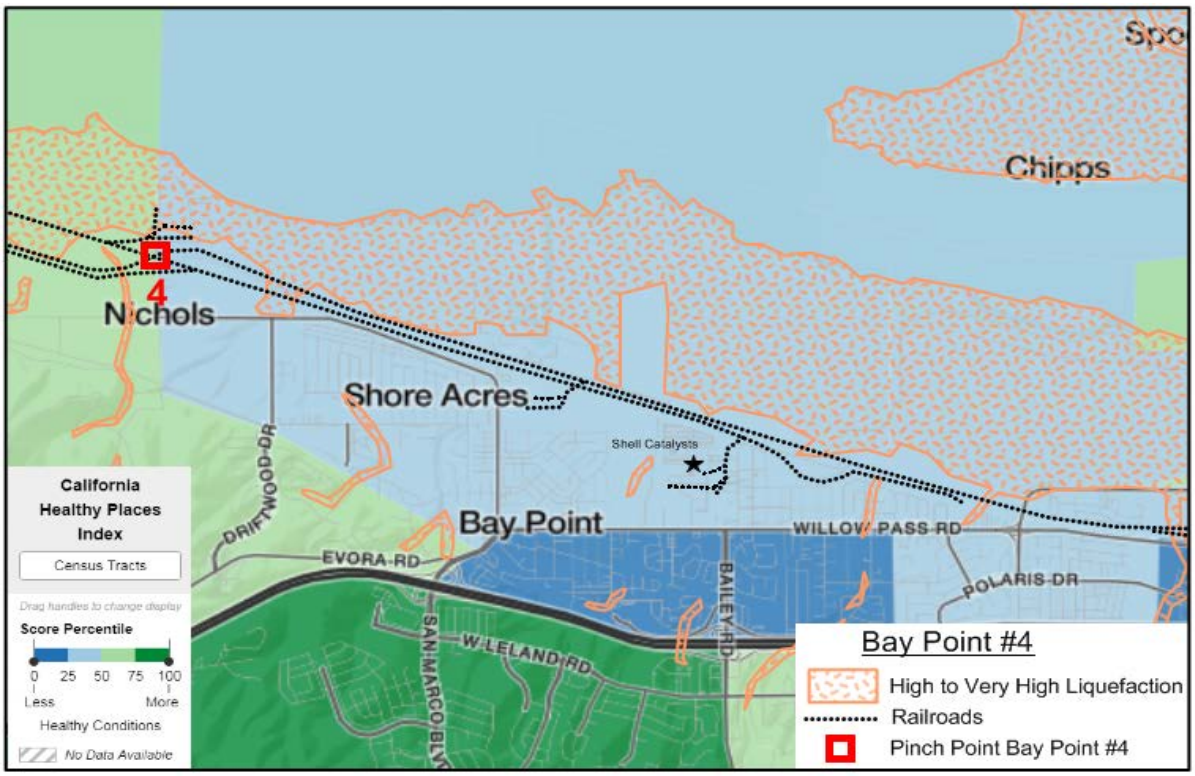
At the Bay Point #4 pinch point, it will be assumed that the hazardous materials spill of a COC will result from an incident with a rail tank car holding 34,397 gallons of the ammonia/anhydrous ammonia (worst-case scenario), a rail tank car holding 34,397 gallons of propane as LPG (worst-case scenario), and 13,350 gallons of sulfuric acid (worst-case scenario). The individual details are contained in the sections below.

Criteria used in the identification of the pinch point are summarized in the table below. Maps showing some of the criteria used in the determination of the pinch point are shown following the table.

BAY POINT PINCH POINT #4 CRITERIA		
CRITERIA	**DESCRIPTION**	**COMMENTS**
Location	Nichols Rd. North of Port Chicago Highway	
Elevation (feet above msl)	18	Above 12" rising tide
Latitude	38.045102	
Longitude	-121.987738	
Railroads	BNSF (pinch point)	Pinch point at railroad junction
	UP (pinch point)	Pinch point at railroad junction
Highways & Arterial Roads	CA-4	
	Kinney Blvd.	
	Port Chicago Highway	
Pipelines	Hazardous liquid, and gas pipelines	Partially co-located with rail lines at pinch point
Nearby CalARP Facilities	3 miles southwest of pinch point	
	Tesoro Refinery	
	Air Products and Chemcial	
	Matheson Tri-Gas	
	MECS	
	CC Water District	
	Shell Catalysts to east-southeast	
Surrounding Land Use	N-industrial/open land	
	E, S, W-open land/some industrial	
	SE-residential (low to moderate income)	Vulnerable population
Healthy Places Index	25-50 (pinch point and east)	
	50-75 (pinch point and west)	
Wind Direction (from)	West (Feb-Nov); North (Nov-Feb)	
Rising Tides 12"	Northwest and northeast	Rail line northwest in area of 12' rising tide
Liquefaction (high to very high)	Immediately north, northwest, and northeast	Rail lines partially in area of liquefaction

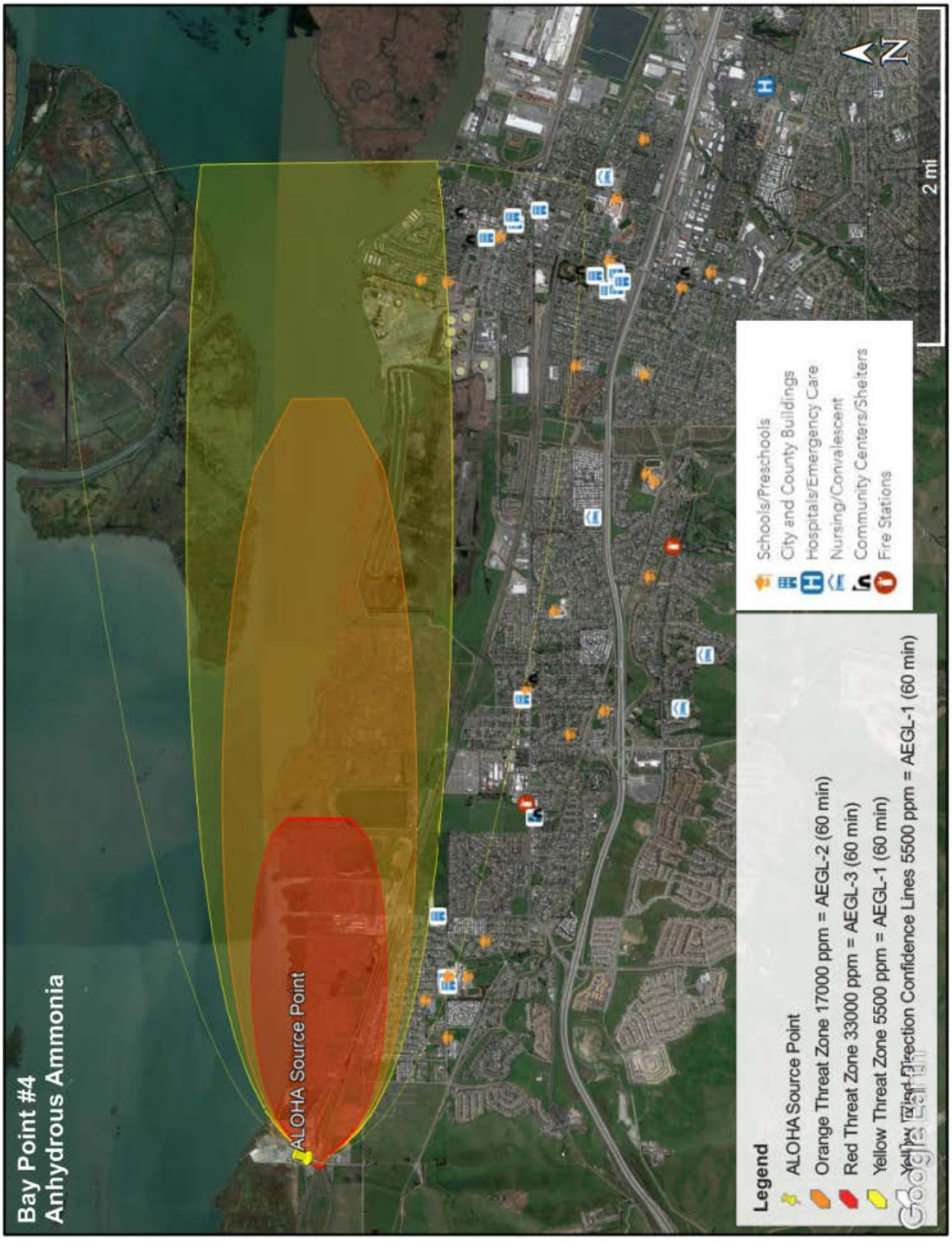

4
Shore Acres
Pacifica Ave
Shell Catalysts
Bay Point
Willow Pass Rd
Evora Rd
4
California Delta Hwy
W Leland Rd
Bay Point #4
CalARP Facility
Railroads
Pinch Point Bay Point #4


Note: 12 inch Sea Level Rise is equivalent to
King Tide with no Sea Level Rise
Chipps
4
Nichols
Shore Acres
Shell Catalysts
Bay Point
DRIFTWOOD DR
EVORA RD
WILLOW PASS RD
POLARIS DR
BAILEY RD
W LELAND RD
SAN MARCO BLVD
California
Healthy Places
Index
Census Tracts
Drag handles to change display
Score Percentile
0 25 50 75 100
Less More
Healthy Conditions
No Data Available
Bay Point #4
12" Sea Level Rise
Railroads
Pinch Point Bay Point #4



5.4.1 Scenario 1: Ammonia

ALOHA model plume mapping at Pinch Point Bay Point #4 for an ammonia/anhydrous ammonia (UN ID# 1005) release is shown in the following map. The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone is approximately 2 miles long and up to a mile wide, and covers the industrial area and natural open land area along Suisun Bay north of the cities of Bay Point and Pittsburg. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are within the commercial, residential, and downtown areas of both Bay Point and Pittsburg.

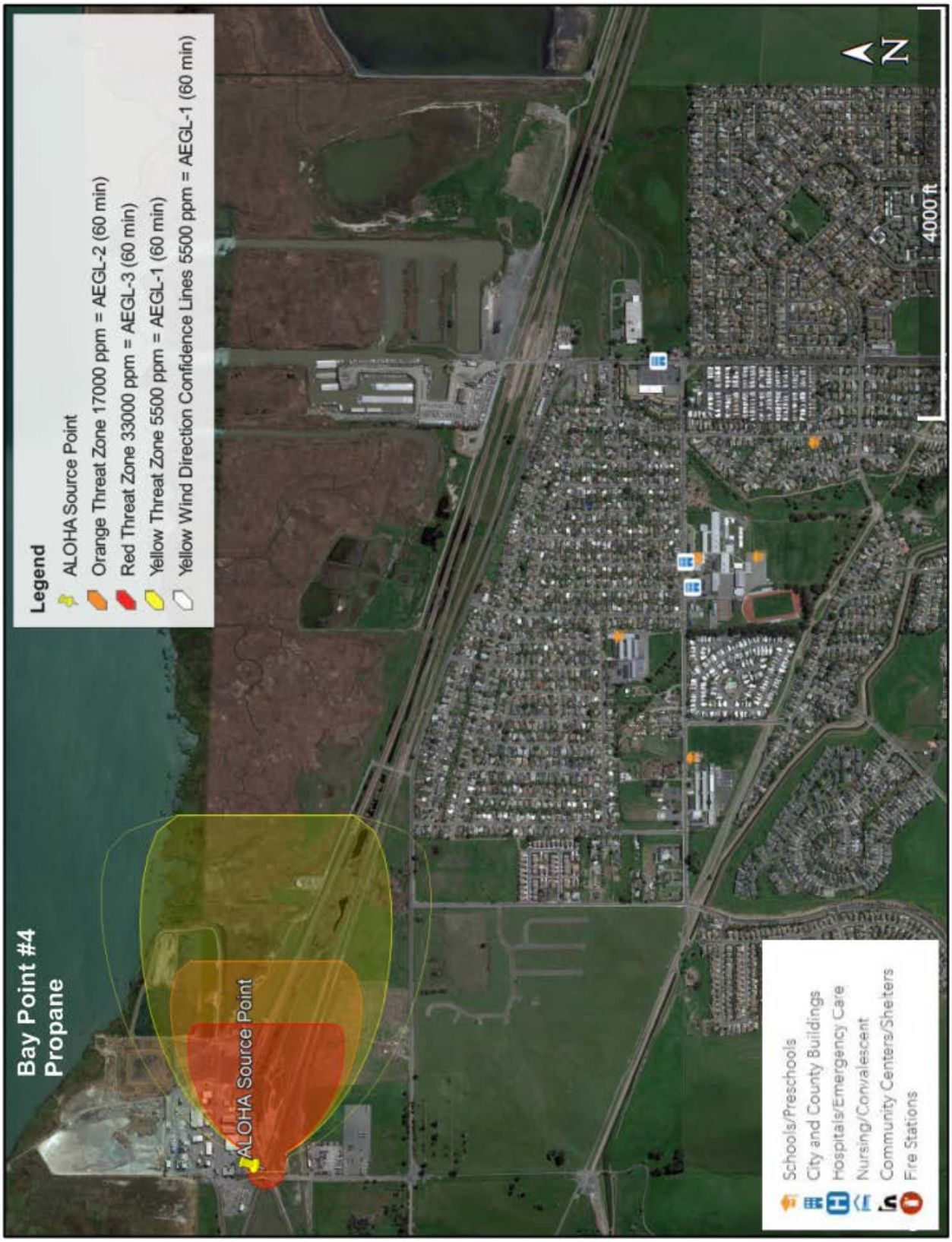

Bay Point #4
Anhydrous Ammonia
ALOHA Source Point
N
2 mi
Legend
ALOHA Source Point
Orange Threat Zone 17000 ppm = AEGL-2 (60 min)
Red Threat Zone 33000 ppm = AEGL-3 (60 min)
Yellow Threat Zone 5500 ppm = AEGL-1 (60 min)
Yellow Dispersion Direction Confidence Lines 5500 ppm = AEGL-1 (60 min)
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
Google Earth

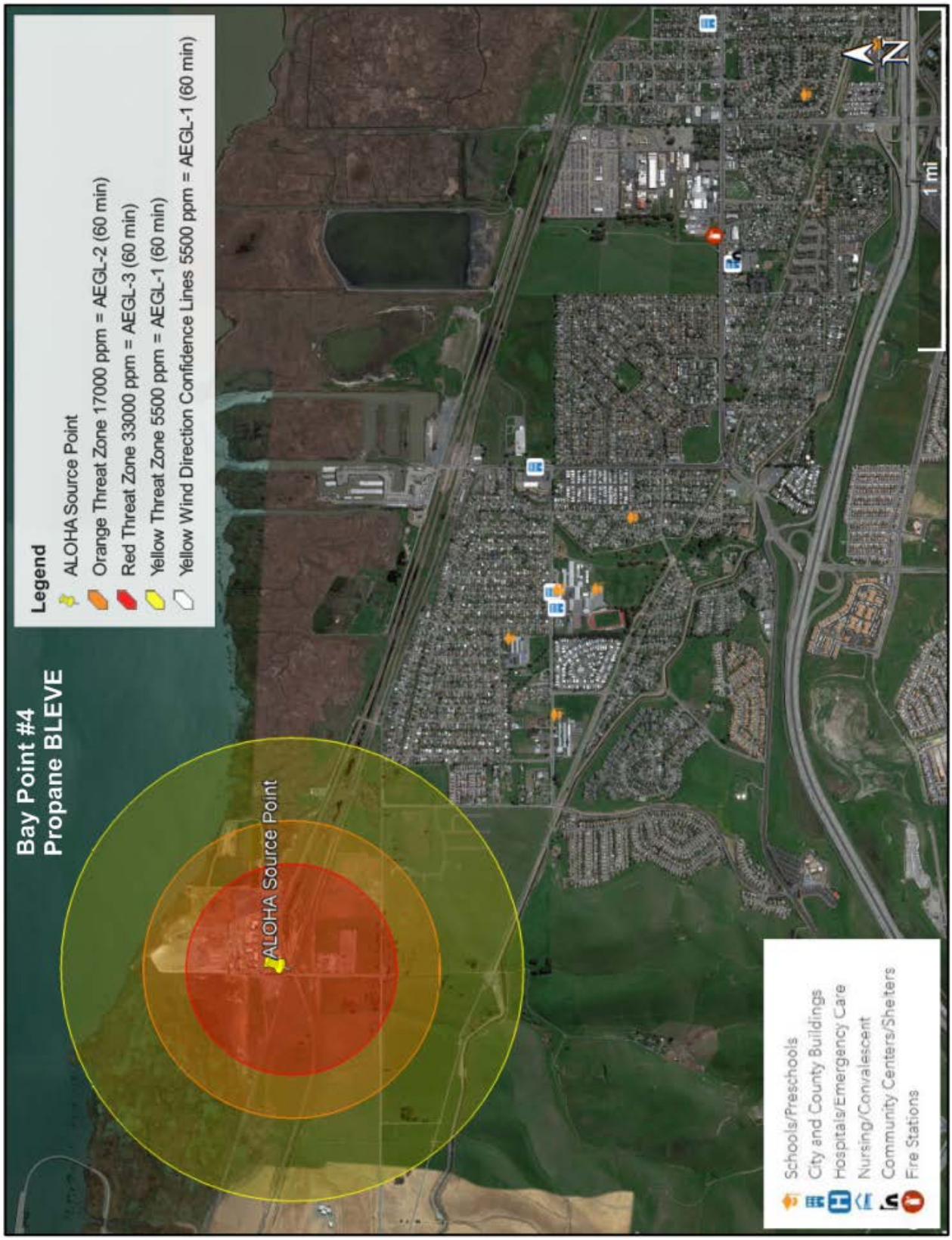
5.4.2 Scenario 2: Propane

ALOHA model plume mapping at Pinch Point Bay Point #4 for propane (UN ID# 1075) release is shown in the following maps. The first map shows the extent of a propane plume release. The second map shows the area affected in the event that the tank car explodes in a BLEVE scenario.

The propane plume is approximately 1 mile long and up to ½ mile wide. The Red Threat Zone is approximately ½ mile long and up to ¼ mile wide. The entire plume covers the industrial and natural open land area north of the city of Bay Point. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place primarily industrial area to the southeast and south at risk from a propane incident. Areas beyond this zone to the southeast are residential.

The second map shows the Propane BLEVE scenario. In this scenario the area affected is known as the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. In general, the entire area is either industrial, natural open lands, or part of Suisun Bay. Areas beyond this zone to the southeast are residential.


Bay Point #4
Propane
ALOHA Source Point
Legend
ALOHA Source Point
Orange Threat Zone 17000 ppm = AEGL-2 (60 min)
Red Threat Zone 33000 ppm = AEGL-3 (60 min)
Yellow Threat Zone 5500 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 5500 ppm = AEGL-1 (60 min)
N
4000 ft
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations


Bay Point #4
Propane BLEVE
Legend
ALOHA Source Point
Orange Threat Zone 17000 ppm = AEGL-2 (60 min)
Red Threat Zone 33000 ppm = AEGL-3 (60 min)
Yellow Threat Zone 5500 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 5500 ppm = AEGL-1 (60 min)
ALOHA Source Point
N
1 mi
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations

5.4.3 Scenario 3: Sulfuric Acid

The sulfuric acid (UN ID #1830) release isolation zone at Pinch Point Bay Point #4 is shown in the following map. According to ERG guidelines, the isolation distance in the event that a fire is involved is ½ mile in all directions. Although slightly less extensive in area, the isolation zone is similar to the Propane BLEVE scenario. The entire isolation zone in industrial and natural open land areas, including part of Suisun Bay.

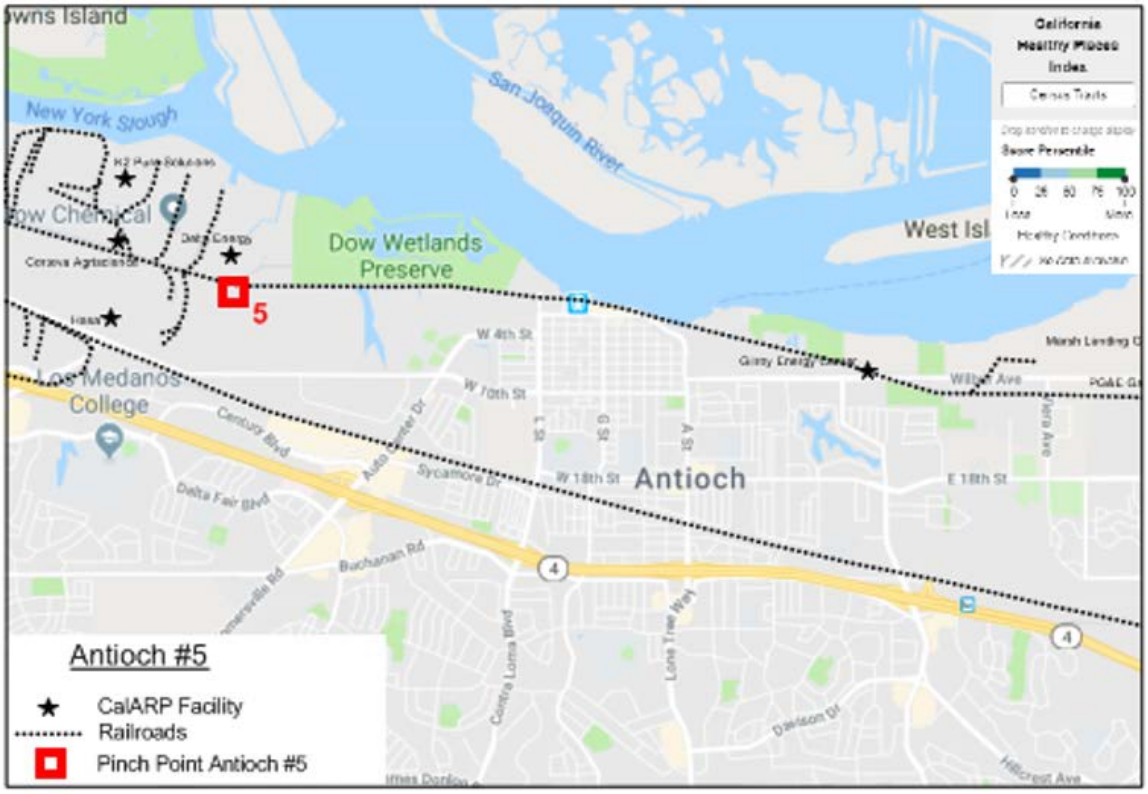

Bay Point #4
Sulfuric Acid
Isolation Zone
4
N
2 mi
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations

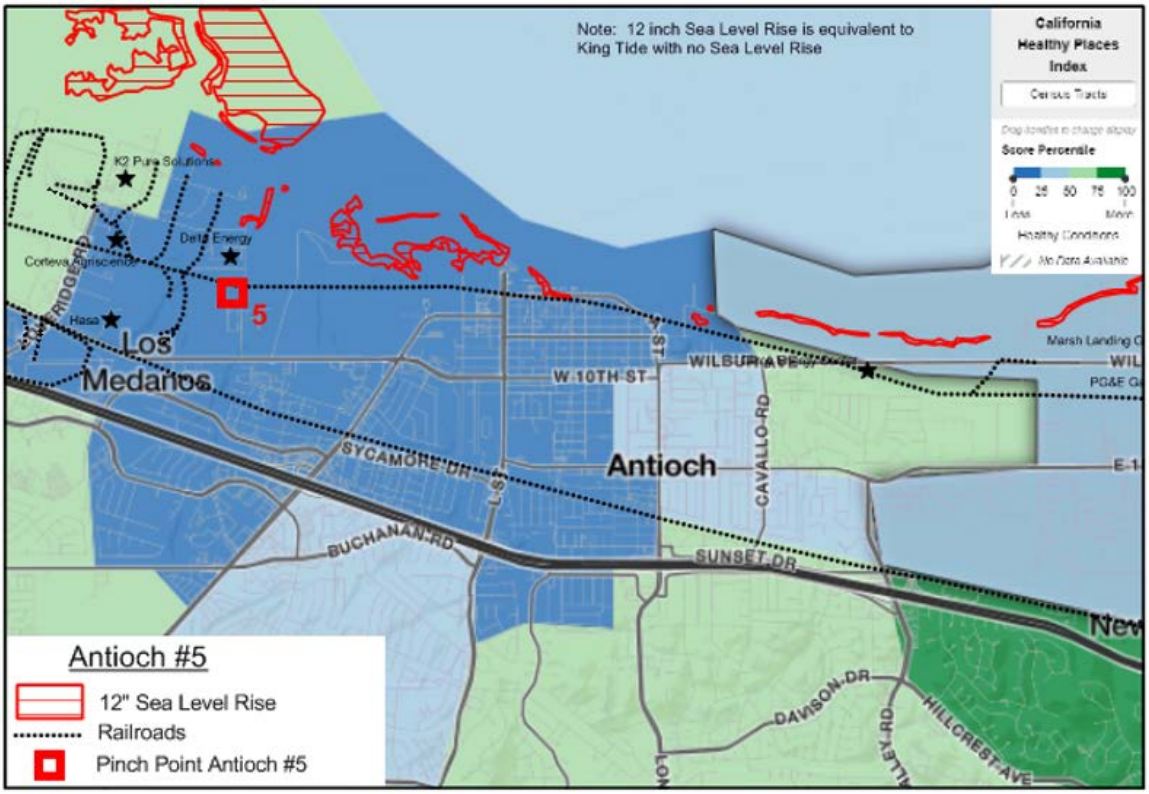
5.5 Pinch Point – Antioch #5

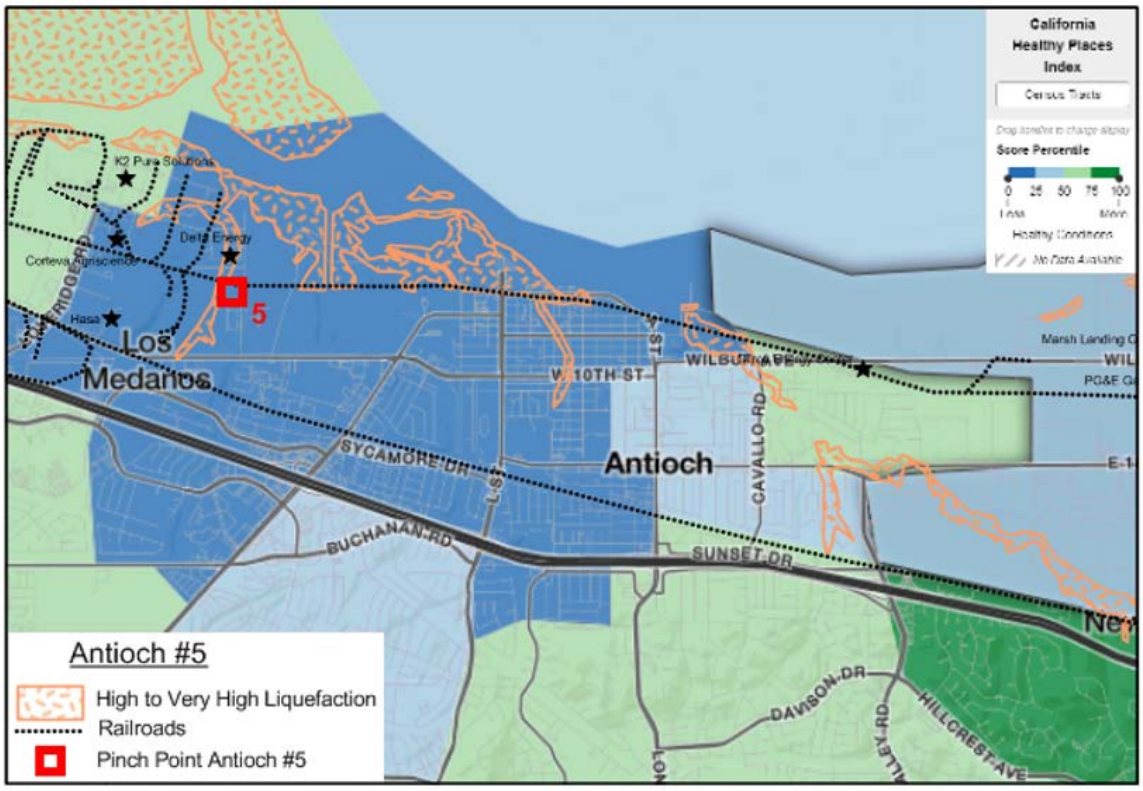
At the Antioch #5 pinch point, it will be assumed that the hazardous materials spill of a COC will result from an incident with a rail tank car holding 34,397 gallons of the ammonia/anhydrous ammonia (worst-case scenario), a rail tank car holding 34,397 gallons of propane as LPG (worst-case scenario), and 13,350 gallons of sulfuric acid (worst-case scenario). The individual details are contained in the sections below.

Criteria used in the identification of the pinch point are summarized in the table below. Maps showing some of the criteria used in the determination of the pinch point are shown following the table.

ANTIOCH PINCH POINT #5 CRITERIA		
CRITERIA	**DESCRIPTION**	**COMMENTS**
Location	End of Arcy Lane	
Elevation (above msl)	17	Above 12" rising tide
Latitude	38.019189	
Longitude	-121.847427	
Railroads	BNSF (pinch point)	Pinch point along major rail line
	UP (south)	
Highways & Arterial Roads	CA-4	
	W. 10th Street	
Pipelines	Gas pipeline at pinch point.	Partially co-located with rail line at pinch point
	Hazardous liquid to south along UP line	
Nearby CalARP Facilities	Hasa	
	Delta Energy	
	Corteva Agriscience	
	K2 Pure Solutions	
	Gilroy Energy Center	
Surrounding Land Use	N and NE-industrial/open land	
	E-open land/industrial	
	SE-commercial/residential beyond industrial	Vulnerable population; critical facilities
	S and SW-open land/industrial	
	W-industrial	
Healthy Places Index	25-50 (pinch point and immediate area; 23.6 percentile)	
Wind Direction (from)	West (Feb-Nov); North (Nov-Feb)	
Rising Tides 12"	North of pinch point along shoreline	
Liquefaction (high to very high)	North of pinch point and nearby drainage to west	Rail lines partially in area of liquefaction

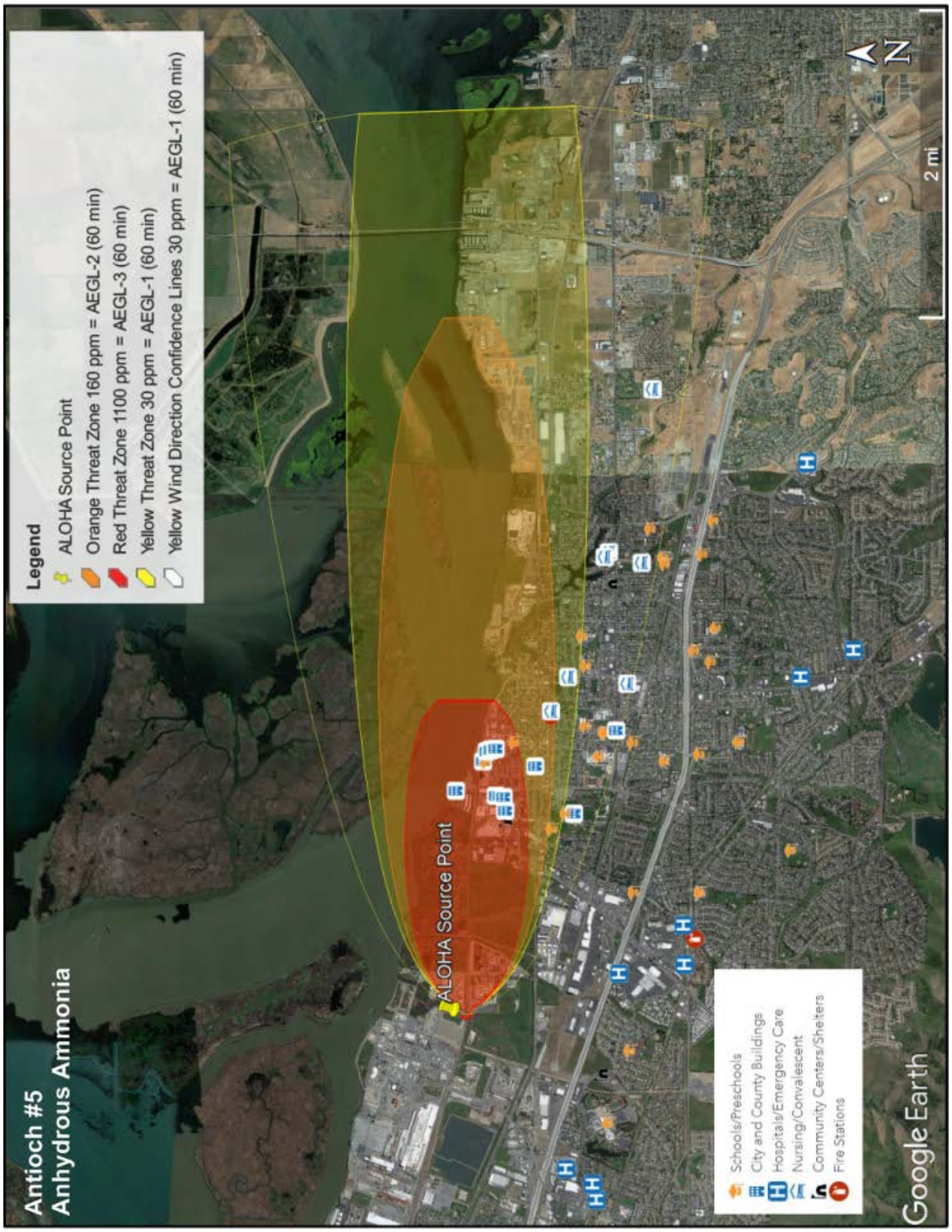

New York Slough
San Joaquin River
Dow Wetlands Preserve
Los Medanos College
Antioch
Century Blvd
Delta Fair Blvd
Buchanan Rd
W 4th St
W 10th St
W 18th St
E 18th St
Sycamore Dr
Lone Tree Way
Davison Dr
Hillcrest Ave
Marsh Landing
California Healthy Places Index
Census Tracts
Score Percentile
Antioch #5
CalARP Facility
Railroads
Pinch Point Antioch #5


Note: 12 inch Sea Level Rise is equivalent to King Tide with no Sea Level Rise
California Healthy Places Index
Census Tracts
Score Percentile
Los Medanos
Antioch
W 10TH ST
WILBUR AVE
SYCAMORE DR
BUCHANAN RD
SUNSET DR
CAVALLO RD
DAVISON DR
HILLCREST AVE
Marsh Landing
Antioch #5
12" Sea Level Rise
Railroads
Pinch Point Antioch #5



5.5.1 Scenario 1: Ammonia

ALOHA model plume mapping at Pinch Point Antioch #5 for an ammonia/anhydrous ammonia (UN ID# 1005) release is shown in the following map. The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone is approximately 2 miles long and up to a mile wide, and covers an industrial area, natural open lands area, and the northern part of the city of Antioch, including part of the downtown area, as well as part of Suisun Bay. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are within the commercial, residential, and downtown areas of Antioch.


Antioch #5
Anhydrous Ammonia
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
ALOHA Source Point
N
2 mi
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
Google Earth

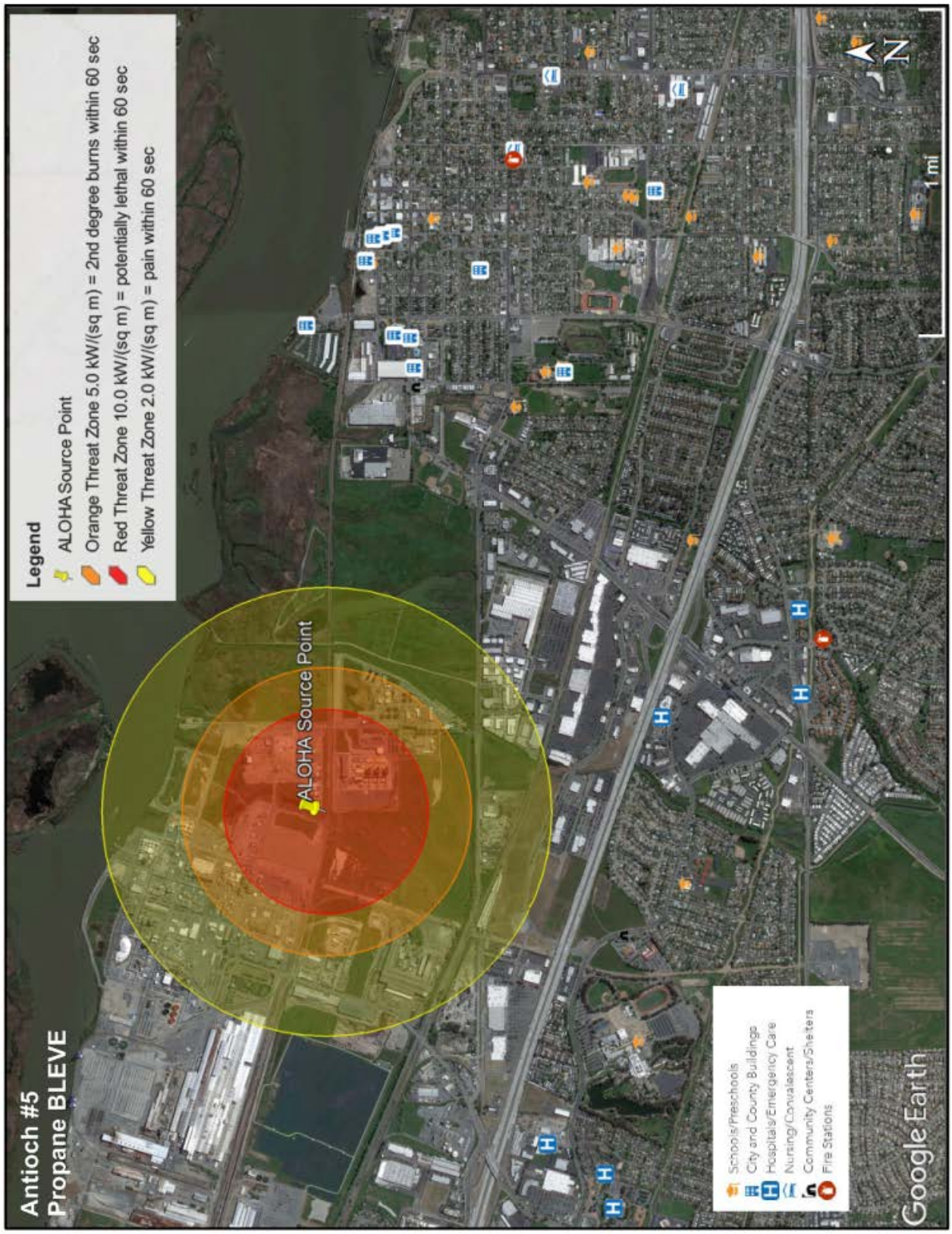
5.5.2 Scenario 2: Propane

ALOHA model plume mapping at Pinch Point Antioch #5 for propane (UN ID# 1075) release is shown in the following maps. The first map shows the extent of a propane plume release. The second map shows the area affected in the event that the tank car explodes in a BLEVE scenario.

The propane plume is approximately 1 mile long and up to ½ mile wide. The Red Threat Zone is approximately ½ mile long and up to ¼ mile wide. The entire plume covers the industrial and natural open land area northwest of the city of Antioch. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place primarily industrial area to the southeast and south at risk from a propane incident. Areas beyond this zone to the southeast are residential.

The second map shows the Propane BLEVE scenario. In this scenario the area affected is known as the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. In general, the entire area is either industrial, natural open lands, or part of Suisun Bay. Areas beyond this zone to the southeast are residential.


Antioch #5
Propane
ALOHA Source Point
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
N
1 mi
Legend
ALOHA Source Point
Orange Threat Zone 160 ppm = AEGL-2 (60 min)
Red Threat Zone 1100 ppm = AEGL-3 (60 min)
Yellow Threat Zone 30 ppm = AEGL-1 (60 min)
Yellow Wind Direction Confidence Lines 30 ppm = AEGL-1 (60 min)
Google Earth


Antioch #5
Propane BLEVE
Legend
ALOHA Source Point
Orange Threat Zone 5.0 kW/(sq m) = 2nd degree burns within 60 sec
Red Threat Zone 10.0 kW/(sq m) = potentially lethal within 60 sec
Yellow Threat Zone 2.0 kW/(sq m) = pain within 60 sec
ALOHA Source Point
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations
1 mi
N
Google Earth

5.5.3 Scenario 3: Sulfuric Acid

The sulfuric acid (UN ID #1830) release isolation zone at Pinch Point Antioch #5 is shown in the following map. According to ERG guidelines, the isolation distance in the event that a fire is involved is ½ mile in all directions. Although slightly less extensive in area, the isolation zone is similar to the Propane BLEVE scenario. The entire isolation zone in industrial and natural open land areas, including part of Suisun Bay.


Antioch #5
Sulfuric Acid
Isolation Zone
5
N
1 mi
Schools/Preschools
City and County Buildings
Hospitals/Emergency Care
Nursing/Convalescent
Community Centers/Shelters
Fire Stations

6.0 Integration of Data with GIS

Following this Flow Study, CCHSHMP will be working to display hazardous materials related data, along with sea level rise and flood data, in a GIS format. GIS mapping will be used to further communicate, display, and identify areas of concern as it relates to hazardous materials and flooding.

7.0 Emergency Response and Mitigation

Data from the Commodity Flow Study portion of this project were used to determine the 5 pinch points which were used for chemical plume analysis. All of the pinch points were located along railroad lines in the coastal areas of Contra Costa County, and portions of the areas surrounding the pinch points are potentially subjected to rising tides. Determination of the pinch points was based on numerous criteria as outlined in Section 4.1 of this report, including the following:

- Rising Tides data and areas most susceptible to rising tides and sea level rise;
- California Healthy Places Index indicating vulnerable populations;
- Liquefaction Susceptibility data;
- Location of CalARP Facilities;
- Locations of Critical Facilities;
- Chemicals of Concern;
- Weather data;
- Railroad Locations; and
- Critical Arterial Road Locations.

In addition to the above criteria, vulnerable populations are located in the vicinity of many of the pinch points, and they typically contain lower and middle income housing, as well as numerous public buildings, medical facilities, shelters and community centers, and schools.

In addition, weather patterns indicate that the 2 major wind directions occur in the coastal cities of Contra Costa County. The major wind direction is from the west and occurs for 9 to ten (10) months of the year. The alternate wind direction is from the north and occurs for 2 to 3 months of the year. The chemical plume analysis utilized the predominant westerly wind direction; however, the plume footprints can change with the change in wind direction.

The ammonia/anhydrous ammonia plume is the most toxic plume that has been mapped at each of the pinch points. In the event that an evacuation is required due to an ammonia release incident, evacuations could be undertaken to remove vulnerable populations from the immediate incident area. Shelters could be set up, generally in areas outside the complete footprint of the plume in facilities such as schools, churches, and public buildings. In addition, shelter-in-place procedures may need to be implemented to protect the population in the area. Shelter in place may be critical in the event that the release has occurred in flooded areas, and evacuation is not practicable or possible.

An incident involving ammonia could have catastrophic effects on these populations. The best approach to mitigate such an incident is a proactive approach, which allows properly equipped and trained first responders to immediately respond to an incident and work to mitigate/terminate the source of the incident. This approach is paramount to preventing a massive reactive approach which would include movement and protection of a large vulnerable population.

The propane and sulfuric acid plumes cover a much smaller footprint than the ammonia plume and would be considered of lower toxicity than the ammonia plume. A propane explosion or BLEVE occurs almost instantaneously, and rapid emergency response, including evacuation, is necessary. Emergency response to a non-BLEVE propane release or a sulfuric acid release

should be similar to an ammonia release; however, evacuation may not be necessary depending upon the circumstances. The most important aspect of immediate response to a propane or sulfuric acid release is to allow properly equipped and trained first responder to proactively mitigate/terminate the source of the incident. Flooding in the release area may complicate the response actions.

The locations of the natural gas transmission pipelines and hazardous liquid pipelines within the coastal areas of Contra Costa County are known, and the major lines are often collocated along the railroad lines, particularly in the coastal areas. In order to mitigate any negative results due to a release incident along the pipelines, the first responders should coordinate with the pipeline operators to immediately isolate the affected lines. Isolation will ensure that a minimal amount of the population is affected by the incident. In addition, evacuation procedures should be in place to quickly and efficiently remove the affected populations from the areas impacted by the incident.

The vulnerable populations within and adjacent to each of the 5 pinch point locations are at high risk in the event of a major hazardous materials incident. Because of this situation, a proactive approach to initial response by first responders, is the best approach, as it reduces the need for an overarching reactive response. There are 3 elements to this approach:

- Proper protective and response equipment, which will allow first responders to react proactively, quickly, and efficiently to a major hazardous materials release incident.
- Comprehensive training, including focused training of first responders to act both proactively and reactively to a major hazardous materials release incident.
- Mutual aid agreements with local, and state agencies that can immediately provide additional manpower, equipment, and trained assistance to a major hazardous materials release incident.

A proactive approach in equipping and training first responders will serve to protect the vulnerable populations within the County in the event of a transportation-related hazardous material accident/incident. This approach will also minimize disruption of essential services, facilities, and infrastructure, and will ultimately save lives and property.

8.0 Summary

The goals and results of the Flow Study and Community Risk Assessment are summarized below.

The Flow Study reviewed rail transport of hazardous chemicals through the County, and particularly within areas of the county where the rail lines may be susceptible to rising tides and flooding risks from changes in our climate. Chemical data from industries in the County helped to determine what types of hazardous chemicals were being transported through the County via rail. Three chemicals of concern (COCs) were determined from the railroad data, and these chemicals (ammonia/anhydrous ammonia, propane, and sulfuric acid) were used in the plume analysis in the CRA portion of this report.

Based on the information obtained from the Flow Study, a series of vulnerable points ("pinch points") were determined from rising tides data and potential flooding, primarily along the rail lines, California Healthy Places data, liquefaction resulting from earthquakes, locations of CalARP facilities, specific COCs, background weather data, locations of railroads and critical arterial roadways, and locations of critical facilities including areas of vulnerable populations. Once specific pinch points were located, a comprehensive CRA, including a chemical plume analysis, was performed to assess worst-case scenarios related to a COC release incident at these locations.

The Flow Study and CRA were completed as a follow-on study to the San Francisco Bay Conservation and Development Commission Adaption to Rising Tides (ART) project. The current project titled Hazardous Materials Commodity Flow Study with Special Focus on Sea Level Rise and Flood Risk, fostered a greater understanding on how major hazardous materials transportation, such as Contra Costa County rail system, could be impacted by sea level rise/flooding and how the increased risk for hazardous materials incidents that could affect the health and safety of our community.

Goals of the project included identifying risks from hazardous materials release due to possible disruption of transportation due to sea level rise/flooding as predicted by the Adapting to Rising Tides program and the effect of a release of various portions of the County, including critical facilities and vulnerable populations through toxic plume mapping using ALOHA technology. Identifying these issues will help the County to better address and plan for hazardous materials releases in order to protect and promote health, safety, and wellbeing of Contra Costa residents.

Historical railroad and highway data were available from the "Hazardous Materials Transportation Study for Contra Costa County. Additional highway flow study data were also available from Marin County (2014) and Solano County (2016). The data used here from Marin and Solano Counties were compiled for the entry points from these counties into Contra Costa, specifically along Interstate Highways I-580 (Marin) and I-80 and I-680 (Solano).

The Flow Study also incorporated railroad commodity information from 2016 through 2018, which was made available from UP and BNSF. The railroad data aided in the identification of the COCs: ammonia/anhydrous ammonia, propane, and sulfuric acid.

Pipeline data, including identification and locations of hazardous liquid and gas transmission pipelines were also included as a reference in this report. In many areas, including the coastal areas, the pipelines are often co-located with the railroad lines. An incident along one of these transportation routes could potentially affect the other. Pipeline incidents dating from 2008 were listed and located on the pipeline maps.

Railroads in Contra Costa County consist primarily of the following railroad lines: UP, BNSF, RPRC, and BART. UP and BNSF transport the majority of commercial traffic, including hazardous materials throughout the coastal areas of Contra Costa County. Rail lines located along the shorelines serve as a first line of defense against inland flooding, also known as ad hoc flood protection. Disruption of rail line transportation can have significant impacts on the movement of goods through Contra Costa County, particularly alternate transportation along roadways. In the event of flooding due to rising tides, the stability of the rail lines in some areas (ballast and track bed materials) may be at risk of becoming structurally unsound. In addition, groundwater table rise due to climate change could also result in the instability of the rail lines due to the potential damage to track bed and ballast materials. Certain areas of the rail lines are in areas at risk of high to very high liquefaction in the event of an earthquake.

Railroad incidents involving hazardous materials were reviewed from the time period of 2000 through 2019. A review of the above data indicates the following trends:

- Major cause of total rail incidents is derailment;
- Major causes of hazardous materials spill incidents are derailment, leaking train cars, and collision;
- Both UP and BNSF lines contained the major portion of the total rail incidents, as these are the major rail lines in the area;
- UP had a higher percentage of hazardous materials spill incidents than BNSF;
- Total rail incidents were located primarily in the cities of Richmond, Martinez, Pittsburg, Rodeo, and Crockett; and.
- Hazardous materials spill incidents were located primarily in Richmond, Martinez, Rodeo, and Crockett.

Information concerning highway and roadway incidents was limited, but some Contra Costa County data were available from the period of 2010 through 2019, and nationwide data were available from 2010 through 2016. The nationwide data indicated that the number of hazardous materials incidents occurs in about 12 to 14 times per 10,000 total truck trips. These numbers can be extrapolated to Contra Costa County, although there may be an increase in the frequency/rate of the incidents due to the following:

- High traffic volumes in a heavily populated urban area;
- Increased frequency of transportation of hazardous materials along arterial roadways; and
- Increased number of incidents because of flooding due to rising tides.

Disruption of commercial rail traffic could result in increased commodity flow via trucks along various arterial roads and highways in the vicinity of the pinch points. This also results in a higher risk of a hazardous materials incident occurring along the roadways. In addition, inundation of

the areas of the pinch points by water, due to rising tides or disruption of rail traffic due to seismic events could also affect the ability to move commercial goods via roadways.

In consideration of transporting hazardous materials via rail, primarily within rail tanker cars, it should be noted that one tanker car can generally contain 2 to 3 times the amount of commodity than one tanker truck. Based on the comparison of the amount of trucks that would be required to transport specific hazardous materials, such as sulfuric acid, which would normally be transported by rail would be dependent on the amount of rail cars that would be disrupted on a time-dependent basis. Unless, materials can be transported on still-operating rail lines or through the ports, then the additional stress in highway transport will be significant. In the event of a large rail incident scenario, a major disruption of commerce through the County could result in a cessation of manufacturing operations for an unspecified amount of time. It is also possible that highway transport may not be a viable option in areas of flooding, as the roadways themselves may also be closed.

The 5 pinch points were determined during this study for extended analysis in the event that a hazardous materials incident/accident occurred at these locations. The pinch points, which are all positioned along railroad lines, were located as follows:

- Richmond #1: I-580 at Meade Street
- Richmond #2: Richmond Parkway South of MacDonald Avenue
- Martinez #3: Shell Avenue and Marina Vista Avenue
- Bay Point #4: Nichols Road North of Port Chicago Highway
- Antioch #5: End of Arcy Lane

The determination of the pinch points was dependent in part on the following parameters, which were used to perform the CRA:

- Rising Tides data and areas most susceptible to rising tides and sea level rise;
- California Healthy Places Index indicating vulnerable populations;
- Liquefaction Susceptibility data;
- Location of CalARP Facilities;
- Locations of Critical Facilities;
- Chemicals of Concern;
- Weather data;
- Railroad Locations; and
- Critical Arterial Road Locations.

A critical aspect of the determination of pinch points is an analysis of flooding due to rising tides and sea level rise, including king tides and storm surges. Data was compiled using the ART Shoreline Flood Explorer on-line maps for three different scenarios:

- 12-Inch Sea Level Rise, Equivalent to King Tide with no Sea Level Rise;
- 24-inch Sea Level Rise, Equivalent to 5-Year Storm Surge with no Sea Level Rise; and
- 36-Inch Sea Level Rise, Equivalent to 50-Year Storm Surge with no Sea Level Rise.

For purposes of the CRA, only the 12-inch Sea Level Rise, equivalent to a King Tide with no Sea Level Rise was used in the Chemical Plume Analysis section of this report.

As a note, levee failure was not included as a potential flood scenario in this project.

The California Healthy Places Index (HPI) was used as an aid to determine more vulnerable populations for the Community Risk Assessment, including areas of lower income residential development. Various HPI indicators and decision support layers were used to determine the HPI into the following categories ranging from "less" to "more" healthy conditions:

- 0-25 (least);
- 25-50;
- 50-75; or
- 75-100 (most).

Large areas of high to very high susceptibility to liquefaction during a seismic event are located in the coastal areas of Contra Costa County. Liquefaction occurs where saturated sand and silt assume the characteristics of a liquid during an intense shaking during an earthquake. These areas are considered to be vulnerable to disruption of rail and road traffic, as a result of an incident during an earthquake.

Locations of CalARP facilities aided in the determination of the pinch points, as hazardous chemical from some of the CalARP sites were transported through the area along the railroads and roadways. Some of the CalARP facilities are considered to be critical operating facilities, as they include water treatment and energy generation /transfer facilities, as well as large economic centers.

The locations of critical facilities were used as an aid in determining the locations of the pinch points. Many of these facilities are relevant to other hazards than the release of hazardous materials. As a result, and for the purposes of this CRA, critical facilities will refer to facilities that may contain vulnerable or essential emergency populations that will require mitigation/evacuation in the event of a hazardous materials release.

Critical facilities located in the coastal areas of Contra Costa County can be summarized as follows:

- City, County, Federal Buildings
- Fire Stations
- Hospitals and Emergency Medical Care
- Nursing and Convalescent Homes
- Community Centers/Shelters
- Schools

Based on the Flow Study data from the railroads, it was determined that the following 3 chemicals of concern would be used in the Chemical Plume Analysis in the CRA portion of this study to cover worst-case scenario situations at the pinch points in the event of a hazardous materials incident/accident :

- Ammonia/anhydrous ammonia: highly toxic;
- Propane: highly explosive and commonly transported along the railroads in Contra Costa County; and
- Sulfuric acid: commonly transported along the railroads in Contra Costa County.

Weather for the coastal regions of Contra Costa County was available for several cities within the County. For the most part, weather patterns for the coastal cities are very similar. This information was used as the basis of the weather patterns for this study. Wind direction is a critical component of toxic plume analysis, as it determines the direction which the plume will travel over the land surface. Based on the weather data, it was determined that in that the major wind direction from the west occurred throughout most of the year. As a result, the plume analysis utilized in this report covered an incident occurring in July.

Each of the pinch points discussed in the CRA are located along or adjacent to railroad lines. These locations are considered to be higher risk. Many of the rail lines are co-located with underground pipelines, particularly along the coastal areas. Portions of the rail lines are located in areas of 12-inch (and greater) sea level rise, as well as in some areas of high to very high liquefaction which could be caused by earthquake events. Rail lines in these areas could become compromised, resulting in potential hazardous materials incidents due to derailment or other causes. In addition, disruption of commercial rail traffic could result in significant increases in commodity flow along major arterial roadways and highways throughout the coastal areas of Contra Costa County. It is also important to note that the rail lines that act as ad hoc flood protection could result in more significant flooding in surrounding areas due to overtopping effects.

Plume diagrams for release of hazardous materials from the pinch points were determined using the CAMEO suite of programs created by the U.S. Environmental Protection Agency (EPA). The CAMEO suite consists of CAMEO chemicals, ALOHA plume modeling through various release scenarios, and MARPLOT, which assists in plotting the information onto various map bases, such as Google Earth.

The plume diagrams are utilized in determining the extent of threat zones based on the release of a particular chemical. Three threat zones were mapped for each chemical release:

- Red zone: Highest threat level
- Orange Zone: Moderate threat level
- Yellow Zone: Low threat level

Chemical Plume Analysis for the CRA was based on the following general parameters:

- Weather conditions;
- COCs; and
- Worst-case scenario conditions.

Ammonia/anhydrous ammonia is one of the highest production chemicals in the United States. It is used in manufacturing, refrigeration, and as an agricultural fertilizer, and is common in household chemicals. Ammonia can be absorbed into the body by inhalation, ingestion, and by

skin and eye contact. A poisonous and visible vapor cloud is produced when ammonia comes in contact with water. Ammonia is extremely corrosive, and when it mixes with air it forms an explosive mixture. Although anhydrous ammonia is classified by the U.S Department of Transportation (USDOT) as nonflammable, ammonia vapor is flammable at concentrations of 15% to 28% by volume of air.

Propane is a by-product of natural gas processing and crude oil refining and is produced from liquid components recovered during natural gas processing. Propane is a colorless, highly flammable liquefied gas and is one of the main components of liquid petroleum gas (LPG). Propane is biodegradable, and will readily evaporate into the environment. Inhalation of propane in minor amounts is not considered toxic; however, large amounts of propane in the air can displace oxygen and act as an asphyxiant. Skin absorption and ingestion of propane is not anticipated, although contact with propane in the liquid phase may result in frostbite.

Propane is highly flammable and explosive, and spillages of large quantities of liquid propane will vaporize to propane gas. Propane vapors can travel considerable distances. An ignition source may cause propane to ignite, flash back, and explode. Propane explosions can result in Boiling Liquid Expanding Vapor Explosion (BLEVE). The U.S. Department of Transport Emergency Response Guidebook (ERG) has determined general evacuation distances to be undertaken in the event of propane-induced BLEVE.

Sulfuric acid is a highly corrosive material. Spill cleanup of large spills of sulfuric acid should be undertaken by isolating the spill area with diking materials, including isolation from waterways. The acid can be treated with soda ash or lime, although neutralization will resolve a release of heat. Sulfuric acid is not flammable, but can be highly reactive with combustible materials.

Sulfuric acid spills are not considered as toxic, but can form a gray cloud. If sulfuric acid is mixed with water, it reacts vigorously forming an exothermic reaction. A vapor cloud of sulfuric acid can mix with water or water vapor to form a white cloud, which, based on the specific gravity is heavier than air.

Evacuation guidelines for sulfuric acid are contained with the ERG, and the isolation distance in the event that a fire is involved is ½ mile in all directions. Although there is no stated isolation distance in the event of a sulfuric acid spill, or a spill into water, the ERG guidelines with respect to fire were used as a basis for evacuation and mitigation.

Plume diagrams were produced using the ALOHA modeling program for the 5 determined pinch points located within coastal area of Contra Costa County At each of the pinch points, the ALOHA plume maps for ammonia and propane were produced based on the following data:

- Incident occurs in mid-July with an air temperature of 85^{o}F;
- Wind is from the west at 9 miles per hour;
- Size of railroad tank care is 34,397 gallons;
- Tank diameter of 10.66 feet; and
- The rupture in the tank car is a 10-inch diameter hole located near the bottom of the tank car.

The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone is approximately 2 miles long and up to a mile wide.

The propane plume is approximately 1 mile long and up to ½ mile wide. The Red Threat Zone is approximately ½ mile long and up to ¼ mile wide. In the BLEVE scenario, the area affected is known as the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source.

Sulfuric acid is not considered a toxic material that will create a toxic vapor plume during a release, and the ALOHA modeling program could not be used for this chemical. Although there is no stated isolation distance in the event of a sulfuric acid spill, or a spill into water, the ERG guidelines with respect to fire were used as a basis for evacuation and mitigation. Some of the major parameters used development of the isolation distance map for sulfuric acid at each of the 5 pinch points are as follows:

- Incident occurs in mid-July with an internal tank temperature of 85^{o}F;
- Size of railroad tank care is 13,350 gallons;
- Tank diameter of 8 feet; and
- The rupture in the tank car is a 10-inch diameter hole located near the bottom of the tank car.

<u>Pinch Point Richmond #1</u>

Pinch Point Richmond #1 is located along a major north-south rail corridor in the city of Richmond. Most of the cirtical facilities for Pinch Point Richmond #1 are located east of the pinch point, which is equivalent to the prevailing downwind direction. Much of this area is in commercial and residential land use. Most of the area west and southwest of the pinch point is industrial.

The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone for the ammonia plume is approximately 2 miles long and up to a mile wide and covers a significant portion of the residential and commercial areas of east Richmond and El Cerrito. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are also residential and commercial. Much of the area to the south is either industrial or part of San Francisco Bay.

The entire propane plume covers a portion of the residential area of east Richmond and El Cerrito. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place a limited area southeast and south at risk from propane incident release. Areas to the southeast are also residential. Much of the area to the south is primarily industrial.

Under the propane BLEVE scenario, the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. In general, areas to the northwest, north, east, and southeast are primarily residential; areas to the west and south are industrial.

The sulfuric acid release isolation zone, although slightly less extensive in area, is similar to the propane BLEVE scenario. In general, areas to the northwest, north, east, and southeast are primarily residential; areas to the west and south are industrial.

Pinch Point Richmond #2

Pinch Point Richmond #2 is located along a major north-south rail corridor and rail siding in the city of Richmond. Most of the cirtical facilities for Pinch Point Richmond #2 are located east of the pinch point, which is equivalent to the prevailing downwind direction. Much of this area is in commercial and residential land use. Downtown Richmond is located directly east of the pinch point. Most of the area west of the pinch point is industrial.

The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone for the ammonia plume is approximately 2 miles long and up to a mile wide and covers a significant portion of the residential and commercial areas of the central and downtown portion of the city of Richmond. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are also residential and commercial with some industry. Much of the area to the south is either industrial or part of San Francisco Bay.

The entire propane plume covers a portion of the commercial and residential area of Richmond, including the downtown area. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place a limited area southeast and south at risk from a propane incident. Areas to the southeast are also residential. Much of the area to the south is primarily industrial.

Under the propane BLEVE scenario, the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. In general, areas to the northeast, east, and southeast are primarily commercial and residential; areas to the northwest, west, and south are industrial.

The sulfuric acid release isolation zone, although slightly less extensive in area, is similar to the propane BLEVE scenario. In general, areas to the northeast, east, and southeast are primarily commercial and residential; areas to the northwest, west, and south are industrial.

Pinch Point Martinez #3

Pinch Point Martinez #3 is located along the major UP rail line entering the Martinez area from the coast to the west. Most of the cirtical facilities for Pinch Point Martinez #3 are located southwest and south of the pinch point. Much of the area southwest of the pinch point is in commercial and residential land use and downtown Matinez is located in this direction. Most of the area to the south of the pinch point is residential. Industrial areas, including oil refineries, are located east of the pinch point, which is equivalent to the downwind direction. Industrial areas are also located north and west of the pinch point.

The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone for the ammonia plume is approximately 2 miles long and up to a mile wide and

covers the industrial area northeast of the city of Martinez, including oil refineries. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are also industrial. Much of the area to the south is partly industrial and partly residential.

The entire propane plume covers a portion of the industrial area in the northeastern part of Martinez. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place the industrial area south of the pinch point at risk from a propane incident.

Under the propane BLEVE scenario, the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. The entire area affected by this scenario is industrial, including oil refineries.

The sulfuric acid release isolation zone, although slightly less extensive in area, is similar to the propane BLEVE scenario. The entire isolation zone is industrial, including oil refineries.

Pinch Point Bay Point #4

Pinch Point Bay Point #4 is located at the intersection of the major UP and BNSF rail lines heading east from Martinez. Most of the cirtical facilities for Pinch Point Bay Point #4 are located east-southeast of the pinch point. The major portion of the cities of Bay Point and Pittsburg, including the commercial, residentia,l and downtown areas of these cities. These cities are partially downwind of the prevaiing wind direction. The area directly west of the pinch point are primarily industrial and natural coastal areas.

The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone for the ammonia plume is approximately 2 miles long and up to a mile wide, and covers the industrial area and natural open land area along Suisun Bay north of the cities of Bay Point and Pittsburg. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are within the commercial, residential, and downtown areas of both Bay Point and Pittsburg.

The entire propane plume covers the industrial and natural open land area north of the city of Bay Point. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place primarily industrial area to the southeast and south at risk from a propane incident. Areas beyond this zone to the southeast are residential.

Under the propane BLEVE scenario, the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. In general, the entire area is either industrial, natural open lands, or part of Suisun Bay. Areas beyond this zone to the southeast are residential.

The sulfuric acid release isolation zone, although slightly less extensive in area, is similar to the propane BLEVE scenario. The entire isolation zone in industrial and natural open land areas, including part of Suisun Bay.

Pinch Point Antioch #5

Pinch Point Antioch #5 is along the BNSF rail heading east from Martinez. Most of the cirtical facilities for Pinch Point Antioch #5 are located east and east-southeast (downwind) of the pinch point and includes a major portion of the city of Antioch, including the commercial, residential, and downtown areas of the city. The area surrounding the pinch point are primarily industrial and natural coastal areas.

The ammonia plume is extensive and is over 6 miles long and up to 2 miles wide. The Red Threat Zone is approximately 2 miles long and up to a mile wide, and covers an industrial area, natural open lands area, and the northern part of the city of Antioch, including part of the downtown area, as well as part of Suisun Bay. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place areas southeast and south at risk from an ammonia release. Areas to the southeast are within the commercial, residential, and downtown areas of Antioch.

The entire propane plume covers the industrial and natural open land area northwest of the city of Antioch. Although the prevailing wind direction is from the west, seasonal variations result in the wind direction coming from the north. This will place primarily industrial area to the southeast and south at risk from a propane incident. Areas beyond this zone to the southeast are residential.

Under the propane BLEVE scenario, the Thermal Radiation Threat Zone and is approximately ¾ mile from the source, and the Red Threat Zone extends approximately ¼ mile from the source. In general, the entire area is either industrial, natural open lands, or part of Suisun Bay. Areas beyond this zone to the southeast are residential.

The sulfuric acid release isolation zone, although slightly less extensive in area, is similar to the propane BLEVE scenario. The entire isolation zone in industrial and natural open land areas, including part of Suisun Bay.

9.0 Concluding Statement

A Commodity Flow Study was prepared from historical and currently available railroad and highway data. Based on the results of the Flow Study, 3 COCs were identified to be used in the Community Risk Assessment portion of this report. Based on the COCs and other criteria, including rising tide data from the ART program, California Healthy Places Index, liquefaction susceptibility, CalARP facilities, locations of critical facilities, weather conditions, railroad locations, and critical arterial road locations, 5 pinch points were located in the coastal areas of Contra Costa County.

The pinch points were used to prepare the Community Risk Assessment and chemical plume analysis to determine worst-case scenario effects of a release of the ammonia/anhydrous ammonia, propane, and sulfuric acid, which were designated as the most critical COCs.

Based on the results of the chemical plume analysis, general emergency response procedures were outlined to allow for emergency response to a chemical release incident. Emergency response covers proper protective and response equipment, comprehensive training for emergency responders, and in-place mutual agreements with local agencies to allow for merging and pooling of emergency response resources.

The addition of the potential flooding of low-lying coastal areas of the county, including residential, commercial, and industrial areas, may serve to complicate emergency response to an incident, and additional measures may need to be implemented to adequately respond to a flooding situation at the site of a release incident.

A proactive approach in equipping and training first responders will serve to protect the vulnerable populations within the County in the event of a transportation-related hazardous material accident/incident. This approach will also minimize disruption of essential services, facilities, and infrastructure, and will ultimately save lives and property.

The East Contra Costa and Bay Area Wide Adapting to Rising Tides projects are still ongoing at the time of the completion of this report. Both projects are anticipated to conclude in winter of 2019 and the final project reports and data will be available on the BCDC website www.adaptingtorisingtides.org/.

APPENDICES

APPENDIX A

Hazardous Liquid Pipeline Details

APPENDIX A-1

Richmond Area Pipeline Data

RL1. SFPP, LP Non-HVL Product Pipeline LS-70; (NIS) RICHMO

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-70; (NIS) RICHMOND - POINT M...
PIPELINE ID	LS-70; (NIS) RICHMO*
MILES	2.40
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

RL2. SFPP, LP Non-HVL Product Pipeline LS-71; LS-89 – RICH

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-71; LS 89 - RICHMOND 8"
PIPELINE ID	LS-71; LS 89 - RICH*
MILES	2.14
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

RL3. Phillips 66 Pipeline, LLC, Non-HVL Product Pipeline 2258_35

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	RICHMOND PRODUCTS LINE
SUBSYSTEM NAME	RICHMOND TERM/RODEO REFINERY
PIPELINE ID	2258_35
MILES	6.32
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

RL4. SFPP, LP Non-HVL Product Pipeline LS-75; IMTT/TIME

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-75; IMTT / TIME - RICHMOND 8/3"
PIPELINE ID	LS-75; IMTT / TIME *
MILES	1.86
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

RL5. SFPP, LP Non-HVL Product Pipeline LS-37; AMORCO-RIC

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-37; AMORCO - RICHMOND 12"
PIPELINE ID	LS-37; AMORCO - RIC*
MILES	20.83
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

RL6. SFPP, LP Non-HVL Product Pipeline LS-8; RICHMOND-CO

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-8; RICHMOND - CONCORD 8"
PIPELINE ID	LS-8; RICHMOND - CO*
MILES	22.42
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

RL7. Phillips 66 Pipeline, LLC Non-HVL Product Pipeline 2258_35

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	RICHMOND PRODUCTS LINE
SUBSYSTEM NAME	RICHMOND TERM/RODEO REFINERY
PIPELINE ID	2258_35
MILES	6.32
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

RL8. SFPP, LP Non-HVL Product Pipeline LS-46/41; RICHMOND

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-46/41; RICHMOND - BRISBANE 8...
PIPELINE ID	LS-46/41; RICHMOND *
MILES	2.31
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

RL9. Shell Pipeline Co., LP Non-HVL Product Pipeline 854529

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	SAN PABLO PIPELINE
SUBSYSTEM NAME	854529 - 12IN SAN PABLO
PIPELINE ID	854529
MILES	10.53
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	EMPTY
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

RL10. Chevron Pipeline Co.; Non-HVL Product Pipeline CAL0001

2731

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	2731
OPERATOR NAME	CHEVRON PIPE LINE CO
SYSTEM NAME	BAY AREA PIPE LINE
SUBSYSTEM NAME	BAY AREA PRODUCTS LINE (BAPL)
PIPELINE ID	CAL0001
MILES	21.69
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	GASOLINE, DIESEL AND/OR JET
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/12/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Garrett
LAST NAME	Parker
TITLE	Regulatory Assurance Specialist
ENTITY	
PHONE	(832) 854-4596
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CITY	Houston
STATE	TX
ZIP	77002

APPENDIX A-2

Crockett Area Pipeline Data

CL1. Shell Pipeline Co., LP Non-HVL Product Pipeline 854529

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	SAN PABLO PIPELINE
SUBSYSTEM NAME	854529 - 12IN SAN PABLO
PIPELINE ID	854529
MILES	10.53
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	EMPTY
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

CL2. SFPP, LP Non-HVL Product Pipeline LS-37; AMORCO-RIC

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-37; AMORCO - RICHMOND 12"
PIPELINE ID	LS-37; AMORCO - RIC*
MILES	20.83
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

CL3. SFPP, LP Non-HVL Product Pipeline LS-8; RICHMOND-CO

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-8; RICHMOND - CONCORD 8"
PIPELINE ID	LS-8; RICHMOND - CO*
MILES	22.42
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

CL4. Shell Pipeline Co.; Non-HVL Product Pipeline 854214

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	SAN PABLO PIPELINE
SUBSYSTEM NAME	854214 - 16IN SAN PABLO
PIPELINE ID	854214
MILES	24.17
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	EMPTY
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

CL5. Phillips 66 Pipeline LLC Non-HVL Product Pipeline 2258_05

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	RICHMOND PRODUCTS LINE
SUBSYSTEM NAME	RICHMOND TERM/RODEO REFINERY
PIPELINE ID	2258_05
MILES	1.30
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

CL6. Phillips 66 Pipeline LLC Non-HVL Product Pipeline 2258_15

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	RICHMOND PRODUCTS LINE
SUBSYSTEM NAME	RICHMOND TERM/RODEO REFINERY
PIPELINE ID	2258_15
MILES	3.82
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

CL7. Phillips 66 Pipeline LLC Non-HVL Product Pipeline 2260_60

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	JUNCTION TO RODEO REFINERY
SUBSYSTEM NAME	COALINGA PMP STA/RODEO REFIN...
PIPELINE ID	2260_60
MILES	7.22
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

CL8. Nustar Terminals Operations Non-HVL Product Pipeline 775

26094

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	26094
OPERATOR NAME	NUSTAR TERMINALS OPERATIONS ...
SYSTEM NAME	SELBY PIPELINES
SUBSYSTEM NAME	SELBY P5 PIPELINE
PIPELINE ID	775
MILES	1.06
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	PRODUCTS
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/14/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Kyle
LAST NAME	Oppliger
TITLE	VP Terminal Operations
ENTITY	
PHONE	(800) 759-0033
EMAIL	kyle.oppliger@nustarenergy.com
ADDRESS	19003 IH-10 West
CITY	San Antonio
STATE	TX
ZIP	78257

CL9. Phillips 66 Pipeline LLC Crude Oil Pipeline 2260_65

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	JUNCTION TO RODEO REFINERY
SUBSYSTEM NAME	COALINGA PMP STA/RODEO REFIN...
PIPELINE ID	2260_65
MILES	0.48
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

CL10. DOD Defense Energy Support Non-HVL Product Pipeline 0064

31460

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31460
OPERATOR NAME	DOD DEFENSE ENERGY SUPPORT...
SYSTEM NAME	OZOL
SUBSYSTEM NAME	OZOL-8 INCH
PIPELINE ID	0064
MILES	7.45
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/13/2019
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Williams
TITLE	Facility Manager/COR, DFSP San Pedro
ENTITY	
PHONE	(310) 241-2834
EMAIL	Todd.williams@dla.mil
ADDRESS	3171 N Gaffy Street
CITY	San Pedro
STATE	CA
ZIP	90731

APPENDIX A-3

Martinez Area Pipeline Data

ML1. Shell Pipeline Co., LP Non-HVL Product Pipeline 854214

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	SAN PABLO PIPELINE
SUBSYSTEM NAME	854214 - 16IN SAN PABLO
PIPELINE ID	854214
MILES	24.17
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	EMPTY
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

ML2. SFPP, LP Non-HVL Product Pipeline LS-37; AMORCO-RIC

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-37; AMORCO - RICHMOND 12"
PIPELINE ID	LS-37; AMORCO - RIC*
MILES	20.83
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML3. Shell Pipeline Co., LP; Non-HVL Product Pipeline 305

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	BAY AREA PRODUCTS LINE
SUBSYSTEM NAME	305 - 10IN BAY AREA PRODUCTS LI...
PIPELINE ID	305
MILES	2.41
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	EMPTY
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

ML4. Shell Pipeline Co., LP; Non-HVL Product Pipeline 306

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	BAY AREA PRODUCTS LINE
SUBSYSTEM NAME	306 - 10IN BAY AREA PRODUCT LIN...
PIPELINE ID	306
MILES	0.21
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	MULTIPLE PRODUCTS
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

ML5. DOD Defense Energy Support; Non-HVL Product Pipeline 0064

31460

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31460
OPERATOR NAME	DOD DEFENSE ENERGY SUPPORT...
SYSTEM NAME	OZOL
SUBSYSTEM NAME	OZOL-8 INCH
PIPELINE ID	0064
MILES	7.45
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/13/2019
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Williams
TITLE	Facility Manager/COR, DFSP San Pedro
ENTITY	
PHONE	(310) 241-2834
EMAIL	Todd.williams@dla.mil
ADDRESS	3171 N Gaffy Street
CITY	San Pedro
STATE	CA
ZIP	90731

ML6. Phillips 66 Pipeline, LLC; Crude Oil Pipeline 2260_60

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	JUNCTION TO RODEO REFINERY
SUBSYSTEM NAME	COALINGA PMP STA/RODEO REFIN...
PIPELINE ID	2260_60
MILES	7.22
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

ML7. Chevron Pipeline Co; Non-HVL Pipeline CAL0001

2731

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	2731
OPERATOR NAME	CHEVRON PIPE LINE CO
SYSTEM NAME	BAY AREA PIPE LINE
SUBSYSTEM NAME	BAY AREA PRODUCTS LINE (BAPL)
PIPELINE ID	CAL0001
MILES	21.69
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	GASOLINE, DIESEL AND/OR JET
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/12/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Garrett
LAST NAME	Parker
TITLE	Regulatory Assurance Specialist
ENTITY	
PHONE	(832) 854-4596
EMAIL	PARKERG@chevron.com
ADDRESS	1500 Lousiana
CITY	Houston
STATE	TX
ZIP	77002

ML8. SFPP, LP; Non-HVL Pipeline LS-8; RICHMOND-CO

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-8; RICHMOND - CONCORD 8"
PIPELINE ID	LS-8; RICHMOND - CO*
MILES	22.42
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML9. Phillips 66 Pipeline, LLC; Non-HVL Pipeline 2234_615

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	SFAR PRODUCTS LINE
SUBSYSTEM NAME	VINE/COLLIER
PIPELINE ID	2234_615
MILES	8.39
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

ML10. Shell Pipeline Co., LP; Crude Oil Pipeline 490

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	VINE HILL
SUBSYSTEM NAME	490 - 10IN VINE HILL CRUDE
PIPELINE ID	490
MILES	1.25
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	CRUDE
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

ML11. SFPP, LP; Non-HVL Pipeline LS-72; RODEO-CONC

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-72; RODEO - CONCORD 8"
PIPELINE ID	LS-72; RODEO - CONC*
MILES	12.94
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML12. Valero Refining Co. CA; Crude Oil Pipeline TRANSBAY_20IN

32223

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	32223
OPERATOR NAME	VALERO REFINING COMPANY - CA...
SYSTEM NAME	SJV TRANSBAY CRUDE (CSFM 060...
SUBSYSTEM NAME	
PIPELINE ID	TRANSBAY_20IN
MILES	2.10
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/05/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	John
LAST NAME	Lazorik
TITLE	Staff Environmental Engineer
ENTITY	
PHONE	(707) 745-7660
EMAIL	john.lazorik@valero.com
ADDRESS	3400 E. 2nd St.
CITY	Benicia
STATE	CA
ZIP	94510

ML13. SFPP, LP; Non-HVL Pipeline LS-47; (NIS) CONCOR

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-47; (NIS) CONCORD - SUISUN J...
PIPELINE ID	LS-47; (NIS) CONCOR*
MILES	4.65
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML14. SFPP, LP; Non-HVL Pipeline LS-130A; CONCORD-WA

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-130; CONCORD - SACRAMENTO...
PIPELINE ID	LS-130A; CONCORD-WA*
MILES	3.47
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML15. Tesoro Logistics Operations; Non-HVL Pipeline 609

31874

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31874
OPERATOR NAME	TESORO LOGISTICS OPERATIONS ...
SYSTEM NAME	GOLDEN EAGLE
SUBSYSTEM NAME	8IN TESORO 203
PIPELINE ID	609
MILES	1.14
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/14/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Matthew
LAST NAME	Marusich
TITLE	Operations Area Manager
ENTITY	
PHONE	(925) 335-3452
EMAIL	Matthew.V.Marusich@andeavor.com
ADDRESS	150 Solano Way
CITY	Martinez
STATE	CA
ZIP	94553

ML16. Tesoro Logistics Operations; Crude Oil Pipeline 611

31874

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31874
OPERATOR NAME	TESORO LOGISTICS OPERATIONS ...
SYSTEM NAME	GOLDEN EAGLE
SUBSYSTEM NAME	TESORO 63 CRUDE
PIPELINE ID	611
MILES	1.24
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/14/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Matthew
LAST NAME	Marusich
TITLE	Operations Area Manager
ENTITY	
PHONE	(925) 335-3452
EMAIL	Matthew.V.Marusich@andeavor.com
ADDRESS	150 Solano Way
CITY	Martinez
STATE	CA
ZIP	94553

ML17. Tesoro Logistics Operations; Crude Oil Pipeline 612

31874

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31874
OPERATOR NAME	TESORO LOGISTICS OPERATIONS ...
SYSTEM NAME	GOLDEN EAGLE
SUBSYSTEM NAME	12IN TESORO 200 CRUDE
PIPELINE ID	612
MILES	1.26
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/14/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Matthew
LAST NAME	Marusich
TITLE	Operations Area Manager
ENTITY	
PHONE	(925) 335-3452
EMAIL	Matthew.V.Marusich@andeavor.com
ADDRESS	150 Solano Way
CITY	Martinez
STATE	CA
ZIP	94553

ML18. Plains Marketing, LP; Non-HVL Product Pipeline 14937

26085

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	26085
OPERATOR NAME	PLAINS MARKETING, L.P.
SYSTEM NAME	PLAINS PRODUCTS TERMINALS
SUBSYSTEM NAME	LINE 191
PIPELINE ID	14937
MILES	0.88
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	PRODUCTS
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (unfilled)
REVISION DATE	03/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	BRYAN
LAST NAME	FERGUSON
TITLE	MGR GIS/DATA INTEGRATION
ENTITY	
PHONE	(713) 646-4308
EMAIL	bcferguson@paalp.com
ADDRESS	333 CLAY STREET SUITE 1600
CITY	HOUSTON
STATE	TX
ZIP	77002

ML19. Phillips 66 Pipeline, LLC; Crude Oil Pipeline 2260_50

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	JUNCTION TO RODEO REFINERY
SUBSYSTEM NAME	COALINGA PMP STA/RODEO REFIN...
PIPELINE ID	2260_50
MILES	3.36
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

ML20. SFPP, LP; Non-HVL Product Pipeline LS-90/50/60; CONCOR

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-90/50/60; CONCORD - FRESNO 12"
PIPELINE ID	LS-90/50/60; CONCOR*
MILES	34.83
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML21. SFPP, LP; Non-HVL Product Pipeline LS-27; MARTINEZ-C

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-27; MARTINEZ - CONCORD 12"
PIPELINE ID	LS-27; MARTINEZ - C*
MILES	5.24
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML22. SFPP, LP; Non-HVL Product Pipeline LS-33; MOCOCO JCT

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-33; MOCOCO JCT - CONCORD 12"
PIPELINE ID	LS-33; MOCOCO JCT -*
MILES	4.55
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	Y
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML23. Shell Pipeline Co., LP; Crude Oil Pipeline 92

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	COALINGA-AVON
SUBSYSTEM NAME	92 - 16IN|20IN|24IN COALINGA TO A...
PIPELINE ID	92
MILES	2.92
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	CRUDE
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

ML24. Plains Marketing, LP; Non-HVL Pipeline 15588

26085

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	26085
OPERATOR NAME	PLAINS MARKETING, L.P.
SYSTEM NAME	PLAINS PRODUCTS TERMINALS
SUBSYSTEM NAME	LINE 191
PIPELINE ID	15588
MILES	2.68
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	PRODUCTS
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	03/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	BRYAN
LAST NAME	FERGUSON
TITLE	MGR GIS/DATA INTEGRATION
ENTITY	
PHONE	(713) 646-4308
EMAIL	bcferguson@paalp.com
ADDRESS	333 CLAY STREET SUITE 1600
CITY	HOUSTON
STATE	TX
ZIP	77002

ML25. SFPP, LP; Non-HVL Pipeline LS-16; CONCORD-SA

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-16; CONCORD - SAN JOSE 10"
PIPELINE ID	LS-16; CONCORD - SA*
MILES	22.81
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML26. Phillips 66 Pipeline, LLC; Crude Oil Pipeline 2260_42

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	JUNCTION TO RODEO REFINERY
SUBSYSTEM NAME	COALINGA PMP STA/RODEO REFIN...
PIPELINE ID	2260_42
MILES	7.95
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

ML27. SFPP, LP; Non-HVL Product Pipeline LS-9; CONCORD-BRADSHAW-10”

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-9; CONCORD - BRADSHAW 10"
PIPELINE ID	LS-9; CONCORD - BRA*
MILES	32.60
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

ML28. Shell Pipeline Co., LP; Crude Oil Pipeline 92

31174

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31174
OPERATOR NAME	SHELL PIPELINE CO., L.P.
SYSTEM NAME	COALINGA-AVON
SUBSYSTEM NAME	92 - 16IN|20IN|24IN COALINGA TO A...
PIPELINE ID	92
MILES	22.49
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	CRUDE
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/15/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Pratik
LAST NAME	Bhakta
TITLE	Regulatory Engineer
ENTITY	
PHONE	(832) 762-2782
EMAIL	pratik.bhakta@shell.com
ADDRESS	P.O. BOX 2648
CITY	Houston
STATE	TX
ZIP	77252

ML29. Phillips 66 Pipeline, LLC; Crude Oil Pipeline 2260_40

31684

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31684
OPERATOR NAME	PHILLIPS 66 PIPELINE LLC
SYSTEM NAME	JUNCTION TO RODEO REFINERY
SUBSYSTEM NAME	COALINGA PMP STA/RODEO REFIN...
PIPELINE ID	2260_40
MILES	22.49
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	02/22/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Todd
LAST NAME	Tullio
TITLE	Manager, DOT Compliance
ENTITY	
PHONE	(832) 765-1636
EMAIL	Todd.L.Tullio@p66.com
ADDRESS	2331 Citywest Blvd HQ-08-S820-05
CITY	Houston
STATE	TX
ZIP	77043

ML30. Chevron Pipeline, Co; Non-HVL Product Pipeline CAL0002-3

2731

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	2731
OPERATOR NAME	CHEVRON PIPE LINE CO
SYSTEM NAME	BAY AREA PIPE LINE
SUBSYSTEM NAME	BAY AREA PRODUCTS LINE (BAPL)
PIPELINE ID	CAL0002-3
MILES	3.53
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	GASOLINE, DIESEL AND/OR JET
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/12/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Garrett
LAST NAME	Parker
TITLE	Regulatory Assurance Specialist
ENTITY	
PHONE	(832) 854-4596
EMAIL	PARKERG@chevron.com
ADDRESS	1500 Lousiana
CITY	Houston
STATE	TX
ZIP	77002

ML31. Crimson Pipeline, LP; Crude Oil Pipeline 76

32103

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	32103
OPERATOR NAME	CRIMSON PIPELINE L.P.
SYSTEM NAME	LOS MEDANOS - VINE HILL
SUBSYSTEM NAME	
PIPELINE ID	76
MILES	15.65
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	08/10/2017
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Mike
LAST NAME	Romley
TITLE	Operations DIrector
ENTITY	
PHONE	(661) 343-3218
EMAIL	rjromley@crimsonpl.com
ADDRESS	2459 Redondo Ave.
CITY	Long Beach
STATE	CA
ZIP	90755

ML32. New Operator Pending; Natural Gas Liquids Pipeline 0770

88888

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	88888
OPERATOR NAME	SOLD - PENDING NEW OPERATOR ...
SYSTEM NAME	RYER COMPRESSOR TO NICHOLS ...
SUBSYSTEM NAME	CONDENSATE
PIPELINE ID	0770
MILES	1.89
COMMODITY CATEGORY	Natural Gas Liquids
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/13/2013
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	
LAST NAME	
TITLE	
ENTITY	NPMS STAFF
PHONE	(703) 317-6294
EMAIL	npms@dot.gov
ADDRESS	NA NA
CITY	NA
STATE	VA
ZIP	0

ML33. Chevron Pipeline Co.; Non-HVL Product Pipeline CAL0006B

2731

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	2731
OPERATOR NAME	CHEVRON PIPE LINE CO
SYSTEM NAME	BAY AREA PIPE LINE
SUBSYSTEM NAME	BAY AREA PRODUCTS LINE (BAPL)
PIPELINE ID	CAL0006B
MILES	1.24
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	GASOLINE, DIESEL AND/OR JET
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/12/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Garrett
LAST NAME	Parker
TITLE	Regulatory Assurance Specialist
ENTITY	
PHONE	(832) 854-4596
EMAIL	PARKERG@chevron.com
ADDRESS	1500 Lousiana
CITY	Houston
STATE	TX
ZIP	77002

ML34. Tesoro Logistics Operations; Crude Oil Pipeline 1107

31874

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31874
OPERATOR NAME	TESORO LOGISTICS OPERATIONS ...
SYSTEM NAME	GOLDEN EAGLE
SUBSYSTEM NAME	TESORO 63A CRUDE LINE
PIPELINE ID	1107
MILES	0.25
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/14/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Matthew
LAST NAME	Marusich
TITLE	Operations Area Manager
ENTITY	
PHONE	(925) 335-3452
EMAIL	Matthew.V.Marusich@andeavor.com
ADDRESS	150 Solano Way
CITY	Martinez
STATE	CA
ZIP	94553

ML35. Tesoro Logistics Operations; Crude Oil Pipeline 1107

31874

Attribute	Value
– Category: PIPELINE ATTRIBUTES	
OPERATOR ID	31874
OPERATOR NAME	TESORO LOGISTICS OPERATIONS ...
SYSTEM NAME	GOLDEN EAGLE
SUBSYSTEM NAME	12IN TESORO 200A CRUDE
PIPELINE ID	1108
MILES	0.25
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/14/2018
FRP SEQUENCE NUMBER	
– Category: GENERAL CONTACT	
FIRST NAME	Matthew
LAST NAME	Marusich
TITLE	Operations Area Manager
ENTITY	
PHONE	(925) 335-3452
EMAIL	Matthew.V.Marusich@andeavor.com
ADDRESS	150 Solano Way
CITY	Martinez
STATE	CA
ZIP	94553

APPENDIX A-4

Pittsburg Area Pipeline Data

PL1. Crimson Pipeline, LP Crude Oil Pipeline 76

32103

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	32103
OPERATOR NAME	CRIMSON PIPELINE L.P.
SYSTEM NAME	LOS MEDANOS - VINE HILL
SUBSYSTEM NAME	
PIPELINE ID	76
MILES	15.65
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	08/10/2017
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Mike
LAST NAME	Romley
TITLE	Operations DIrector
ENTITY	
PHONE	(661) 343-3218
EMAIL	rjromley@crimsonpl.com
ADDRESS	2459 Redondo Ave.
CITY	Long Beach
STATE	CA
ZIP	90755

PL2. SFPP, LP Non-HVL Product Pipeline LS-90/50/60; CONCOR

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-90/50/60; CONCORD - FRESNO 12"
PIPELINE ID	LS-90/50/60; CONCOR*
MILES	34.83
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

PL3. Chevron Pipeline Co., Non-HVL Product Pipeline CAL0002-8

2731

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	2731
OPERATOR NAME	CHEVRON PIPE LINE CO
SYSTEM NAME	BAY AREA PIPE LINE
SUBSYSTEM NAME	BAY AREA PRODUCTS LINE (BAPL)
PIPELINE ID	CAL0002-8
MILES	19.60
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	GASOLINE, DIESEL AND/OR JET
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/12/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Garrett
LAST NAME	Parker
TITLE	Regulatory Assurance Specialist
ENTITY	
PHONE	(832) 854-4596
EMAIL	PARKERG@chevron.com
ADDRESS	1500 Lousiana
CITY	Houston
STATE	TX
ZIP	77002

PL4. SFPP, LP; Non-HVL Product Pipeline LS-9; Concord-BRA

18092

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	18092
OPERATOR NAME	SFPP, LP
SYSTEM NAME	SFPP_NORTH
SUBSYSTEM NAME	LS-9; CONCORD - BRADSHAW 10"
PIPELINE ID	LS-9; CONCORD - BRA*
MILES	32.60
COMMODITY CATEGORY	Non-HVL Product
COMMODITY DESCRIPTION	NON HVL PRODUCT
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	06/21/2018
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	PATRICK
LAST NAME	RIBAN
TITLE	MANAGER-ENGINEERING
ENTITY	
PHONE	(713) 420-5608
EMAIL	patrick_riban@kindermorgan.com
ADDRESS	1001 LOUISIANA ST
CITY	HOUSTON
STATE	TX
ZIP	77002

PL5. Crimson Pipeline, LP Crude Oil Pipeline 499

32103

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	32103
OPERATOR NAME	CRIMSON PIPELINE L.P.
SYSTEM NAME	LOS MEDANOS
SUBSYSTEM NAME	
PIPELINE ID	499
MILES	20.50
COMMODITY CATEGORY	Crude Oil
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Active (filled)
REVISION DATE	08/10/2017
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	Mike
LAST NAME	Romley
TITLE	Operations DIrector
ENTITY	
PHONE	(661) 343-3218
EMAIL	rjromley@crimsonpl.com
ADDRESS	2459 Redondo Ave.
CITY	Long Beach
STATE	CA
ZIP	90755

PL6. Abandoned Pittsburg-Antioch Pipeline 31590

99999

Attribute	Value
Category: PIPELINE ATTRIBUTES	
OPERATOR ID	99999
OPERATOR NAME	ABANDONED
SYSTEM NAME	PITTSBURG-ANTIOCH PIPELINE
SUBSYSTEM NAME	PITTSBURG-ANTIOCH PIPELINE
PIPELINE ID	31590
MILES	8.40
COMMODITY CATEGORY	Empty Liquid
COMMODITY DESCRIPTION	
INTERSTATE DESIGNATION	N
PIPELINE STATUS CODE	Permanently Abandoned
REVISION DATE	03/26/2004
FRP SEQUENCE NUMBER	
Category: GENERAL CONTACT	
FIRST NAME	
LAST NAME	
TITLE	
ENTITY	NPMS STAFF
PHONE	(703) 317-6294
EMAIL	npms@dot.gov
ADDRESS	NA NA
CITY	NA
STATE	VA
ZIP	0

APPENDIX B

Critical Facilities Data

APPENDIX B-1

CRITICAL FACILITIES: RICHMOND PINCH POINT #1

Critical Facility Category	Critical Facility	Street Addess	City	State	Latitude	Longitude
City and County Buildings	El Cerrito Building Inspection	10890 San Pablo Ave.	El Cerrito	CA	37.915730	-122.311030
	El Cerrito Police Department	10900 San Pablo Ave.	El Cerrito	CA	37.916210	-122.311490
	Kensington Police Department	217 Arlington Ave.	Kensington	CA	37.913850	-122.280670
	Bayview Branch Public Library	5100 Hartnett Ave.	Richmond	CA	37.915187	-122.323848
	El Cerrito Library-Contra Costa County Library	6510 Stockton Ave.	El Cerrito	CA	37.908499	-122.303988
	Kensington Library-Contra Costa County Library	61 Arlington Ave.	Kensington	CA	37.913179	-122.281082
Fire Stations	Richmond Fire Department Station 64	4801 Bayview Ave.	Richmond	CA	37.914680	-122.323770
	El Cerrito Fire Department	10900 San Pablo Ave.	El Cerrito	CA	37.916210	-122.311490
	Kensington Fire District	217 Arlington Ave.	Kensington	CA	37.913850	-122.280670
Hospitals/Emergency Care	Castro Therapy Unit	1435 Lawrence St.	El Cerrito	CA	37.920390	-122.304560
	New MD & Urgent Care	10612 San Pablo Ave.	El Cerrito	CA	37.911990	-122.307410
	Kensington Clinic	60 Arlington Ave.	El Cerrito	CA	37.929730	-122.304330
	Kensington Physical Therapy	303 Arlington Ave.	Kensington	CA	37.903309	-122.277489
	UHS Surgical Services	3427 Regatta Blvd.	Richmond	CA	37.919381	-122.334950
Nursing/Convalescent	El Cerrito Royale	6510 Gladys Ave.	El Cerrito	CA	37.919320	-122.311930
Community Centers/Shelters	Booker T. Anderson Community Center	960 S. 47th St.	Richmond	CA	37.918610	-122.326740
	Monterey Pines Community Room	680 S. 37th St.	Richmond	CA	37.923210	-122.333950
	St. Johns Community Center	6500 Gladys Ave.	El Cerrito	CA	37.919470	-122.312050
	El Cerrito Midtown Activity Center	10940 San Pablo Ave.	El Cerrito	CA	37.916750	-122.311770
	El Cerrito Community Center	7007 Moeser Lane	El Cerrito	CA	37.914620	-122.302880
	Kensington Community Center	59 Arlington Ave.	Kensington	CA	37.903660	-122.278310
Schools/Preschools	Fairmont Elementary	724 Kearney St.	El Cerrito	CA	37.915670	-122.310430
	Kensington Elementary	90 Highland Blvd.	Kensington	CA	37.914170	-122.278950
	Wilson Elementary	7150 Portola Dr.	El Cerrito	CA	37.915370	-122.302390
	Stege Elementary	4949 Cypress Ave.	Richmond	CA	37.919800	-122.322390
	El Cerrito High School	540 Ashbury Ave.	El Cerrito	CA	37.906170	-122.294390
	Summit Public Schools	1800 Elm St.	El Cerrito	CA	37.925720	-122.312990
	Caliber Beta Academy	4301 Berk Ave.	Richmond	CA	37.922720	-122.327400
	Kennedy High School	4300 Cutting Blvd.	Richmond	CA	37.925170	-122.329290
	King elementary	4022 Florida Ave.	Richmond	CA	37.929430	-122.347640
	Little House Preschool	4443 Potrero Ave.	Richmond	CA	37.920910	-122.318720
	Keystone Montessori Pre-School	6639 Blake St.	El Cerrito	CA	37.923240	-122.312620
	Sycamore Christian School	1111 Navellier St.	El Cerrito	CA	37.917280	-122.301330
	Pride and Joy Pre-School	1226 Liberty St.	El Cerrito	CA	37.916010	-122.308380
	El Cerrito Preschool Co-op	7200 Moeser Ln.	El Cerrito	CA	37.915080	-122.300620
	Nomura Preschool	1711 Carlson Blvd.	Richmond	CA	37.909490	-122.315100
	Little Inti Daycare Preschool	Everett and Eureka	El Cerrito	CA	37.907740	-122.299730
	Ocean View Montessori Day Care	717 Clayton Ave.	El Cerrito	CA	37.909060	-122.297820

APPENDIX B-2

CRITICAL FACILITIES: RICHMOND PINCH POINT #2

Critical Facility Category	Critical Facility	Street Addess	City	State	Latitude	Longitude
City and County Buildings	Richmond Police Department	1701 Regatta Blvd.	Richmond	CA	37.917180	-122.349950
	Richmond Police Commission	450 Civic Center Plaza	Richmond	CA	37.937590	-122.343210
	Richmond City Hall	450 Civic Center Plaza	Richmond	CA	37.937590	-122.343210
	Richmond Humn Resources Department	2544 Barrett Ave.	Richmond	CA	37.935900	-122.329300
	Richmond Emergency Services Office	440 Civic Center Plaza	Richmond	CA	37.936800	-122.342890
	Richmond Memorial Convention Center	403 Civic Center Plaza	Richmond	CA	37.937020	-122.344130
	Machalilla	430 Civic Center Plaza	Richmond	CA	37.936320	-122.343490
	Richmond Private Industry Council	330 25th St.	Richmond	CA	37.936690	-122.345260
	Richmond City Recreation Complex	3230 MacDonald Ave.	Richmond	CA	37.934120	-122.338210
	Richmond Building Services	6 13th St.	Richmond	CA	37.931520	-122.356890
	Memorial Youth Center	213 S. 33rd St.	Richmond	CA	37.927950	-122.338100
	Richmond Sewer Maintenance	3200 Regatta Blvd.	Richmond	CA	37.916680	-122.340190
	Richmond Housing Community	1401 Marina Way S.	Richmond	CA	37.912750	-122.356290
	Port of Richmond Administration	1411 Harbour Way S.	Richmond	CA	37.913680	-122.361470
	Contra Costa County Office of the Public Defender	3811 Bissell Ave.	Richmond	CA	37.933070	-122.333110
	Contra Costa County Victim Witness	100 S. 37th St.	Richmond	CA	37.930740	-122.334520
	Contra Costa Supervisor Office	11780 San Pablo Ave.	El Cerrito	CA	37.917910	-122.313270
	Contra Costa County Employment and Human Services	4006 MacDonald Ave.	Richmond	CA	37.917910	-122.313270
	Contra Costa County Perinatal Services	100 38th St.	Richmond	CA	37.932394	-122.332973
	Contra Costa County Court	100 S. 37th St.	Richmond	CA	37.930763	-122.334445
	Contra Costa County Community Center	300 S. 27th St.	Richmond	CA	37.927288	-122.343399
	West County Housing Corporation	170 21st St.	Richmond	CA	37.933608	-122.349156
	Contra Costa County Children and Family Services	1275 Hall Ave.	Richmond	CA	37.914901	-122.357240
	Contra Costa County Probation	1275 Hall Ave.	Richmond	CA	37.914901	-122.357240
	Richmond Public Library	325 Civic Center Plaza	Richmond	CA	37.935987	-122.344111
	Contra Costa County Law Library	100 37th St.	Richmond	CA	37.932619	-122.333994
	Northern Regional Library	1301 S. 46th St.	Richmond	CA	37.917708	-122.334969
	Northern Regional Library Facility	400 S. 47th St.	Richmond	CA	37.917454	-122.335430
Fire Stations	Richmond Fire Department Station 61	140 W. Richmond Ave.	Richmond	CA	37.926169	-122.385421
	Richmond Fire Department Station 67	1131 Cutting Blvd.	Richmond	CA	37.925532	-122.358283
	Richmond Fire Department Station 62	1065 7th St.	Richmond	CA	37.947760	-122.365558
	Richmond Fire Department Station 66	4100 Clinton Ave.	Richmond	CA	37.940417	-122.328887
	Richmond Fire Department	440 Civic Center Plaza	Richmond	CA	37.936800	-122.342890
Hospitals/Emergency Care	Kaiser Permanente Richmond Medical Center	901 Nevin Ave.	Richmond	CA	37.937222	-122.360545
	LifeLong Brookside Richmond Health Center	1030 Nevin Ave.	Richmond	CA	37.936649	-122.359183
	LifeLong William Jenkins health Center	150 Harbour Way	Richmond	CA	37.933379	-122.359809
	RotaCare Bay Area Richmond Clinic	256 24th St.	Richmond	CA	37.935025	-122.346134
	LifeLong Brazell H. Carter health Center	2600 MacDonald Ave.	Richmond	CA	37.934913	-122.343620
	Nevin House	3215 Nevin Ave.	Richmond	CA	37.935720	-122.337902
	Community Clinic Consortium	3720 Barrett Ave.	Richmond	CA	37.936308	-122.333293
	Contra Costa County Mental	100 38th St.	Richmond	CA	37.932344	-122.332983
	UHS Surgical Services	3427 Regatta Blvd.	Richmond	CA	37.919361	-122.334909
	Kaiser Permanente School of Allied Health	938 Marina Way	Richmond	CA	37.918565	-122.354768
Nursing/Convalescent	El Cerrito Royale	6510 Gladys Ave.	El Cerrito	CA	37.919027	-122.311572
	Shields-Richmond Nursing Center	1919 Cutting Blvd.	Richmond	CA	37.925546	-122.350905
	Grace Homes Residential Care	423 McLaughlin St.	Richmond	CA	37.934253	-122.323838
	Grace Homes Assisted Living	527 McLaughlin	Richmond	CA	37.936061	-122.324613
	Palm Tree Care Home	712 McLaughlin	Richmond	CA	37.941350	-122.326462
	Rosewood Residence Assisted Living	5311 Garvin Ave.	Richmond	CA	37.945339	-122.324934
	Richmond Post-Acute Care	955 23rd St.	Richmond	CA	37.946382	-122.347785
	TLC Home Care Agency	13201 San Pablo Ave.	San Pablo	CA	37.951585	-122.333290
Community Centers/Shelters	Booker T. Anderson Community Center	960 S. 47th St.	Richmond	CA	37.918503	-122.326794
	St. Johns Community Center	6500 Gladys Ave.	El Cerrito	CA	37.919494	-122.312036
	El Cerrito Midtown Activity Center	10940 San Pablo Ave.	El Cerrito	CA	37.916793	-122.311746
	El Cerrito Community Center	7007 Moeser Lane	El Cerrito	CA	37.914847	-122.303138
	E.M. Downer Family YMCA	263 S. 20th St.	Richmond	CA	37.928575	-122.350715
	Bobby Bowen Progressive Center	2540 MacDonald Ave.	Richmond	CA	37.935046	-122.344440
	Nevin Community Center	598 Nevin Ave.	Richmond	CA	37.936607	-122.363998
	Atchison Village Mutual Homes Corp.	270 Curry St.	Richmond	CA	37.934701	-122.371511
	Point Richmond Community Center	139 Washington	Richmond	CA	37.926558	-122.385314
	Catholic Charities of the East Bay West County Service Center	217 Harbour Way	Richmond	CA	37.934488	-122.360148
	Bay Area Rescue Mission	200 MacDonald Ave.	Richmond	CA	37.935415	-122.367472
	Bay Area Rescue Mission	2114 MacDonald Ave.	Richmond	CA	37.935566	-122.349177
	West Contra Costa Family Justice Center	256 24th St.	Richmond	CA	37.935033	-122.346123
	Rubicon Programs	2500 Bissell Ave.	Richmond	CA	37.933693	-122.345300
	Rubicon Programs	101 Broadway	Richmond	CA	37.933031	-122.346266
	Richmond Emergency Food Pantry	2369 Barrett Ave.	Richmond	CA	37.938622	-122.345982
	House Rabbit Society	148 Broadway	Richmond	CA	37.932930	-122.345447
	Good NewZ Pittie Pups Rescue	2369 Brooks Ave.	Richmond	CA	37.941010	-122.345846
	The Milo Foundation	220 S. Garrard Blvd.	Richmond	CA	37.928634	-122.379965
Schools	Arlington Christian School	6382 Arlington Blvd.	Richmond	CA	37.940956	-122.312302

APPENDIX B-2

CRITICAL FACILITIES: RICHMOND PINCH POINT #2

Critical Facility Category	Critical Facility	Street Addess	City	State	Latitude	Longitude
	Mira Vista Elementary	6397 Hazel Avenue	Richmond Heigh	CA	37.941057	-122.313808
	De Jean Middle School	3400 MacDonald Ave.	Richmond	CA	37.932582	-122.336903
	Stege Elementary	4949 Cypress Ave.	Richmond	CA	37.920019	-122.322952
	Summit Public Schools	1800 Elm St.	El Cerrito	CA	37.925312	-122.313563
	Caliber Beta Academy	4301 Berk Ave.	Richmond	CA	37.922820	-122.328938
	Kennedy High School	4300 Cutting Blvd.	Richmond	CA	37.924780	-122.328610
	King elementary	4022 Florida Ave.	Richmond	CA	37.929096	-122.331587
	Manzanita Charter Middle School	461 33rd St.	Richmond	CA	37.936665	-122.337477
	Grant Elementary	2400 Downer Ave.	Richmond	CA	37.942513	-122.345048
	St. Cornelius Catholic School	201 28th St.	Richmond	CA	37.933887	-122.342160
	Coronado Elementary	2100 Maine Ave.	Richmond	CA	37.927785	-122.349510
	Nystrom Elementary	230 Harbour Way S.	Richmond	CA	37.928159	-122.359269
	Richmond College Prep Schools	1014 Florida Ave.	Richmond	CA	37.929065	-122.359316
	West Contra Costa Costa Unified School District/Delta High	1108 Bissell Ave.	Richmond	CA	37.933594	-122.358640
	Leadership Public Schools	880 Bissell Ave.	Richmond	CA	37.933805	-122.361142
	Samuel Gompers Continuation School	831 Chanslor Ave.	Richmond	CA	37.933384	-122.361163
	John Henry High	1402 Marina Way S.	Richmond	CA	37.912774	-122.354919
	Peres Elementary	719 5th St.	Richmond	CA	37.942773	-122.364531
	Chavez Elementary	960 17th St.	Richmond	CA	37.946992	-122.352907
	Richmond High	1250 23rd St.	Richmond	CA	37.952453	-122.345902
	Washington Elementary	565 Wine St.	Richmond	CA	37.924457	-122.380994
	Downer Elementary	1231 18th St.	San Pablo	CA	37.952095	-122.352947
	United Christian College	3219 MacDonald Ave.	Richmond	CA	37.934653	-122.338147
	Little house Preschool	4443 Potrero Ave.	Richmond	CA	37.921264	-122.327371
	Richmond Children's Academy	2900 Cutting Rd.	Richmond	CA	37.924958	-122.341429
	Curious Explorers Academy	4121 MacDonald Ave.	Richmond	CA	37.933663	-122.330236
	A Little World Montessori	374 37th St.	Richmond	CA	37.934432	-122.333815
	Happy Brown Bears Pre-school	2225 Gaynor Ave.	Richmond	CA	37.944706	-122.347760
	La Petite Academy of Richmond	1221 Nevin Ave.	Richmond	CA	37.937552	-122.357002

APPENDIX B-3
CRITICAL FACILITIES: MARTINEZ PINCH POINT #3

Critical Facility Category	Critical Facility	Street Addess	City	State	Latitude	Longitude
City and County Buildings	Martinez City Hall	525 Henrietta St.	Martinez	CA	38.014112	-122.135351
	Martinez Planning and Zoning	525 Henrietta St.	Martinez	CA	38.014112	-122.135351
	Martinez Police Department	525 Henrietta St.	Martinez	CA	38.014112	-122.135351
	Martinez Water Department	525 Henrietta St.	Martinez	CA	38.014112	-122.135351
	Martinez Detention Facility	1000 Ward St.	Martinez	CA	38.017912	-122.133154
	Martinez traffic Signal Maintenance	2467 Waterbird Way	Martinez	CA	38.001369	-122.073085
	Contra Costa County Jail	901 Court St.	Martinez	CA	38.017168	-122.132167
	Contra Costa County Court Records	1111 Ward St.	Martinez	CA	38.018607	-122.133033
	Contra Costa county Sheriff's Office	651 Pine St.	Martinez	CA	38.019302	-122.133676
	Contra Costa County Sheriff-Criminalistics	1122 Escobar St.	Martinez	CA	38.019518	-122.133310
	Contra Costa County Sheriff	500 Court St.	Martinez	CA	38.019112	-122.135273
	Contra Costa County Sheriff Department	1980 Muir Rd.	Martinez	CA	37.989702	-122.085985
	Contra Costa County Sheriff-Technical Services	30 Glacier Dr.	Martinez	CA	37.990742	-122.086928
	Contra Costa Public Works Surplus	4785 Blum Rd.	Martinez	CA	38.000368	-122.073975
	Contra Costa County Public Works Department	255 Glacier Dr.	Martinez	CA	37.988076	-122.086851
	Contra Costa County Flood Control	2475 Waterbird Way	Martinez	CA	37.999965	-122.071539
	Contra Costa Animal Services Department	4800 Imhoff Pl.	Martinez	CA	37.999225	-122.071217
	Contra Costa County Library-Martinez Branch	740 Court Street	Martinez	CA	38.017990	-122.134161
	Contra Costa County Law Library	1020 Ward St.	Martinez	CA	38.018074	-122.132927
	Degan Medical Library	2500 Alhambra Ave.	Martinez	CA	38.006961	-122.132743
Fire Stations	Contra Costa Fire Station 12	1240 Shell Ave.	Martinez	CA	38.010631	-122.118225
	Contra Costa Fire Station 14	521 Jones St.	Martinez	CA	38.012950	-122.134297
Hospitals/Emergency Care	Contra Costa Regional Medical Center	2500 Alhambra Ave.	Martinez	CA	38.006789	-122.132804
	Contra Costa County-Martinez Health Center	2500 Alhambra Ave.	Martinez	CA	38.006789	-122.132804
	Telecare Hope House	300 Ilene St.	Martinez	CA	38.008029	-122.133843
	Kaisere Permanente	200 Muir Rd.	Martinez	CA	37.993657	-122.110355
Nursing/Convalescent	Alhambra Convalescent Hospital	331 Ilene St.	Martinez	CA	38.008379	-122.133399
	Tender Touch Residential Care	58 Midhill Dr.	Martinez	CA	37.997924	-122.098379
	Martinez Convalescent Home	4110 Alhambra Way	Martinez	CA	37.993374	-122.128530
	Legacy Nursing and Rehab	1790 Muir Rd.	Martinez	CA	37.988972	-122.090789
Community Centers/Shelters	Northern California Family Center	2244 Pacheco Blvd.	Martinez	CA	38.012737	-122.121054
	City of Martinez Senior Center	818 Green St.	Martinez	CA	38.016676	-122.134297
	Martinez Community and Economic Center	525 Henrietta St.	Martinez	CA	38.014112	-122.135351
	Shell Clubhouse	1635 Pacheco Blvd.	Martinez	CA	38.014692	-122.125935
	Mountain View Emergency Family Shelter	1391 Shell Ave.	Martinez	CA	38.012520	-122.118061
	Contra Costa County Care Group	1350 Arnold Dr.	Martinez	CA	37.992109	-122.098600
	Contra Costa County Adoption	2530 Arnold Dr.	Martinez	CA	37.992721	-122.078862
Schools	Martinez Unified School District	921 Susana St.	Martinez	CA	38.014815	-122.132498
	Martinez Early Intervention	921 Susana St.	Martinez	CA	38.014815	-122.132498
	Creekside Montessori	1333 Estudillo St.	Martinez	CA	38.013748	-122.133144
	St. Catherine of Siena School	604 Mellus St.	Martinez	CA	38.014694	-122.134897
	Martinez Junior High School	1600 Court St.	Martinez	CA	38.013582	-122.130663
	Alhambra High School	150 E St.	Martinez	CA	38.002629	-122.133375
	American Indian Cultural and Education Program	600 F St.	Martinez	CA	38.000612	-122.130826
	John Muir Elementary	205 Vista Way	Martinez	CA	38.000191	-122.120000
	International Mission-Higher Education	1117 Brittany Hills Ct.	Martinez	CA	38.002084	-122.100287
	Morello Park Elementary	1200 Morello Park Dr.	Martinez	CA	38.001644	-122.099178
	Community Day Schools Program	3930 Pacheco Blvd.	Martinez	CA	38.008221	-122.095910
	Las Juntas Elementary	4105 Pacheco Blvd.	Martinez	CA	38.008372	-122.092840
	White Stone Christian Academy	1151 Polson	Martinez	CA	37.991556	-122.103172
	Electrical Trade School	1255 Muir Rd.	Martinez	CA	37.990672	-122.099489
	Mt. McKinley School	202 Glacier Dr.	Martinez	CA	37.988808	-122.087844
	Contra Costa Community College District	500 N. Court St.	Martinez	CA	38.019142	-122.135067
	Creekside Montessori	1333 Estudillo St.	Martinez	CA	38.013748	-122.133144
	Morello Hills Christian Preschool and Daycary	1000 Morello Hills Dr.	Martinez	CA	38.000527	-122.103590
	Forest Hills Preschool	127 Midhill Rd.	Martinez	CA	37.997407	-122.095239
	Helping Hands Christian Preschool	1865 Arnold Dr.	Martinez	CA	37.992202	-122.089436
	Sunshine House	4950 Pacheco Blvd.	Martinez	CA	37.996675	-122.076922

APPENDIX B-4

CRITICAL FACILITIES: BAY POINT PINCH POINT #4

Critical Facility Category	Critical Facility	Street Addess	City	State	Latitude	Longitude
City and County Buildings	Pittsburg Housing Rehabilitation	710 Black Diamond St.	Pittsburg	CA	38.030467	-121.885856
	Pittsburg Community Access	915 Cumberland St.	Pittsburg	CA	38.028210	-121.883603
	Pittsburg Housing Authority	916 Cumberland St.	Pittsburg	CA	38.027961	-121.884400
	Pittsburg Public Works Department	357 E. 12th St.	Pittsburg	CA	38.025882	-121.882888
	Pittsburg City Engineeering	65 Civic Ave.	Pittsburg	CA	38.019983	-121.891780
	Pittsburg City Center	Center Dr.	Pittsburg	CA	38.019248	-121.891683
	Pittsburg Police Department	65 Civic Ave.	Pittsburg	CA	38.019983	-121.891780
	Contra Costa County Sheriff Department	659 Port Chicago Hwy.	Bay Point	CA	38.034690	-121.960503
	Contra Costa County Community Services	2430 Willow Pass Rd.	Bay Point	CA	38.027363	-121.936615
	Contra Costa County Community Services	3103 Willow Pass Rd.	Bay Point	CA	38.026323	-121.949583
	Contra Costa County Public Health	215 Pacifica Ave.	Bay Point	CA	38.033785	-121.968129
	Contra Costa County Small Claims Court	1000 Center Dr.	Pittsburg	CA	38.019357	-121.889802
	Contra Costa County Municipal Court-Traffic Citations	45 Civic Ave.	Pittsburg	CA	38.021091	-121.890156
	Bay Point Library-Contra Costa County Library	205 Pacifica Ave.	Bay Point	CA	38.033960	-121.967276
	Pittsburg Library-Contra Costa County Library	80 Power Avenue	Pittsburg	CA	38.018858	-121.890875
	Contra Costa County Public Law Library	1000 Center Drive	Pittsburg	CA	38.019272	-121.889942
Fire Stations	Contra Costa Fire Station 87	800 W. Leland Ave.	Pittsburg	CA	38.014433	-121.919832
	Contra Costa Fire Station 86	3000 Wllow Pass Rd.	Pittsburg	CA	38.027093	-121.948066
Hospitals/Emergency Care	Pittsburg Health Center	2311 Loveridge Rd.	Pittsburg	CA	38.006538	-121.869691
Nursing/Convalescent	Pittsburg Care Center	535 School Street	Pittsburg	CA	38.020257	-121.879342
	Rose's Garden	372 Ocean Drive	Pittsburg	CA	38.021294	-121.916632
	Westwood Residential Care	2228 Westwood Ct.	Pittsburg	CA	38.013779	-121.937522
	Sivi Lay Elderly Home Care	2242 Mt. Whitney Dr.	Pittsburg	CA	38.011661	-121.931778
Community Centers/Shelters	Ambrose Recreation and Park District	3105 Willow Pass Rd.	Bay Point	CA	38.026273	-121.949188
	Teen Community Center	60 Civic Ave.	Pittsburg	CA	38.022657	-121.889648
	People Who Care Children Association Youth Center	2231 Railroad Ave.	Pittsburg	CA	38.013586	-121.889909
	Love-A-Child Missions Homeless Recovery Shelter	2279 Willow Pass Rd.	Bay Point	CA	38.026690	-121.934428
	Pittsburg Family Center	84 W. 6th St.	Pittsburg	CA	38.032089	-121.886121
	Pacific Community Services	329 Railroad Ave.	Pittsburg	CA	38.033064	-121.882999
Schools	Rio Vista Elementary	611 Pacifica Ave.	Bay Point	CA	38.033776	-121.973884
	Riverview Middle School	205 Pacifica Ave.	Bay Point	CA	38.033660	-121.967191
	Gateway High School	235 Pacifica	Bay Point	CA	38.033677	-121.967174
	New Jerusalem School	290 Anchor Dr.	Bay Point	CA	38.030529	-121.963251
	Above and Beyond Academy	68 Amador Ct.	Bay Point	CA	38.023197	-121.940500
	Bel Air Elementary	663 Canal Rd.	Bay Point	CA	38.020228	-121.937877
	Willow Cove Elementary	1880 Hanlon Way	Pittsburg	CA	38.024522	-121.926921
	Rancho Medanos Junior High School	2301 Range Rd.	Pittsburg	CA	38.015920	-121.912775
	Shore Acres Elementary	351 Marina Rd.	Pittsburg	CA	38.035718	-121.969783
	Rancho Medanos Junior High School	2301 Range Rd.	Pittsburg	CA	38.016630	-121.911927
	Los Medanos Elementary School	610 Crowley Ave.	Pittsburg	CA	38.016794	-121.901093
	Parkside Elementary	985 W. 17th St.	Pittsburg	CA	38.022699	-121.900094
	St. Peter Martyr School	425 W. 4th St.	Pittsburg	CA	38.033796	-121.890735
	Marina Vista	50 E. 8th St.	Pittsburg	CA	38.029231	-121.885830
	Pittsburg School District Office	2000 Railroad Ave.	Pittsburg	CA	38.019804	-121.888679
	Child Nutrition Services Department	2000 Railroad Ave.	Pittsburg	CA	38.019804	-121.888679
	Pittsburg High School	1750 Harbor St.	Pittsburg	CA	38.019190	-121.881826
	YMCA Contra Costa/Sacramento - Bay point	225 Pacifica Ave.	Bay Point	CA	38.032025	-121.967098
	Kids First Academy	2340 Willow Pass Rd.	Bay Point	CA	38.026921	-121.935477
	Mi Mi's Learning Center	2131 Riesling Ct.	Pittsburg	CA	38.016378	-121.923166
	First Baptist Head Start	204 Odessa Ave.	Pittsburg	CA	38.036056	-121.890380
	Railroad Junction School	2224 Railroad Ave.	Pittsburg	CA	38.013564	-121.891587
	Pittsburg Pre-School and Community	1760 Chester Dr.	Pittsburg	CA	38.016808	-121.875283
	Pittsburg KinderCare	150 E. Leland Rd.	Pittsburg	CA	38.011087	-121.889935

APPENDIX B-5

CRITICAL FACILITIES: ANTIOCH PINCH POINT #5

Critical Facility Category	Critical Facility	Street Addess	City	State	Latitude	Longitude
City and County Buildings	Antioch City Hall	200 H St.	Antioch	CA	38.016712	-121.815191
	Antioch Building Inspection Division	200 H St.	Antioch	CA	38.016712	-121.815191
	Antioch City Marina	5 Marina Plaza	Antioch	CA	38.020070	-121.820229
	Antioch Engineeing and Land	200 H St.	Antioch	CA	38.016712	-121.815191
	Antioch Animal Services	300 L St.	Antioch	CA	38.016192	-121.820785
	Antioch Public Works Department	1201 W. 4th St.	Antioch	CA	38.015480	-121.820933
	Antioch City Purchasing	1307 W. 4th St.	Antioch	CA	38.015308	-121.822609
	Antioch Lynn House Gallery	809 W. 1st St.	Antioch	CA	38.017450	-121.816608
	Antioch City Human Resources	3rd St. and H St.	Antioch	CA	38.016231	-121.815042
	Antioch Police Department	300 L St.	Antioch	CA	38.016192	-121.820785
	East County Veterans Resource Center	708 W. 2nd St.	Antioch	CA	38.017103	-121.815375
	Contra Costa Housing Choice	801 W. 8th St.	Antioch	CA	38.012440	-121.817132
	Contra Costa County Event Center	1201 W. 10th St.	Antioch	CA	38.008732	-121.822840
	Antioch Library-Contra Costa County Library	501 W. 18th Street	Antioch	CA	38.004716	-121.812695
Fire Stations	Contra Costa Fire Station 81	315 W. 10th St.	Antioch	CA	38.010976	-121.810952
	Contra Costa Fire Station 83	2717 Gentrytown Dr.	Antioch	CA	37.997322	-121.837802
Hospitals/Emergency Care	Kaiser Antioch	3400 Delta Fair Blvd.	Antioch	CA	38.004428	-121.842125
	Sutter Delta Medical Center	3901 Lone Tree Way	Antioch	CA	37.982569	-121.802908
	John Muir Primary Care	3440 Hillcrest Ave.	Antioch	CA	37.986844	-121.780537
	Kaiser Permanente Antioch Medical Center	4501 Sand Creek Rd.	Antioch	CA	37.950952	-121.775229
	RotaCare Bay Area	2210 Gladstone Dr.	Pittsburg	CA	38.009467	-121.866036
	Pittsburg Health Center	2311 Loveridge Rd.	Pittsburg	CA	38.006547	-121.869626
	La Clinica Medical	2240 Gladstone Dr.	Pittsburg	CA	38.006922	-121.867712
	Brighter Beginnings	2213 Buchanan Rd.	Antioch	CA	37.998344	-121.836101
	Contra Costa Industrial Medical Clinic	2339 Buchanan Rd.	Antioch	CA	37.998256	-121.840827
	Older Adults Clnic	3505 Lone Tree Way	Antioch	CA	37.987446	-121.806125
Nursing/Convalescent	Antioch Convalescent Hospital	1201 A Street	Antioch	CA	38.009288	-121.806247
	Independent Living Resource	301 W. 10th St.	Antioch	CA	38.010922	-121.810418
	Amarylis Care Home	100 W. 20th St.	Antioch	CA	38.003659	-121.807026
	Hilcrest Memory Care	825 E. 18th St.	Antioch	CA	38.005412	-121.791095
	Lighthouse Mentoring Center	1925 Garden Ct.	Antioch	CA	38.002307	-121.792408
	Country Place Assisted Living	1715 Olive Ln.	Antioch	CA	38.005809	-121.791674
	Viera Residential Care Home	2129 Viera Ave.	Antioch	CA	38.001280	-121.771568
Community Centers/Shelters	East County Shelter	1401 W. 4th St.	Antioch	CA	38.015349	-121.823755
	East County Senior Coalition	301 W. 10th St.	Antioch	CA	38.010922	-121.810418
	Community Outreach Center	525 E. 18th St.	Antioch	CA	38.005317	-121.795089
	Shelter, Inc.	4553 Delta Fair Blvd.	Antioch	CA	38.006207	-121.854410
Schools	East County Elementary Special Education	4207 Delta Fair Blvd.	Antioch	CA	38.003377	-121.851461
	Mission Elementary	1711 Mission Dr.	Antioch	CA	37.996817	-121.832163
	Park Middle School	1 Spartan Way	Antioch	CA	37.993181	-121.814011
	Belshaw Elementary	2801 Roosevelt Ln.	Antioch	CA	37.995322	-121.800307
	The Child Day Schools	112 E. Tregallas Rd.	Antioch	CA	37.997345	-121.803021
	Marsh Elementary	2304 G St.	Antioch	CA	38.000119	-121.816369
	Bidwell Continuation High School	800 Gary Ave.	Antioch	CA	38.000087	-121.792597
	Antioch High School	700 W. 18th St.	Antioch	CA	38.006321	-121.815937
	Live Oak High School	1708 F St.	Antioch	CA	38.005615	-121.813065
	Antioch Middle School	1500 D St.	Antioch	CA	38.005883	-121.812974
	Fremont Elementary	1413 F. St.	Antioch	CA	38.007605	-121.812210
	Holy Rosary Catholic School	25 E. 15th St.	Antioch	CA	38.007549	-121.804934
	Kimball Elementary	1310 August Way	Antioch	CA	38.007934	-121.801303
	Antioch Charter Academy	3325 Hacienda Way	Antioch	CA	37.988348	-121.826899
	Antioch Charter Academy II	1201 W. 10th St.	Antioch	CA	38.009488	-121.822868
	Prospects High School	820 W. 2nd St.	Antioch	CA	38.017147	-121.816797
	Antioch Unified School District	510 G St.	Antioch	CA	38.014419	-121.814276
	First Baptist Head Start	1203 W. 10th	Antioch	CA	38.010821	-121.824801
	So Big Preschool	1201 W. 10th St.	Antioch	CA	38.008856	-121.822601
	Vicky's Day Care & Preschool	84 Russell Dr.	Antioch	CA	38.003103	-121.814155
	Imagination Academy Preschool	2032 Hillcrest Ave.	Antioch	CA	38.001454	-121.788335
	Kids Clubs Preschool	800 Gary Ave.	Antioch	CA	38.000245	-121.791851
	Mahogany Way Kinder Care	2300 Mahogany Way	Antioch	CA	38.003030	-121.832294
	Little Lu Lu's christian Preschool	2725 Minta Ln.	Antioch	CA	37.996861	-121.815499
	Corner Christian Preschool	2800 Sunset Ln.	Antioch	CA	37.995786	-121.804377
	Harbour Light Preschool	1020 E. Tregallas Rd.	Antioch	CA	37.996569	-121.791437
	La Petite Academy of Antioch	1350 E. Tregallas Rd.	Antioch	CA	37.995521	-121.787375
	Los Medanos College	2700 E. Leland Rd.	Antioch	CA	38.005430	-121.860328

APPENDIX C

ALOHA Background Data

APPENDIX C-1

Pinch Point Richmond #1

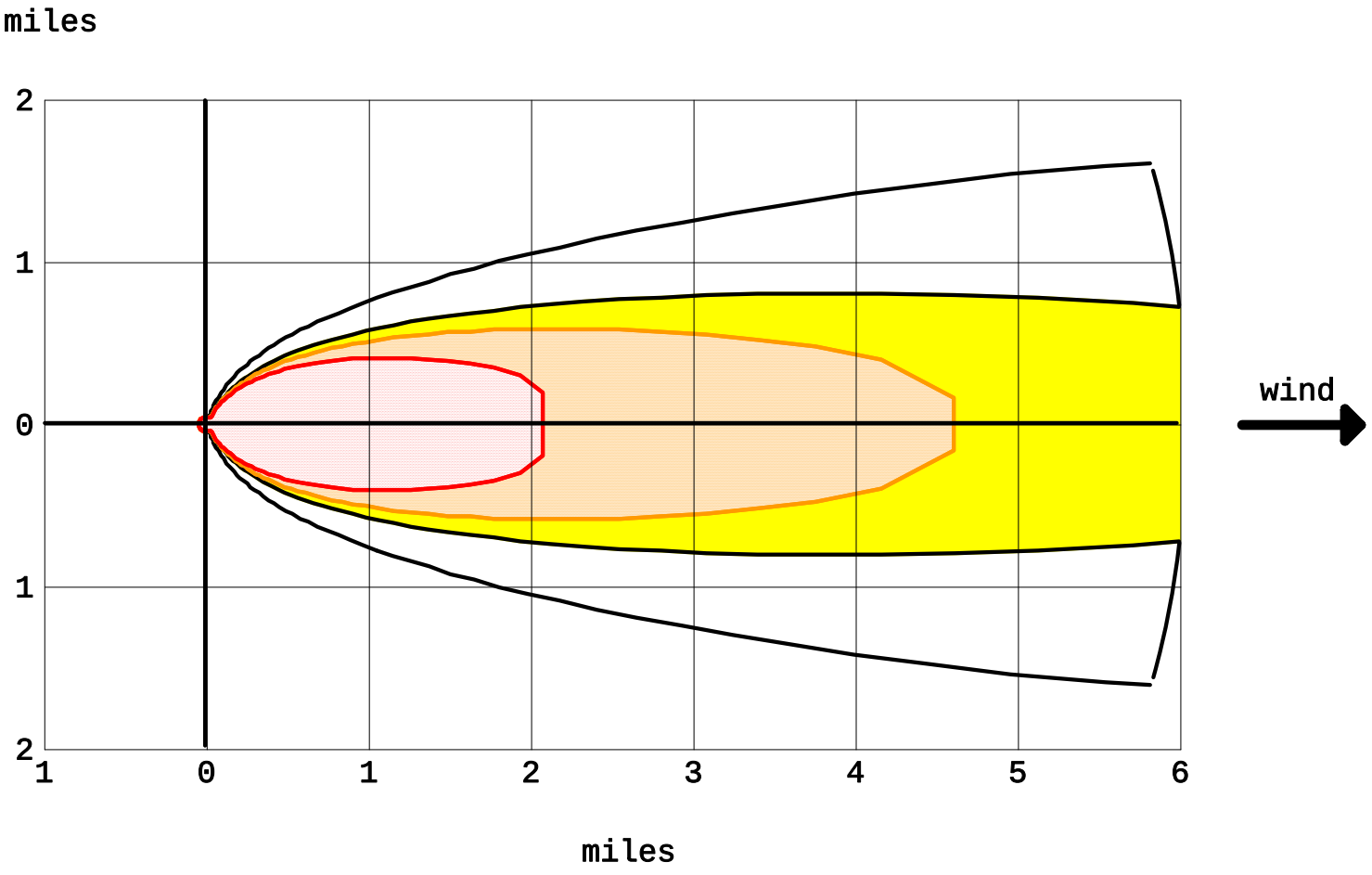
Toxic Threat Zone ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: AMMONIA

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
Model Run: Heavy Gas
Red : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])



greater than 1100 ppm (AEGL-3 [60 min])
greater than 160 ppm (AEGL-2 [60 min])
greater than 30 ppm (AEGL-1 [60 min])
wind direction confidence lines

Note: Threat zone picture is truncated at the 6 mile limit.

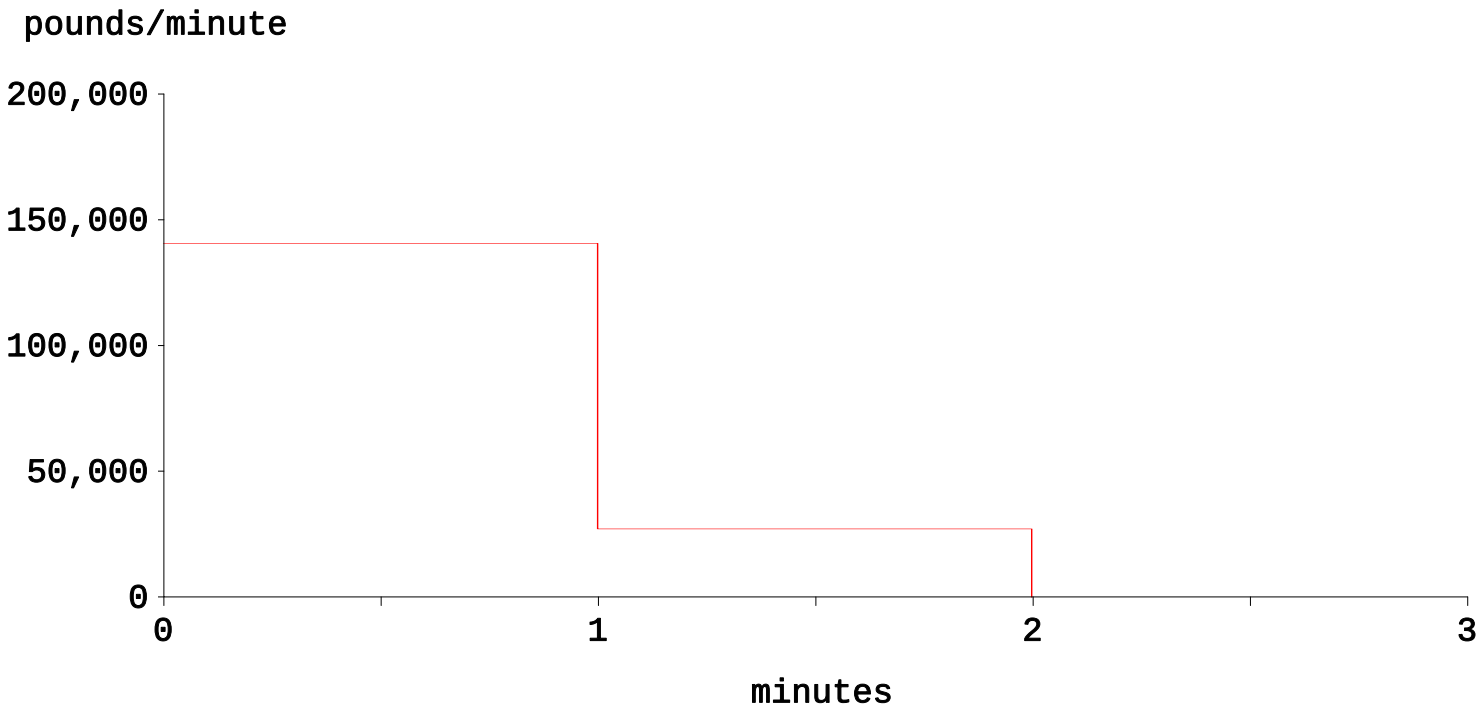
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: AMMONIA

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
SITE DATA:
  Location: RICHMOND, CALIFORNIA
  Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
  Time: July 18, 2019  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AMMONIA
  CAS Number: 7664-41-7                  Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm     UEL: 280000 ppm
  Ambient Boiling Point: -28.2° 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: 9 miles/hour from w at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 85° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
  Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
  Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])
```

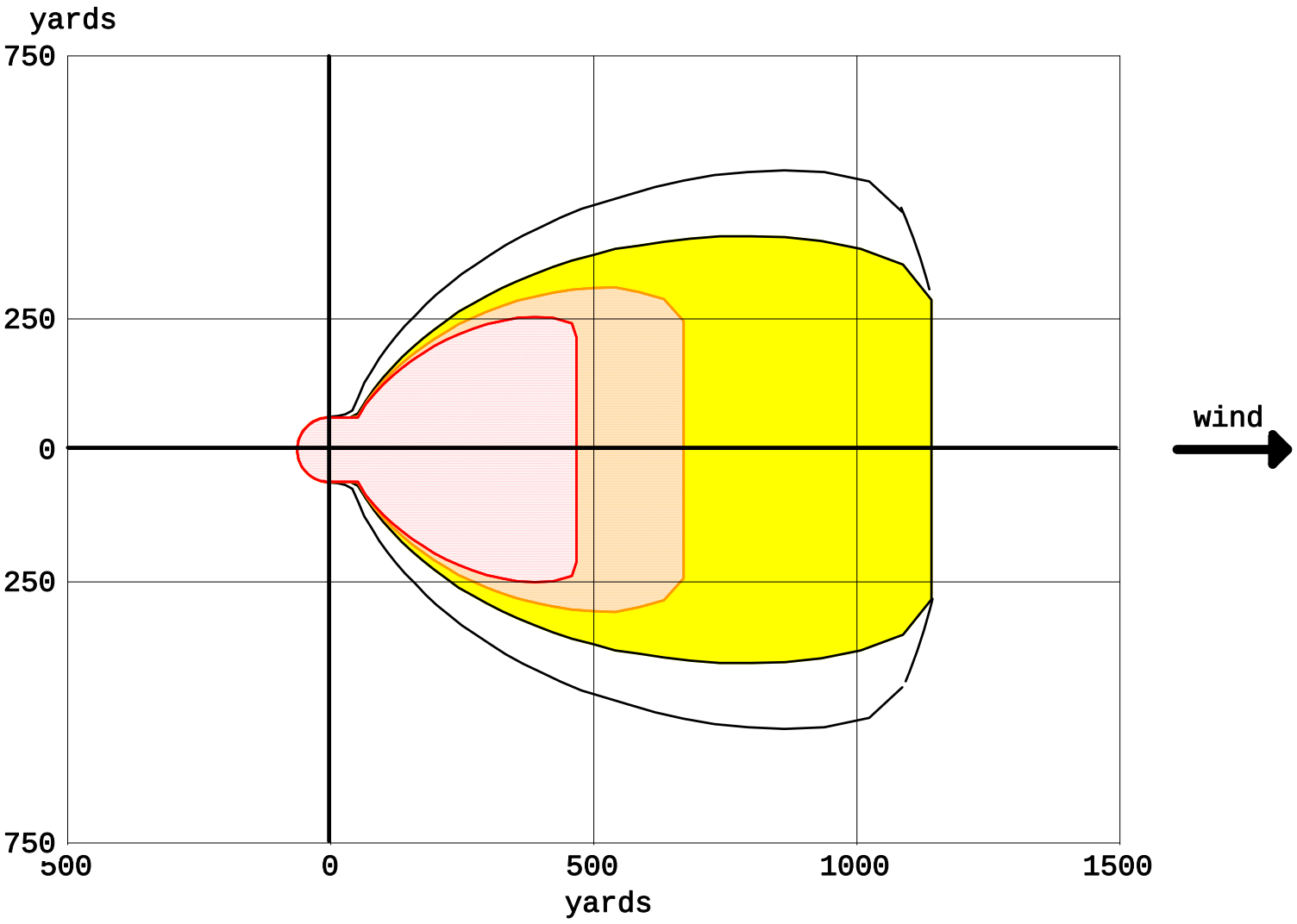
Toxic Threat Zone ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 469 yards --- (33000 ppm = AEGL-3 [60 min])
  Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
  Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```



greater than 33000 ppm (AEGL-3 [60 min])
greater than 17000 ppm (AEGL-2 [60 min])
greater than 5500 ppm (AEGL-1 [60 min])
wind direction confidence lines

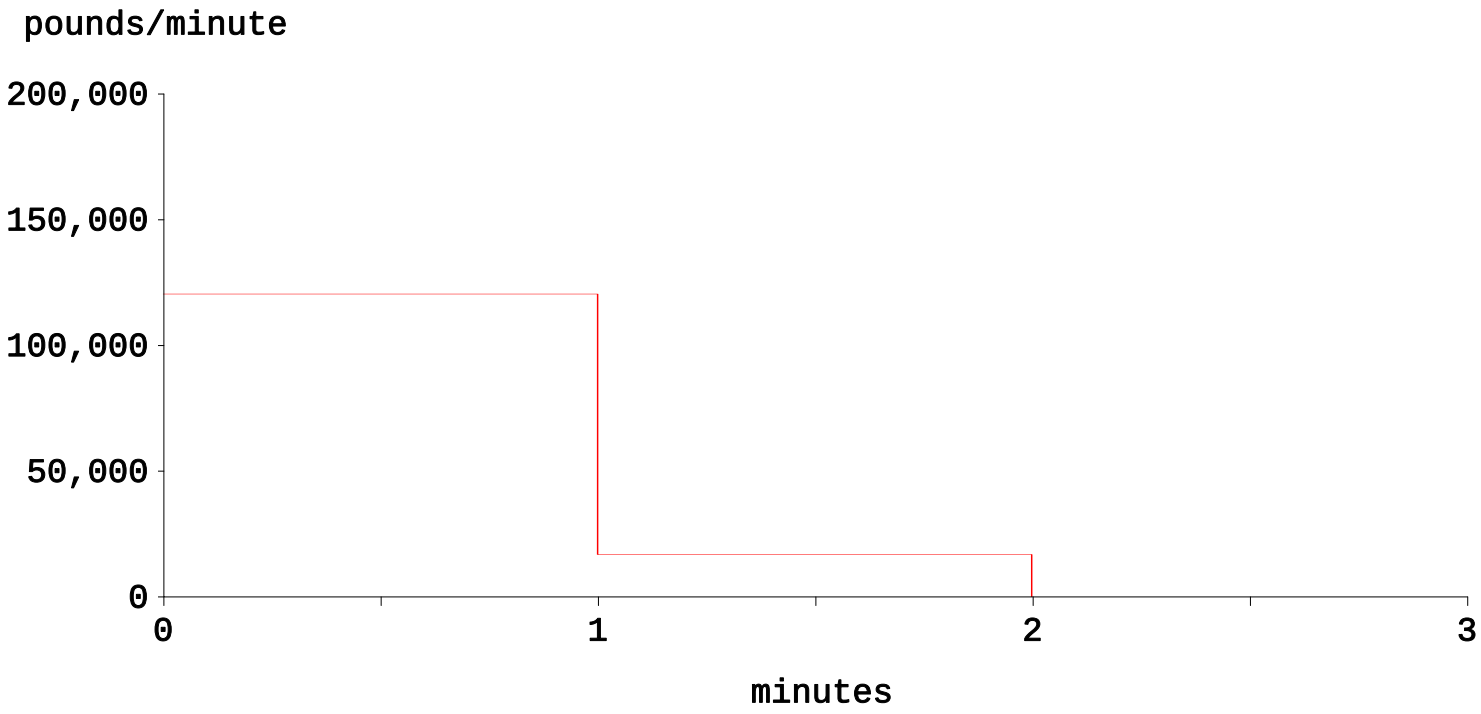
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 68.1 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 120,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 136,200 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
 SITE DATA:
   Location: RICHMOND, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.7° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid                   Internal Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Circular Opening Diameter: 10 inches
   Opening is 5 inches from tank bottom
   Release Duration: 2 minutes
   Max Average Sustained Release Rate: 120,000 pounds/min
      (averaged over a minute or more)
   Total Amount Released: 136,200 pounds
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 469 yards --- (33000 ppm = AEGL-3 [60 min])
   Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
   Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```

Thermal Radiation Threat Zone

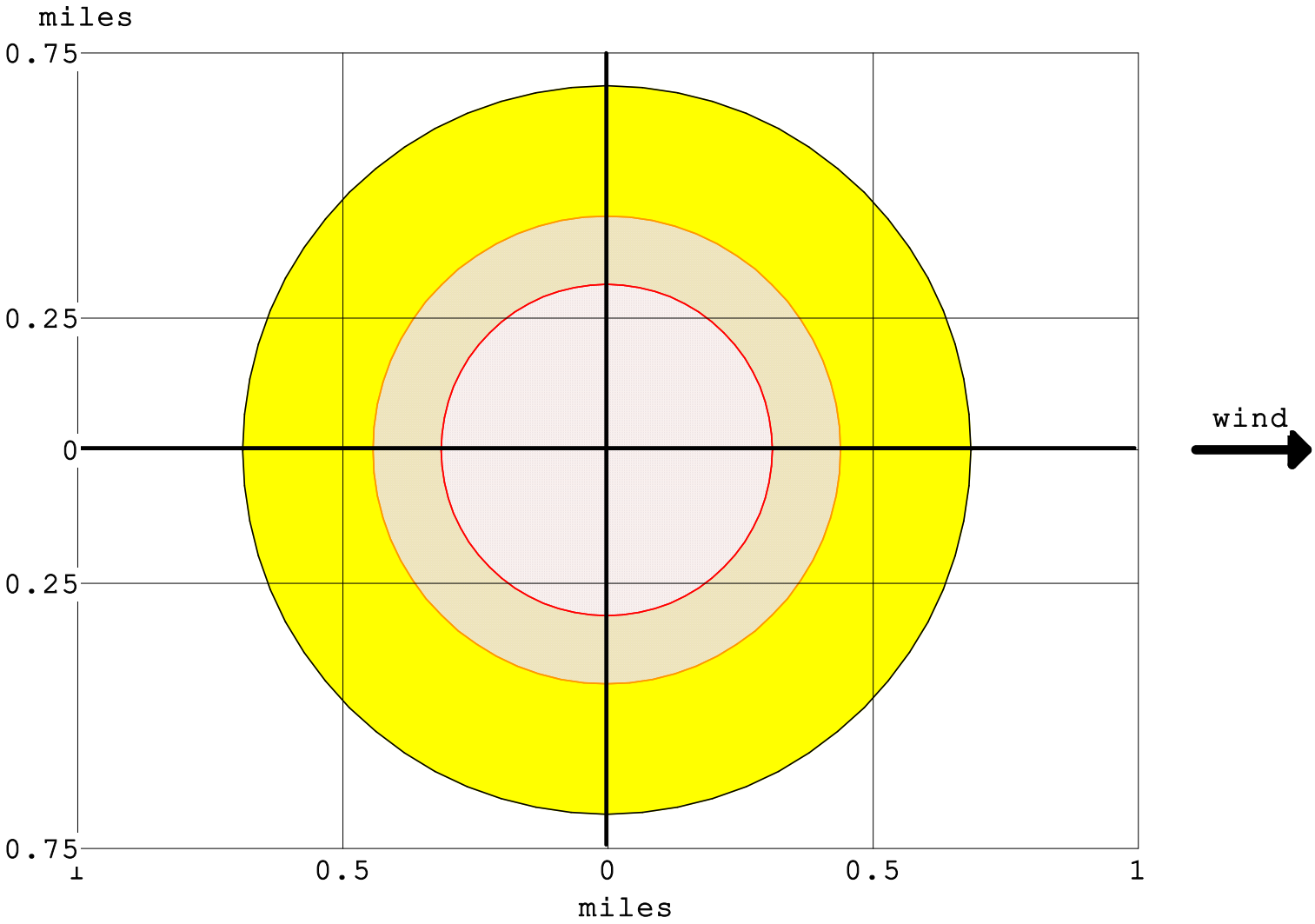
ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from fireball
  Red   : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
  Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
  Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)



greater than 10.0 kW/(sq m) (potentially lethal within 60 sec)
greater than 5.0 kW/(sq m) (2nd degree burns within 60 sec)
greater than 2.0 kW/(sq m) (pain within 60 sec)

```
 SITE DATA:
   Location: RICHMOND, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.7° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   BLEVE of flammable liquid in horizontal cylindrical tank
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid
   Internal Storage Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Percentage of Tank Mass in Fireball: 100%
   Fireball Diameter: 251 yards           Burn Duration: 14 seconds

 THREAT ZONE:
   Threat Modeled: Thermal radiation from fireball
   Red    : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
   Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
   Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)
```

APPENDIX C-2

Pinch Point Richmond #2

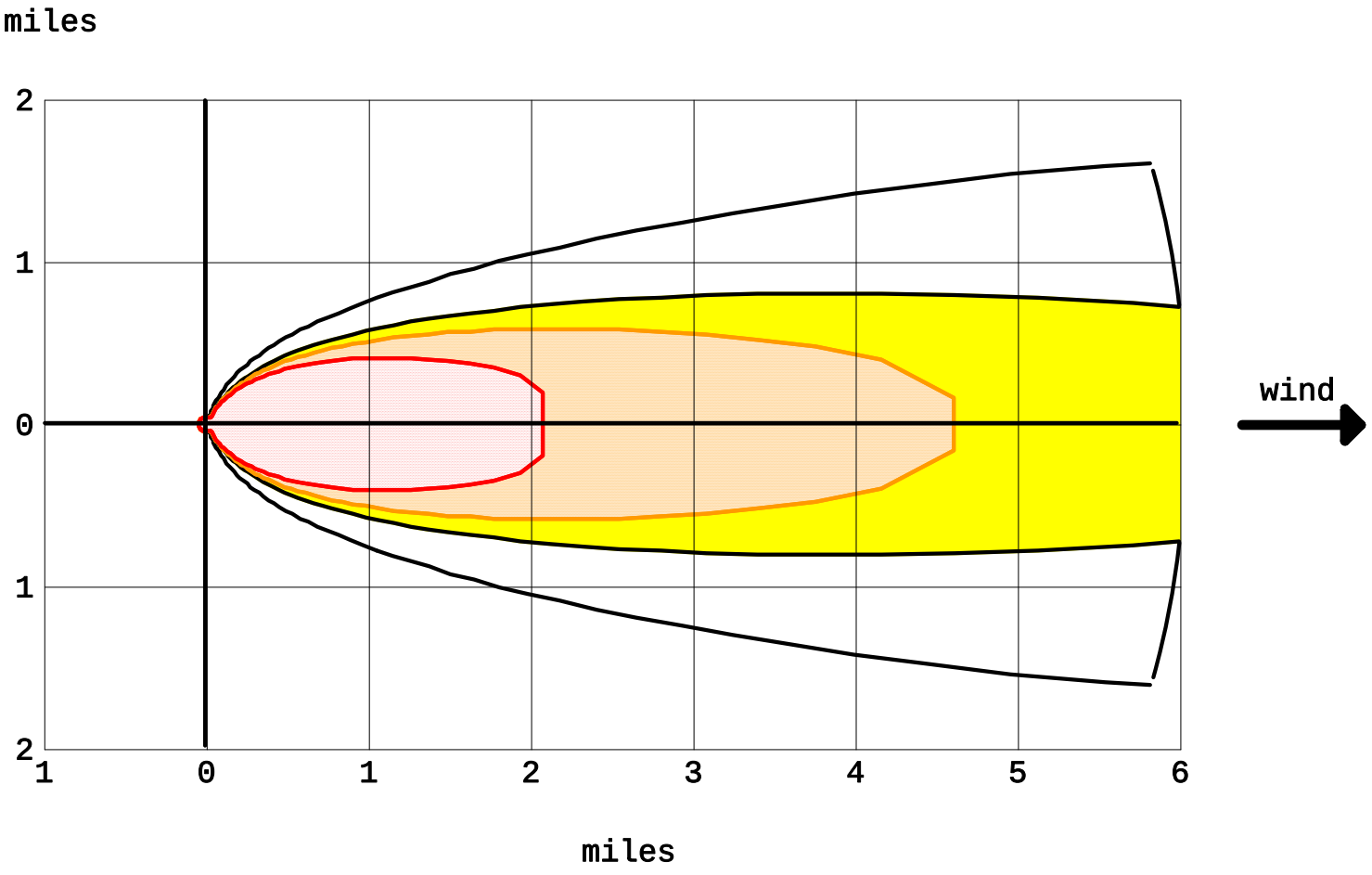
Toxic Threat Zone ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: AMMONIA

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
Model Run: Heavy Gas
Red : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])



greater than 1100 ppm (AEGL-3 [60 min])
greater than 160 ppm (AEGL-2 [60 min])
greater than 30 ppm (AEGL-1 [60 min])
wind direction confidence lines

Note: Threat zone picture is truncated at the 6 mile limit.

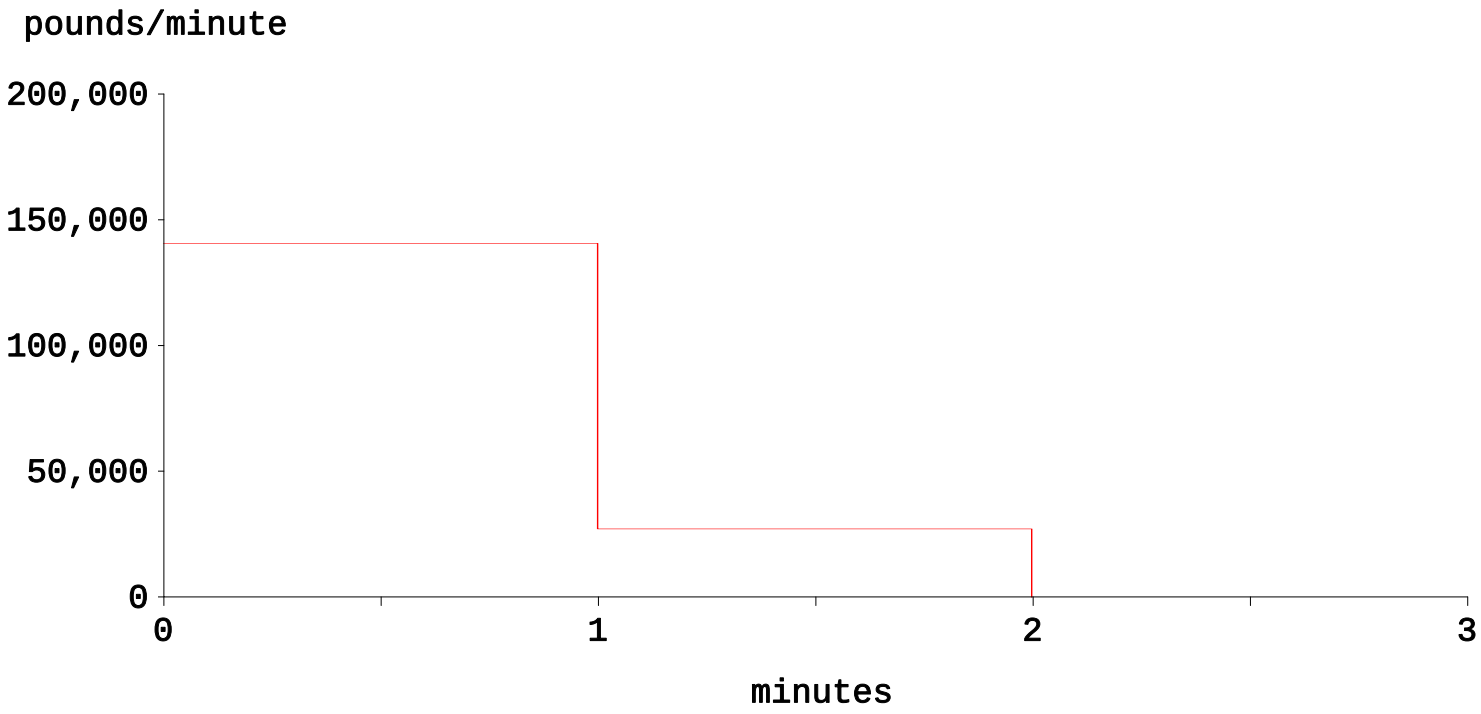
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: AMMONIA

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
SITE DATA:
  Location: RICHMOND, CALIFORNIA
  Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
  Time: July 18, 2019  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AMMONIA
  CAS Number: 7664-41-7                  Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm     UEL: 280000 ppm
  Ambient Boiling Point: -28.2° 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: 9 miles/hour from w at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 85° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
  Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
  Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])
```

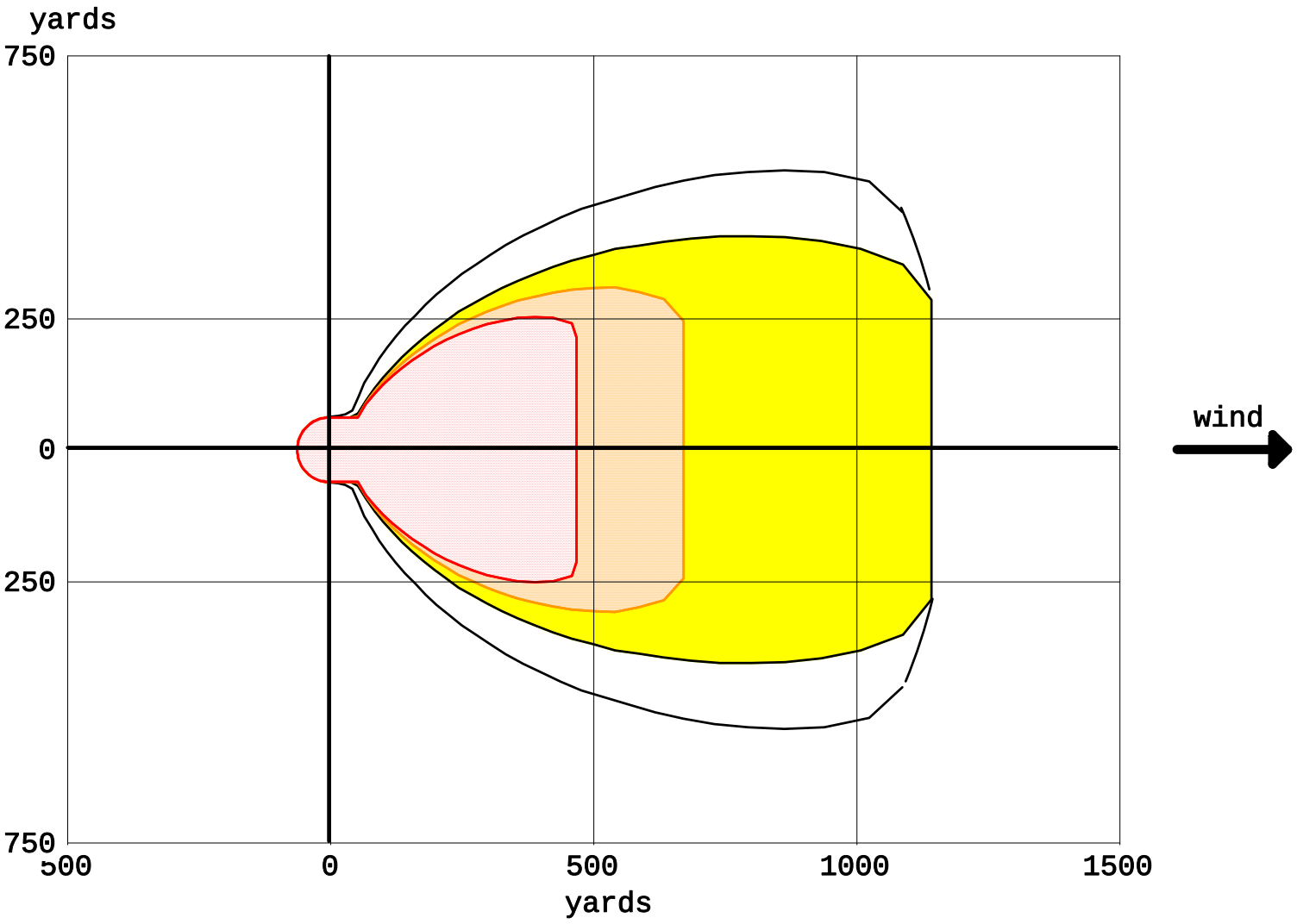
Toxic Threat Zone ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 469 yards --- (33000 ppm = AEGL-3 [60 min])
  Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
  Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```



greater than 33000 ppm (AEGL-3 [60 min])
greater than 17000 ppm (AEGL-2 [60 min])
greater than 5500 ppm (AEGL-1 [60 min])
wind direction confidence lines

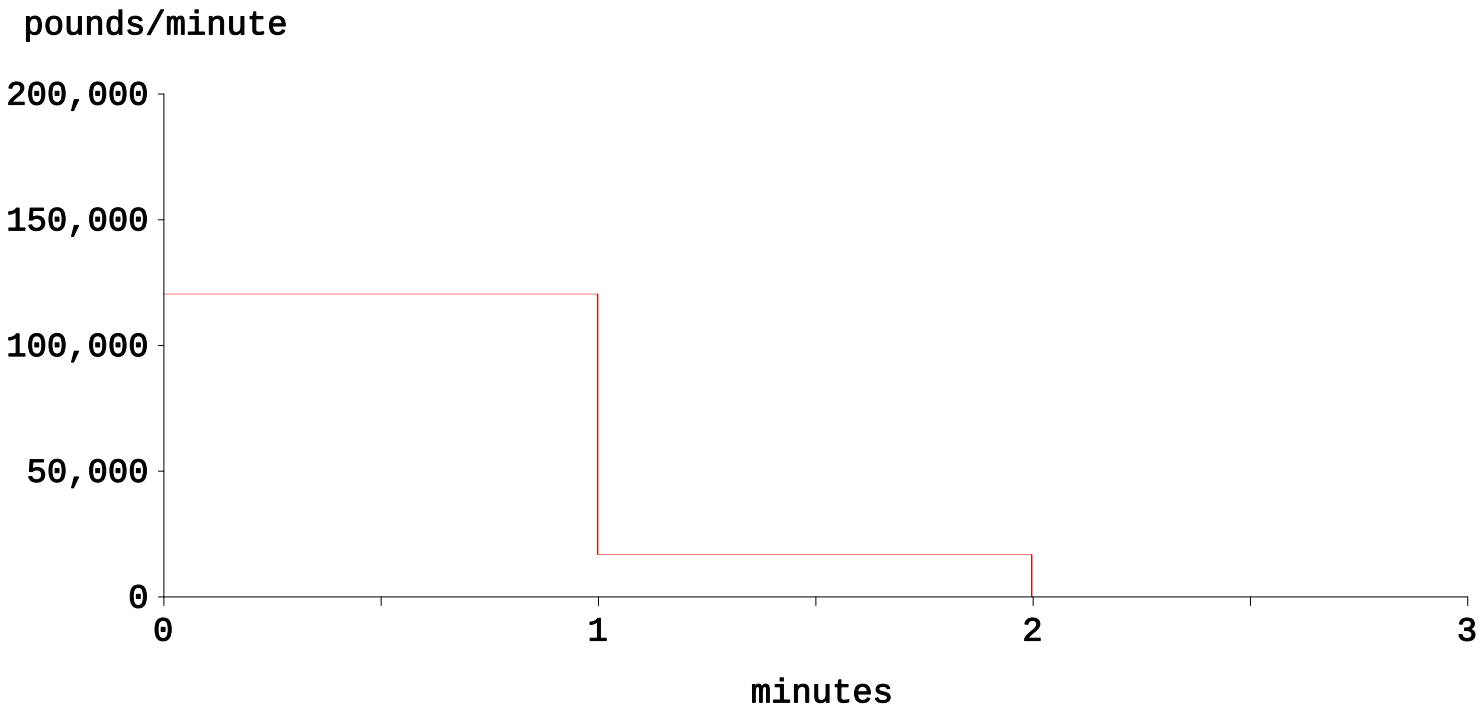
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 68.1 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 120,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 136,200 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
 SITE DATA:
   Location: RICHMOND, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.7° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid                   Internal Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Circular Opening Diameter: 10 inches
   Opening is 5 inches from tank bottom
   Release Duration: 2 minutes
   Max Average Sustained Release Rate: 120,000 pounds/min
      (averaged over a minute or more)
   Total Amount Released: 136,200 pounds
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 469 yards --- (33000 ppm = AEGL-3 [60 min])
   Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
   Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```

Thermal Radiation Threat Zone

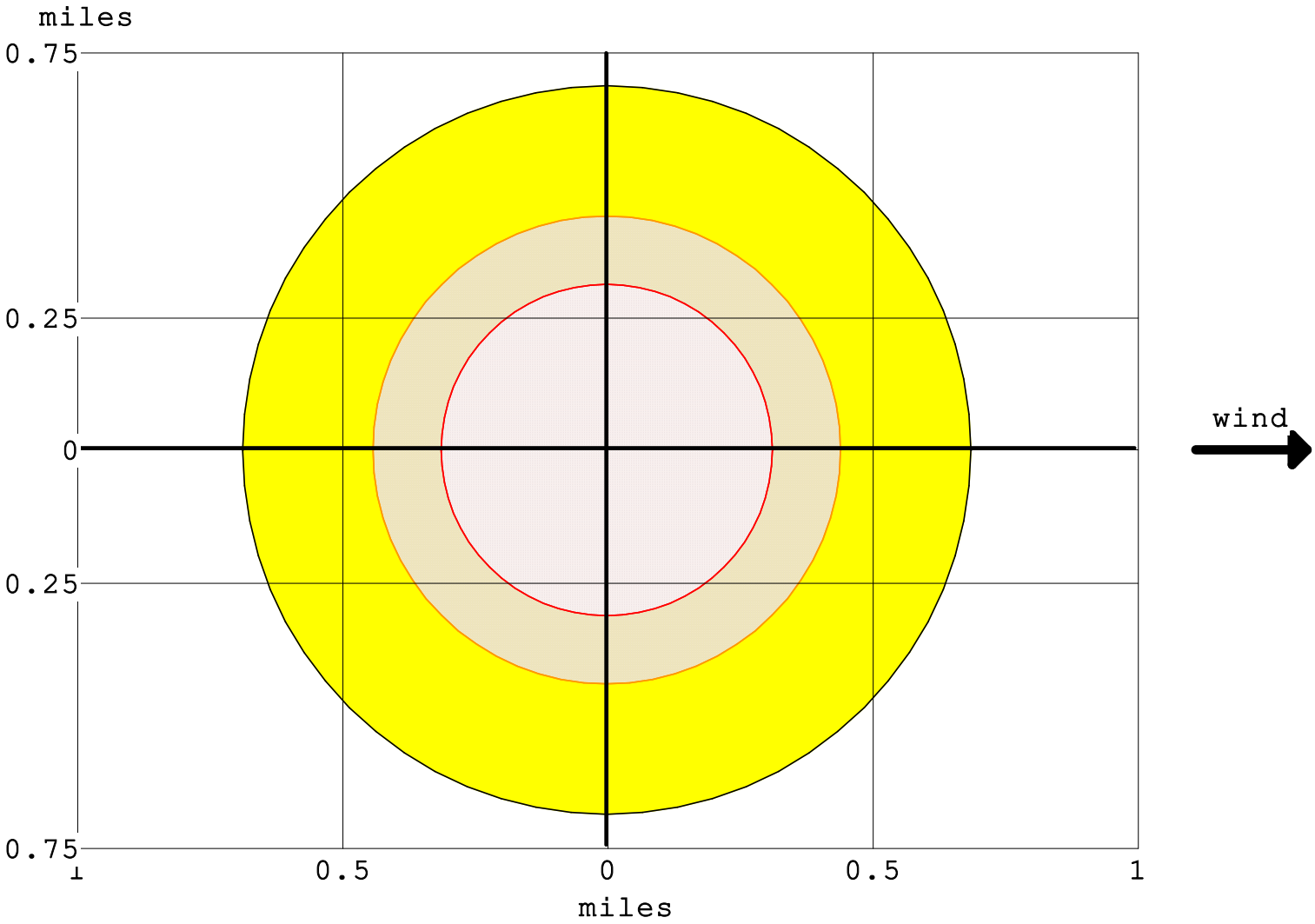
ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from fireball
  Red   : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
  Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
  Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)



greater than 10.0 kW/(sq m) (potentially lethal within 60 sec)
greater than 5.0 kW/(sq m) (2nd degree burns within 60 sec)
greater than 2.0 kW/(sq m) (pain within 60 sec)

```
 SITE DATA:
   Location: RICHMOND, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.7° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   BLEVE of flammable liquid in horizontal cylindrical tank
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid
   Internal Storage Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Percentage of Tank Mass in Fireball: 100%
   Fireball Diameter: 251 yards           Burn Duration: 14 seconds

 THREAT ZONE:
   Threat Modeled: Thermal radiation from fireball
   Red    : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
   Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
   Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)
```

APPENDIX C-3

Pinch Point Martinez #3

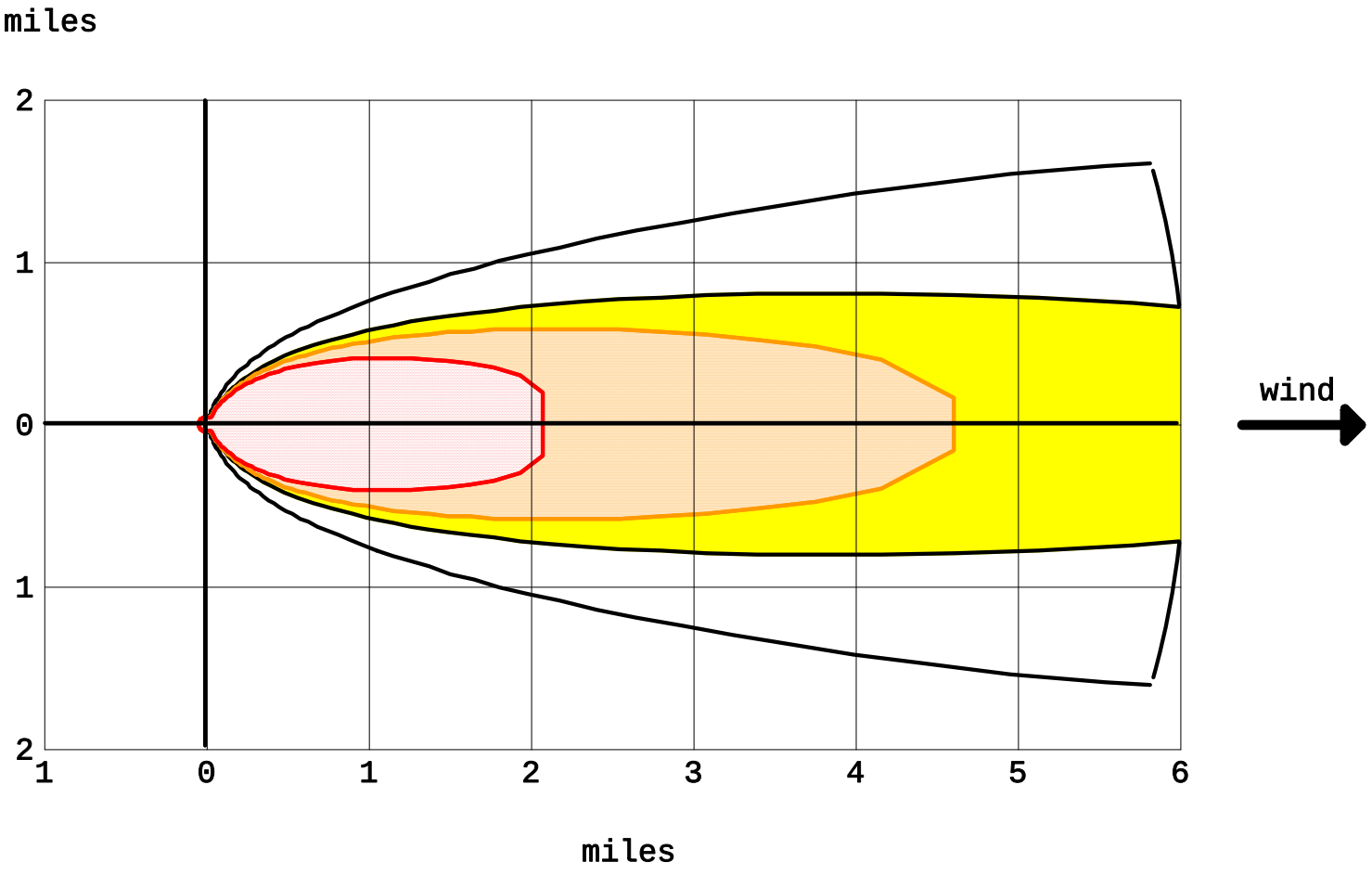
Toxic Threat Zone ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: AMMONIA

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
Model Run: Heavy Gas
Red : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])



greater than 1100 ppm (AEGL-3 [60 min])
greater than 160 ppm (AEGL-2 [60 min])
greater than 30 ppm (AEGL-1 [60 min])
wind direction confidence lines

Note: Threat zone picture is truncated at the 6 mile limit.

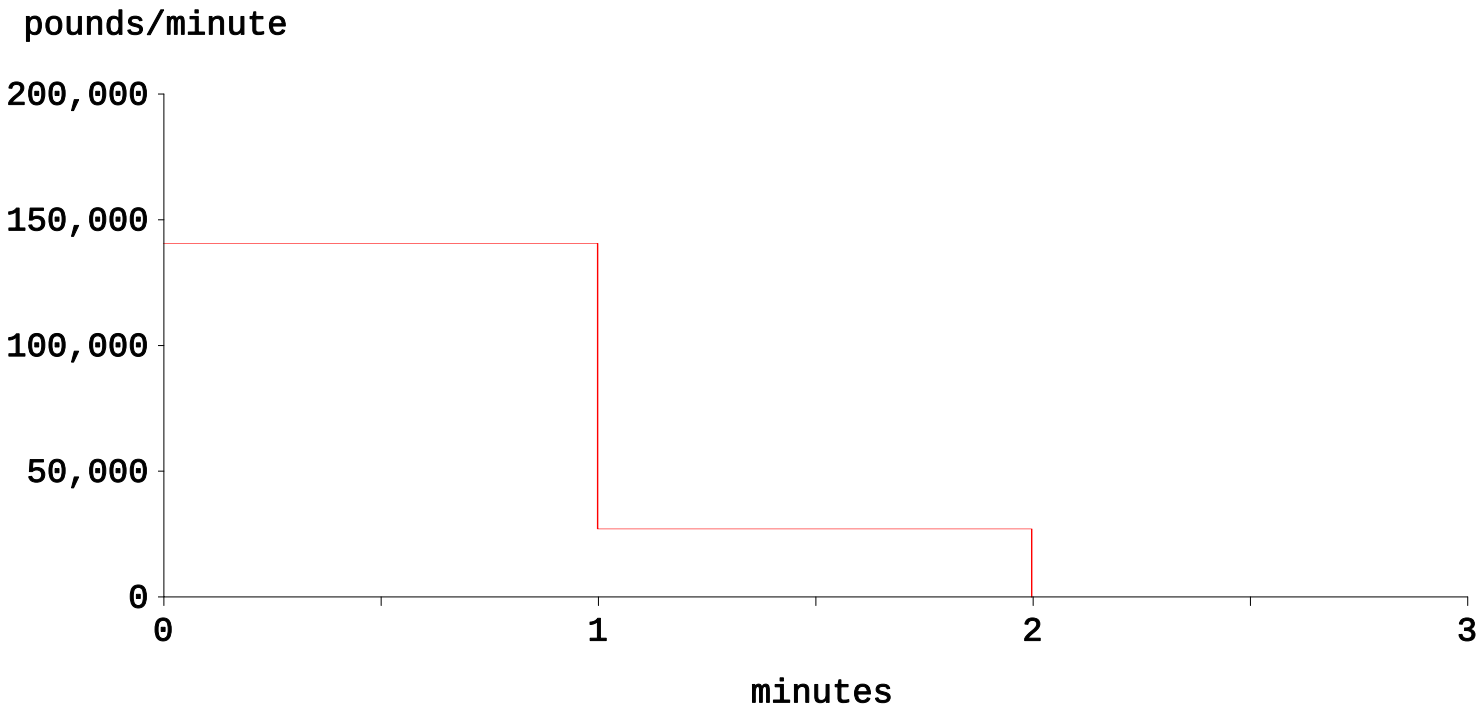
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: AMMONIA

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
SITE DATA:
  Location: MARTINEZ, CALIFORNIA
  Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
  Time: July 18, 2019  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AMMONIA
  CAS Number: 7664-41-7                  Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm     UEL: 280000 ppm
  Ambient Boiling Point: -28.2° 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: 9 miles/hour from w at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 85° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
  Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
  Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])
```

Toxic Threat Zone

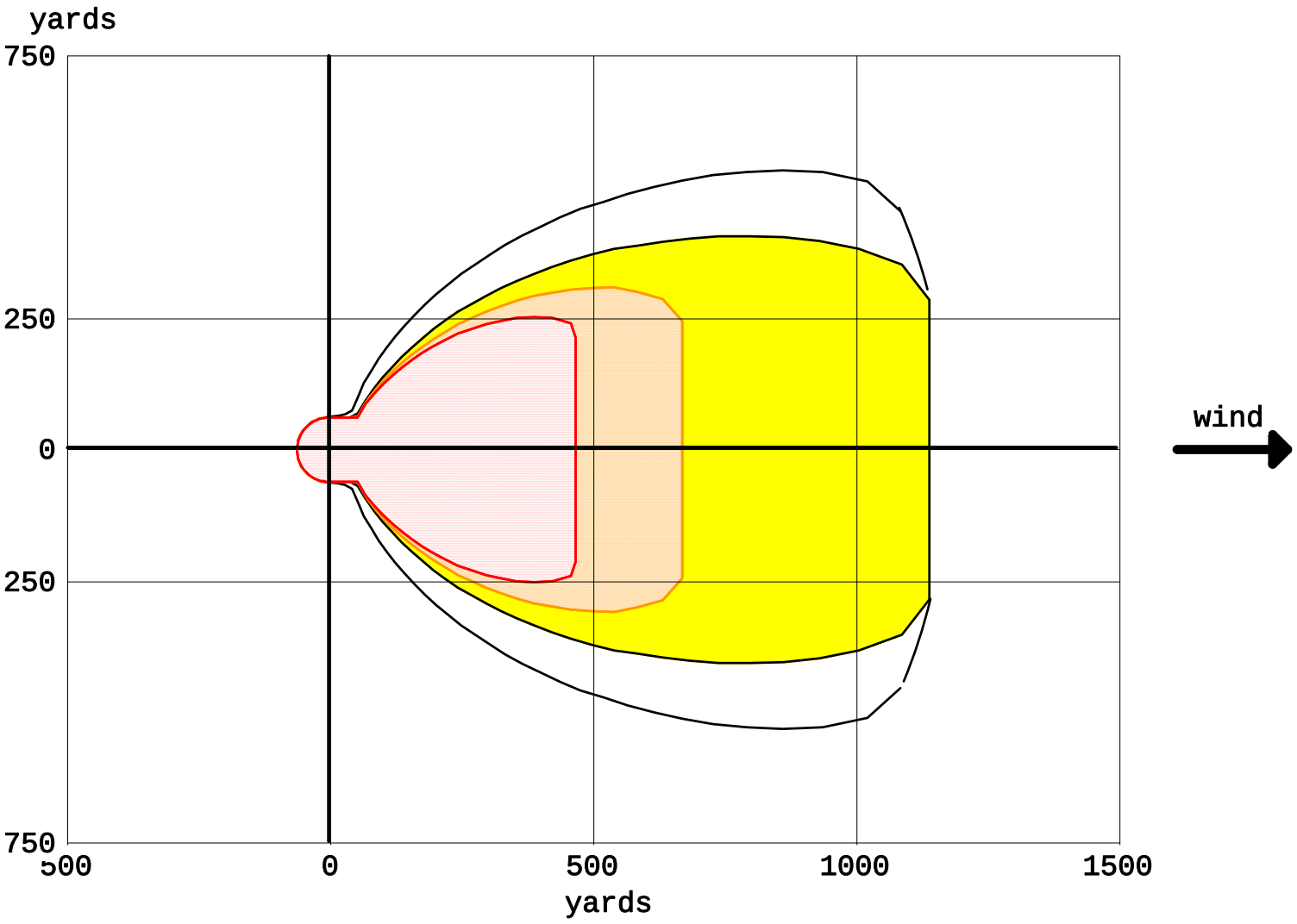
ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 469 yards --- (33000 ppm = AEGL-3 [60 min])
  Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
  Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])



greater than 33000 ppm (AEGL-3 [60 min])
greater than 17000 ppm (AEGL-2 [60 min])
greater than 5500 ppm (AEGL-1 [60 min])
wind direction confidence lines

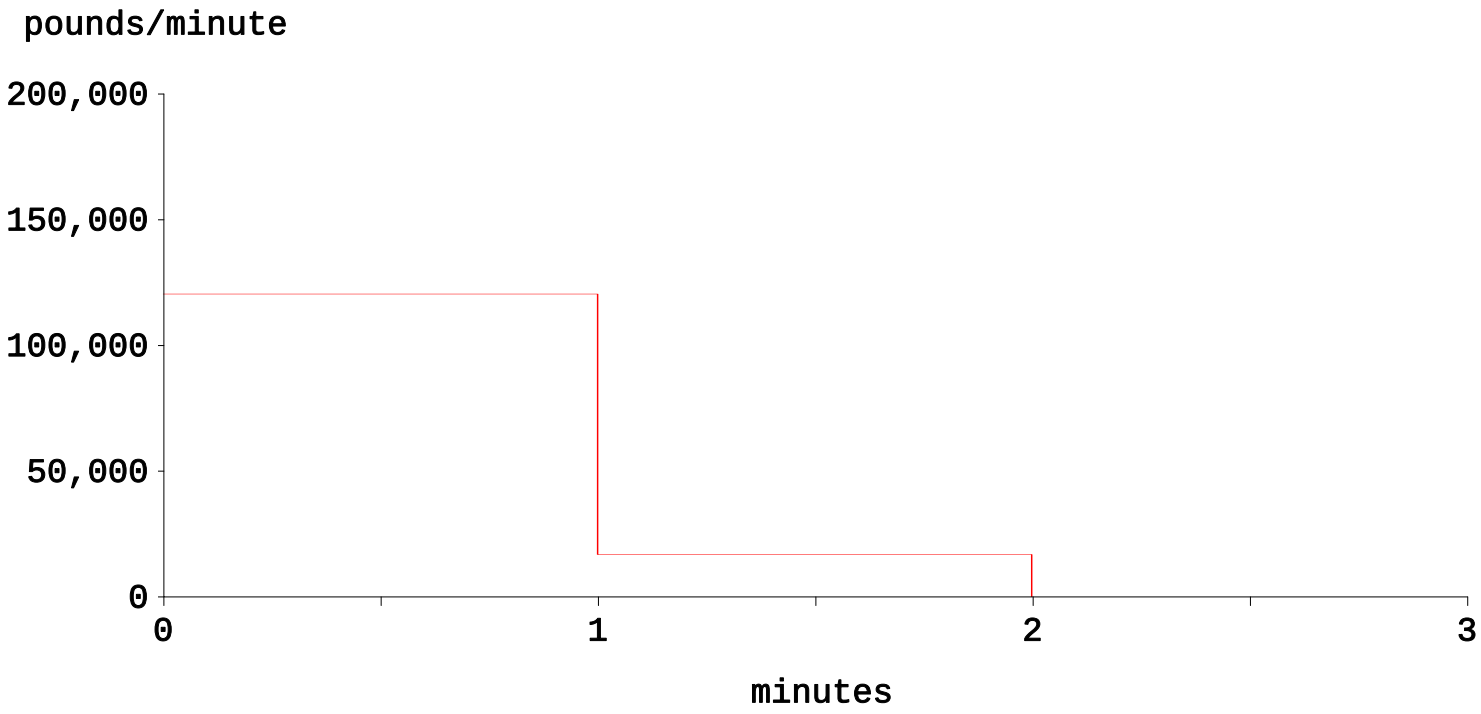
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 68.1 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 120,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 136,200 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
 SITE DATA:
   Location: MARTINEZ, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.7° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid                   Internal Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Circular Opening Diameter: 10 inches
   Opening is 5 inches from tank bottom
   Release Duration: 2 minutes
   Max Average Sustained Release Rate: 120,000 pounds/min
      (averaged over a minute or more)
   Total Amount Released: 136,200 pounds
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 469 yards --- (33000 ppm = AEGL-3 [60 min])
   Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
   Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```

Thermal Radiation Threat Zone

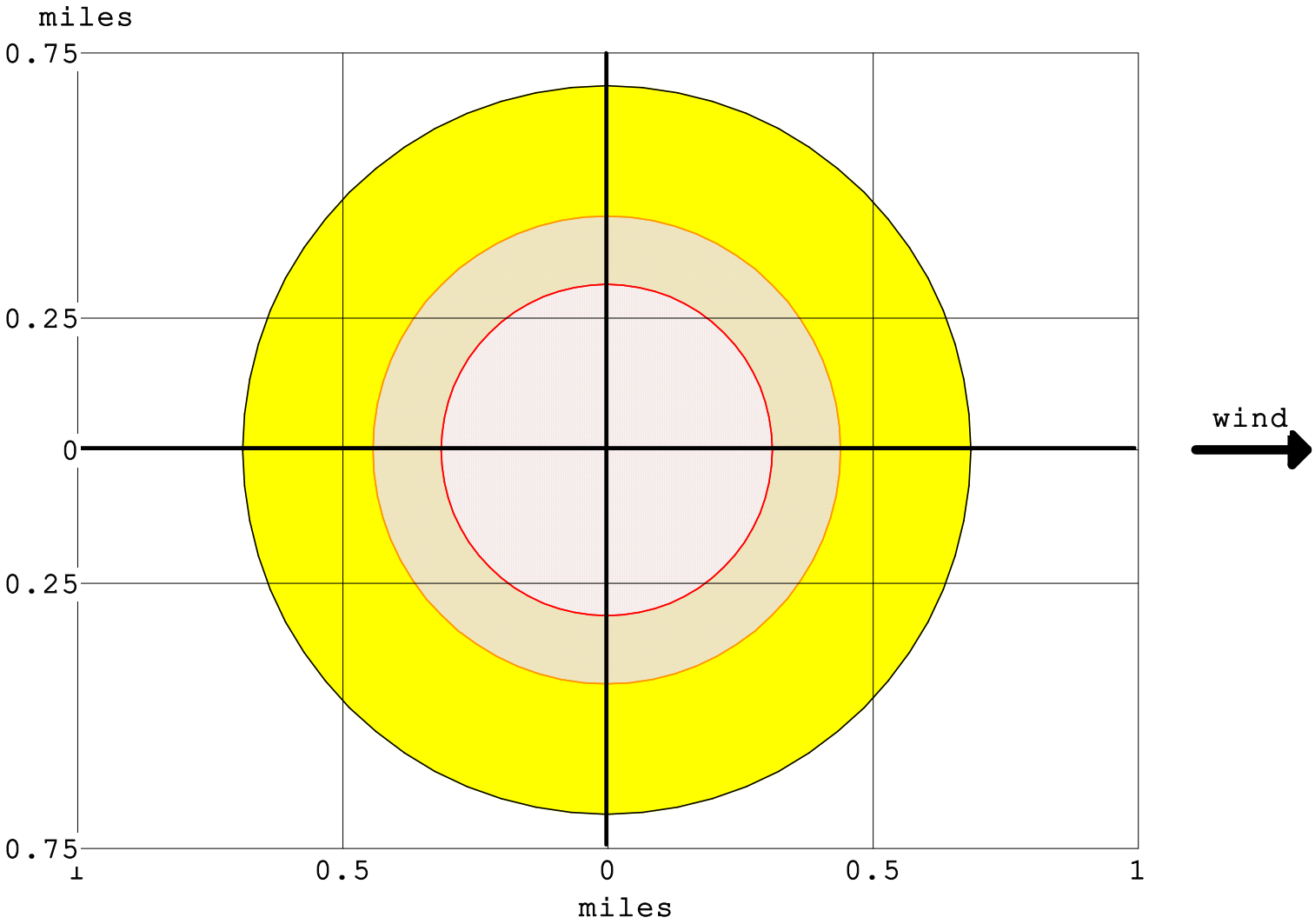
ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from fireball
  Red   : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
  Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
  Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)



greater than 10.0 kW/(sq m) (potentially lethal within 60 sec)
greater than 5.0 kW/(sq m) (2nd degree burns within 60 sec)
greater than 2.0 kW/(sq m) (pain within 60 sec)

```
 SITE DATA:
   Location: MARTINEZ, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.7° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   BLEVE of flammable liquid in horizontal cylindrical tank
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid
   Internal Storage Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Percentage of Tank Mass in Fireball: 100%
   Fireball Diameter: 251 yards           Burn Duration: 14 seconds

 THREAT ZONE:
   Threat Modeled: Thermal radiation from fireball
   Red    : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
   Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
   Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)
```

APPENDIX C-4

Pinch Point Bay Point #4

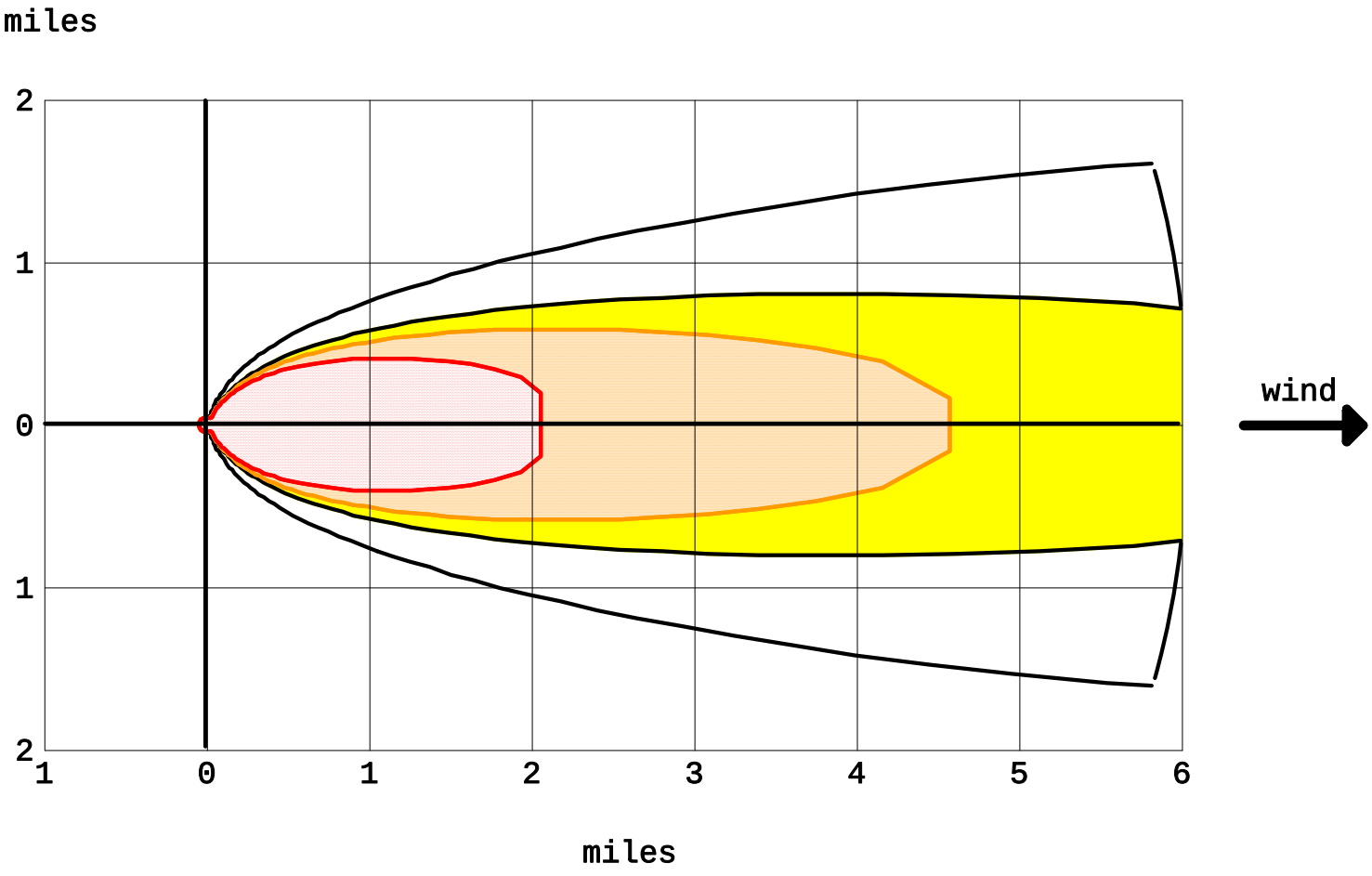
Toxic Threat Zone ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: AMMONIA

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
Model Run: Heavy Gas
Red : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])



greater than 1100 ppm (AEGL-3 [60 min])
greater than 160 ppm (AEGL-2 [60 min])
greater than 30 ppm (AEGL-1 [60 min])
wind direction confidence lines

Note: Threat zone picture is truncated at the 6 mile limit.

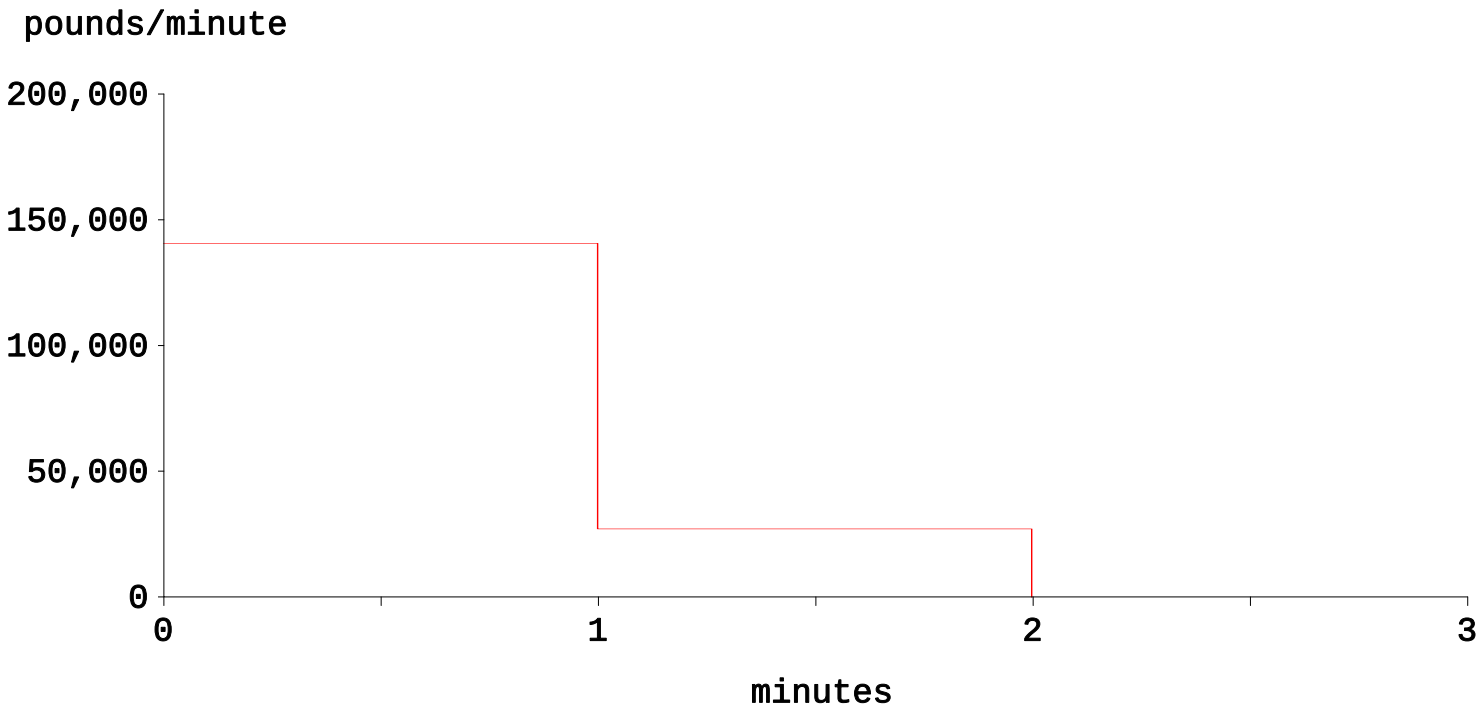
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: AMMONIA

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
SITE DATA:
  Location: BAY POINT, CALIFORNIA
  Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
  Time: July 18, 2019  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AMMONIA
  CAS Number: 7664-41-7                  Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm     UEL: 280000 ppm
  Ambient Boiling Point: -28.3° 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: 9 miles/hour from w at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 85° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
  Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
  Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])
```

Toxic Threat Zone

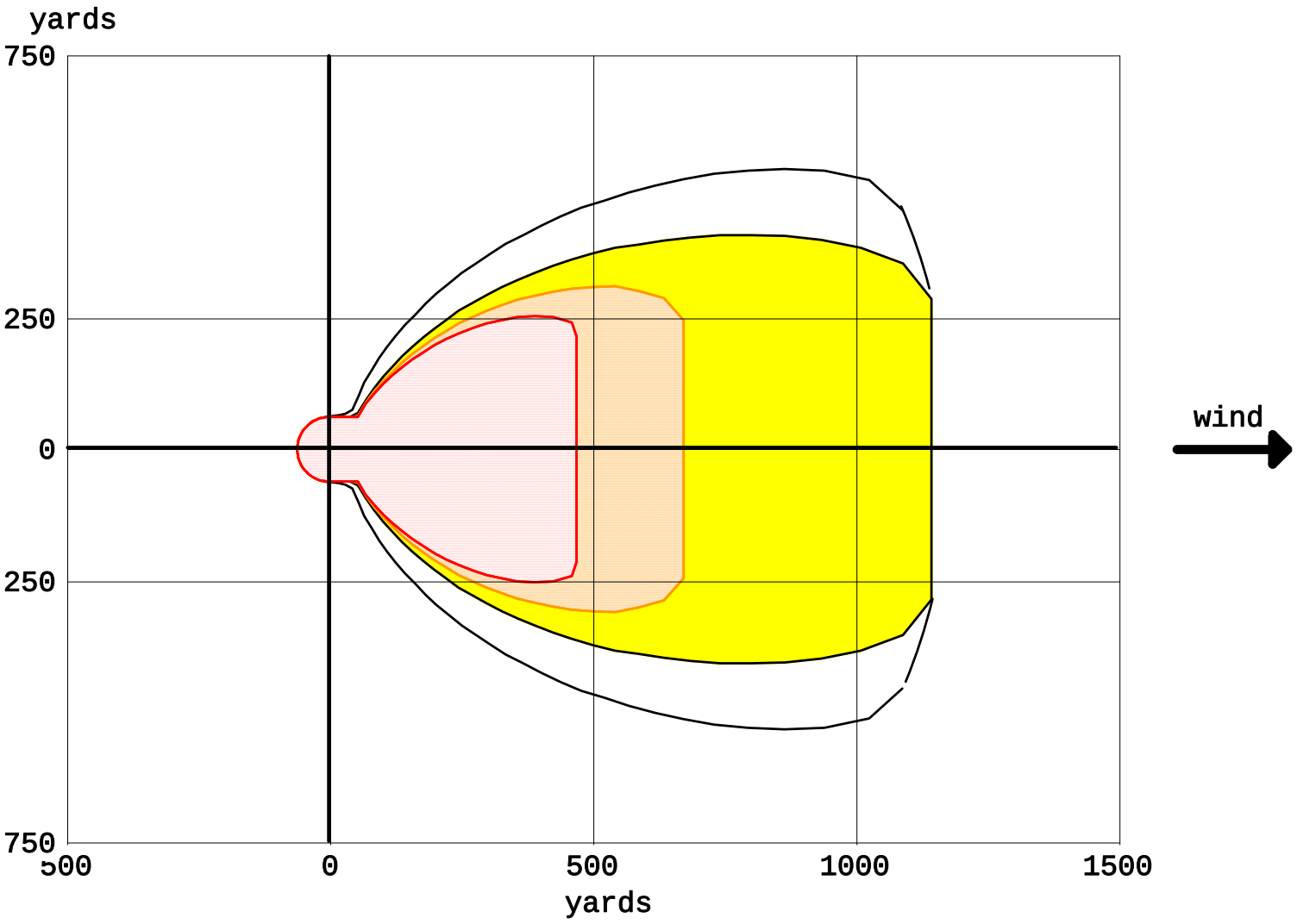
ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 468 yards --- (33000 ppm = AEGL-3 [60 min])
  Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
  Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```



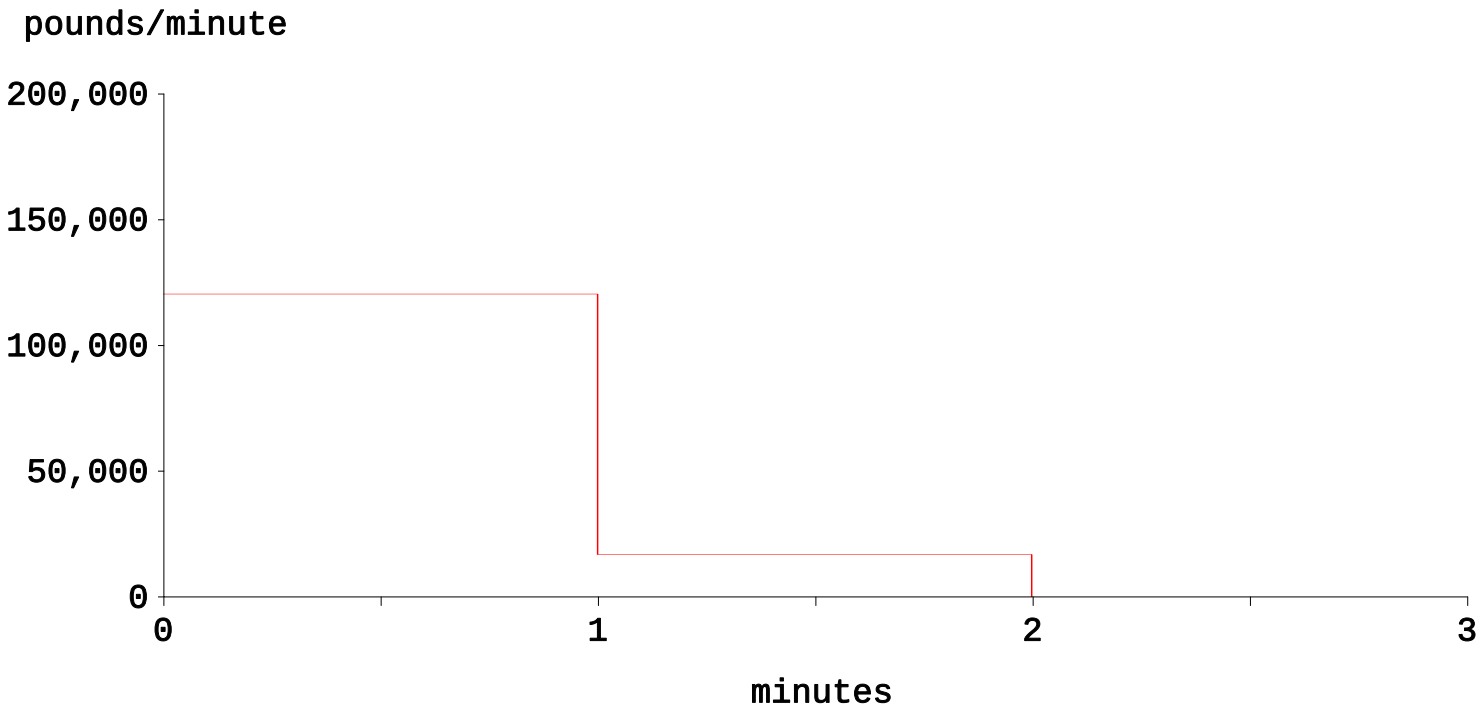
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 68.1 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 120,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 136,200 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
 SITE DATA:
   Location: BAY POINT, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.9° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid                   Internal Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Circular Opening Diameter: 10 inches
   Opening is 5 inches from tank bottom
   Release Duration: 2 minutes
   Max Average Sustained Release Rate: 120,000 pounds/min
      (averaged over a minute or more)
   Total Amount Released: 136,200 pounds
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 468 yards --- (33000 ppm = AEGL-3 [60 min])
   Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
   Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```

Thermal Radiation Threat Zone

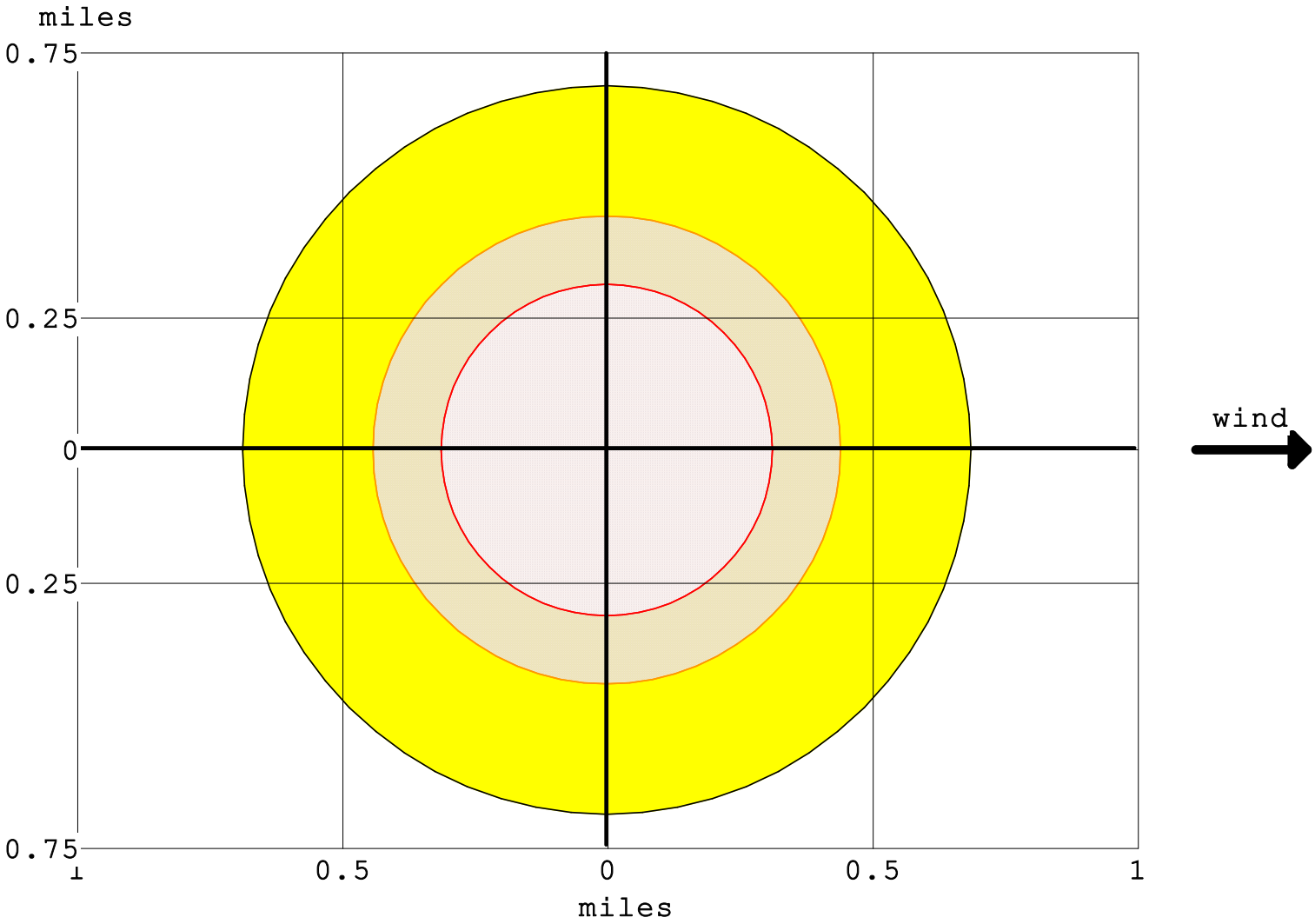
ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from fireball
  Red   : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
  Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
  Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)



greater than 10.0 kW/(sq m) (potentially lethal within 60 sec)
greater than 5.0 kW/(sq m) (2nd degree burns within 60 sec)
greater than 2.0 kW/(sq m) (pain within 60 sec)

```
 SITE DATA:
   Location: BAY POINT, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.9° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   BLEVE of flammable liquid in horizontal cylindrical tank
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid
   Internal Storage Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Percentage of Tank Mass in Fireball: 100%
   Fireball Diameter: 251 yards           Burn Duration: 14 seconds

 THREAT ZONE:
   Threat Modeled: Thermal radiation from fireball
   Red    : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
   Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
   Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)
```

APPENDIX C-5

Pinch Point Antioch #5

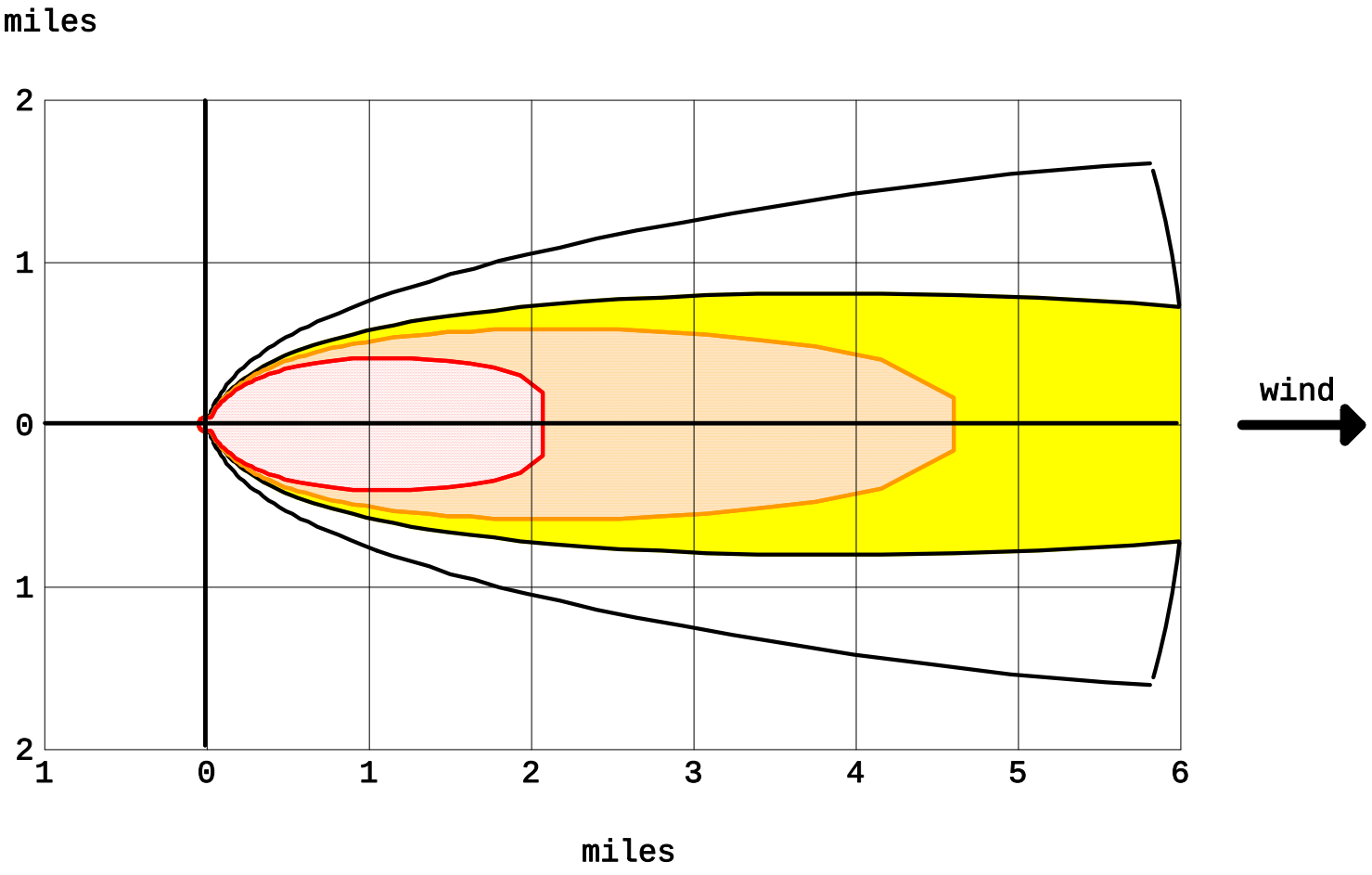
Toxic Threat Zone ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: AMMONIA

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
  Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
  Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])
```



greater than 1100 ppm (AEGL-3 [60 min])
greater than 160 ppm (AEGL-2 [60 min])
greater than 30 ppm (AEGL-1 [60 min])
wind direction confidence lines

Note: Threat zone picture is truncated at the 6 mile limit.

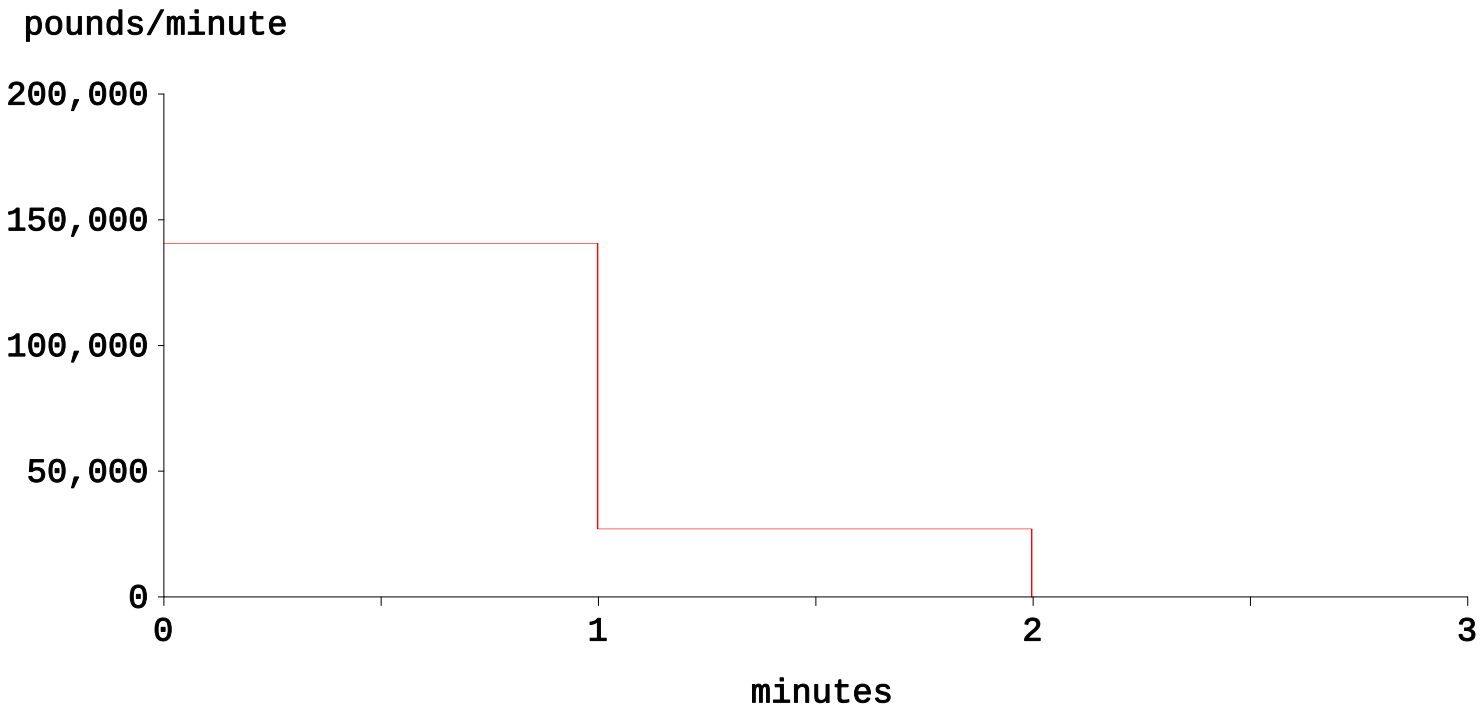
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: AMMONIA

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
SITE DATA:
  Location: ANTIOCH, CALIFORNIA
  Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
  Time: July 18, 2019  1200 hours PDT (user specified)

CHEMICAL DATA:
  Chemical Name: AMMONIA
  CAS Number: 7664-41-7                  Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm     UEL: 280000 ppm
  Ambient Boiling Point: -28.2° 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: 9 miles/hour from w at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 85° F                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 83.5 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 140,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 167,000 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 2.1 miles --- (1100 ppm = AEGL-3 [60 min])
  Orange: 4.6 miles --- (160 ppm = AEGL-2 [60 min])
  Yellow: greater than 6 miles --- (30 ppm = AEGL-1 [60 min])
```

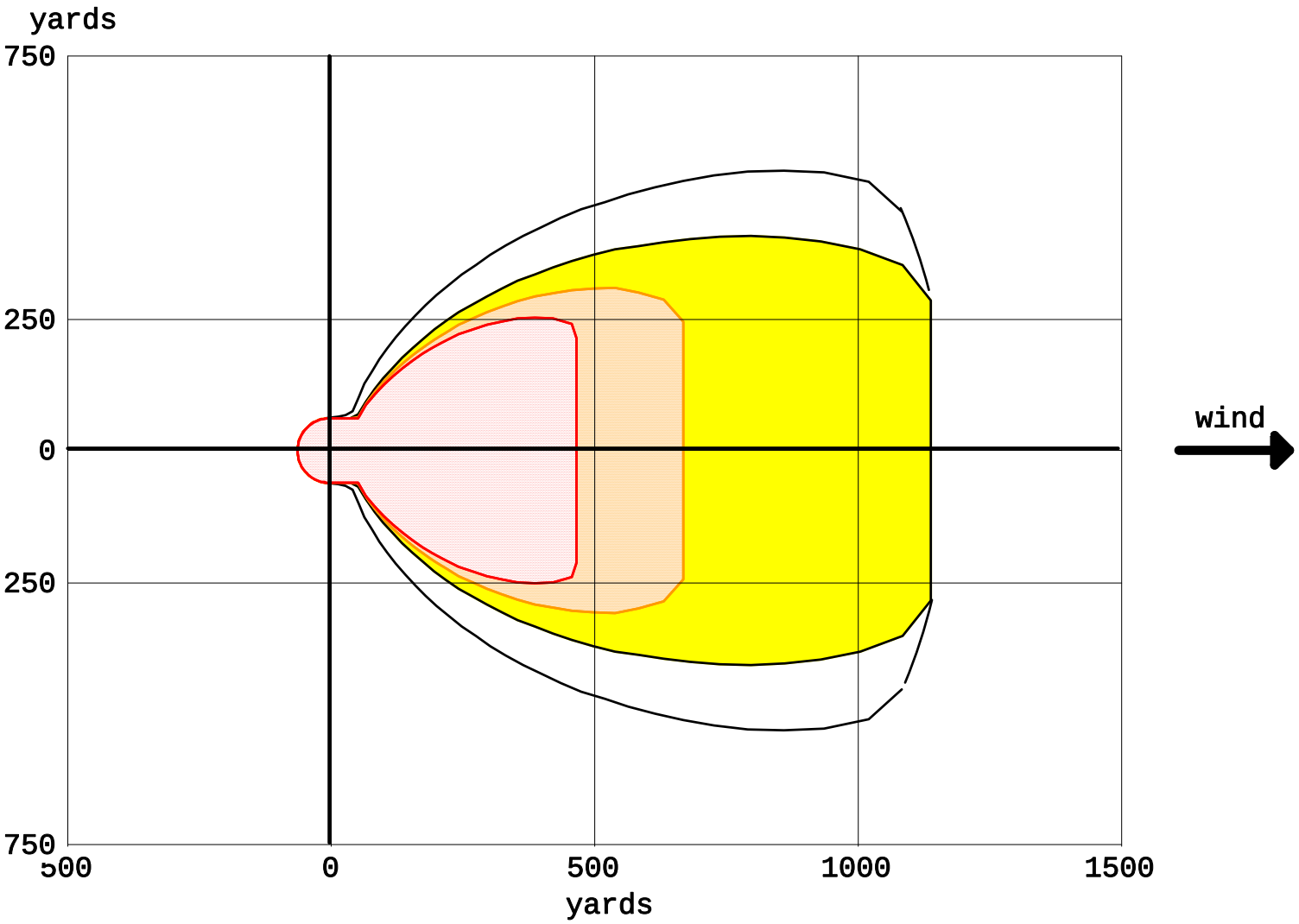
Toxic Threat Zone ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Model Run: Heavy Gas
  Red    : 469 yards --- (33000 ppm = AEGL-3 [60 min])
  Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
  Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```



greater than 33000 ppm (AEGL-3 [60 min])
greater than 17000 ppm (AEGL-2 [60 min])
greater than 5500 ppm (AEGL-1 [60 min])
wind direction confidence lines

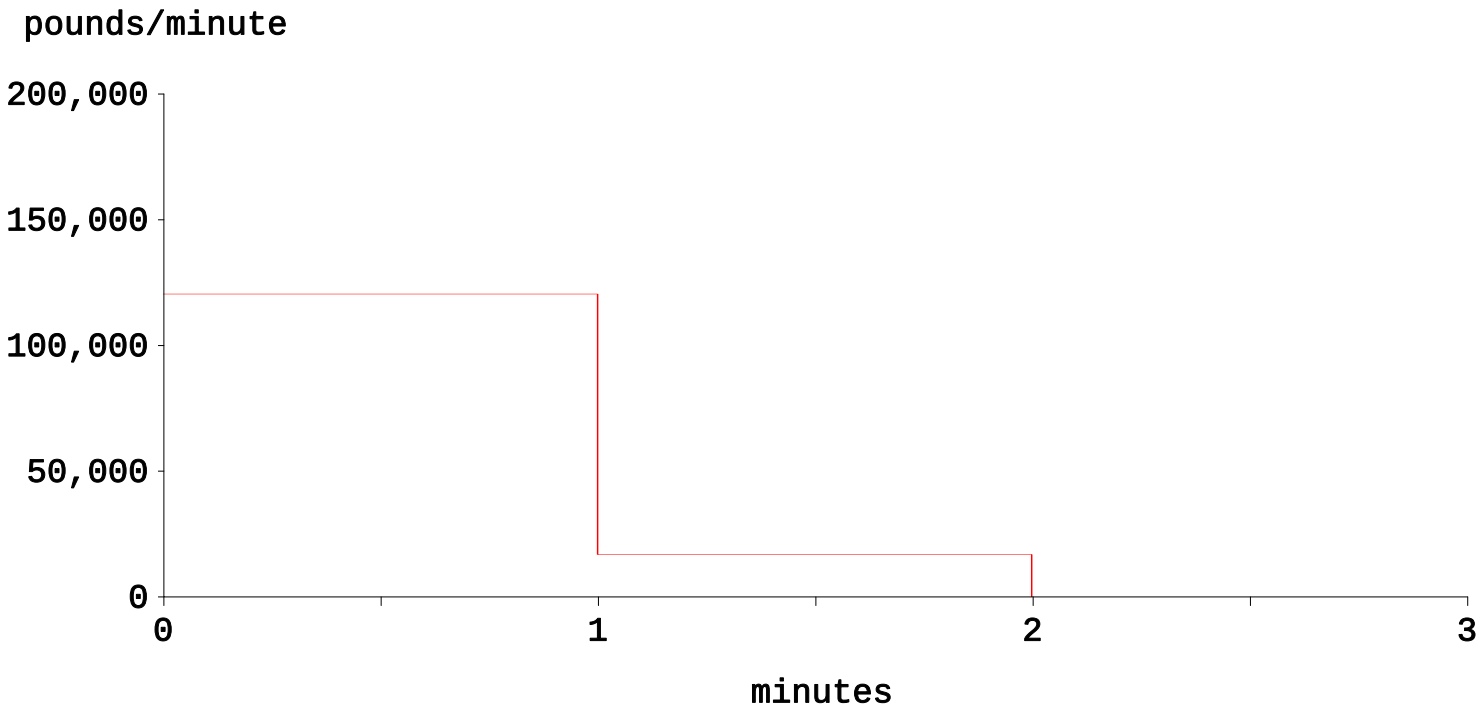
Source Strength (Release Rate)

ALOHA® 5.4.7

```
Time: July 18, 2019  1200 hours PDT (user specified)

Chemical Name: PROPANE

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
  Tank Volume: 34397 gallons
  Tank contains liquid                   Internal Temperature: 85° F
  Chemical Mass in Tank: 68.1 tons       Tank is 98% full
  Circular Opening Diameter: 10 inches
  Opening is 5 inches from tank bottom
  Release Duration: 2 minutes
  Max Average Sustained Release Rate: 120,000 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 136,200 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```



```
 SITE DATA:
   Location: ANTIOCH, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.7° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   Leak from hole in horizontal cylindrical tank
   Flammable chemical escaping from tank (not burning)
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid                   Internal Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Circular Opening Diameter: 10 inches
   Opening is 5 inches from tank bottom
   Release Duration: 2 minutes
   Max Average Sustained Release Rate: 120,000 pounds/min
      (averaged over a minute or more)
   Total Amount Released: 136,200 pounds
   Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

 THREAT ZONE:
   Model Run: Heavy Gas
   Red   : 469 yards --- (33000 ppm = AEGL-3 [60 min])
   Orange: 671 yards --- (17000 ppm = AEGL-2 [60 min])
   Yellow: 1142 yards --- (5500 ppm = AEGL-1 [60 min])
```

Thermal Radiation Threat Zone

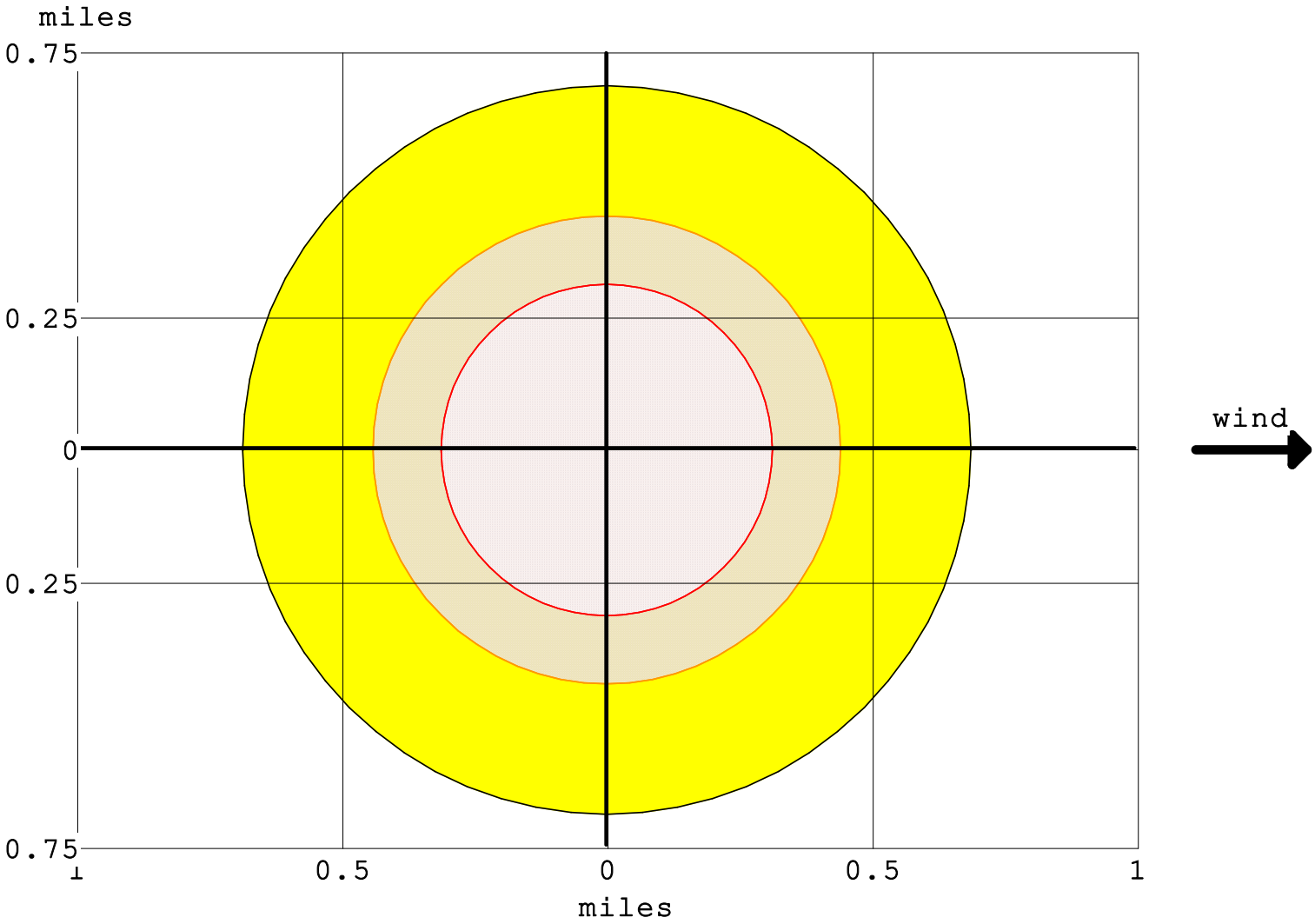
ALOHA® 5.4.7

Time: July 18, 2019 1200 hours PDT (user specified)

Chemical Name: PROPANE

Wind: 9 miles/hour from w at 3 meters

THREAT ZONE:
  Threat Modeled: Thermal radiation from fireball
  Red   : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
  Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
  Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)



greater than 10.0 kW/(sq m) (potentially lethal within 60 sec)
greater than 5.0 kW/(sq m) (2nd degree burns within 60 sec)
greater than 2.0 kW/(sq m) (pain within 60 sec)

```
 SITE DATA:
   Location: ANTIOCH, CALIFORNIA
   Building Air Exchanges Per Hour: 0.85 (unsheltered single storied)
   Time: July 18, 2019  1200 hours PDT (user specified)

 CHEMICAL DATA:
   Chemical Name: PROPANE
   CAS Number: 74-98-6                    Molecular Weight: 44.10 g/mol
   AEGL-1 (60 min): 5500 ppm   AEGL-2 (60 min): 17000 ppm   AEGL-3 (60 min):
33000 ppm
   IDLH: 2100 ppm     LEL: 21000 ppm      UEL: 95000 ppm
   Ambient Boiling Point: -43.7° 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: 9 miles/hour from w at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 85° F                 Stability Class: D
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   BLEVE of flammable liquid in horizontal cylindrical tank
   Tank Diameter: 10.66 feet              Tank Length: 51.5 feet
   Tank Volume: 34397 gallons
   Tank contains liquid
   Internal Storage Temperature: 85° F
   Chemical Mass in Tank: 68.1 tons       Tank is 98% full
   Percentage of Tank Mass in Fireball: 100%
   Fireball Diameter: 251 yards           Burn Duration: 14 seconds

 THREAT ZONE:
   Threat Modeled: Thermal radiation from fireball
   Red    : 549 yards --- (10.0 kW/(sq m) = potentially lethal within 60 sec)
   Orange: 775 yards --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)
   Yellow: 1206 yards --- (2.0 kW/(sq m) = pain within 60 sec)
```