Appendix D

Health Risk Assessment

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1998 Whipple Road 7-Eleven Project

Retail Gasoline Station Health Risk Assessment

March 2020 | CUC-01

Prepared for:

City of Union City
Economic & Community Development Department
34009 Alvarado-Niles Road
Union City, CA 94587

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ADMRT	Air Dispersion Modeling and Risk Tool
AERMAP	AERMOD terrain preprocessor
AERMOD	USEPA gaussian plume air dispersion model
BACTs	best available control technologies
BAAQMD	Bay Area Air Quality Management District
BPIP	Building Profile Input Program
CalEPA	California Environmental Protection Agency
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
EVR	enhanced vapor recovery
°F	Fahrenheit
HARP	Hotspots Analysis and Reporting Program
HRA	health risk assessment
IARC	International Agency on Research for Cancer
IEM	Iowa Environmental Mesonet
ISD	in-station diagnostic
K	Kelvin
m	meters
NED	National Elevation Dataset
OEHHA	Office of Environmental Health Hazard Assessment
ORVR	onboard refueling vapor recovery
REL	Recommended Exposure Limit
SFBAAB	San Francisco Bay Area Air Basin
TACs	toxic air contaminants
TOG	total organic gasses
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	underground storage tank
UTM	Universal Transverse Mercator

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EXECUTIVE SUMMARY

This report presents an assessment of potential increased cancer and chronic health risks associated with long-term operation of the proposed retail gasoline dispensing facility (gas station) included as a component of the 1998 Whipple Road 7-Eleven project (project). Future emissions of the toxic air contaminant (TAC) benzene were estimated following the California Air Pollution Control Officers Association (CAPCOA 1997) *Gasoline Service Station Industrywide Risk Assessment Guidelines* and the California Air Resources Board (CARB 2013) *Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities*. The project would be required to install, operate, and maintain Phase I and Phase II Enhanced Vapor Recovery (EVR) systems to control the emissions of gasoline vapor. The air dispersion modeling and health risk analysis was completed conservatively assuming the maximum permitted annual throughput of 6 million gallons per year. The increased cancer risk and non-cancer chronic and acute hazard indices for the maximum exposed individual resident and off-site worker would be below their respective thresholds. Long-term operation of the proposed gas station would not result in a significant impact related to the exposure of sensitive receptors to substantial TAC concentrations.

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1.0 INTRODUCTION

This report presents an assessment of potential community health risk impacts associated with long-term operation of the proposed retail gasoline dispensing facility (gas station) component of the 1998 Whipple Road 7-Eleven project (project).

1.1 PROJECT LOCATION

The project site is located at 1998 Whipple Road, Union City, CA, at the southeast corner of the Whipple Road and Amaral Street intersection. The site coordinates are 37°36'20.74"N latitude and 122° 3'30.38"W longitude (WGS84 coordinate reference system). See Figure 1, *Vicinity Map* and Figure 2, *Location Map*. The project site is within the western Alameda County portion of the San Francisco Bay Area Air Basin (SFBAAB). Air quality in the project area is under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD).

1.1.1 Existing Site Conditions

The project site is currently vacant, undeveloped land covered by grass and ruderal vegetation.

1.2 PROJECT DESCRIPTION

The proposed project would consist of a 7-Eleven convenience store and a gas station with 3 multi-product dispensers, 6 dispensing nozzles, and three underground storage tanks (USTs; two for gasoline and one for diesel). The gasoline dispensers/refueling stations would be covered by a 1,646 square-foot canopy. See Figure 3, *Proposed Site Plan*.

The proposed project would require an authority to construct and a permit to operate for a gasoline dispensing facility from the BAAQMD. Toxic emissions from gas stations are proportional to the annual throughput of gasoline at the facility. The project developers anticipate the average annual throughput of gasoline to be 2.7 million gallons per year. However, for permitting purposes and to account for potential fluctuations in annual gasoline sales, and to be conservative (health protective) in evaluating risks, this report analyzes emissions and health risks at a maximum gasoline throughput of 6 million gallons per year.

2.0 AIR QUALITY SETTING

2.1 TOXIC AIR CONTAMINANTS

Toxic air contaminants (TACs) are a diverse group of air pollutants that may cause or contribute to an increase in deaths or in serious illness or that may pose a present or potential hazard to human health. TACs can cause long-term health effects such as cancer, birth defects, neurological damage, asthma, bronchitis, or genetic damage, or short-term acute effects such as eye watering, respiratory irritation (a cough), runny nose, throat pain, and headaches. TACs are considered either carcinogenic or noncarcinogenic based on the nature of the health effects associated with exposure to the pollutant. For carcinogenic TACs, there is no level of exposure that is considered safe and impacts are evaluated in terms of overall relative risk expressed as excess cancer cases per one million exposed individuals.

Noncarcinogenic TACs differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis.

Activities at gasoline dispensing facilities can release TACs into the air, including the organic compounds benzene, toluene, and xylene.[1] Benzene is a potent carcinogen and is one of the highest risk air pollutants regulated by the California Air Resources Board (CARB). Toluene and xylenes are not considered carcinogens, but they (along with benzene) can contribute to chronic health conditions. Emissions of benzene are known to be the dominate source of health risks from gasoline vapors. Not until the benzene emissions are several orders of magnitude above the 10 in 1 million cancer risk threshold do the emissions of other TACs in gasoline begin to cause adverse health effects. Therefore, other TAC concentrations and resulting health risks do not need to be determined unless the cancer risk from benzene emissions exceeds 100 in 1 million (California Air Pollution Control Officers Association [CAPCOA] 1997). Note that, although the proposed gas station may include diesel dispensing, TACs associated with diesel vapor are not released in quantities sufficient enough to require analysis or reporting. For example, gasoline in the U.S. contains 0.6 to 1.3 percent benzene by volume, diesel fuel contains less than 0.02 percent benzene (IARC 1989).

2.2 SENSITIVE RECEPTORS

CARB and the Office of Environmental Health Hazard Assessment (OEHHA) have identified the following groups of individuals as the most likely to be affected by air pollution: the elderly over 65, children under 14, infants (including in utero in the third trimester of pregnancy), and persons with cardiovascular and chronic respiratory diseases such as asthma, emphysema, and bronchitis (CARB 2005, OEHHA 2015). Some land uses are considered more sensitive to air pollution than others due to the types of population groups or activities involved and are referred to as sensitive receptors. Examples of these sensitive receptors are residences, schools, hospitals, and daycare centers. For health risk assessments, the health impacts are analyzed for individual residents assumed to be standing in their primary outdoor spaces closest to the source of TACs and for individual off-site workers assumed to be standing outside of a commercial or industrial building.

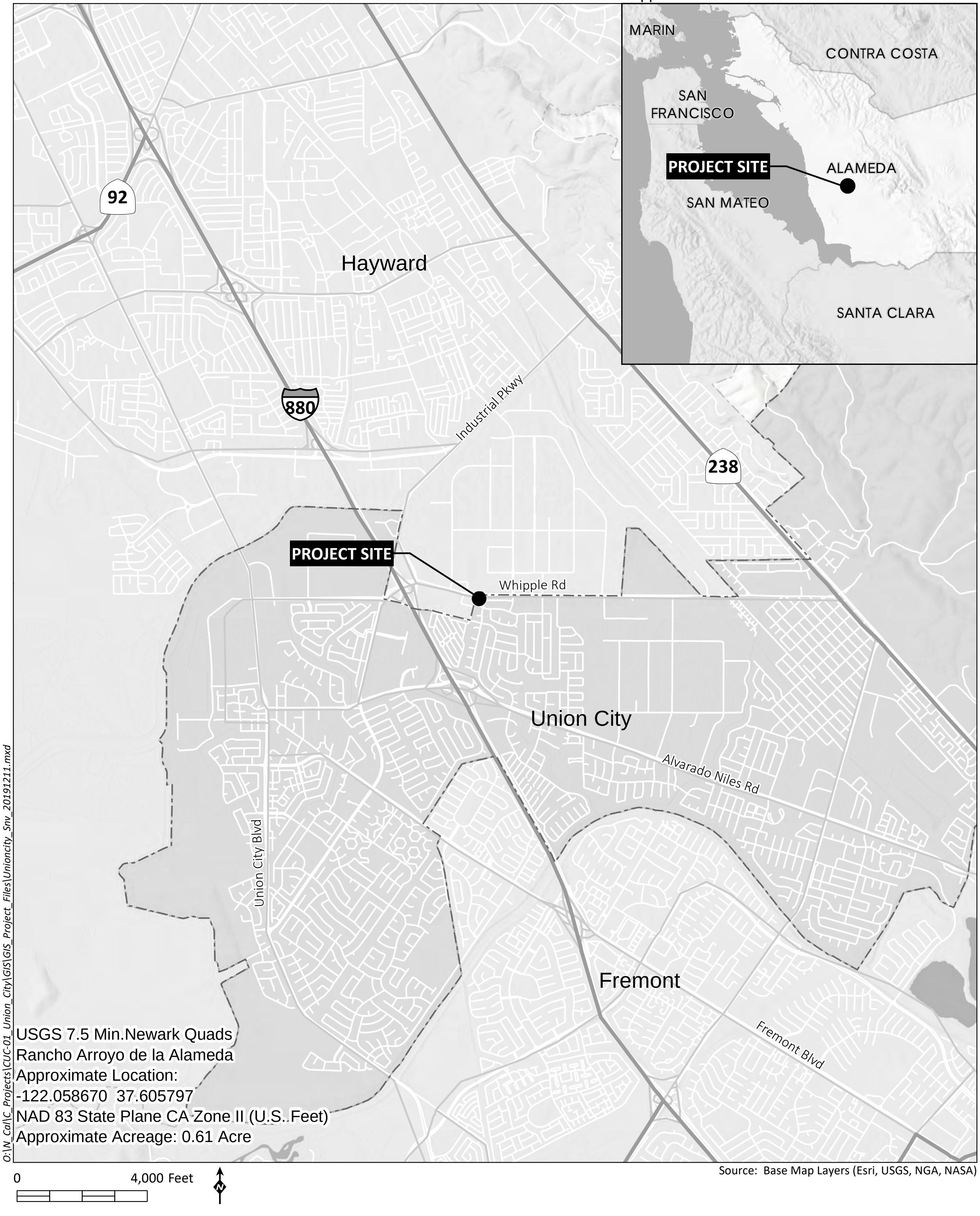
The closest existing sensitive receptors to the project site are five single-family residences adjacent the project site to the south and east. The closest existing worker areas are commercial buildings across Amaral Street west of the project site and across Whipple Road north of the project site. See Figure 4, *Receptor Locations*.

3.0 REGULATORY FRAMEWORK

3.1 STATE REGULATIONS

The Health and Safety Code (§39655[a]) defines TAC as "an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health." All substances that are listed as hazardous air pollutants pursuant to subsection (b) of Section 112 of the Clean air Act (CAA; 42 United States Code Sec. 7412[b]) are designated as TACs.

[1] Gasoline vapor can contain as many as 16 different TACs, including 3 carcinogens. Benzene, toluene, and xylenes are the focus of the 1997 CAPCOA Gas Station Risk Assessment Guidelines, which concluded that only cancer risk from benzene needs to be evaluated.



Source: Base Map Layers (Esri, USGS, NGA, NASA)

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Vicinity Map

Figure 1

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0 375 Feet

Source: ESRI Base Maps

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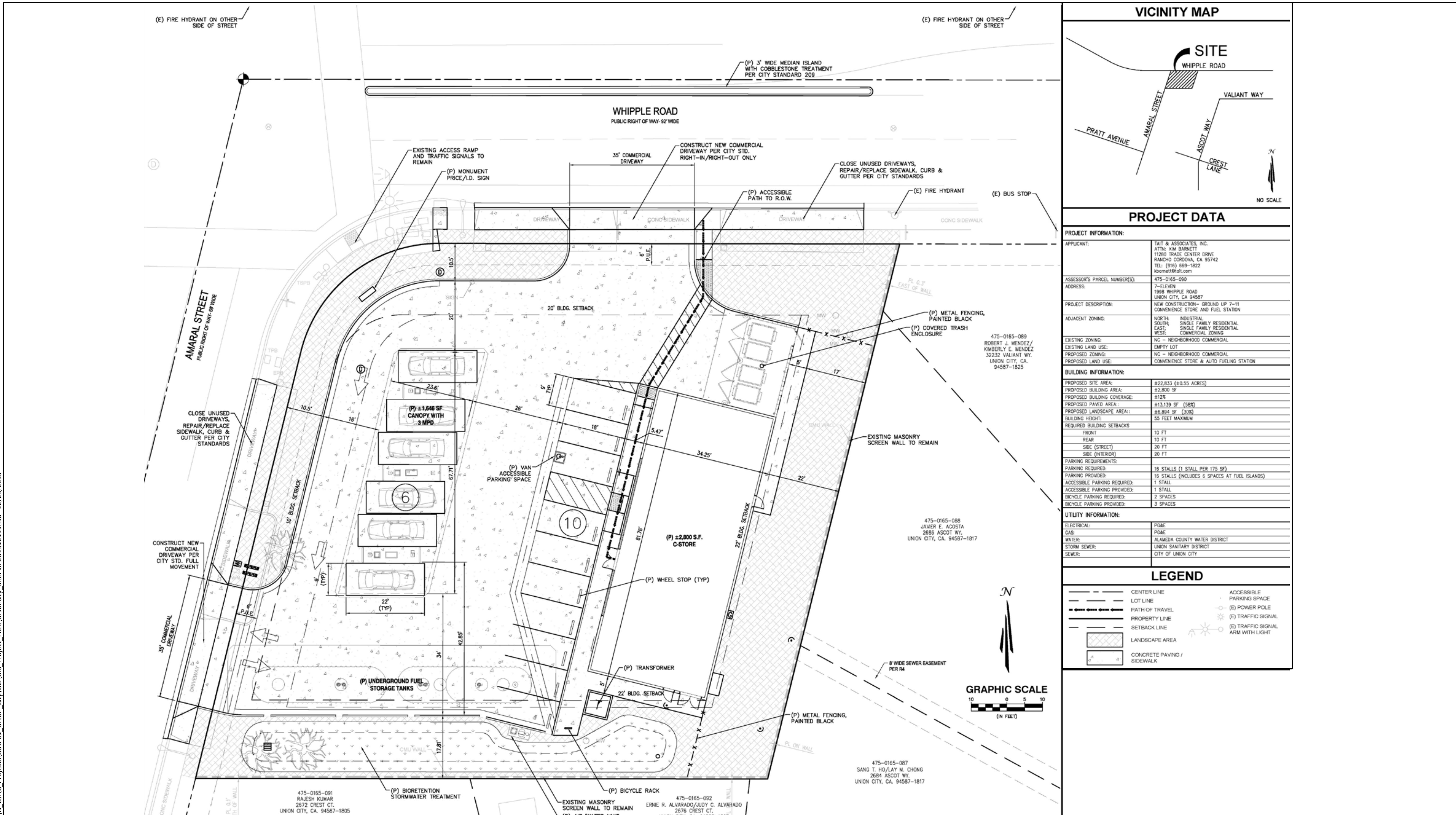
Location Map

Figure 2



Source: TAIT & Associates, 2019

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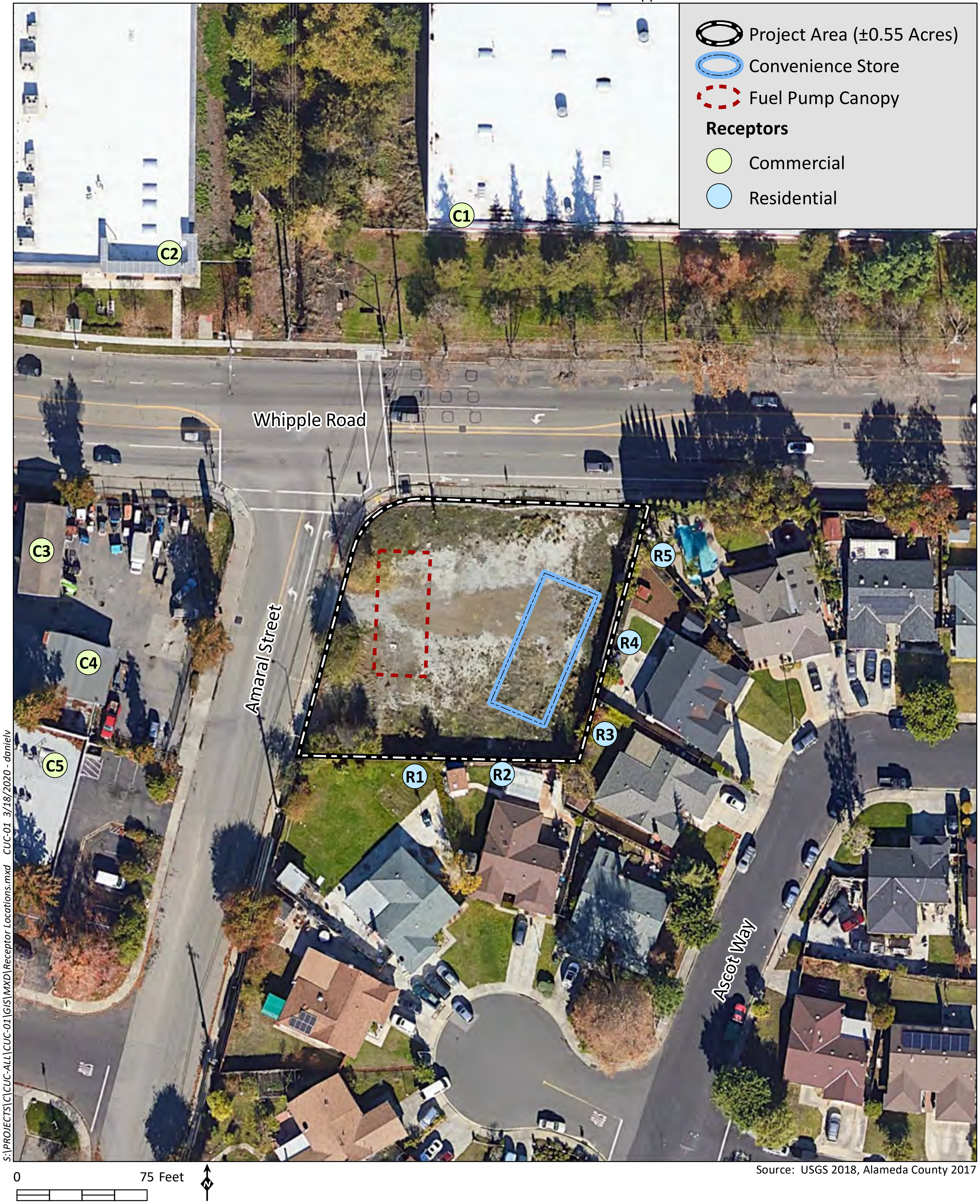
Proposed Site Plan

Figure 3



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Source: USGS 2018, Alameda County 2017

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Receptor Locations

Figure 4

Assembly Bill (AB) 1807 - the Toxic Air Contaminant Identification and Control Act, also known as the "Tanner Bill", was passed in 1983 and established a regulatory process for the scientific and public review of individual toxic compounds. The California Environmental Protection Agency (CalEPA), acting through CARB, is authorized to identify a substance as a TAC if it determines the substance is an air pollutant that may cause or contribute to an increase in mortality or an increase in serious illness, or that may pose a present or potential hazard to human health.

AB 2588 - the Air Toxics "Hot Spots" Information and Assessment Act was enacted in September 1987 and requires facilities with stationary sources of TACs to report the types and quantities of certain substances their facilities routinely release into the air. Emissions of interest are those that result from the routine operation of a facility or that are predictable, including but not limited to continuous and intermittent releases and process upsets or leaks.

3.2 LOCAL REGULATIONS

State regulations require all new gas stations to obtain an Authority to Construct (A/C) and a Permit to Operate (P/O) from the local air district. The BAAQMD stationary source permitting process is defined and regulated through Regulation 2 *Permits*, Rule 1 *General Requirements* and Rule 2 *New Source Review*. BAAQMD regulates gas stations through Regulation 8, Rule 7 *Gasoline Dispensing Facilities* which requires implementation, maintenance and testing of the Best Available Control Technologies (BACTs) to minimize TAC emissions and resulting public health risks from the facility.

3.2.1 Best Available Control Technology

The BACTs for gas stations are vapor recovery systems to collect gasoline vapors that would otherwise escape into the atmosphere. Gasoline vapor emissions at gas stations are controlled in two phases. Phase I vapor recovery collects vapors displaced from USTs when a cargo tank truck delivers gasoline to a gas station. Phase II vapor recovery collects vapors displaced during the transfer of gasoline from a dispensing nozzle to a vehicle, fuel container, or gasoline-powered equipment; and the storage of gasoline at a gas station. CARB regulations establish standards for the level of emissions control vapor recovery systems must achieve during the transfer and storage of gasoline.

Vapor recovery system performance standards for gas stations have become more stringent over the years. Since 2001, CARB has adopted a number of significant advancements as part of the enhanced vapor recovery (EVR) program. Phase I EVR, in accordance with California Executive Order VR-102, requires more durable and leak-tight components, along with an increased collection efficiency of 98 percent. Phase II EVR, in accordance with California Executive Order VR-204, includes three major advancements: (1) dispensing nozzles with less spillage and required compatibility with onboard refueling vapor recovery (ORVR) vehicles, (2) a processor to control the static pressure of the ullage, or vapor space, in the underground storage tank, and (3) an in-station diagnostic (ISD) system that provides warning alarms to alert a gas station operator of potential vapor recovery system malfunctions. Phase I EVR was fully implemented in 2005. Phase II EVR was fully implemented between 2009 and 2011 (CARB 2013). The project would be required to implement Phase I EVR and Phase II EVR systems (with an ISD system) meeting the latest CARB performance standards.

ORVR systems were phased in beginning with 1998 model year passenger vehicles, and are now installed on all passenger, light-duty, and medium-duty vehicles manufactured since the 2006 model year. When an ORVR vehicle is fueled, almost all the gasoline vapor displaced from the fuel tank is routed to a carbon canister in the vehicle fuel system. At the start of dispensing, a small portion of the vapor in the vehicle fuel tank may escape through the fill-pipe before the onboard system is fully engaged. Uncontrolled fill-pipe emissions from ORVR vehicles are approximately two orders of magnitude lower than the same emissions from vehicles without ORVR and are easily captured by Phase II vapor recovery systems (CARB 2013).

4.0 METHODOLOGY

Potential health risks to nearby sensitive receptors from the emission of TACs during operations at the proposed gasoline fueling facility were analyzed in accordance with the CAPCOA *Gasoline Service Station Industrywide Risk Assessment Guidelines* (CAPCOA 1997), and the OEHHA *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (OEHHA 2015).

4.1 TAC EMISSIONS

The emissions of benzene were calculated in accordance with CAPCOA (1997) *Gasoline Service Station Industrywide Risk Assessment Guidelines* and the CARB *Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities* (2013). Emissions were broken into five sources:

Loading – Emissions occur when gasoline vapors are displaced by rising liquid in the gasoline station USTs during bulk transfer of gasoline from a cargo tank to an UST. The displaced vapors are collected by a Phase I vapor recovery system that returns approximately 98 percent of vapors to the cargo tank. The remaining vapors may be emitted from the UST vent stack.

Breathing – Emissions are generated when gasoline vapors are displaced to the atmosphere during the day to day operation of a gas station. During periods when there is either no dispensing or when there is a significant slowdown in the dispensing of fuel to vehicles, such as overnight periods, gasoline in an UST evaporates into the headspace above the liquid fuel. The vapor growth caused by this evaporation increases UST static pressure and results in pressure driven emissions. Pressure-driven emissions are currently controlled by a processing unit that includes either a bladder tank, membrane separator, carbon canister, or thermal oxidizer. The remaining vapors may be emitted from the UST vent stack.

Refueling – During the refueling process, gasoline vapors are emitted at the vehicle/nozzle interface. When dispensing gasoline to vehicles not equipped with ORVR, the rising liquid level in the vehicle fuel tank displaces gasoline vapors back through the fill-pipe where they are captured by a Phase II vapor recovery system. Vapors not captured by the Phase II vapor recovery system are emitted to the atmosphere. When an ORVR vehicle is fueled, almost all the gasoline vapor displaced from the fuel tank is routed to a carbon canister in the vehicle fuel system. At the start of dispensing, a small portion of the vapor in the vehicle fuel tank may escape through the fill-pipe before the onboard system is fully engaged. All passenger, light-duty, and medium-duty vehicles manufactured since the 2006 model year are equipped with ORVR systems. For this analysis, 88 percent of vehicles refueling at the proposed gas station were assumed to be equipped with ORVR systems, corresponding to the 2021 estimated statewide penetration of ORVR vehicles in the fleet mix (CARB 2013).

Spillage – Emissions occur during vehicle fueling if there is overflow after a tank is filled or when other liquid fuel unintentionally discharges from the nozzle and evaporates.

Hose Permeation – Emissions occur when liquid gasoline or gasoline vapors diffuse through the dispensing hose outer surface to the atmosphere. CARB adopted performance standards for gasoline dispensing hose permeation on July 26, 2012 with all facilities subject to the standard required to comply by 2017 (CARB 2013).

The CARB revised emission factors for the above sources are expressed in pounds of Total Organic Gasses (TOG) per 1,000 gallons of gasoline dispensed (CARB 2013). The California standards for gasoline formulation from 1996 specifies a maximum benzene content of 0.3 percent of TOG by weight in gasoline vapor (CAPCOA 1997). Table 1, *Benzene Emissions*, shows the CARB emissions factors and the project's calculated benzene emissions for a throughputs 6 million gallons per year.

Table 1
BENZENE EMISSIONS

Source	Emission Factor (TOG lb/1000 gal)	Benzene 6 million gal/year lb/year	Benzene 6 million gal/year lb/hour
Loading	0.150	2.70	3.08E-04
Breathing	0.024	0.43	4.93E-05
Refueling Non-ORVR	0.420	0.91	1.03E-04
Refueling ORVR	0.021	0.33	3.79E-05
Refueling Total	-	1.24	1.41E-04
Spillage	0.240	4.32	4.93E-04
Hose Permeation	0.009	0.16	1.85E-05

Source: CARB 2013.
TOG = Total Organic Gasses; lb = pounds; gal = gallons.

4.2 DISPERSION MODELING

Localized concentrations of benzene were modeled using Lakes AERMOD View version 9.8.3. The Lakes program utilizes the U.S. Environmental Protection Agency's (USEPA) AERMOD gaussian air dispersion model version 19191. Plot files from AERMOD using unitized emissions (one gram per second) for each benzene source were imported into CARB's Hotspots Analysis and Reporting Program (HARP), Air Dispersion Modeling and Risk Tool (ADMRT) version 19121. The ADMRT calculated ground-level concentrations of benzene utilizing the imported plot files and the annual and hourly emissions inventory shown in Table 1.

4.2.1 Source Parameters

The loading and breathing sources were modeled as point sources with emissions emanating from the USTs vent stack at 12 feet (3.66 meters) above the ground. Because the proposed vent stack location was not known at the time of this analysis, it was positioned in the model at the default location of the center of the gas pump canopy. The stack diameter was set at 2 inches (0.05 meters) and the exhaust gas temperature was set to 60 degrees Fahrenheit (°F; 289 Kelvin [K]) in accordance with the CAPCOA risk assessment guidelines (CAPCOA 1997). The UST vent stack was assumed to have a rain cap resulting in a near-zero initial vertical gas velocity.

The refueling, spillage, and hose permeation sources were modeled as volume sources corresponding to the approximate volume beneath the gas pump canopy. The release height for the refueling and hose permeation was set to the approximate average refueling height of 3.3 feet (1 meter). The release height for the spillage source was set to ground level (0 feet). The source parameters are summarized in Table 2, *Source Modeling Parameters*.

Table 2
SOURCE MODELING PARAMETERS

Process	Release Height (m)	Point Source Parameters			Volume Source Parameters	
		Stack Diameter (m)	Gas Temperature (K)	Gas Velocity[1] (m/s)	Volume Side (m)	Volume Height (m)
Loading	3.7	0.05	289	0.01	-	-
Breathing	3.7	0.05	289	0.01	-	-
Refueling	1	-	-	-	13.0	4.0
Spillage	0	-	-	-	13.0	4.0
Hose Permeation	1	-	-	-	13.0	40

Source: CAPCOA *Gasoline Service Station Industrywide Risk Assessment Guidelines* (1997).
[1] Assumes the vent pipe is fitted with a rain cap and the initial gas exit vertical velocity is near zero.
m = meters; m/s = meters per second; K = Kelvin; - = not applicable

Emissions of gasoline vapor for gas stations are not constant throughout the day. Refueling and spillage sources vary by the quantity dispensed each hour. Loading sources only occur during fuel deliveries, typically one hour in a day on several days per week. Breathing and permeation sources may vary depending on environmental conditions and on gasoline dispensing activity. All emission sources were assumed to be steady throughout all hours of the day. This modeling assumption is generally conservative (health protective; CAPCOA 1997).

Downwash from the project's buildings was modeled using the Building Profile Input Program (BPIP – a building preprocessing program for AERMOD). The project convenience store's size and location were estimated from the project site plan (Tait and Associates 2019).

4.2.2 Meteorological Data

CARB provides pre-processed meteorological data suitable for use with AERMOD for projects within the SFBAAB (CARB 2014). The available data set most representative of conditions in the project vicinity was from the Oakland International Airport station, approximately 11 miles northwest of the project site. The Oakland International Airport set includes 5 years of data collected between 2009 and 2014. A wind rose for the Oakland International Airport shows an average speed of 8.6 miles per hour from the west (Iowa Environmental Mesonet 2019). The wind rose graphic is included in Appendix A to this report. Urban dispersion coefficients were selected in the model to reflect the existing developed nature of the project vicinity

4.2.3 Terrain Data

United States Geological Survey (USGS) National Elevation Dataset (NED) files with a 10-meter resolution covering an area approximately one kilometer by one kilometer centered on the project site were used in the model to cover the analysis area. Terrain data was imported to the model using AERMAP (a terrain preprocessing program for AERMOD).

4.2.4 Receptor Modeling

To develop risk isopleths (linear contours showing equal level of risk) and ensure that the area of maximum impact was captured, receptors were placed in a cartesian grid 490 meters by 490 meters (approximately 1,607 feet by 1,607), centered on the project site with a grid spacing of 10 meters (33 feet) and a receptor height (flagpole height) of 1.2 meters (4 feet) above the ground. Additional discrete receptors were placed at the residential property line of the 5 closest identified sensitive receptors and the five closest existing worker buildings. See Figure 4 for the discrete receptor locations relative to the project site and proposed gas pump location.

4.3 RISK DETERMINATION

Health risks resulting from localized concentration of benzene were estimated using the ADMRT. The latest cancer slope factors, chronic Recommended Exposure Limits (RELs), and exposure paths for all TACs designated by CARB are included in the ADMRT. For the residential cancer risk, an exposure duration of 30 years was selected in accordance with the OEHHA (2015) guidelines. The model conservatively assumes that residents would be standing and breathing outdoors at the location of the property line closest to the gas station every day between 17 and 21 hours per day (depending on the age group, starting with infants in utero in the third trimester of pregnancy) for 30 years. For off-site worker cancer risk, an exposure duration of 25 years was selected with an assumption of 8 hours per day, 5 days per week of exposure while standing outside, in accordance with the OEHHA guidelines. As described in Section 2.1, only the cancer risk, chronic risk, and acute from exposure to benzene was evaluated. The OEHHA derived intake rate percentile method was selected.

4.4 SIGNIFICANCE CRITERIA

For a Type A project (siting a new source of emissions), the BAAQMD recommends the following thresholds for the project's incremental contribution to community health risks (BAAQMD 2017):

Cancer Risk – An increased risk of 10 in 1 million for the maximum exposed individual to project emissions.

Chronic and Acute Health Risk – A Hazard Index of 1 for the maximum exposed individual to project emissions.

5.0 HEALTH RISK IMPACT ANALYSIS

The incremental excess cancer risk is an estimate of the chance a person exposed to a specific source of a TAC may have of developing cancer from that exposure beyond the individual's risk of developing cancer from existing background levels of TACs in the ambient air. For context, the average cancer risk from TACs in the ambient air for an individual living in an urban area of California is 830 in 1 million (CARB 2015). Cancer risk estimates do not mean, and should not be interpreted to mean, that a person will develop cancer from estimated exposures to toxic air pollutants.

The estimated incremental excess cancer risks due to exposure to the project's TAC (benzene) emissions for each receptor location (shown in Figure 4) for the proposed permitted throughput of 6 million gallons per year are presented in Table 3, *Discrete Receptor Incremental Cancer and Chronic Health Risk* *for Benzene Emissions*. The model inputs, outputs, and cancer risk isopleth figures are available in Appendix A to this report.

Table 3
DISCRETE RECEPTOR INCREMENTAL CANCER AND CHRONIC HEALTH RISK FOR BENZENE EMISSIONS

Receptor ID	Type	Location	Cancer Risk	Hazard Index
R1	Residential	2672 Crest Court	3.4 in 1 million	0.01
R2	Residential	2676 Crest Court	3.4 in 1 million	0.01
R3	Residential	2684 Ascot Way	5.6 in 1 million	0.02
R4	Residential	2686 Ascot Way	7.2 in 1 million	0.03
R5	Residential	32232 Valiant Way	3.2 in 1 million	0.01
C1	Commercial	31353 Huntwood Avenue	<0.1 in 1 million	<0.01
C2	Commercial	2401 Whipple Road	<0.1 in 1 million	<0.01
C3	Commercial	2408 Whipple Road	<0.1 in 1 million	<0.01
C4	Commercial	2408 Whipple Road	<0.1 in 1 million	<0.01
C5	Commercial	2409 Pratt Avenue	<0.1 in 1 million	<0.01

Source: Lakes AERMOD View version 9.8.3 and CARB ADMRT version 19121. See Appendix A for model inputs, outputs, and risk isopleths.

The point of maximum impact (offsite) would be at receptor ID R4, on the project's east boundary approximately 125 feet from the proposed gas pumps, at approximately Universal Transverse Mercator (UTM) coordinates Zone 10, 583135 meters east, 4162488 meters north. The incremental excess cancer risk at the point of maximum impact would be 7.2 in 1 million, as listed in Table 3. This location also has the highest hazard index at 0.03.

Of the receptor locations analyzed in the model, the maximum exposed individual (MEI) incremental cancer risk and hazard index due to exposure to the project TAC emissions of benzene from long term operation of the proposed retail gasoline dispensing facility at the maximum proposed permitted gasoline throughput are presented in Table 4, *Maximum Exposed Individual Incremental Cancer Health Risk and Hazard Index*. These estimates are conservative (health protective) and assume that the resident or worker is outdoors for the entire exposure period.

Table 4
MAXIMUM EXPOSED INDIVIDUAL INCREMENTAL CANCER RISK AND HAZARD INDEX

	MEI Resident Cancer Risk	MEI Worker Cancer Risk	MEI Resident Chronic Hazard Index	MEI Worker Chronic Hazard Index	MEI Acute Hazard Index
Results	7.2 in 1 million	<0.1 in 1 million	0.03	<0.01	0.03
Threshold	10 in 1 million	10 in 1 million	1	1	1
Exceed Threshold?	No	No	No	No	No

Source: Lakes AERMOD View version 9.8.3 and CARB ADMRT version 19121. See Appendix A for model inputs, outputs, and risk isopleths.
MEI = Maximum Exposed Individual.

As shown in Tables 3 and 4, the maximum incremental increased cancer risks and maximum chronic health index due to exposure to benzene emissions from long term operation of the proposed retail gasoline dispensing facility would not exceed the BAAQMD thresholds at the maximum proposed permitted throughput of 6 million gallons per year. Therefore, long-term operation of proposed gas station would not result in a significant impact related to the exposure of sensitive receptors to substantial TAC concentrations.

6.0 LIST OF PREPARERS

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Joanne M. Dramko, AICP	Principal Technical Specialist, QA/QC

7.0 REFERENCES

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Appendix A

HRA Modeling Output

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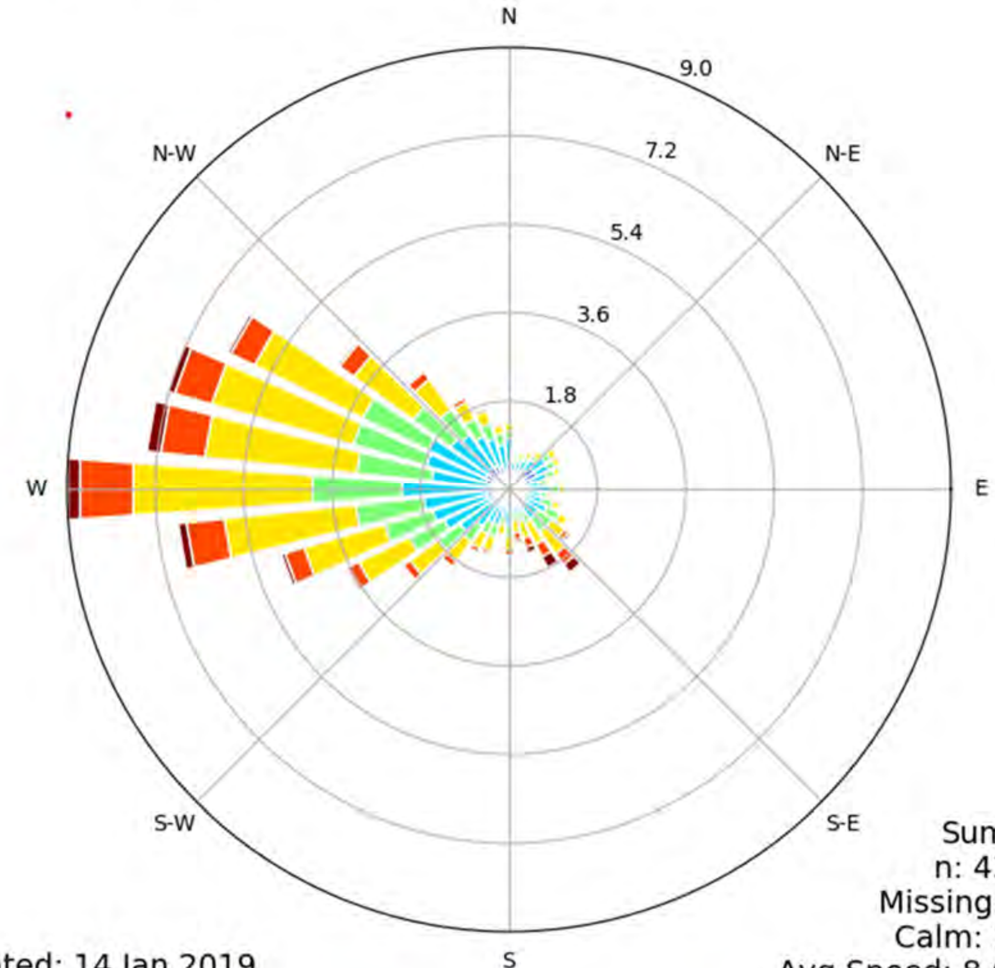
Benzene Emissions

Percent Benzene in gasoline vapor		0.3%		
Percent ORVR Vehicles		88.0%		
Throughput (gal/year)		6,000,000		
Source	TOG	Benzene		
	lb/1000 gal	lb/1000 gal	lb/year	lb/hr
Loading	0.150	0.000450	2.70	3.08E-04
Breathing	0.024	0.000072	0.43	4.93E-05
Refueling Non-ORVR	0.420	0.001260	0.91	1.03E-04
Refueling ORVR	0.021	0.000063	0.33	3.79E-05
Refueling Total	-	-	1.24	1.41E-04
Spillage	0.240	0.000720	4.32	4.93E-04
Hose Permeation	0.009	0.000027	0.16	1.85E-05

Source: California Air Resources Board. 2103. Revised Emission Factors for Gasoline Marketing

[OAK] OAKLAND
Windrose Plot [All Year]
Period of Record: 01 Jan 1970 - 14 Jan 2019



Summary
n: 437860
Missing: 5518
Calm: 10.4%
Avg Speed: 8.6 mph

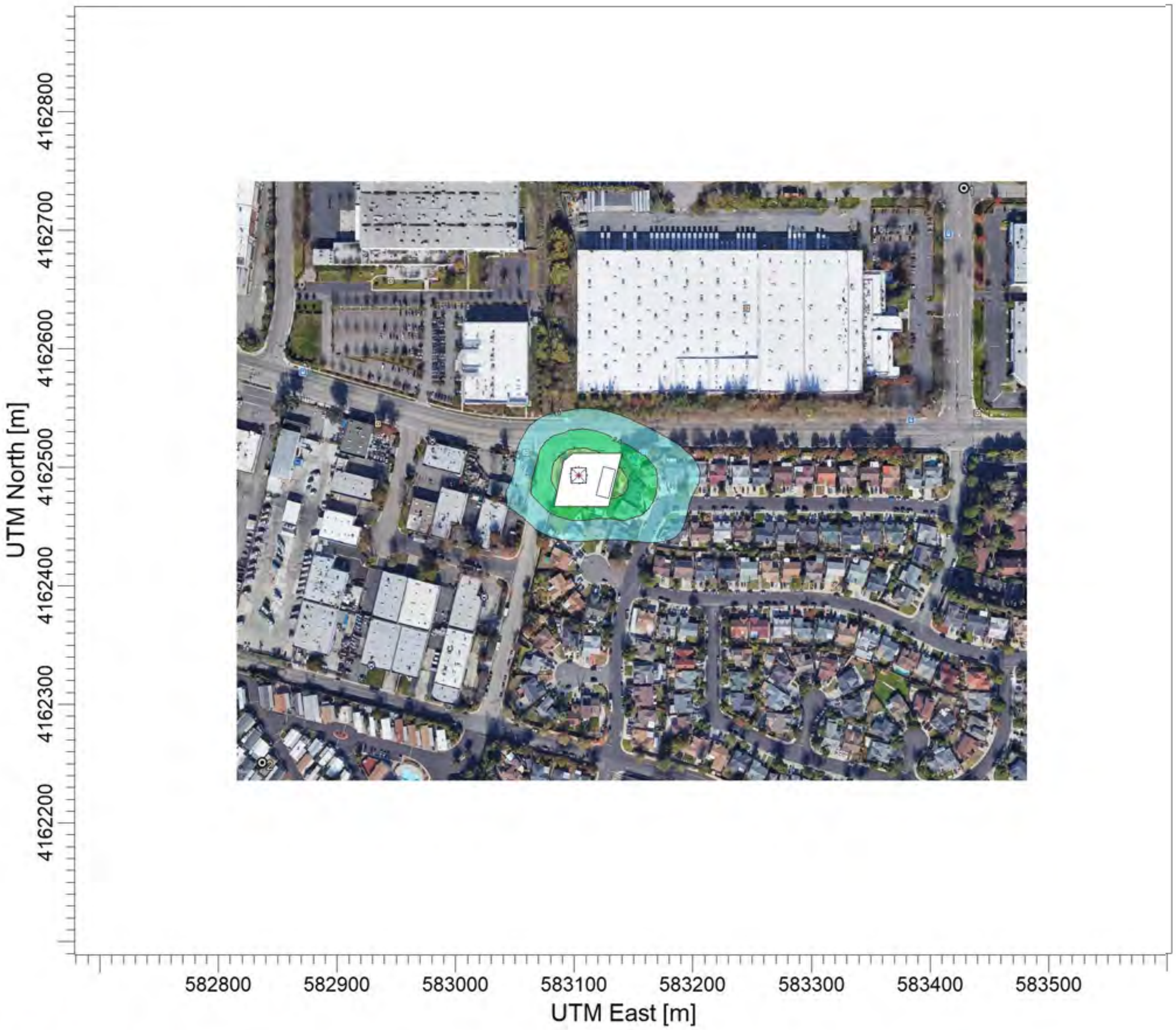
Generated: 14 Jan 2019

Wind Speed [mph]

2-5 | 5-7 | 7-10 | 10-15 | 15-20 | 20+

PROJECT TITLE:

1998 Whipple Road Residential Increased Cancer Risk



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL

COMMENTS:	SOURCES:	COMPANY NAME:	
Increased Risk in chances per million	**5**		
	RECEPTORS: **2515**	MODELER:	
	OUTPUT TYPE:	SCALE: 1:5,816 (0 — 0.2 km)	
	MAX:	DATE: **2/13/2020**	PROJECT NO.:

Control Pathway

Dispersion Options

Titles
C:\Users\mdrol\OneDrive\Desktop\Whipple Road HRA\Whipple Road HRA.is

Dispersion Options

- [x] Regulatory Default
- [ ] Non-Default Options

Dispersion Coefficient

Urban

Population:
Name (Optional):
Roughness Length:

Output Type

- [x] Concentration
- [ ] Total Deposition (Dry & Wet)
- [ ] Dry Deposition
- [ ] Wet Deposition

Plume Depletion

- [ ] Dry Removal
- [ ] Wet Removal

Output Warnings

- [ ] No Output Warnings
- [ ] Non-fatal Warnings for Non-sequential Met Data

Pollutant / Averaging Time / Terrain Options

Pollutant Type

OTHER - BENZENE

Averaging Time Options

Hours

1	2	3	4	6	8	12	24
[x]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

- [ ] Month
- [x] Period
- [ ] Annual

Flagpole Receptors

- [x] Yes
- [ ] No

Default Height = 1.20 m

Exponential Decay

Option not available
Half Life of 4 hrs will be used

Terrain Height Options

- [ ] Flat
- [x] Elevated

SO: Meters
RE: Meters
TG: Meters

Optional Files

☐	Re-Start File
☐	Init File
☐	Multi-Year Analyses
☐	Event Input File
☒	Error Listing File

Detailed Error Listing File

Filename: Whipple Road HRA.err

Source Pathway - Source Inputs

AERMOD

Point Sources

Source Type	Source ID	X Coordinate [m]	Y Coordinate [m]	Base Elevation (Optional)	Release Height [m]	Emission Rate [g/s]	Gas Exit Temp. [K]	Gas Exit Velocity [m/s]	Stack Inside Diameter [m]
POINT	LOAD	583103.80 Loading	4162493.10	4.55	3.70	1.00000	289.00	0.01	0.05
POINT	BREA	583103.80 Breathing	4162493.10	4.55	3.70	1.00000	289.00	0.01	0.05

Volume Sources

Source Type	Source ID	X Coordinate [m]	Y Coordinate [m]	Base Elevation (Optional)	Release Height [m]	Emission Rate [g/s]	Length of Side [m]	Building Height [m]	Initial Lateral Dim. [m]	Initial Vertical Dim. [m]
VOLUME	REFU	583103.80 Refue;ing	4162493.10	4.55	1.00	1.00000	13.00	Surface-Based	3.02	1.86
VOLUME	SPIL	583103.80 Spillage	4162493.10	4.55	0.00	1.00000	13.00	Surface-Based	3.02	1.86
VOLUME	PERM	583103.80 Permeation	4162493.10	4.55	1.00	1.00000	13.00	Surface-Based	3.02	1.86

Building Downwash Information

Source ID: LOAD

Heights [m] (10 to 360 deg)

10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	7.62	7.62	7.62	0.00	0.00	7.62
130-180 deg	7.62	7.62	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	7.62	7.62	7.62	7.62	7.62	7.62
310-360 deg	7.62	7.62	0.00	0.00	0.00	0.00

Widths [m] (10 to 360 deg)

10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	26.53	27.02	26.70	0.00	0.00	26.84
130-180 deg	26.97	26.28	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	26.53	27.02	26.70	25.57	25.90	26.84
310-360 deg	26.97	26.28	0.00	0.00	0.00	0.00

Lengths [m] (10 to 360 deg)

10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	22.55	19.62	16.10	0.00	0.00	16.99
130-180 deg	20.38	23.15	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	22.55	19.62	16.10	12.09	13.08	16.99
310-360 deg	20.38	23.15	0.00	0.00	0.00	0.00

Along Flow [m] (10 to 360 deg)

10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	8.13	11.64	14.80	0.00	0.00	14.36
130-180 deg	11.24	7.78	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	-30.68	-31.26	-30.90	-29.60	-30.13	-31.35
310-360 deg	-31.62	-30.93	0.00	0.00	0.00	0.00

Across Flow [m] (10 to 360 deg)

10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	-13.52	-9.93	-6.05	0.00	0.00	6.19
130-180 deg	10.05	13.62	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	13.52	9.93	6.05	1.98	-2.13	-6.19
310-360 deg	-10.05	-13.62	0.00	0.00	0.00	0.00

Source ID: BREA

Heights [m] (10 to 360 deg)

10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00

70-120 deg	7.62	7.62	7.62	0.00	0.00	7.62
130-180 deg	7.62	7.62	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	7.62	7.62	7.62	7.62	7.62	7.62
310-360 deg	7.62	7.62	0.00	0.00	0.00	0.00
Widths [m] (10 to 360 deg)						
10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	26.53	27.02	26.70	0.00	0.00	26.84
130-180 deg	26.97	26.28	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	26.53	27.02	26.70	25.57	25.90	26.84
310-360 deg	26.97	26.28	0.00	0.00	0.00	0.00
Lengths [m] (10 to 360 deg)						
10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	22.55	19.62	16.10	0.00	0.00	16.99
130-180 deg	20.38	23.15	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	22.55	19.62	16.10	12.09	13.08	16.99
310-360 deg	20.38	23.15	0.00	0.00	0.00	0.00
Along Flow [m] (10 to 360 deg)						
10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	8.13	11.64	14.80	0.00	0.00	14.36
130-180 deg	11.24	7.78	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	-30.68	-31.26	-30.90	-29.60	-30.13	-31.35
310-360 deg	-31.62	-30.93	0.00	0.00	0.00	0.00
Across Flow [m] (10 to 360 deg)						
10-60 deg	0.00	0.00	0.00	0.00	0.00	0.00
70-120 deg	-13.52	-9.93	-6.05	0.00	0.00	6.19
130-180 deg	10.05	13.62	0.00	0.00	0.00	0.00
190-240 deg	0.00	0.00	0.00	0.00	0.00	0.00
250-300 deg	13.52	9.93	6.05	1.98	-2.13	-6.19
310-360 deg	-10.05	-13.62	0.00	0.00	0.00	0.00

Emission Rate Units for Output

For Concentration

Unit Factor:	1E6
Emission Unit Label:	GRAMS/SEC
Concentration Unit Label:	MICROGRAMS/M**3

Source Pathway

Receptor Pathway

AERMOD

Receptor Networks

Note: Terrain Elavations and Flagpole Heights for Network Grids are in Page RE2 - 1 (If applicable)
Generated Discrete Receptors for Multi-Tier (Risk) Grid and Receptor Locations for Fenceline Grid are in Page RE3 - 1 (If applicable)

Uniform Cartesian Grid

Receptor Network ID	Grid Origin X Coordinate [m]	Grid Origin Y Coordinate [m]	No. of X-Axis Receptors	No. of Y-Axis Receptors	Spacing for X-Axis [m]	Spacing for Y-Axis [m]
UCART1	582858.80	4162248.10	50	50	10.00	10.00

Discrete Receptors

Discrete Cartesian Receptors

Record Number	X-Coordinate [m]	Y-Coordinate [m]	Group Name (Optional)	Terrain Elevations	Flagpole Heights [m] (Optional)
1	583096.45	4162465.93		4.92	
2	583110.42	4162466.09		4.90	
3	583133.43	4162476.05		4.82	
4	583135.57	4162485.62		4.81	
5	583140.72	4162508.73		4.55	
6	583107.50	4162560.44		5.11	
7	583060.20	4162551.16		3.70	
8	583042.25	4162502.43		4.45	
9	583051.02	4162484.59		4.58	
10	583045.14	4162465.44		4.46	

Plant Boundary Receptors

Cartesian Plant Boundary

Primary

Record Number	X-Coordinate [m]	Y-Coordinate [m]	Group Name (Optional)	Terrain Elevations	Flagpole Heights [m] (Optional)
1	583083.00	4162467.00	FENCEPRI	4.31	
2	583129.00	4162467.00	FENCEPRI	4.93	
3	583140.00	4162512.00	FENCEPRI	4.36	
4	583099.00	4162512.00	FENCEPRI	4.30	
5	583091.00	4162505.00	FENCEPRI	4.18	

Receptor Groups

Record Number	Group ID	Group Description
1	FENCEPRI	Cartesian plant boundary Primary Receptors

Meteorology Pathway

AERMOD

Met Input Data

Surface Met Data

Filename: ..\724930.SFC

Format Type: Default AERMET format

Profile Met Data

Filename: ..\724930.PFL

Format Type: Default AERMET format

Wind Speed

☐ Wind Speeds are Vector Mean (Not Scalar Means)

Wind Direction

Rotation Adjustment [deg]:

Potential Temperature Profile

Base Elevation above MSL (for Primary Met Tower): 1.80 [m]

Meteorological Station Data

Stations	Station No.	Year	X Coordinate [m]	Y Coordinate [m]	Station Name
Surface		2009			OAKLAND/WSO AP
Upper Air		2009			OAKLAND/WSO AP

Data Period

Data Period to Process

Start Date: 1/1/2009 Start Hour: 1 End Date: 1/2/2014 End Hour: 24

Wind Speed Categories

Stability Category	Wind Speed [m/s]	Stability Category	Wind Speed [m/s]
A	1.54	D	8.23
B	3.09	E	10.8
C	5.14	F	No Upper Bound

Output Pathway

Tabular Printed Outputs

Short Term Averaging Period	RECTABLE Highest Values Table										MAXTABLE Maximum Values Table	DAYTABLE Daily Values Table
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th		
1	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐		No

Contour Plot Files (PLOTFILE)

Path for PLOTFILES: Whipple Road HRA.AD

Averaging Period	Source Group ID	High Value	File Name
1	ALL	1st	01H1GALL.PLT
Period	ALL	N/A	PE00GALL.PLT

Residential Cancer Risk

*HARP - HRACalc v19044 2/12/2020 9:33:41 PM - Cancer Risk

REC	GRP	NETID	X	Y	RISK_SUM	SCENARIO
2501	ALL	RES02	583096.5	4162466	3.40E-06	30YrCancerDerived_InhSoilDermMMilk
2502	ALL	RES02	583110.4	4162466	3.38E-06	30YrCancerDerived_InhSoilDermMMilk
2503	ALL	RES03	583133.4	4162476	5.61E-06	30YrCancerDerived_InhSoilDermMMilk
2504	ALL	RES04	583135.6	4162486	7.17E-06	30YrCancerDerived_InhSoilDermMMilk
2505	ALL	RES05	583140.7	4162509	3.22E-06	30YrCancerDerived_InhSoilDermMMilk

Residential Chronic Risk

*HARP - HRACalc v19044 2/12/2020 9:36:01 PM - Chronic Risk

REC	GRP	NETID	X	Y	SCENARIO	MAXHI
2501	ALL	RES01	583096.5	4162466	NonCancerChronicDerived_InhSoilDermMMilk	1.41E-02
2502	ALL	RES02	583110.4	4162466	NonCancerChronicDerived_InhSoilDermMMilk	1.40E-02
2503	ALL	RES03	583133.4	4162476	NonCancerChronicDerived_InhSoilDermMMilk	2.32E-02
2504	ALL	RES04	583135.6	4162486	NonCancerChronicDerived_InhSoilDermMMilk	2.97E-02
2505	ALL	RES05	583140.7	4162509	NonCancerChronicDerived_InhSoilDermMMilk	1.33E-02

Worker Cancer Risk

*HARP - HRACalc v19044 2/12/2020 9:35:04 PM - Cancer Risk

REC	GRP	NETID	X	Y	RISK_SUM	SCENARIO
2506	ALL	COM01	583107.5	4162560	5.11E-08	25YrCancerDerived_InhSoilDerm
2507	ALL	COM02	583060.2	4162551	4.74E-08	25YrCancerDerived_InhSoilDerm
2508	ALL	COM03	583042.3	4162502	5.48E-08	25YrCancerDerived_InhSoilDerm
2509	ALL	COM04	583051	4162485	8.45E-08	25YrCancerDerived_InhSoilDerm
2510	ALL	COM05	583045.1	4162465	6.90E-08	25YrCancerDerived_InhSoilDerm

Worker Chronic Risk

*HARP - HRACalc v19044 2/12/2020 9:36:36 PM

REC	GRP	NETID	X	Y	SCENARIO	MAXHI
2506	ALL	COM01	583107.5	4162560	NonCancerChronicDerived_InhSoilDerm	3.03E-03
2507	ALL	COM02	583060.2	4162551	NonCancerChronicDerived_InhSoilDerm	2.81E-03
2508	ALL	COM03	583042.3	4162502	NonCancerChronicDerived_InhSoilDerm	3.24E-03
2509	ALL	COM04	583051	4162485	NonCancerChronicDerived_InhSoilDerm	5.00E-03
2510	ALL	COM05	583045.1	4162465	NonCancerChronicDerived_InhSoilDerm	4.09E-03

Acute Risk

*HARP - HRACalc v19044 2/12/2020 9:37:01 PM

REC	GRP	NETID	X	Y	SCENARIO	MAXHI
2501	ALL	RES01	583096.5	4162466	NonCancerAcute	1.63E-02
2502	ALL	RES02	583110.4	4162466	NonCancerAcute	1.41E-02
2503	ALL	RES03	583133.4	4162476	NonCancerAcute	3.10E-02
2504	ALL	RES04	583135.6	4162486	NonCancerAcute	3.18E-02
2505	ALL	RES05	583140.7	4162509	NonCancerAcute	2.37E-02
2506	ALL	COM01	583107.5	4162560	NonCancerAcute	7.33E-03
2507	ALL	COM02	583060.2	4162551	NonCancerAcute	2.44E-02
2508	ALL	COM03	583042.3	4162502	NonCancerAcute	1.14E-02
2509	ALL	COM04	583051	4162485	NonCancerAcute	2.45E-02
2510	ALL	COM05	583045.1	4162465	NonCancerAcute	2.92E-02

HARP Project Summary Report 2/13/2020 8:00:36 AM

PROJECT INFORMATION

HARP Version: 19121

Project Name: WHIPPLE ROAD RISK

Project Output Directory: C:\Users\mdrol\OneDrive\Desktop\CUC-01 HRA\WHIPPLE ROAD RISK

HARP Database: NA

EMISSION INVENTORY

No. of Pollutants:5

No. of Background Pollutants:0

Emissions

ScrID	StkID	ProID	PolID	PolAbbrev	Multi	Annual Ems (lbs/yr)	MaxHr Ems (lbs/hr)	MWAF
LOAD	0	0	71432	Benzene	1	2.7	0.00030801	1
BREA	0	0	71432	Benzene	1	0.432	4.9281E-05	1
REFU	0	0	71432	Benzene	1	1.23984	0.00014144	1
SPILL	0	0	71432	Benzene	1	4.32	0.00049281	1
PERM	0	0	71432	Benzene	1	0.162	1.848E-05	1

Background

PolID	PolAbbrev	Conc (ug/m^3)	MWAF

Ground level concentration files (\glc\)

71432MAXHR.txt

71432PER.txt

POLLUTANT HEALTH INFORMATION

Health Database: C:\HARP2\Tables\HEALTH17320.mdb

Health Table Version: HEALTH19252

Official: True

PolID	PolAbbrev	InhCancer	OralCancer	AcuteREL	InhChronicREL	OralChronicREL	InhChronic8HRREL
71432	Benzene	0.1		27	3		3

LIST OF RISK ASSESSMENT FILES

Health risk analysis files (\hra\)

Acute60GLCList.csv
Acute60HRAInput.hra
Acute60NCAcuteRisk.csv
Acute60NCAcuteRiskSumByRec.csv
Acute60Output.txt
Acute60PathwayRec.csv
Acute60PolDB.csv
ResCancer60CancerRisk.csv
ResCancer60CancerRiskSumByRec.csv
ResCancer60GLCList.csv
ResCancer60HRAInput.hra
ResCancer60Output.txt
ResCancer60PathwayRec.csv
ResCancer60PolDB.csv
ResChronic60GLCList.csv
ResChronic60HRAInput.hra
ResChronic60NCChronicRisk.csv
ResChronic60NCChronicRiskSumByRec.csv
ResChronic60Output.txt
ResChronic60PathwayRec.csv
ResChronic60PolDB.csv
WorkCancer60CancerRisk.csv
WorkCancer60CancerRiskSumByRec.csv
WorkCancer60GLCList.csv
WorkCancer60HRAInput.hra
WorkCancer60Output.txt
WorkCancer60PathwayRec.csv
WorkCancer60PolDB.csv
WorkChronic60GLCList.csv
WorkChronic60HRAInput.hra
WorkChronic60NCChronicRisk.csv
WorkChronic60NCChronicRiskSumByRec.csv
WorkChronic60Output.txt
WorkChronic60PathwayRec.csv
WorkChronic60PolDB.csv