California Air Resources Board
and California Air Pollution Control Officers Association

Gasoline Service Station Industrywide Risk Assessment Technical Guidance

February 18, 2022

Table of Contents

List of Tables

Table of Figures

Table of Equations

Executive Summary

California Air Resources Board[1] (CARB) staff and the California Air Pollution Control Officers Association (CAPCOA)[2] conducted health analyses to evaluate the health impacts of emissions from gasoline service stations operating throughout the state. From these analyses, CARB and CAPCOA developed the 2022 Gasoline Service Station Industrywide Risk Assessment Technical Guidance Manual (Technical Guidance). The Technical Guidance provides an update to the CAPCOA Air Toxics "Hot Spots" Program *Gasoline Service Station Industrywide Risk Assessment Guidelines*[3] (CAPCOA, 1997). The Technical Guidance also provides California Air Pollution Control and Air Quality Management Districts[4] (Districts) with recommended procedures for preparing gas station emission inventories and health risk assessments[5] (HRA) to meet the requirements of individual facilities subject to Assembly Bill 2588, the Air Toxics "Hot Spots" Information and Assessment Act (Hot Spots Act or Hot Spots Program).[6,7]

As part of the Technical Guidance update, CARB and CAPCOA completed the following:

- Performed air dispersion modeling[8] to incorporate changes in health risk analyses and emission control technology.

---

1 The California Air Resources Board (CARB) is a state agency that works to protect the public from the harmful effects of air pollution and develops programs and actions to fight climate change.

2 The California Air Pollution Control Officers Association (CAPCOA) is an association of air pollution control officers representing the 35 Air Pollution Control and Quality Management Districts (Districts) in California. The CAPCOA Toxics Committee Working Group included representatives of eight local air districts and the Office of Environmental Health Hazard Assessment.

3 California Air Pollution Control Officers Association, Air Toxics Hot Spots Program, Gasoline Service Station Industrywide Risk Assessment Guidelines, November 1997, available at: *Guidance Document: 1998-02-27 CAPCOA "Hot Spots" Gasoline Service Station Industrywide Risk Assessment Guidelines*.

4 Per California Health and Safety Code § 40000, Air Pollution Control and Air Quality Management Districts are local and regional authorities with primary responsibility for controlling air pollution from all sources other than from motor vehicles.

5 A health risk assessment is an evaluation of the health impacts affecting people living and working near sources of air quality emissions.

6 Assembly Bill 2588, Air Toxics "Hot Spots" Information and Assessment Act (Hot Spots Act), Connelly, Statutes of 1987, Chapter 1252, in California Health and Safety Code § 44300-44394. Available at: *PART 6. AIR TOXICS "HOT SPOTS" INFORMATION AND ASSESSMENT*

7 The Hot Spots Act requires facilities to submit information on certain pollutants. The purpose of the Hot Spots Act is to collect emissions data, identify facilities with elevated impacts, determine health risks, notify people living near facilities with elevated risks, and institute risk reduction measures if health impacts meet district-specified levels.

8 An air dispersion model is a computer model that estimates the concentration of air pollutants at distances away from a source of emissions (e.g., gas stations). The air dispersion model uses characteristics of the source, initial pollutant emissions, and meteorological conditions to estimate ground level concentrations of pollutants at specific distances.

- Assembled air dispersion modeling results into health risk tables.
- Created a spreadsheet tool[9] to streamline the risk assessment process.

The risk tables in this Technical Guidance were calculated using the methodology presented in the Office of Environmental Health Hazard Assessment's[10] (OEHHA) *Air Toxics Hot Spots Program Risk Assessment Guidelines: Guidance Manual for the Preparation of Health Risk Assessments*[11] (OEHHA Manual). Detailed information on modeling parameters and assumptions can be found in *Appendix D*. Together, the modeling procedures and risk tables in the Technical Guidance are intended to be used as a statewide screening risk assessment[12] and can be used to identify potential individual cancer risks[13] and noncancer health impacts near gas stations. Risk estimates generated by an HRA should not be interpreted as the expected rates of disease in the exposed population but rather as an estimate of potential for disease, based on current knowledge and a number of assumptions.

CARB and CAPCOA recommend using these methods for evaluating gas stations when site-specific risk assessments[14] are not needed or required. CARB and CAPCOA recommend contacting the local District to determine if any additional guidelines or requirements exist before completing a health risk assessment.

Industrywide sources are not precluded from meeting all applicable requirements under the Hot Spots Act (i.e., public notification and risk reduction audit and plan[15]). The Hot Spots Act requires the Districts to establish health risk levels where facilities are required to notify exposed members of the public when these levels are exceeded. Many Districts set public notification cancer risk thresholds of 10 chances per million.[16] Gas stations may have potential cancer risks above 10 chances per million in areas where large amounts of gasoline (gas) are dispensed or where people

---

9 The spreadsheet tool is available at: *Gasoline Service Station Industrywide Risk Assessment Guidance | California Air Resources Board*.

10 The Office of Environmental Health Hazard Assessment (OEHHA) is a state agency that evaluates health risks from chemical pollutants in the environment.

11 Office of Environmental Health Hazard Assessment, The Air Toxics Hot Spots Program, Guidance Manual for Preparation of Health Risk Assessments, February 2015. Available at: *February 2015, Air Toxics Hot Spots Program Risk Assessment (ca.gov)*.

12 A screening risk assessment is designed to generate results that are protective of public health.

13 Cancer risk is the probability of developing cancer based on exposure to a substance over a period of time. It is often expressed as the maximum number of new cases of cancer projected to occur in a population of one million people (chances per million) due to exposure to the cancer-causing substance over a 30-year residential period. In the Guidance, cancer risk is calculated for people living and working near gas stations.

14 Site-specific risk assessments are risk assessments that contain information relevant to a specific site. Section K of the Executive Summary includes more information on site-specific risk assessments.

15 Senate Bill 1731 (Calderon, 1992) requires facilities which are determined to present a significant risk to conduct a toxic risk reduction audit and develop a plan to implement measures to reduce that risk.

16 A cancer risk of 10 chances per million means that in a population of one million people exposed to a substance, 10 people may potentially develop cancer.

live or work in close proximity to the gas station. Consequently, gas stations located in Districts with public notification cancer risk thresholds set at 10 chances per million will need to work with their local District to notify the public. If the cancer or noncancer risk levels are above risk reduction levels, then gas stations will need to implement measures to reduce emissions and potential health impacts.

The following section of the Technical Guidance provides an overview and summary of the results in a question-and-answer format. A more technical discussion on the health analyses follows in the body of this Technical Guidance.

A. What types of gas stations does the Technical Guidance apply to?

Gasoline service stations are also referred to as gasoline dispensing facilities or gas stations. For the purposes of this document, a gasoline service station (gas station) is any new or existing retail motor vehicle fueling facility where gasoline is transferred from underground storage tanks to motor vehicles[17], fuel containers, and other gasoline-powered equipment. Retail gas stations may include additional fuel types (i.e., natural gas, propane, diesel or alternative fuels); however, this Technical Guidance only applies to the gasoline dispensed at those stations. Any retail gas station dispensing motor vehicle gasoline and requiring a District permit is subject to this Guidance.

The emission factors used in this Technical Guidance can be applied to both retail and non-retail gas stations with underground storage tanks. However, this Technical Guidance does not apply to non-retail gas stations such as commercial gas stations[18], bulk-fueling stations[19], or mobile refueling operations[20] because they operate differently from stationary retail gas stations. For example, non-retail gas stations typically service captive fleets[21], which lack vehicle diversity and variability. For gas stations where underground storage tanks service both a bulk-fueling operation and a cardlock fueling station[22], this Guidance will only apply to the retail portion of the cardlock facility. Because the modeling and risk tables in this Technical Guidance are based on the operational assumptions for a retail gas station, we do not recommend using the Technical Guidance for non-retail gas stations.

17 Motor vehicles include, but are not limited to, autos, trucks, and off-road highway recreational vehicles.

18 Commercial gas stations service industrial or privately owned fleets.

19 Bulk-fueling stations service fuel tanker trucks that deliver gasoline to gas stations.

20 For the purposes of this document, a mobile refueling operation is any tanker truck or trailer that is used to transport and dispense gasoline from an on-board storage tank into any motor vehicle fuel tank. Mobile refueling operations are also referred to as mobile dispensing facilities or mobile refuelers.

21 A captive fleet is a subsidiary of a larger entity that moves its own cargo in a continuous stream.

22 A cardlock fueling station a fully automated commercial fueling station that provides gasoline, diesel, and other services and is designed to be accessible for both large commercial trucks and cars.

Although the fueling applications discussed above are not addressed in this Guidance, they are additional sources of gasoline emissions with the potential to increase adverse health impacts to people nearby. Additional evaluation of mobile refueling operations may be needed to address potential significant health impacts from these types of refueling operations. Mobile refuelers have the potential to fuel vehicles and equipment adjacent to various sensitive receptors at several locations. Also, multiple mobile refuelers are capable of fueling fleets at a single location at the same time. These unique factors for mobile refueling emissions are not addressed in this Guidance. To address these emissions and health impacts, CARB recommends that all owners and/or operators of these applications work closely with their local Districts to comply with local rules and permitting requirements.

B. Why are CARB and CAPCOA concerned about air pollution from gas stations?

Gas station emissions can be a large contributor to community air pollution and may lead to adverse health impacts for people living or working near gas stations. Localized health risks from gas stations are typically higher in areas where large amounts of gas are dispensed and where multiple gas stations are located near each other.

Gasoline is a complex mixture of multiple substances. Over the years, CARB has identified many toxic air contaminants in gasoline. A toxic air contaminant is defined as an air pollutant which may cause or contribute to an increase in mortality, an increase in serious illness, or which may pose a present or potential hazard to human health.[23] This Technical Guidance focuses on the following seven toxic air contaminants with associated OEHHA health values:[24] benzene, ethyl benzene, n-hexane, propylene (or propene), naphthalene, xylenes, and toluene.

Of the toxic air contaminants in gasoline, benzene is the most toxic component of gas station emissions. Exposure to these toxic air contaminants may lead to the following health issues: increased potential cancer risk, hematologic (or blood) disorders, reproductive or development issues, kidney problems, and issues with the nervous, respiratory, or endocrine systems. More information on the potential health impacts of these seven substances can be found in *Section II.D* of this Guidance. Emissions of toxic air contaminants from gas stations may adversely impact people and the environment the following ways:

23 California Health and Safety Code § 39655.

24 An OEHHA health value can be a cancer potency factor or a noncancer reference exposure level. A reference exposure level is an exposure level at or below which no adverse health effects are anticipated to occur.

- Short (acute) and long-term (chronic) exposures to people working, living and recreating near gas stations.
- Long-term (chronic) exposure to gas-related air pollutants (e.g., ozone) which are formed in the atmosphere.

In addition to the seven toxic air contaminants described above, there are many other toxic substances associated with gasoline that are included in the Hot Spots Program. Although most of these substances do not currently have OEHHA health values and have not been quantified in this Technical Guidance, they should be considered for Hot Spots Program emission inventory reporting purposes. A list of these substances can be found in *Section* IV.A.1 *(*Appendix A*)* of this Guidance.

C. What are the sources of emissions at gas stations?

Both gas station infrastructure and vehicles visiting gas stations are sources of emissions at gas stations. However, this Technical Guidance primarily focuses on five routine sources (i.e., recurring, predictable sources) of emissions from gas station infrastructure. These emission sources are: loading, breathing, fueling, spillage, and hose permeation. Gas stations may have other emission sources that are not included in this Technical Guidance such as soil remediation (i.e., soil vapor extraction) or combustion processes (e.g., afterburner, thermal oxidizers, flares). If CARB identifies additional routine sources of emissions at gas stations, these sources will be added to future updates to the Technical Guidance. Furthermore, in accordance with Hot Spots Program health risk assessment procedures, intermittent sources such as vehicle exhaust, and mobile source emissions are not included in this analysis. If additional emissions sources are added to the health risk assessment, cancer risk would increase.

Table 1 on the next page includes a description of each emission source. Loading, breathing, fueling, and hose permeation emissions are in the form of gasoline vapors, while spillage emissions are in the form of liquid gasoline that turns into gasoline vapors when exposed to the air.

Table 1. Emissions Sources at Gas Stations

Emission Source	Description
Loading	Loading emissions occur when a fuel tanker truck makes a delivery to a gas station. During each delivery, gas is transferred from the fuel tanker truck into the underground storage tanks at a gas station. Gasoline vapors may be emitted as the liquid gasoline enters the underground storage tanks.
Breathing	Breathing emissions (or breathing losses) occur during periods of low activity or inactivity (e.g., after hours, station closed for repairs) at a gas station. During these periods, temperature changes inside the underground storage tank can cause gasoline vapor pressures to increase. If the vapor pressure rises above the pressure limit for the underground storage tank, excess pressure will be released from the gas station vent pipe in the form of gasoline vapor emissions. Breathing emissions are also called breathing losses or pressure-driven losses.
Fueling	Fueling emissions occur at the gas pump during vehicle fueling. During the fueling process, gasoline vapors are emitted from the space due to a poor seal between the nozzle and the vehicle.
Spillage	Spillage emissions are generated from dispensing nozzle spillage of liquid gasoline during the act of vehicle fueling, including pre-fueling, fueling and post-fueling spillage.
Hose Permeation	Hose Permeation emissions occur from the fueling hoses at the gas pump. Gasoline vapors can pass through (or permeate) the fuel delivery hoses.

D. What is the purpose of the Technical Guidance?

The purpose of the Technical Guidance is to provide a cost-effective and uniform methodology that California's 35 Districts may use for preparing gas station emissions inventories and risk assessments to meet the requirements of the Hot Spots Act. The information, data, and procedures presented in this document are intended to promote statewide consistency for evaluating the impacts of gas stations.

E. Why is it necessary to update the Gasoline Service Station Industrywide Risk Assessment Guidelines (1997)?

This update is important to Districts who may use this for permitting gas stations and is required by state law (i.e., Hot Spots Act). As part of an effort for continual improvement, CARB and Districts routinely update documents to incorporate new data or methods. Several changes have been made since the previous guidance. These changes include new health risk methodologies, new and updated dispersion models, updated emission factors for gas stations, and new information on the content of gasoline.

The goal of Assembly Bill (AB) 617[25] is to reduce exposure and improve public health in communities most impacted by air pollution. It requires new, community-focused actions that go beyond existing State and regional programs to reduce air pollution exposure in disproportionately burdened communities. To support implementation of AB 617, CARB's Office of Community Air Protection released the Community Air Protection Blueprint in October 2018. The Blueprint defines statewide strategies and establishes requirements for: public engagement and community partnerships; selecting communities for focused action; preparing community emissions reduction programs; and conducting community air monitoring. The Blueprint also identifies updated guidance on conducting health risk assessments for gas stations as an important tool to support community engagement on land use and transportation strategies for impacted communities. Community risk information gathered through industrywide health risk assessments can be used to support the assessment of community risk impacts under AB 617.

F. What is an industrywide risk assessment?

CARB and CAPCOA developed industrywide risk assessment procedures to help Districts and facilities meet the emission inventory and risk assessment requirements of the Hot Spots Act. Industrywide risk assessments provide uniform procedures and recommendations for efficiently addressing source categories that have numerous facilities.[26] To qualify for an industrywide assessment, facilities must meet a specific set of requirements outlined in Health and Safety Code (HSC) section 44323 that focus on conditions such as economic hardship and small business status.

HSC section 44323 requires Districts to prepare industrywide emissions inventories for facilities that emit less than 10 tons per year of criteria pollutants and meets all of the following conditions:

- All facilities fall within the same Standard Industrial Classification Code.[27]
- Individual compliance would impose severe economic hardships on the majority of the facilities within the industrial class.
- The majority of the class is composed of small businesses.

---

25 Assembly Bill 617, Garcia, C., Chapter 136, Statutes of 2017, modified the California Health and Safety Code, amending § 40920.6, § 42400, and § 42402, and adding § 39607.1, § 40920.8, § 42411, § 42705.5, and § 44391.2 dated July 26, 2017. Available at: *Bill Text - AB-617 Nonvehicular air pollution: criteria air pollutants and toxic air contaminants.*

26 California Air Resources Board and California Air Pollution Control Officers Association, Risk Management Guidance for Stationary Sources of Air Toxics, July 2015, Available at: *Microsoft Word - FINAL RISK MANAGEMENT GUIDANCE 9.23.15.docx (ca.gov)*

27 A Standard Industrial Classification Code is a four-digit code government agencies use to classify industry areas.

- Releases from individual facilities in the class can easily and generically be characterized and calculated.

Industrywide sources are required to meet all applicable requirements under the Hot Spots Act (i.e., public notification and risk reduction audit and plan). Currently, there are industrywide risk assessment documents for gas stations and autobody shops.

G. What types of evaluations are gas stations subject to under Assembly Bill 2588?

The Hot Spots Act requires that each District determine which facilities will prepare a health risk assessment. Generally, facilities that are deemed high priority[28] are required to prepare a health risk assessment. A health risk assessment includes a comprehensive analysis of the dispersion of hazardous substances in the environment, their potential for human exposure, and a quantitative assessment of both individual and population-wide health risks associated with those levels of exposure. The level of detail required for analysis (e.g., screening or refined) requires case-by-case analysis and professional judgment.

As an industrywide source, gas stations are subject to all applicable requirements under the Hot Spots Act, including both individual and population-wide health risk analyses. The individual receptor[29] approach evaluates the exposures that may occur to an individual receptor over a period of time at a specific location. The population-wide approach (e.g., cancer burden or population exposure estimates) evaluates potential exposures to an entire population over a 70-year period using site-specific meteorology and population information. It provides an illustration of widespread impacts for facilities that may have individual cancer risks below public notification thresholds[30], but expose a larger population to emissions.

This Technical Guidance provides a generic presentation of potential impacts to individual receptors and does not include site-specific data necessary to perform population exposure estimates; thus, no population exposure estimates are included. To provide a complete illustration of a facility's health impacts when site-specific information is available, CARB recommends evaluating both the individual and population-wide risks when appropriate. Methods for evaluating population-wide cancer risk are outlined in the OEHHA Manual.

---

28 Under the Hot Spots Act, prioritization methods are used by Districts to determine which facilities will be required to submit a health risk assessment to the District. These methods consider factors such as the quantity of emissions, the cancer or noncancer health factor associated with each emitted substance, and the proximity of the nearest residence or business.

29 Receptors may include nearby residences, workplaces, schools, hospitals, and care facilities.

30 A cancer risk notification threshold is the health risk level at which a facility must notify exposed members of the public of potential health risks associated with facility emissions

H. What are the differences between the Technical Guidance and the 1997 Industrywide Guidelines Document?

The updated Technical Guidance incorporates changes in health risk assessment methodology, air dispersion models, speciation profiles for fuel, and emission factors addressing improved vapor recovery and control technology, which have occurred since 1997. Specifically, the changes include:

- New health risk assessment methodology issued by OEHHA in 2015 that is more health-protective of children and people of all ages.[31]
- Updated OEHHA health values for substances in gasoline.[32]
- A change in the composition of gas due to Reid Vapor Pressure requirements.[33,34]
- New liquid and vapor speciation profiles reflecting current fuels.[35]
- A new refined air dispersion model[36] and updated meteorology.
- Updated process emission factors[37] for gas station operations (i.e., enhanced vapor recovery technologies on gasoline dispensing equipment and onboard refueling vapor recovery on vehicles that have reduced emissions).

I. How did CARB and CAPCOA develop the air dispersion modeling parameters and risk methodology used in the Technical Guidance?

CARB and CAPCOA distributed a survey to the 35 Districts to determine current control configurations of California gas stations. The responses encompassed just

---

31 Office of Environmental Health Hazard Assessment, the Air Toxics Hot Spots Program, Guidance Manual for Preparation of Health Risk Assessments, February 2015. Available at: *Notice of Adoption of Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments 2015 - OEHHA (ca.gov)*

32 Office of Environmental Health Hazard Assessment, Chemical Database, available at: https://oehha.ca.gov/chemicals, accessed October 2018.

33 Reid Vapor Pressure is a measure of the volatility of gas. An increase in Reid Vapor Pressure leads to increased emissions from gas while a decrease in Reid Vapor Pressure leads to lower emissions.

34 California Air Resources Board, Reid Vapor Pressure Requirements, available at: *Gasoline Reid Vapor Pressure Requirements | California Air Resources Board*, accessed October 2018.

35 California Air Resources Board, References: Consolidated List for Speciation Profiles retrieved May 11, 2017, available at: *Consolidated List for Speciation Profiles | California Air Resources Board*, accessed October 2018.

36 United States Environmental Protection Agency, Users Guide for the AMS/EPA Regulatory Model (AERMOD), April 2018, available at: *User's Guide for the AMS/EPA Regulatory Model (AERMOD)*.

37 California Air Resources Board, Revised Emission Factors for Gas Marketing Operations at California Gas Dispensing Facilities, December 23, 2013, available at: *Gasoline Dispensing Facility Emission Factors | California Air Resources Board*.

over 10,000 of the estimated 10,200[38] retail gas stations in California. Using the configuration information gathered by the Districts, CARB and CAPCOA developed the source parameters for modeling presented in this document. Thus, these parameters can be applied to a wide range of gas station configurations. Ninety-seven percent of gas stations in California use the highest vapor and liquid control technology available. Details on gas station control technologies are discussed in *Section II.A*. A table of the gas station configurations used in this document can be found in *Section II.A.7*.

The risk tables in this Guidance were calculated using the methodology presented in the OEHHA Manual. Detailed information on modeling parameters and assumptions can be found in *Appendix D*.

J. How do I use the Technical Guidance?

Districts, gas station owners/operators, and members of the public may use the Technical Guidance to identify potential risk from gas stations with underground storage tanks. Potential cancer risk and noncancer health impact results are provided for localized exposures near gas stations. Results are not provided for gas station employees because the Division of Occupational Safety and Health of California (Cal/OSHA)[39] has jurisdiction over on-site workers.

The appendices of the Technical Guidance include tables presenting potential cancer risk (*Appendix G* and *Appendix H*) and noncancer health impacts (*Appendix I* and *Appendix J*) up to 1,000 meters from a gas station. Districts, gas station owners/operators, and members of the public may compare values from these tables to existing risk thresholds after adjusting the potential health impacts by the amount of gasoline used (i.e., throughput) at the gas station. Step-by-step instructions for using the tables to determine health risk from individual gas stations can be found in *Section II.J.1* and *Section II.J.4*.

K. How do I use the Spreadsheet Tool?

The purpose of the spreadsheet tool[40] (or tool) is to streamline the calculation of community health impacts from a gas station with underground storage tanks. This tool can be used to estimate potential cancer risks or hazard indices without referring to the step-by--step instructions in *Section II.J.1* and *Section II.J.4* or using the tables in Appendices G through J. The tool generates cancer and noncancer (chronic and acute) impacts up to 1,000 meters from a gas station based on user inputs. The tool is

38 California Energy Commission, California Retail Fuel Outlet Annual Reporting (CEC-A15) Results Reporting Year 2016, available at: *California Retail Fuel Outlet Annual Reporting (CEC-A15) Results*.

39 The Division of Occupational Safety and Health (or Cal/OSHA) protects and improves the health and safety of working men and women in California.

40 The spreadsheet tool and user guide is available at: *Gasoline Service Station Industrywide Risk Assessment Guidance | California Air Resources Board*

separated into three parts, which generate results ranging from health-protective screening values to site-specific values for individual gas stations.

Table 2 below describes the three parts of the spreadsheet tool.

Table 2. Description of Spreadsheet Tool

Spreadsheet Tool	Description
Part I	Generates risk estimates based on the gas station configurations, emission factors, meteorological data sets, and receptor distances used in the Guidance.
Part II	Part I tool with the added ability to select a meteorological data set specific to the gas station of interest.
Part III	Provides modeling input files for the Hotspots Analysis and Reporting Program (HARP)[41]. This enables Districts and members of the public to generate site-specific risk estimates for individual gas stations.

L. When would a site-specific risk assessment be warranted?

Site-specific risk assessments are risk assessments that contain information relevant to a specific facility. If the screening methodology results identify a significant risk, a site-specific risk assessment may be warranted. Users or District staff may want to consider site-specific information when evaluating gas stations. Gas stations may have certain characteristics that are important to consider and vary from the modeling parameters in this Guidance. Examples of these characteristics may include:

- Adjacent buildings.
- People located nearby in the predominant wind direction.
- Presence of sensitive receptors such as a school, daycare center, hospital, or care facility.
- The need to show residential population exposure adjacent to gasoline stations.

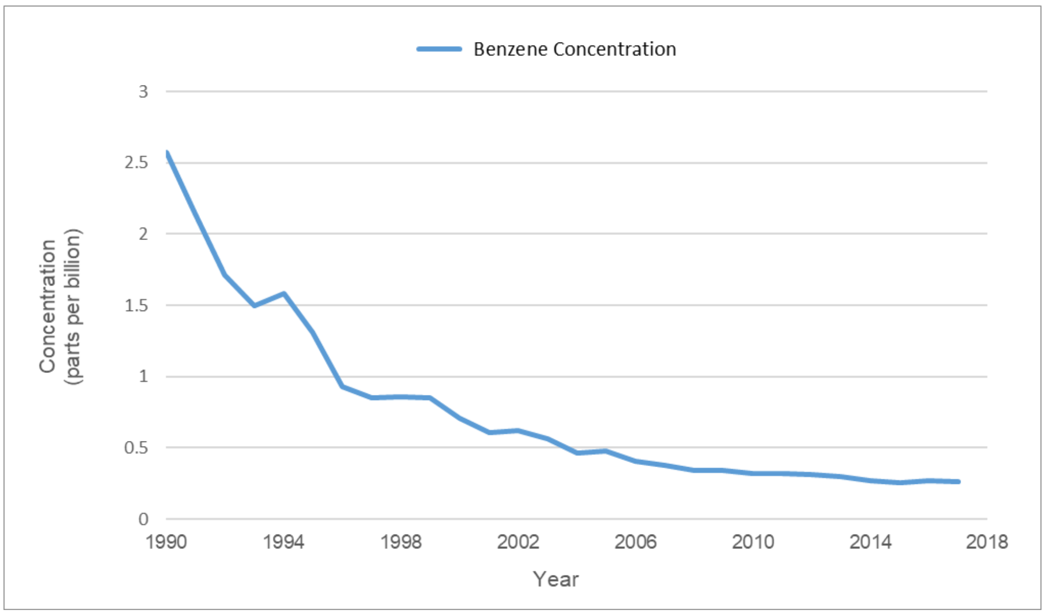
If elevated cancer risks or noncancer health impacts are calculated using the screening parameters in the Technical Guidance, gas station owners/operators or the District may choose to prepare a site-specific risk assessment to more accurately quantify risks. Additional information on situations where site-specific risk assessments may be preferred can be found in *Appendix D*.

41 The Hotspots Analysis and Reporting Program (HARP) is a collection of computer programs that addresses the requirements of Assembly Bill 2588 (Hot Spots Act). More information on HARP and access to the computer programs can be found at: *Hot Spots Analysis & Reporting Program | California Air Resources Board*.

M. What regulations are currently in place to reduce emissions and community exposure from gas stations in California?

Beginning in 1988, emissions from gas stations were significantly reduced due to air quality regulations requiring reformulated gasoline and emission control technology. Data from CARB's statewide ambient air monitoring network shows that concentrations of benzene, the most toxic of the gas station emissions, have decreased by approximately 90 percent since 1989. This trend is shown in Figure 1 below. Benzene is produced through many industrial sources such as oil refineries, landfills, gas stations, and the production of lubricants and synthetic fibers.

Figure 1. Statewide Average Ambient Benzene Concentrations from 1990 to 2017 (parts per billion)



The data presented in this table comes from the CARB, iADAM Annual Toxics Statewide Summary for Benzene, available at: *California Ambient Toxics Data Summaries*.

State and federal vapor recovery regulations that address gasoline and gas stations are listed below:

- In 1988, the Benzene Airborne Toxic Control Measure[42] required all existing and new gas stations with annual throughput[43] greater than 480,000 gallons to install vapor recovery systems[44] by 1991.
- From 1995 to 2005, national standards required On-Board Refueling Vapor Recovery[45] (ORVR) to be phased in on all passenger cars and trucks.
- In 2001, the Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities (CP-201)[46] required enhanced vapor recovery (EVR) systems to be phased in for existing gas stations in state ozone nonattainment areas[47] and new stations statewide. CARB certification procedures have been used to specify performance standards for gas station vapor recovery systems since 1975.
- In 2003, California's Phase 3 Reformulated Gasoline (CaRFG Phase 3) Regulations[48] lowered Reid Vapor Pressure requirements on gas used in motor vehicles below the national standard.
- In 2015, specifications for Enhanced Conventional (ECO) Nozzles[49] were approved for non-retail gas stations.
- In 2018, CARB approved specifications for Enhanced ORVR-Vehicle- Recognition (EOR) nozzles[50] for gas stations with vapor assist control systems.
- In 2018, CARB approved amendments to specifications for fill pipes[51] and openings of motor vehicle fuel tanks.

42 California Code of Regulations, Title 17 § 93101.

43 Annual throughput is the amount of gas dispensed at a gas station in one year.

44 A vapor recovery system reduces the amount of gas station emissions escaping into the atmosphere by capturing gasoline vapors emitted during fuel tanker truck deliveries or vehicle fueling.

45 On Board Refueling Vapor Recovery is a vehicle system that captures gasoline vapor emissions during vehicle fueling.

46 California Air Resources Board, Certification procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities (CP-201), April 23, 2015, available at: *Vapor Recovery Certification Procedure CP - 201*, accessed January 2019.

47 A state ozone nonattainment area is an area with ozone levels above the state air quality standard.

48 California Code of Regulations, Title 13 § 2260.

49 Enhanced Conventional (ECO) Nozzles reduce liquid gasoline emissions due to gas spilling on the ground after vehicle fueling, or spillage. ECO nozzles allow only three drops of liquid gasoline to spill from the nozzle.

50 Enhanced ORVR Vehicle Recognition (EOR) nozzles reduce gasoline vapor emissions during vehicle fueling by forming a tight seal at the vehicle/nozzle interface.

51 A fill pipe is part of a vehicle fueling system that connects the gas cap to the fuel tank.

N. What are options to reduce emissions from existing gas stations?

Emissions from gas stations have been significantly reduced through California's air quality programs and regulations (see *Section M* above for the list of regulations). However, additional reductions in gas station emissions can be achieved by encouraging modes of transportation that either do not use gas or use gas more efficiently.

Examples include, but are not limited to, the following:

- Retrofitting high-throughput stations with high capacity vapor processors.
- Driving zero-emission vehicles including all-electric and fuel cell vehicles.
- Driving hybrids and other fuel efficient vehicles that reduce the amount of gas required per vehicle mile.
- Riding non-gas public transit methods (e.g., electric light rail trains and buses).
- Riding electric and non-motorized bicycles or scooters.
- Creating safe walking and bicycling corridors to maximize safety while using alternative transit modes.

I. Introduction

This Gasoline Service Station Industrywide Risk Assessment Technical Guidance Manual (Technical Guidance) provides an update to the CAPCOA *Gas Service Station Industrywide Risk Assessment Guidelines* (CAPCOA, 1997) for underground storage tanks (UST). Districts should continue to refer to the original guidelines for risk assessment methods on gas stations with aboveground storage tanks (AST). However, for convenience, the table of AST emission factors from the original guidelines is included for reference in *Section II.B.2*. Once updated AST emission factors are available, the Guidance may be updated to include gas stations with ASTs.

The Technical Guidance includes the health-protective exposure information discussed in the 2015 OEHHA Manual (e.g., age sensitivity factors and breathing rates). It also incorporates the changes in risk methodology, as well as vapor recovery and control technologies, which occurred since the original guidelines document was published in 1997. The Technical Guidance is based on the best science and data currently available.

The changes in this document include:

- New risk methodology issued by OEHHA in 2015 that is more protective of children and other sensitive individuals (OEHHA, 2015).
- Updated OEHHA health values for substances in gasoline (OEHHA, 2018).
- A change in the composition of gasoline due to Reid Vapor Pressure (RVP) requirements (CARB, 2007).
- New liquid and vapor speciation profiles reflecting current fuels (CARB, 2017).
- A new refined air dispersion model (U.S. EPA, 2018) and updated meteorology.
- Updated emission factors (CARB, 2013) for gas station operations (i.e., enhanced vapor recovery (EVR) technologies on gas dispensing equipment and onboard refueling vapor recovery (ORVR) on late-model vehicles that have reduced emissions).

A. Approach Used in Health Analyses

This Guidance describes the methodology used to conduct a health risk assessment (HRA) for impacts from a non-site-specific gas station. This analysis is intended to apply to any retail gas station in any District. The HRA includes modeling to simulate emission impacts from a gas station and the resulting estimated risk tables produced from the modeling results. Exposure to gas station emissions has an associated potential cancer risk as well as potential noncancer chronic and acute health effects. The analysis considered impacts from emissions of benzene, ethyl benzene, n-hexane, naphthalene, propylene (or propene), xylenes, and toluene.

The approach CARB and CAPCOA used in this HRA is outlined below:

- Developed an emissions inventory based on current emission factors and current gas station control configurations.

- Conducted air dispersion modeling to estimate the ground-level concentrations that result from these emissions.
- Estimated the potential cancer and noncancer health impacts from the modeled concentrations.

II. Health Risk Assessment

A. Gas Station Controls and Emissions

The quantity of gasoline vapor emitted from a gas station depends on the type of storage tank and type of vapor recovery systems in use. The following sections describe the types of storage tanks and emission control systems at California gas stations.

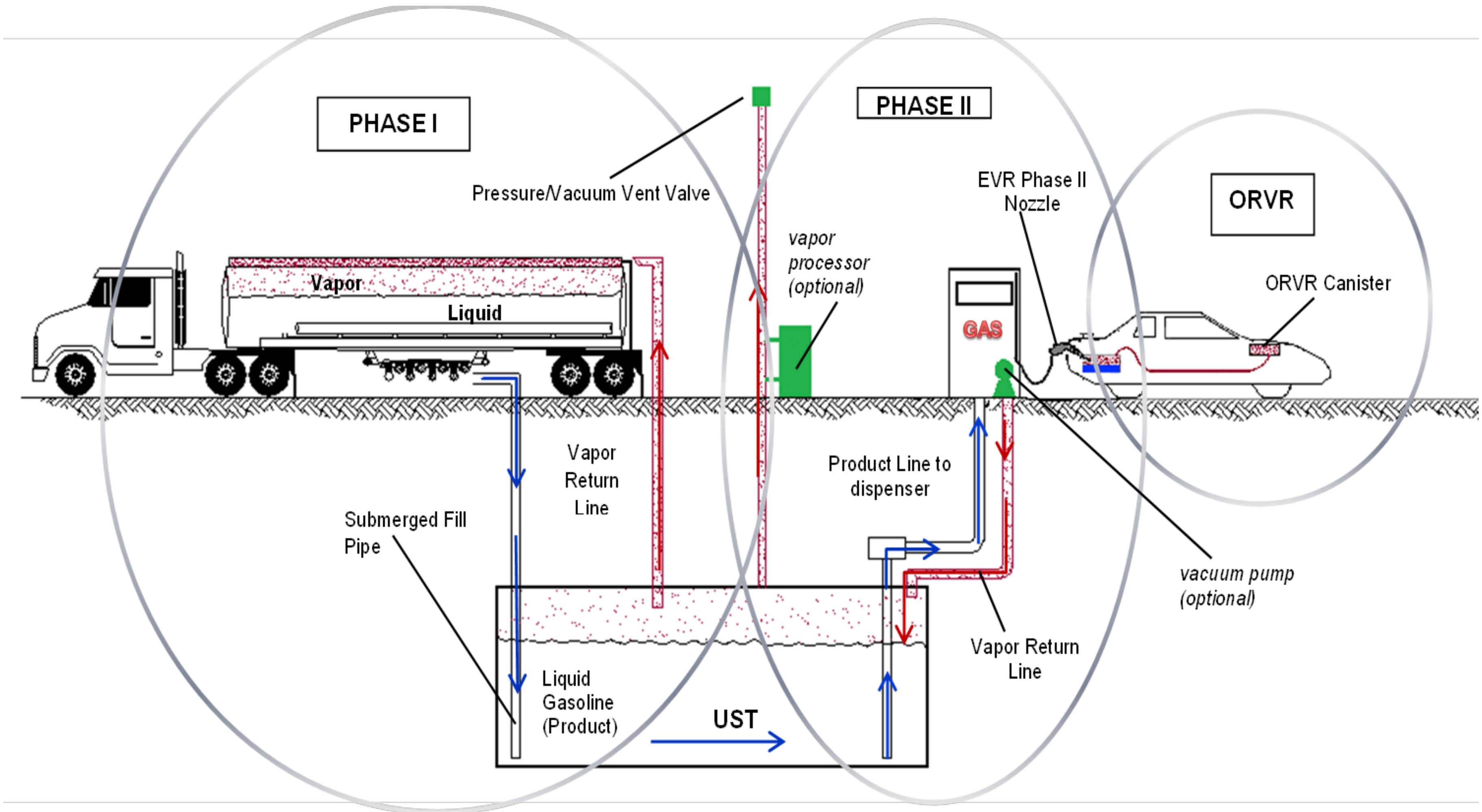
1. Gas Station Storage Tanks and Ancillary Equipment

Gas stations have either USTs or ASTs. Most gas stations have USTs to reduce the loss of gasoline vapors due to diurnal temperature changes.

Submerged fill tubes are required by California Health and Safety Code (HSC), Section 41950, for all storage tanks with a capacity greater than 250 gallons. A submerged fill tube extends from the top of the storage tank to below the residual liquid level in the storage tank. The discharge opening of the submerged fill tube must be six inches above the bottom of the tank. This reduces splashing and emissions during the UST filling process.

Pressure/vacuum (P/V) valves are installed on the vent pipes of storage tanks. With no P/V valve, the vent pipe is open. Vent pipes with P/V valves effectively reduce emissions if they are leak tight. All certified vapor recovery systems must contain P/V valves on the UST vent pipes.

Figure 2. Diagram of Gas Station Equipment[1]



This figure was taken directly from the 2013 CARB Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities (CARB, 2013a).

2. Vapor Recovery Regulations

Emissions from gas station vapor recovery systems have been significantly reduced through implementation of CARB certification procedure requirements. These requirements improved test procedures for vapor recovery system certifications, modified gas station applicability requirements to improve cost-effectiveness, and modified performance standards and implementation dates to reflect evolving technology. Highlights of key requirements are listed in *Table 3* below.

Table 3. Vapor Recovery Regulations

Date	Regulation	Requirements
December 1975	Certification Procedures for Vapor Recovery Systems at Gasoline Dispensing Facilities	Described procedure for certifying equipment that recovers vapors emitted in association with gas stations.
May 1988	Benzene Airborne Toxic Control Measure for Retail Service Stations (17 California Code of Regulations (CCR) 93101)	All existing and new gas stations with annual throughput greater than 480,000 gallons must install Phase I and Phase II vapor recovery systems by February 1991.
March 2000	Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities (CP-201) Amended	All existing gas stations with USTs in state non-attainment areas must upgrade to EVR by Phase I and Phase II tiered timelines. All new gas stations with USTs statewide require EVR Phase I and EVR Phase II control. Gas stations with ASTs have different tiered timelines. Increased testing requirements and new performance standards adopted.
April 2015	Certification Procedure for Vapor Recovery Systems for Enhanced Conventional (ECO) Nozzles and Low Permeation Conventional Hoses for Use at Gasoline Dispensing Facilities (CP-207) Approved	Approved new performance standards and specifications for Enhanced Conventional (ECO) nozzles. Non-retail gas stations exempted from Phase II control requirements use ECO nozzles. These non-retail gas stations have captive fleets of newer vehicles with On-Board Refueling Vapor Recovery (ORVR) systems (e.g., rental car facilities, new car dealerships).).
October 2018	Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities (CP-201) Amended Certification Procedure for Enhanced Conventional (ECO) Nozzles and Low Permeation Conventional Hoses for Use at Gasoline Dispensing Facilities (CP-207) Amended	Amended dimensional requirements for nozzles to improve their compatibility with newer motor vehicle fill pipes. This compatibility is necessary to reduce air ingestion at the nozzle that leads to pressure driven emissions. All currently certified balance nozzles meet the amended dimensions. The Enhanced ORVR Vehicle Recognition (EOR) version of the assist nozzle meets the amended dimensions but the earlier assist nozzle version does not. Amendments allow GDF operators to use their old model nozzles until the end of their useful life.

3. Phase I Vapor Recovery

Phase I vapor recovery refers to the collection of gasoline vapors displaced from storage tanks when fuel tanker trucks make gas deliveries. CARB certified Phase I EVR systems to collect 98 percent of displaced vapors for return to the delivery truck and Phase I predating (pre) EVR systems to collect 95 percent of displaced vapors. Spillage that occurs during delivery has not been quantified and is not included in the emission factors.

4. Phase II Vapor Recovery

Phase II vapor recovery systems control the vapors displaced from vehicle fuel tanks during fueling. The vapors recovered from vehicle tanks return to the gas station's storage tanks in pre-ORVR vehicles. In late-model cars, the ORVR in the vehicle captures the bulk of the vapors. Phase II pre-EVR systems must capture at least 90 percent of the vapors resulting from fueling of non-ORVR vehicles. Phase II EVR systems certified by CARB must capture at least 95 percent of the fueling vapors. Both balance and assist vapor recovery systems are currently certified to achieve both EVR and pre-EVR standards.

a) Balance Systems

Balance systems rely on positive and negative pressure changes during vehicle fueling to direct vapors to the vapor control systems. Balance systems draw gasoline vapors back into the UST as a result of pressure differences between the empty vehicle fuel tank and the UST. If the UST is unable to draw in enough gasoline vapor during vehicle fueling to replace the volume of liquid fuel being dispensed, the UST will enter a vacuum state. When this occurs, the balance system will draw ambient air from around the nozzle until equilibrium is achieved. CARB has certified balance systems to capture and return emissions during fueling when installed and operated properly.

The efficiency of a balance system can be decreased when cuts and tears occur on the boot or hose, when check valves are worn, or when the return vapor is blocked by liquid in the return line. Additionally, balance systems may pressurize during periods of gas station inactivity due to shut down or low throughput. This over-pressurization leads to excess breathing emissions from the UST.

b) Assist Systems

Assist systems draw a mixture of vehicle gas tank vapors and ambient air from around the nozzle back to the UST using vacuum pumps during vehicle fueling. Non-operational vacuum pumps will render this vapor recovery system ineffective. In addition, because these systems are under pressure, loose fittings or other leak points can be the cause of excess emissions.

5. Enhanced Vapor Recovery

Vapor recovery system performance standards have become more stringent over the years. Since 2000, CARB has adopted a number of significant advancements as part of the EVR program. Phase I EVR requires more durable and leak-tight components, along with an increased collection efficiency of 98 percent.

Phase II EVR includes three major advancements:

- Dispensing nozzles with less spillage and required compatibility with ORVR vehicles.
- A processor to control the static pressure of the ullage, or vapor space, in the UST.
- An in-station diagnostic (ISD) system that provides warning alarms to alert an operator of a potential vapor recovery system malfunction.

6. Additional Vapor Recovery Controls

With increasingly effective and efficient controls, emissions from gas stations have decreased significantly over the past three decades. The remaining control options described below may not be viable in most gas stations due to applicability or cost. Multiple vapor recovery improvements are currently being investigated due to overpressure concerns.

High-capacity vapor processors are used for reducing overpressure events at high throughput gas stations. A vapor processor is a control device that manages the pressure of the vapor in a gasoline storage tank to prevent overpressure issues and reduce breathing emissions from the pressure/vent valve. CARB has certified high-capacity processors and anticipates that additional processor designs could be certified in the future.

The installation of high-capacity processors is at the option of owners of the gas stations with underground storage tanks. The costs associated with the installation of a high-capacity vapor processor could have a significant impact on the profitability of an individual gas station. We believe that high-capacity processors would only be required on a case-by-case basis as a result of permitting decisions made by the Districts and only in cases where there is a concern that overpressure emissions could significantly impact the surrounding community. Revised certification standards for ISD assessments and data reports could help identify the gas stations that should be studied further to determine if the expense of a high-capacity processor is warranted. Proposed changes to the vapor recovery certification procedures were scheduled to go before the CARB Board in late 2020 to address in-station diagnostic system monitoring and records requirements related to overpressure.

Additional technologies and controls may be identified during the gas station emissions evaluations in the post-2022 timeframe. The currently identified technologies are shown in *Table 4* on the next page.

Table 4. Current and Potential Gas Station Control

Emission Source	Current Control	Potential Additional Control
Loading	Phase I EVR	No new or improved controls
Breathing	Phase II EVR	ISD and Zero Leak Vent Valve to determine need for control
		High Capacity Vapor Processor
Fueling	ORVR	Vehicle Fill Pipe specifications and EOR nozzle to improve seal
	Phase II EVR Nozzles	
Spillage	Phase II EVR "Dripless" Nozzles	No new or improved controls
Hose Permeation	Low Permeation Hoses	No new or improved controls

7. Types of Gas Station Vapor Control Systems in California

In 2017, CARB staff conducted a survey of the Districts to determine current relevant retail gas station control scenarios for retail gas stations with USTs. The survey results confirmed that over 97 percent of California gas stations have EVR Phase I and EVR Phase II control. Six additional control scenarios are in limited use. These scenarios are listed below in *Table 5*.

Table 5. Current Gas Station Configurations[1]

Scenario Number	Control Equipment
1	EVR Phase I and EVR Phase II
2	EVR Phase I and pre-EVR Phase II
3	EVR Phase I (ORVR Only)
4	EVR Phase I
5	Pre-EVR Phase I and pre-EVR Phase II
6	Pre-EVR Phase I (ORVR Only)
7	Pre-EVR Phase I

Phase II emission factors are based on the volume of fuel dispensed to ORVR and Non-ORVR vehicles at California gas stations.

8. Emission Sources from Gas Stations

Table 6 on the next page describes the gas station emission sources included in this assessment.

Table 6. Emission Source Descriptions

Emission Source	Descriptions
Loading	Emissions that occur when a fuel tanker truck unloads gas to the USTs at the gas station. Storage tank vapors may be emitted from the vent pipe during the initial fuel transfer period. The emissions are significantly reduced by the pressure/vacuum valve on the vent pipe.
Breathing	Gasoline vapors are emitted from the storage tank vent pipe due to temperature and pressure changes within the UST vapor space.
Fueling	During the fueling process, gasoline vapors are emitted at the vehicle/nozzle interface. Vehicles with ORVR further reduce the emissions from fueling.
Spillage	Emissions generated from dispensing nozzle spillage of liquid gasoline during the act of vehicle fueling, including pre-fueling, fueling and post-fueling spillage that occur from spills during vehicle fueling.
Hose Permeation	Gasoline vapors can permeate the fuel delivery hoses. Low permeation hoses reduce the hose emissions.

B. Emission Factors

1. Emission Factors for Gas Stations with Underground Storage Tanks

CARB published "Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities" on December 23, 2013 (CARB, 2013). The document describes the methodologies used to develop new or revised emission factors for the gas station emission sources reflecting different levels of control equipment. The revised total organic gas (TOG) emission factors are presented in *Table 7* on the next page.

The emission factors are separated into three tiers, each representing varying degrees of vapor recovery equipment control: (1) no vapor recovery system, or uncontrolled emission factor (UEF); (2) Phase I or Phase II vapor recovery systems predating EVR (Pre-EVR); and (3) Phase I or Phase II EVR.

Table 7. Emission Factor Table for Underground Storage Tanks[1,2]

Emission Source	Total Organic Gases (TOG) Emission Factors (pound/thousand gallons) (lb/kgal)[3]		
	Uncontrolled Emission Factor (UEF)	Pre-EVR	EVR
Loading	7.7	0.38	0.15
Breathing	0.76	0.092	0.024
Fueling (Non-ORVR)	8.4	2.4	0.42
Fueling (ORVR)	0.42	0.12	0.021
Spillage	0.61	0.42	0.24
Hose Permeation (2017)	0.009	0.009	0.009

1. All emission factors in this table were taken directly from the 2013 CARB Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities (CARB, 2013b). The table reflects 2013 factors for loading, breathing, fueling, and spillage; and a 2017 factor for hose permeation. The 2013 emission factors do not reflect control technologies required by any Vapor Recovery regulations (found in Table 3) later than 2013. These emission factors will be updated when CARB publishes revised emission factors.
2. These emission factors apply to both retail and non-retail gas stations with underground storage tanks.
3. Pounds per thousand gallons dispensed or transferred. Phase I for loading emissions and Phase II for all other emission sources.

Two emissions factors are used for fueling, one for ORVR vehicles and one for non-ORVR vehicles. These emission factors are used separately if the gas station services only one type of vehicle. The factors are combined based on the ratio of ORVR and non-ORVR vehicles fueled at California gas stations. The relative percentage of ORVR vehicles will increase as older non-ORVR vehicles reach the end of their useful life and are replaced with ORVR vehicles (CARB, 2013a). In 2013, CARB staff determined projections for statewide percentages of gas dispensed to ORVR vehicles verses non-ORVR vehicles for 2014 through 2020. The projected percentage of gas dispensed to ORVR vehicles for 2018 was 83 percent (CARB, 2013b). The remaining 17 percent of gas was dispensed to non-ORVR vehicles. The 2017 hose permeation emission factor is used for gas station modeling as it is the current standard for stations with assist systems.

CARB and CAPCOA recommend using the emission factors in *Table 7* above for statewide consistency, as these are based on sound science and extensive CARB test data. CARB staff, in consultation with CAPCOA, will continue to evaluate new test data generated by CARB and others since the 2013 emission factor update. CARB staff will invite input from all interested stakeholders in an open, public process when considering new data. Potential areas of interest include ORVR systems, aboveground storage tanks, and pressure driven emissions for underground storage tanks.

CARB recognizes that some Districts may choose to continue to use different emission factors in their planning and permit evaluation processes until updated emission factors are available. California Health and Safety Code (HSC) Section 44365(b) allows air districts to establish more stringent criteria and requirements than those specified by the Hot Spots Act to be used for approval of emission inventories and the preparation and submission of health risk assessments (HSC, 1987).

2. Emission Factors for Gas Stations with Aboveground Storage Tanks

Emission factors for gas stations with ASTs have not been updated since the original guidelines were published in 1997. For convenience, we have summarized the AST emission factors from the 1997 Guidelines (CAPCOA, 1997) in Table 8 below. These factors pre-date EVR control systems, low permeation hoses, and ORVR vehicle systems, so factors for these control configurations are not included. In 2008, CARB adopted Certification Procedure 206 (CP-206) which outlines new certification requirements for vapor recovery systems used on new and existing gas stations with ASTs. However, CARB has not developed AST emission factors for systems certified by CP-206 so the emission factors in the 1997 Guidelines should continue to be used for gas stations with ASTs.

Table 8. Emission Factor Table for Aboveground Storage Tanks from the 1997 CAPCOA Gasoline Service Station Industrywide Risk Assessment Guidelines[1]

Emission Source	Total Organic Gases (TOG) Emission Factors (pound/thousand gallons) (lb/kgal)[2]		
	Uncontrolled Emission Factor (UEF)	Pre-EVR	EVR
Loading	8.4	0.42	N/A[3]
Breathing	2.1	0.053	N/A
Fueling-Non-ORVR	8.4	0.63	N/A
Fueling-ORVR	N/A	N/A	N/A
Spillage	0.61	0.42	N/A
Hose Permeation	N/A	N/A	N/A

1. Table included for reference purposes only. All emission factors in this table were taken directly from the 1997 CAPCOA Gasoline Service Station Industrywide Risk Assessment Guidelines (CAPCOA, 1997). Note that the 1997 Guidelines did not include a factor for hose permeation.
2. Pounds per thousand gallons dispensed or transferred. Phase I for loading emissions and Phase II for all other emission sources.
3. Not applicable (N/A).

3. Scenario Total Organic Gasoline Emission Factors

The seven UST statewide scenarios recommended for modeling in *Table 5* are listed in *Table 9* (next page) with their associated emission factors. Any scenario that specifies "ORVR Only" uses the ORVR fueling emission factor. All other scenarios use the weighted ORVR/non-ORVR fueling emission factor described above in *Section II.B.1*.

Table 9. Emission Factors per Gas Station Scenario[1]

Scenario	Scenario Description	Total Organic Gases (TOG) Emission Factors				
		Loading (lb/kgal)	Breathing (lb/kgal)	Fueling (lb/kgal)[2]	Spillage (lb/kgal)	Hose Permeation (lb/kgal)
1	EVR Phase I and EVR Phase II	0.15	0.024	0.089	0.24	0.009
2	EVR Phase I and pre-EVR Phase II	0.15	0.092	0.508	0.42	0.009
3	EVR Phase I (ORVR Only)[3]	0.15	0.76	0.420	0.61	0.009
4	EVR Phase I only	0.15	0.76	1.777	0.61	0.009
5	Pre-EVR Phase I and pre-EVR Phase II	0.38	0.092	0.508	0.42	0.009
6	Pre-EVR Phase I (ORVR Only)[3]	0.38	0.76	0.420	0.61	0.009
7	Pre-EVR Phase I	0.38	0.76	1.777	0.61	0.009

1. Phase II emission factors are based on the volume of fuel dispensed to ORVR and Non-ORVR vehicles at California gas stations.
2. Based on 83 percent ORVR vehicles and 17 percent non-ORVR vehicles.
3. Assumes 100 percent penetration of ORVR vehicles and uses the ORVR fueling emission factor.

4. Speciation of Gasoline Formulations

Gasoline vapor and liquid speciation is available on CARB's speciation profile website (CARB, 2017) at *Consolidated List for Speciation Profiles | California Air Resources Board*. The four speciation profiles are OG691 (Summer Vapor), OG692 (Summer Liquid), OG694 (Winter Liquid), and OG695 (Winter Vapor). Seven substances in the gas profiles have OEHHA health risk factors (OEHHA, 2018). These substances are benzene, ethyl benzene, nhexane, naphthalene, propylene (or propene), xylenes and toluene. The speciation profiles for each substance in the liquid and vapor of winter and summer fuels are shown in *Appendix A*.

a) Annual Emissions

Summer and winter speciation profiles were combined to estimate concentrations of individual substances for annual emissions. The speciation apportionment of summer and winter fuels, 59.2 percent summer and 40.8 percent winter, is based on the 2012 Board of Equalization throughput data used in the 2013 emission factor document (CARB, 2013).

The weighted annual average percent equation is:

Equation 1. Weighted Annual Average Substance Weight Percent

$$\boldsymbol{Annual\ Average\ Substance\ Weight}\ \% = \left(\boldsymbol{Summer\ Fuel\ Substance\ Weight}\ \%\ \boldsymbol{x}\ \left(\frac{\mathbf{59.2}}{\mathbf{100}}\right)\right) + \left(\boldsymbol{Winter\ Fuel\ Substance\ Weight}\ \%\ \boldsymbol{x}\ \left(\frac{\mathbf{40.8}}{\mathbf{100}}\right)\right)$$

By scenario and source, each substance uses the concentration multiplied by the total organic gases (TOG) scenario source emission factor, normalized to one-million-gallon per year throughput. All emission sources use vapor emissions, except spillage which uses liquid emissions. The annual emissions equation for each substance, source, and scenario at one-million-gallon gas station is below:

Equation 2. Annual Emissions for a One-Million-Gallon Gas Station

$$\boldsymbol{Annual\ Emissions}_{\boldsymbol{Substance,Source,Scenario}}\left(\frac{\boldsymbol{lb}}{\boldsymbol{year}}\right) = \frac{\boldsymbol{Substance\ Weight}\ \%}{\mathbf{100}}\ \boldsymbol{x}\ \boldsymbol{Source\ Emission\ Factor}_{\boldsymbol{Scenario}}\left(\frac{\boldsymbol{lb}}{\boldsymbol{kgal}}\right)\boldsymbol{x}\ \frac{\mathbf{1000}\ \boldsymbol{kgal}}{\mathbf{1}\ \boldsymbol{million\ gal}}\ \boldsymbol{x}\ \frac{\mathbf{1}\ \boldsymbol{million\ gal}}{\boldsymbol{year}}$$

Results of the calculations for annual individual substance emission factors are shown in *Appendix B*.

b) Maximum Hourly Emissions

To estimate concentrations of individual substances in the maximum hourly emission factors, staff used substance-specific summer speciation profiles. This aligns with the assumption that the maximum hourly throughputs occur during summer as gas station throughputs are higher during summer months. This assumption is also more conservative as the toxic air contaminant content is higher in summer, with benzene liquid the only exception. Benzene, xylenes, and toluene have acute health values (OEHHA, 2018) so these three compounds will have maximum hourly emission factors.

To calculate the maximum hourly emission factors, maximum hourly bulk transfer volume and maximum hourly dispensing volume are required. The Phase I loading emission factor uses the maximum hourly bulk transfer volume and the Phase II emission factors use the maximum hourly dispensing volume.

Phase I Loading Operation

The Phase I operation offloading varies by the bulk transfer volume. A fuel delivery creates the maximum hourly loading emissions. Per the United States Department of Transportation (U.S. DOT), the Gross Vehicle Weight on the Interstate Highway System is 80,000 pounds (U.S. DOT, 2019). This weight equates to a maximum legal gasoline delivery volume of 210 barrels or two 4,400-gallon tankers. Thus, one 8,800-gallon loading event is reasonable for one hour. When considering noncancer acute impacts, the risk values in *Appendix I* (rural) and *Appendix J* (urban) can be scaled up or down depending on the size of the hourly loading event.

Phase II Dispensing Operations

The Phase II operations of Breathing, Fueling, Spillage, and Hose Permeation vary by dispensing volume. Hourly emission factors are presented per one-thousand-gallon per hour throughput for ease of calculations.

By scenario and source, each substance uses the concentration multiplied by the TOG scenario source emission factor, normalized to 8,800 gallons per year throughput for Phase I loading and 1,000 gallons per year for Phase II dispensing. All source emissions use vapor emissions except liquid spillage.

The calculation for maximum hourly emissions for each substance, source, and scenario is below:

Equation 3. Maximum Hourly Emissions

$$\textit{Maximum Hourly Emissions}_{\textit{Substance,Source,Scenario}} \left(\frac{lb}{hour}\right) = \frac{\textit{Substance Weight}\ \%}{100}\ x\ \textit{Source Emission Factor}_{\textit{Scenario}} \left(\frac{lb}{kgal}\right)\ x\ \textit{Maximum Hourly Throughput} \left(\frac{kgal}{hour}\right)$$

Results of the calculation for maximum hourly individual substance emission factors can be found in *Appendix C*.

c) Estimated Maximum Hourly Throughputs

As actual maximum hourly throughput is often difficult to estimate, an alternative is to use annual throughput to estimate maximum hourly throughput. However, CARB and CAPCOA do not recommend dividing the annual throughput by the annual hours of operation because it may not adequately represent the acute health impacts. As an alternative, the estimated hourly throughputs presented in *Table 10* (next page) can be used to estimate potential acute exposures.

CARB conducted limited monitoring of overpressure data in December 2015 for approximately 400 stations statewide, known as the 2015 Mega Blitz. Staff analyzed the ullage data from this monitoring study to determine hourly throughput during the limited data collection period. Staff compared the maximum hourly throughputs from the data across estimated annual throughput ranges. The hourly volumes were generally proportional to annual throughputs, but varied significantly within each range. Staff determined natural cut points encompassing 80 to 100 percent of the data points in each range. The hourly maximum ranges and recommended estimates are shown in *Table 10* (next page).

Table 10. Estimated Maximum Hourly Throughput by Annual Throughput

Annual Throughput (million gallons)	Phase I Hourly Throughput	Phase II Hourly Throughput	
	Phase I Loading (gal/hour)	Phase II Estimated Hourly Throughput Range (gal/hour)	Phase II Estimated Hourly Throughput (gal/hour) (% data points encompassed)
<1	8,800	100-1,000	500 (86%)
1 - <3	8,800	100-1,370	700 (88%)
3 - <5	8,800	250-1,230	1,000 (86%)
5 - <10	8,800	1,040-2,680	2,000 (83%)
≥10	8,800	2,450-3,990	4,000 (100%)

1. These hourly throughput ranges were created based on CARB's 2015 Mega Blitz data analyses.

C. Operation Schedule

1. Annual Operation Schedule

CARB and CAPCOA used the hourly throughput information from the 2015 Mega Blitz data analyses to determine statewide dispensing operation schedules. This data showed that statewide gas is variably dispersed daily on an 85/15 schedule (85 percent between 6 AM to 8 PM and 15 percent between 8 PM and 6 AM).

2. Hourly Operating Schedule

It is not necessary to determine an hourly operating schedule as maximum hourly throughput is used.

D. Toxic Substances in Gasoline

1. Speciation of Toxic Substances in Gasoline Formulations

Gasoline vapor and liquid speciation are in CARB's speciation profiles (CARB, 2017). The four speciation profiles are OG691 (Summer Vapor), OG692 (Summer Liquid), OG694 (Winter Liquid), and OG695 (Winter Vapor). Weighted average concentrations were calculated for each substance using the procedures outlined in *Section II.B.4*. The combined weighted average concentrations for the seven substances in gasoline with chronic health factors are shown in *Table 11* (next page). The summer-only weighted average concentrations for the three substances in gasoline with acute health factors are shown in *Table 12* (next page). Only summer speciation profiles were used for the acute health factors because summer generally has higher levels of air toxics and maximum hourly throughputs.

Table 11. Content of Gasoline for Substances with OEHHA Chronic Health Factors (Combined Winter/Summer)[1]

Substance	Average Substance Weight % in Liquid	Average Substance Weight % in Vapor
Benzene	0.707	0.457
Ethyl Benzene	1.29	0.107
n-Hexane	1.86	1.82
Naphthalene	0.174	0.000445
Propylene (propene)[2]	0.000122	0.003594
Toluene	5.63	1.11
Xylenes	6.59	0.409

1. These values were calculated using the annual average weight percent equations in *Section II.B.4.a.*
2. Propylene is only present in winter gasoline.

Table 12. Content of Gas for Substances with OEHHA Acute Health Factors (Summer Only)[1]

Substance	Average Substance Weight % in Liquid	Average Substance Weight % in Vapor
Benzene	0.702	0.549
Toluene	5.80	1.35
Xylenes	6.91	0.509

1. Summer-only speciation profiles were used to calculate weight percentages for the acute health factors because summer generally has higher levels of air toxics and maximum hourly throughputs.

2. Toxicity of Substances in Gasoline

The health values of the various substances in gas are listed in the table 13 below.

Table 13. OEHHA/CARB Risk Assessment Health Values

Substance	CAS[1]	Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Chronic REL[2] ($\mu g/m^3$)	Chronic REL[2] Target Organ	8-Hour Inhalation REL ($\mu g/m^3$)	8-Hour REL[2] Target Organ	Acute REL[2] (ug/m^3)	Acute REL[2] Target Organ
Benzene[3]	71432	1.0E-01	3.0E+00	Hematologic	3.0E+00	Hematologic	2.7E+01	Reproductive/ Development Hematologic Immune
Ethyl Benzene	100414	8.7E-03	2.0E+03	Alimentary Reproductive/ Development Endocrine Kidney	NR[4]	NR	NR	N/A
n-Hexane	110543	NC[5]	7.0E+03	Nervous	NR	NR	NR	N/A
Naphthalene	91203	1.2E-01	9.0E+00	Respiratory	NR	NR	NR	N/A
Propylene (propene)	115071	NC	3.0E+03	Respiratory	NR	NR	NR	N/A
Toluene	108883	NC	4.2E+02	Eye	8.3+02	Eye	5.0E+03	Eye Nervous Respiratory
Xylenes	1330207	NC	7.0E+02	Eye Nervous Respiratory	NR	NR	2.2E+04	Eye Nervous Respiratory

1. The Chemical Abstract Service (CAS) is a division of the American Chemical Society that maintains a database of chemical compounds.
2. REL = Reference Exposure Level.
3. Benzene can be absorbed through the skin but has no OEHHA oral health value, so dermal absorption of benzene is not included in the Technical Guidance.
4. NR = No REL currently available.
5. NC = Not identified as a carcinogen.

E. Point and Volume Sources

1. Point Sources (Loading and Breathing)

Vent stack emissions from loading and breathing are best characterized as point sources. *Table 14* below shows the parameters for these two point sources based on the collective experience of CARB and District staff. A low exit velocity was used in order to account for the pressure/vacuum (P/V) valve on the stack. Since the P/V valve on the vent pipe acts similar to a rain cap, but is not truly a rain cap, the exit velocity of 0.001 meters per second (m/s) was used to approximate the capped release. A P/V valve only releases vapor from the stack during overpressure events where the P/V valve pressure threshold is exceeded.

Based on CARB monitoring data, overpressure events could result in exit velocities ranging from 0.016 m/s to 0.16 m/s. CARB staff performed a sensitivity study to analyze the impact of exit velocity on cancer risk. The sensitivity study showed that exit velocities of 0.001 m/s, 0.01 m/s, and 0.1 m/s yielded similar risk results. The cancer risk decreased approximately one percent from 0.001 to 1.0 m/s and increased less than 0.05 percent from 0.001 m/s to a rain capped point source. Because 0.001 m/s yielded slightly more health-protective results than other exit velocities, staff used 0.001 m/s for modeling.

Table 14. Point Sources Parameters

Parameter	Loading	Breathing
Unit Rate Emission Factor (g/s)	1	1
Release Height (m)	3.66	3.66
Temperature (K)	291	289
Stack Diameter (m)	0.0508	0.0508
Exit Velocity (m/s)	0.001	0.001

2. Volume Source Emissions (Fueling, Spillage and Hose Permeation)

Fueling, spillage, and hose permeation emissions are best characterized as volume sources. *Table 15* (next page) shows the parameters for these three sources.

a) Volume Source Dimensions Used for Fueling, Spillage, and Hose Permeation Emissions

Fueling, spillage and hose permeation emissions were modeled as volume sources. Volume source modeling most appropriately represents downwind concentrations influenced by turbulence factors due to cars and pump islands disrupting the flow of wind. The size of the volume sources originated from the previous guidelines (CARB, 1997) and was determined to be:

4 meters high x 13 meters long x 13 meters wide

In 2018, CARB staff used Google Earth Street View to visually determine the height of the volume source using the indicated height marked on the gas station canopy, if visible. Staff compared the canopy heights of over 70 gas stations in the state and determined that the average canopy height was four meters. Thus, the volume source parameters used in the 1997 Guidelines are still representative of California gas stations.

b) Release Heights Used for Fueling, Spillage, and Hose Permeation Emissions

In the 1997 Guidelines, release heights of zero and one meter were selected for spillage and fueling emissions, respectively. These parameters were based on the height of most car fill tubes and gasoline spills landing on the ground. While these are release points, the emissions released at the nozzle during fueling and from spillage are subjected to additional influences affecting the initial plume rise and shape of the modeled volume source. Thus, CARB staff reevaluated and revised the modeling parameters to be more representative of what occurs during fueling. The adjustments made to the volume source considered the wake effect caused by structures under the canopy (e.g., gasoline dispensers, surrounding vehicles, the vehicle being fueled) and turbulence from moving vehicles, which corresponds to observations shown with infrared videos during fueling.

To account for fueling height and vertical mixing due to cars and the pump islands, health-protective release heights were used for fueling, spillage, and hose permeation emissions. For fueling and hose permeation emissions, the release heights of the volume sources were selected to be 1.5 meters. For spillage emissions, the release height of the volume source was selected to be one meter. The release heights can be found in *Table 15* below.

Table 15. Volume Sources Parameters

Parameter	Fueling	Spillage	Hose Permeation
Height (m)	4	4	4
Width (m)	13	13	13
Length (m)	13	13	13
Sigma y[1] (dimensionless)	3.02	3.02	3.02
Sigma z[2] (dimensionless)	1.86	1.86	1.86
Release Height (m)	1.5	1	1.5

1. Sigma y is defined as the initial lateral dimension (length/4.3).
2. Sigma z is defined as the initial vertical dimension (height/2.15).

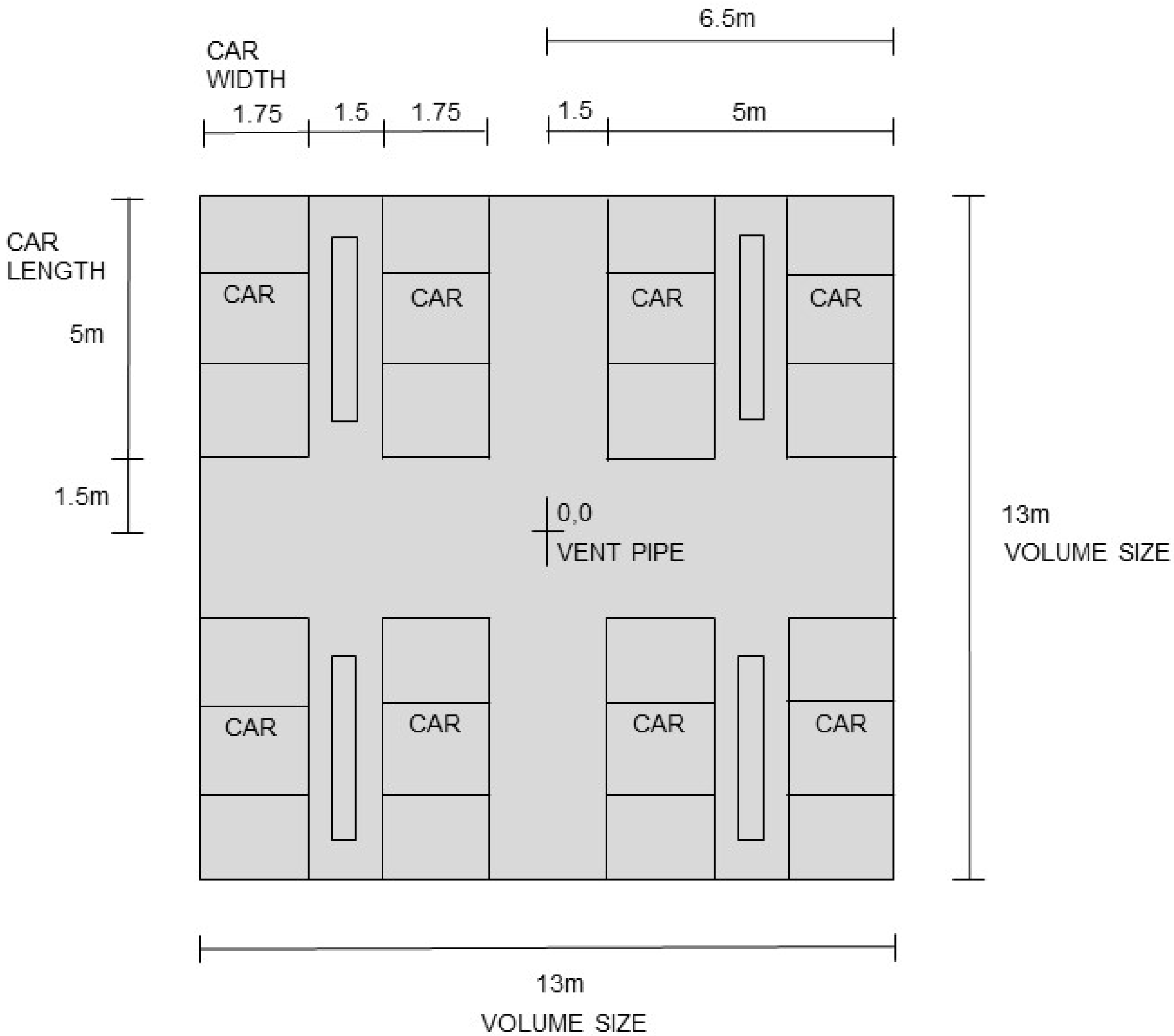
F. Pump Islands and Vent Pipes Locations

Ideally, the location of the pump islands and vent pipes should be determined on a site-specific basis. Because it is very costly to gather this information and apply it to individual gas stations, a generic gas station configuration was assumed. Gas station owners or Districts may want to refine the risk assessment results using site-specific configurations if the risk appears significant.

Figure 3 (next page) shows the generic gas station configuration used to model emissions. Four multiproduct dispensers were assumed to be spaced four meters from the center point of the gas station. The vent pipes were modeled as a single vent pipe located at the center of the property. We recognize that vent pipes are typically located near the property boundary; however, the vent pipe was modeled in the center of the canopy for ease of simulating a non-site-specific source and providing meaningful receptor concentrations for a variety of meteorological data sets. Depending on site-specific considerations, vent pipes positioned in the middle of the gas station may result in lower risks than vent pipes located near the property boundary. It may be appropriate to model the vent pipes using the actual location if receptors are located near the vent pipes.

The three volume sources, representing spillage, fueling, and hose permeation emissions, are shown as the shaded area in the middle of the gas station. The spillage volume is superimposed over the fueling volume.

Figure 3: Plan Showing Point and Volume Sources Relative to Cars and Gas Pumps[1,2]



1. The shaded area represents the volume sources used for modeling emissions from spillage, fueling, and hose permeation.
2. The vent pipe represents the point sources used for modeling emissions from loading and breathing.

G. Miscellaneous Modeling Parameters

CARB and CAPCOA used version 18081 of AERMOD, the atmospheric dispersion modeling software developed by the United States Environmental Protection Agency (U.S. EPA), to prepare the risk assessment modeling. The assumptions used for the modeling are described in *Section II.G.1* and *Section II.G.2* below.

1. Dispersion Coefficients (Rural Versus Urban)

In Appendix W of Title 40 in the U.S. Code of Federal Regulations (40 CFR Part 51), U.S. EPA recommends two methods for determining whether the rural or the urban dispersion coefficients should be applied (U.S. EPA, 2017b)[52]. One method is based upon U.S. EPA's Land Use Procedure, while the other is based upon their Population Density Procedure. These methods are further described in 40 CFR Part 51 Section 7.2.1.1 Dispersion Coefficients. To determine dispersion coefficients in the Land Use Procedure, U.S. EPA references "Correlation of Land Use and Cover with Meteorological Anomalies" (Auer, 1978).

Due to the diversity of land use throughout California, each District should select the appropriate dispersion coefficient appropriate for the location of each gas station. If a District is unsure which coefficient to use, then the U.S. EPA default rural dispersion coefficients should be used.

AERMOD uses population to determine the magnitude of the urban heat island effect. We chose a population of 100,000 for the urban dispersion coefficient, rounded up from the average city population (68,403) in California as of January 2017 (DOF, 2017). CARB staff performed a sensitivity study to evaluate the effect of population size on cancer risk. Staff modeled cancer risk using various population sizes ranging from 100 to 20 million, however, based on the average city population in California, we focused on the differences in risk between using a population of 68,403 and 100,000. The results showed that risk does not vary more than 3 percent between population inputs of 68,403 and 100,000. Results of the sensitivity study also showed that as population increases, risk may decrease. The difference in risk between a population of 100,000 and 20 million is 16 percent. Therefore, a population of 100,000 was used to be health-protective and representative of the average city population in California.

2. Building Downwash

The entrainment of a plume in the wake of a building can result in the "downwash" of the plume to the ground. This effect can increase the maximum ground-level concentration downwind of the source. To estimate this increase, AERMOD includes algorithms to model the effects of building downwash on emissions from nearby or adjacent point sources.

As building downwash algorithms do not apply to volume or area sources, only the emissions from the vent pipe (i.e., loading and breathing emissions) are affected. The effects of building downwash can be highly site-specific depending on factors such as meteorological conditions, building orientation, receptor location, source location,

---

[52] U.S. EPA, 2017b. United States Environmental Protection Agency, 40 CFR Part 51, Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter. Available at: *2017 Appendix W Final Rule | US EPA*.

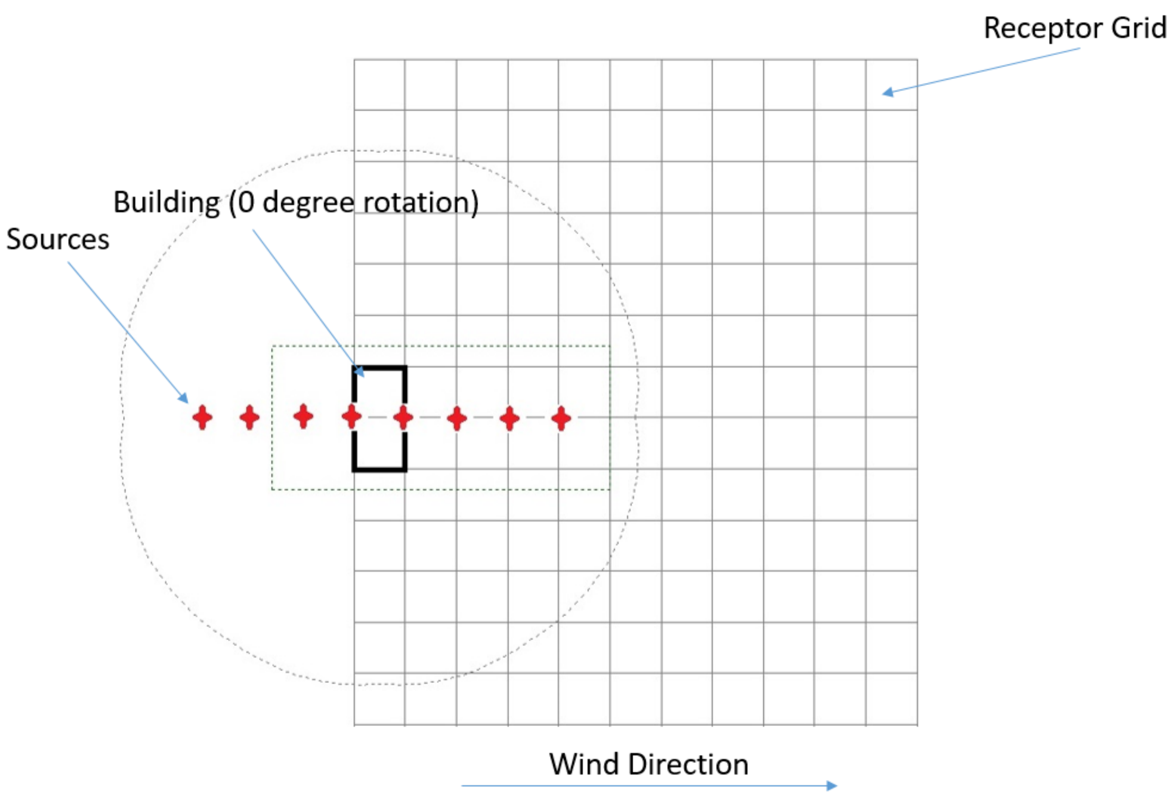
and emission source parameters. To determine how building downwash affects potential residential cancer risk and noncancer acute health impacts (HI), CARB staff performed multiple building downwash scenarios for all of the meteorological data sets in the Guidance. Noncancer chronic HI is not included in this analysis because adverse chronic health affects do not appear until the cancer risk and acute HI are orders of magnitude above the thresholds of 10 chances per million and one, respectively.

Each modeling scenario consisted of the following:

1. A 10 m long x 5 m wide x 4 m high building.
2. Point sources located at 5 m increments upwind and downwind of the building.
3. Receptors located up to 1000 m from the gas station. Receptors are placed in 5 m increments from 20 m to 100 m and 10 m increments from 100 m to 1000 m.
4. Building orientations of 0 degrees, 45 degrees (positive and negative), and 90 degrees.

Figure 4 below shows a schematic of the modeling layout.

Figure 4. Schematic of Building Downwash Modeling Domain



1. Point sources are located at five-meter increments upwind and downwind of the building.
2. The building dimensions are 10 m long x 5 m wide x 4 m high.
3. CARB Staff modeled the following building orientations: 0 degrees, 45 degrees, negative 45 degrees, and 90 degrees.

4. CARB Staff rotated meteorology to align the predominant wind direction with the building and emission sources.

CARB staff developed adjustment factors to scale cancer risk and noncancer acute HI based on building downwash effects. Cancer risk is based on annual average concentrations, while noncancer acute HI is based on maximum hourly concentrations. Thus, the adjustment factors for potential cancer risk are calculated separately from the noncancer acute HI. CARB staff calculated average values at each receptor for cancer risk and maximum values at each receptor distance for acute HI. The full analysis and results can be found in *Appendix E*.

Table 16 and Table 17 below show the adjustment factors for each range of receptor distances considered in the building downwash analysis. Adjustment factors are provided for all the gas station control scenarios in the Guidance.

Table 16. Building Downwash Adjustment Factors for Cancer Risk

Receptor Distance[2]	Scenario[1] 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
0 m - 50 m	1.25	1.40	1.15	1.25	1.30	1.45	1.30
>50 m - 100 m	1.20	1.30	1.10	1.20	1.20	1.35	1.25
>100 m - 200 m	1.15	1.25	1.10	1.15	1.15	1.25	1.20
>200 m - 300 m	1.05	1.05	1.05	1.05	1.05	1.10	1.05
>300 m	1.00	1.00	1.00	1.00	1.00	1.00	1.00

1. A list of the gas station control scenarios used in the Guidance can be found in *Section II.A.7*.
2. Receptors are located up to 1000 m from the emission source. Receptors are placed in five meter increments from 20 m to 100 m and 10 m increments from 100 m to 1000 m.

Table 17. Building Downwash Adjustment Factors for Acute Health Impacts

Receptor Distance[2]	Scenario[1] 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
0 m - 60 m	4.25	3.30	3.55	2.75	4.25	4.25	3.50
>60 m - 150 m	4.85	2.73	3.06	2.09	3.88	3.91	3.01
>150 m - 200 m	3.90	3.05	3.30	2.55	3.90	3.90	3.25
>200 m - 300 m	2.05	1.75	1.85	1.55	2.05	2.05	1.80
>300 m	1.00	1.00	1.00	1.00	1.00	1.00	1.00

1. A list of the gas station control scenarios used in the Guidance can be found in *Section II.A.7*.
2. Receptors are located up to 1000 m from the emission source. Receptors are placed in five meter increments from 20 m to 100 m and 10 m increments from 100 m to 1000 m.

The adjustment factors in the tables above must be combined with the cancer risk and noncancer acute HI values in Appendices G through J to determine building downwash values at individual gas stations. The procedure below outlines this process.

1. Compare the site-specific building with the building used in the building downwash analysis above (or default modeling). If the site-specific building

varies greatly in shape or size from the rectangular
10 m (length) X 5 m (width) X 4 m (height) building used for the default modeling, consider conducting a site-specific risk assessment.

2. Determine the distance of the site-specific station P/V valve from the building. If that distance is less than five times the shortest dimension of the site-specific building, then building downwash should be considered in the screening analysis. For example, the shortest dimension for the default building is the height of 4 m. Therefore, if the P/V valve is located within 20 m (5x4 m) of the building the building downwash effects should be quantified.
3. Use the spreadsheet tool provided to calculate potential cancer risk and noncancer acute health impacts with building downwash. The spreadsheet tool is available at: *Gasoline Service Station Industrywide Risk Assessment Guidance | California Air Resources Board*. In lieu of using the spreadsheet tool, follow steps 4 and 5 to calculate potential cancer risk and noncancer acute health impacts with building downwash.
4. Use the cancer risk and health impact tables in Appendices G through J of this document to determine the potential cancer risk and noncancer acute health impacts without building downwash.
5. Select the appropriate adjustment factor(s) from Table 16 (Cancer Risk) and Table 17 (Noncancer Acute HI) on the previous page. Adjust the values determined in step 4 by multiplying by the selected adjustment factors to determine the value of potential cancer risk or noncancer acute HI with building downwash.

Equation 4. Facility Cancer Risk with Building Downwash

$$\textit{Facility Cancer Risk}_{\textit{Building Downwash}} = \\ \textit{Cancer Risk from Appendix H or I (chances per million) x } \left(\frac{\textit{Annual Throughput}}{\textit{1 million gal}}\right) \\ \textit{x Adjustment Factor from table}$$

Equation 5. Facility Loading Acute Hazard Index with Building Downwash

$$\textit{Facility Hazard Index}_{\textit{Building Downwash}} = \\ \textit{Hazard Index from Appendix J or K (chances per million) x } \left(\frac{\textit{Hourly Loading Throughput}}{8800\ \textit{gal}}\right) \\ \textit{x Adjustment Factor from table}$$

Equation 6. Facility Dispensing Acute Hazard Index with Building Downwash

$$\textit{Facility Hazard Index}_{\textit{Building Downwash}} = \\ \textit{Hazard Index from Appendix J or K (chances per million)x } \left(\frac{\textit{Hourly Dispensing Throughput}}{1000\ \textit{gal}}\right) \\ \textit{x Adjustment Factor from table}$$

H. Meteorological Data

1. AERMOD Requirements for Meteorological Data

Each District should model gas stations using meteorological data that best represents their sources. Tables of risk results are provided in Appendices G through J using six meteorological data sets. If a District wants to model using data representative of their stations, then the District will need to acquire enough representative meteorological data to ensure that worst-case meteorological conditions are represented in the model results. To fulfill the requirement for representative data, the meteorological data must be 90 percent complete on a monthly basis (OEHHA, 2015). Districts with missing or incomplete meteorological data should refer to the OEHHA Air Toxics Hotspots Program Guidance Manual for Preparation of Health Risk Assessments (OEHHA Manual) for further instruction (OEHHA, 2015).

CARB and CAPCOA recommend the use of five years of representative National Weather Service (NWS) or comparable meteorological data for modeling gas stations. If sufficient site-specific data is not available, other options include:

- At least one year of site-specific meteorological data; or
- At least three years of prognostic meteorological data.

2. AERMET Processing with ADJ_U*

With AERMOD Version 18081, U.S. EPA has integrated the ADJ_U* option into the AERMET meteorological processor to adjust the surface friction velocity (u*) to address issues with the AERMOD model's tendency to over predict concentration from some sources under stable, low wind conditions. U.S. EPA found improved model performance with the ADJ_U* option for sources where peak impacts are likely to occur during low wind speed and stable conditions. The ADJ_U* option is applied when Automated Surface Observing System (ASOS) data is used or when site-specific meteorological stations without turbulence data are chosen.

3. Use of Meteorological Data Sets for Gas Station Modeling

In choosing the meteorological data sets for these analyses, CARB consulted with the Districts to determine what meteorological data sets were worst-case or most commonly used for low volume sources such as gas stations. The meteorological data for the urban sites were processed by the corresponding Districts using AERMET with the "ADJ_U*" option. The rural data sets were processed by CARB using AERMET with the "ADJ_U*" option. Meteorological data files are available at: *HARP AERMOD Meteorological Files | California Air Resources Board*.

Table 18 and *Table 19* (next page) show information about the different meteorological data stations used in the risk assessment modeling. The meteorological data sets were processed with the ADJ_U* option using District or CARB procedures. If alternate meteorological data is desired, the modeler may use data provided by a District, CARB, or prepared by a third-party using district-approved methodology.

Table 18. Urban Meteorological Data Parameters

Meteorological Data Station	Period	Average Wind Speed (m/s)	Calms (%)	AERMET Version	Years	Processing Agency
KFAT (Fresno)	24 hours	2.87	1.73	16216	2010 - 2014	SJVAPCD
	6 AM - 8 PM	2.89	1.40			
	8 PM - 6 AM	2.82	2.23			
KSJC (San Jose)	24 hours	3.19	1.21	18081	2013 - 2017	BAAQMD
	6 AM - 8 PM	3.69	1.03			
	8 PM - 6 AM	2.48	1.52			
KSAN (San Diego)	24 hours	2.81	0.99	16216	2010 - 2014	SDCAPCD
	6 AM - 8 PM	3.29	0.65			
	8 PM - 6 AM	2.04	1.48			
KONT (Ontario)	24 hours	2.88	2.91	16216	2012 - 2016	SCAQMD
	6 AM - 8 PM	3.36	2.07			
	8 PM - 6 AM	2.18	4.20			

Table 19. Rural Meteorological Data Parameters

Meteorological Data Station	Period	Average Wind Speed (m/s)	Calms (%)	AERMET Version	Years	Processing Agency
KRDD (Redding)	24 hours	2.94	1.16	18081	2013 - 2017	CARB
	6 AM - 8 PM	3.27	1.03			
	8 PM - 6 AM	2.42	1.40			
KWJF (Lancaster)	24 hours	5.18	4.37	18081	2013 - 2017	CARB
	6 AM - 8 PM	5.52	5.21			
	8 PM - 6 AM	4.65	3.20			

The locations of the meteorological data sets modeled are shown in *Figure 5* (next page).

Figure 5. Meteorological Stations for Gas Station Modeling

I. Risk Exposure Scenarios

To analyze the estimated health impacts from a generic gas station configuration, staff evaluated both the potential residential and off-site worker cancer risks, and noncancer chronic and acute hazard indices. CARB and CAPCOA calculated the health impacts using the methodology consistent with the OEHHA Manual (OEHHA, 2015). The description of the exposure scenarios and assumptions are presented below.

1. Exposure Scenarios for Inhalation Cancer Risk

The OEHHA Manual provides a description of the risk algorithms, recommended exposure variates, and health values for calculating potential cancer risk. Cancer risk is calculated by converting an annual average concentration to a dose and then comparing it to a pollutant-specific health value. Cancer risk is calculated by age bins (i.e., third trimester, 0<2, 2<9, 2<16, 16<30, and 16<70) and then summed for the exposure duration of interest (e.g., 30 years) to yield a total cancer risk. The bins allow age-specific exposure variates to be applied. Exposure variates include breathing rates, age sensitivity factors, fraction of time at home (FAH), and exposure duration. For example, age sensitivity factors will multiply the risk by a factor of 10 for age bins less than two and use a factor of three for age bins between two and 16.

For the Guidance, CARB and CAPCOA compared modeling results from the air dispersion analysis to the air toxic inhalation cancer potency factor for benzene, ethyl benzene, and naphthalene. In addition, we applied the CARB and the CAPCOA risk management policy (RMP) for inhalation-based cancer risk assessment (RMP, 2015). The policy recommends using a combination of the 95th percentile and 80th percentile daily breathing rates (DBR) as the minimum exposure inputs for risk management decisions. Specifically, the policy recommends using the 95th percentile breathing rates for age bins less than two years old and the 80th percentile breathing rates for age bins greater than or equal to two years old. This policy was used for calculating the 30-year residential cancer risks.

Table 20 below provides a description of the exposure scenarios used in the Guidance. *Table 21* and *Table 22* (next page) summarize the exposure assumptions for each scenario.

Table 20. Exposure Scenario Descriptions

Risk Scenario	Descriptions
30-year Residential Cancer Risk	The 30-year residential cancer risk represents the highest potential cancer risk to an individual residential receptor. The 30-year residential cancer risk uses a 30-year exposure duration with the FAH applied to age bins greater than 16 years.
25-year Worker Cancer Risk	The 25-year worker cancer risk represents the highest potential cancer risk to an off-site worker. The worker exposure duration is assumed to be 25 years, 8 hours per day, and 250 days per year. Since the emission sources are continuous, no adjustment factor will be applied to the annual concentration. In addition, the OEHHA Manual recommends an 8-hour breathing rate for moderate intensity (OEHHA, 2015).

Table 21. Summary of Exposure Parameters

Risk Scenario	*Exposure Duration*			*Breathing Rate (DBR)*	*Fraction of Time at Home*	*Pathway Evaluated*
	Days per Year	**Hours per Day**	**Years**			
30-year Residential Cancer Risk	350	24	30	RMP (95^{th} percentile DBRs for age bins less than 2 years and 80^{th} percentile DBRs for age bins greater than 2 years)	1 for age bins less than 16 years 0.73 for age bins greater than 16 years	Inhalation Only
25-year Worker Cancer Risk	250	8	25	8-hour moderate intensity BRs	Not applied (All age bins use 1)	

Table 22. Age Bin Exposure Duration Distribution

Risk Scenario	**Age Bins**					**Total**
	3^{rd} Trimester	**0<2**	**2<16**	**16<30**	**16-70**	
30-year Residential Cancer Risk	0.25 years	2 years	14 years	14 years	N/A	30 years
25-year Worker Cancer Risk	N/A	N/A	N/A	N/A	25 years	25 years

2. Exposure Scenarios for Noncancer Chronic Health Impacts

The chronic hazard index is calculated by dividing the annual average concentration by the chronic reference exposure level (REL). The chronic health impacts assessed with the chronic REL is most appropriate for residents or off-site workers (i.e., does not include gas station workers) who are continuously exposed to gas station emissions. If the hazard index yields a value above one, this may indicate a potential issue and requires further evaluation. Seven of the substances in gasoline have OEHHA chronic RELs.

The eight-hour hazard index is calculated by dividing the daily average concentration by the eight-hour REL. If the hazard index yields a value above one, this may indicate a potential issue and requires further evaluation. Benzene and toluene are the only components of gasoline that have eight-hour RELs. Benzene has an eight-hour chronic REL of 3.0 $\mu g/m^3$, and toluene has an eight-hour chronic REL of 830 $\mu g/m^3$.

The daily average concentration represents the long-term average concentration the worker is breathing during the work shift. This concentration can be estimated using the hourly concentrations coincident with the worker hours. However, when worker hours are unknown or when the source is continuous, the more appropriate approach is to estimate the eight-hour health hazard index using the annual average concentration.

3. Exposure Scenarios for Noncancer Acute Health Impacts

The acute health hazard index is calculated by dividing the maximum hourly concentration by the acute REL. If the hazard index yields a value above one, this may indicate a potential issue and requires further evaluation. Three of the substances (benzene, toluene, and xylenes) in gas have OEHHA acute RELs. Two of the compounds, toluene and xylenes, have similar target organs (eye, nervous, and respiratory).

J. Procedure for Calculating Potential Cancer Risks for Gas Stations

1. Results for Inhalation Cancer Risk

Results of modeling potential cancer risk for each of the seven gas station configurations with all six meteorological data sets are located in *Appendix G* (residential) and *H* (worker).

Figure 6 below shows the contribution of each substance to the total cancer risk. Benzene is the driving substance, contributing 78 percent. *Figure 7* (next page) shows the contribution of each emission source to the total cancer risk. Spillage is the driving emissions source, contributing 67 percent.

Figure 6. Cancer Risk Contribution by Substance - Scenario 1

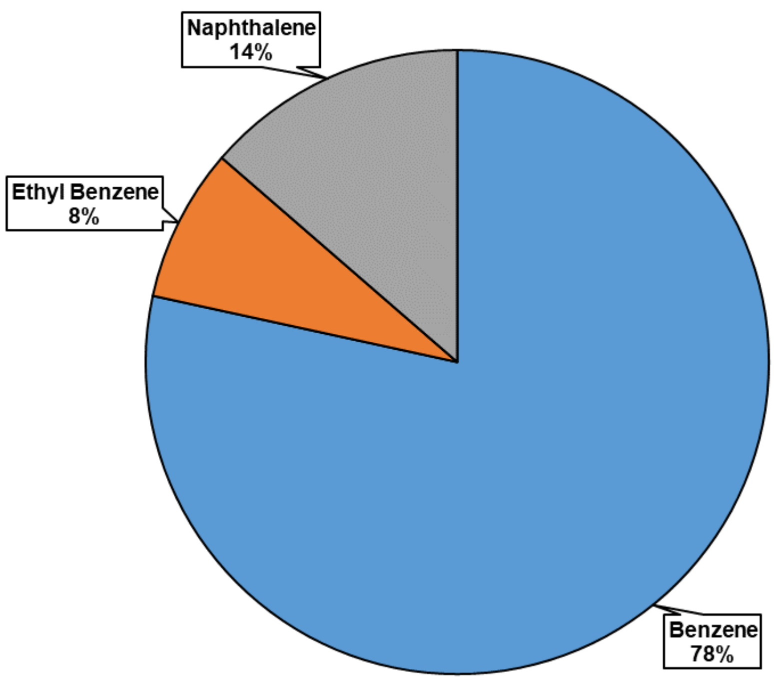
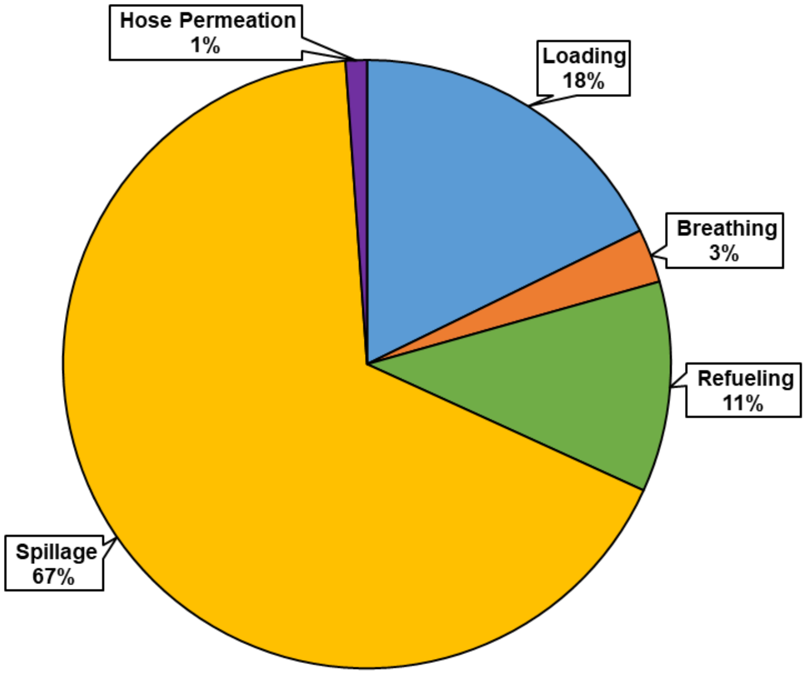


Figure 7. Cancer Risk Contribution by Emission Source - Scenario 1



The potential cancer risk varies with the extent of control equipment used in each Scenario. Scenario 1 (highest control equipment) has the lowest risk while Scenario 7 (least control equipment) has the highest risk. Most gas stations in California (97 percent) use the configuration in Scenario 1. Thus, *Table 23* and *Table 24* (next page) show the highest Scenario 1 risk values for residential receptors and workers, respectively.

Table 23. Scenario 1 (EVR Phase I and EVR Phase II) - Maximum Residential Cancer Risk (chances per million)[1,2,3,4]

Grid Distance (meters)[3]	Rural[2]	Urban[2]
10	8.86	7.64
20	4.94	4.55
30	3.15	2.99
40	2.19	2.11
50	1.62	1.57
60	1.25	1.21
70	0.99	0.96
80	0.81	0.79
90	0.68	0.66
100	0.57	0.56
120	0.43	0.41
140	0.33	0.32
160	0.27	0.26
180	0.22	0.21
200	0.19	0.18
220	0.16	0.15
240	0.14	0.13
260	0.12	0.11
280	0.11	0.10
300	0.09	0.09
350	0.07	0.07
400	0.06	0.05
450	0.05	0.04
500	0.04	0.04
600	0.03	0.03
700	0.02	0.02
800	0.02	0.02
900	0.01	0.01
1000	0.01	0.01

1. Per million gallons dispensed.
2. Meteorological data sets: Rural - Redding; Urban - San Jose.
3. All receptor distances are measured from the edge of the canopy.
4. Risk results do not include building downwash.

Table 24. Scenario 1 (EVR Phase I and EVR Phase II) - Maximum Worker Cancer Risk (chances per million)[1,2,3,4]

Grid Distance (meters)[3]	Rural	Urban
10	0.73	0.63
20	0.41	0.38
30	0.26	0.25
40	0.18	0.17
50	0.13	0.13
60	0.10	0.10
70	0.08	0.08
80	0.07	0.07
90	0.06	0.05
100	0.05	0.05
120	0.04	0.03
140	0.03	0.03
160	0.02	0.02
180	0.02	0.02
200	0.02	0.01
220	0.01	0.01
240	0.01	0.01
260	0.01	0.01
380	0.01	0.01
300	0.01	0.01
350	0.01	0.01
400	0.00	0.00
450	0.00	0.00
500	0.00	0.00
600	0.00	0.00
700	0.00	0.00
800	0.00	0.00
900	0.00	0.00
1000	0.00	0.00

1. Per million gallons dispensed.
2. Meteorological data sets: Rural - Redding; Urban - San Jose.
3. All receptor distances are measured from the edge of the canopy.
4. Risk results do not include building downwash.

The procedure below outlines how to apply the tables in *Appendix G* (residential) and *Appendix H* (worker) to determine the risk from individual gas stations. The cancer risk values in Appendices G and H are based on gas stations with a throughput of one million gallons per year. The actual risks must be scaled to account for actual throughputs.

1. Determine the annual gasoline throughput at the facility. Note: Appendix M includes a survey form that may be used to obtain this information.
2. Select the control scenario used by the gas station. A list of the gas station control scenarios used in this Guidance can be found in *Section II.A.7*.
3. Determine if the facility is characterized as being located in a rural or urban area. If a facility designation is unknown, assume rural as the default to be the most health protective.
4. Determine the most representative meteorological data set for the facility location. If the most representative meteorological data set is unknown, assume Redding as the default to be the most health protective.
5. Determine the location of the nearest receptor to the facility. If the distance to the nearest receptor is unknown, assume 10 meters as the default.
6. Use the tables in *Appendix G* (residential) or *Appendix H* (worker) to determine the potential cancer risk. Select the table for the applicable gas station control scenario chosen in Step 2. Then, use the information gathered in steps 3 through 5 to select a cancer risk value. This risk is based on a gas station throughput of one million gallons per year.
7. Determine the estimated cancer risk for the gas station by scaling the risk based on a gas station with a throughput of one million gallons per year as follows:

Equation 7. Facility Cancer Risk

$$\textbf{Facility Cancer Risk} = \frac{\textbf{Throughput}\left(\frac{\textbf{gal}}{\textbf{year}}\right)}{\textbf{1,000,000}\left(\frac{\textbf{gal}}{\textbf{year}}\right)}\ \textbf{x Cancer Risk from Appendix H or I}$$

2. Results for Noncancer Chronic Health Impacts

Gas station emissions do not cause adverse chronic health affects until the potential cancer risks are 25 times higher than the 10 chances per million cancer risk threshold. Therefore, results of modeling noncancer chronic health impacts are not included in this Guidance. Figure 8 (next page) shows the contribution of each substance to the total chronic HI. Benzene is the driving substance, contributing 100 percent. Figure 9 (next page) shows the contribution of each emission source to the total chronic HI. Spillage is the driving emissions source, contributing 59 percent.

Figure 8. Contribution to Chronic Health Impacts by Substance - Scenario 1

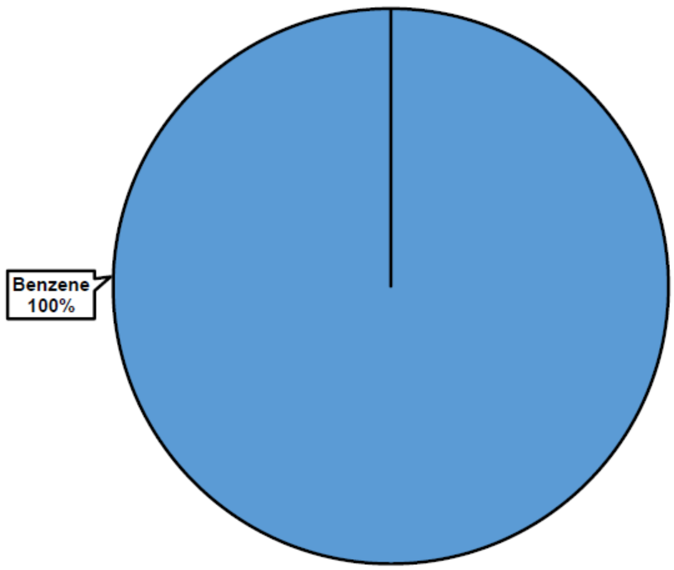
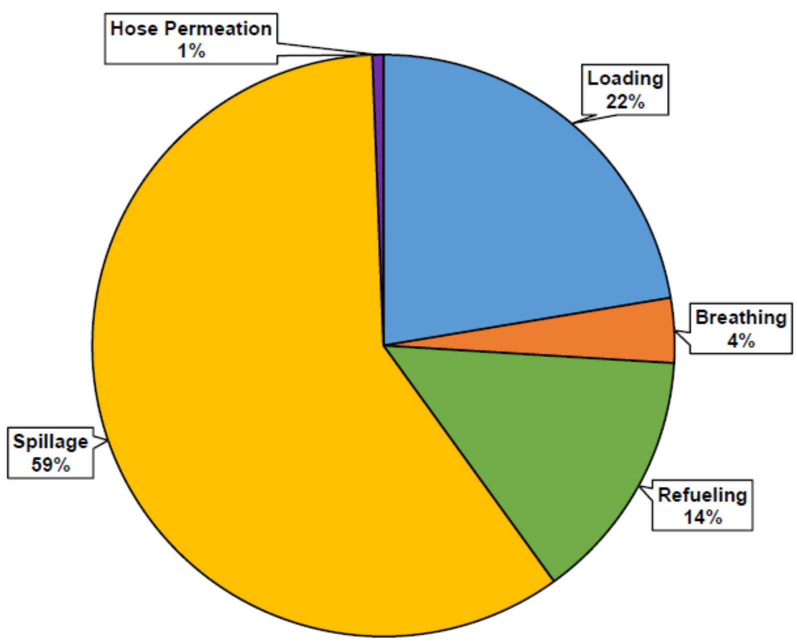


Figure 9. Contribution to Chronic Health Impacts by Emission Source - Scenario 1



The worst case chronic hazard index of 0.19 per million gallons annual throughput occurred in Scenario 7 at a receptor distance of 10 meters from the gas station canopy. However, this scenario is pre-EVR Phase I only (least control equipment) and may be used on stations in ozone attainment areas. Gas stations using the Scenario 7 configuration are unlikely to have a throughput which would trigger a chronic hazard index of one or greater. The chronic hazard index for the most common scenario (Scenario 1, highest control equipment) will not exceed one for a receptor distance of

10 m from the gas station canopy until the annual throughput exceeds 30 million gallons per year. At that point, the potential cancer risk would be over 250 chances in a million.

Although, the hazard quotient will not exceed one in this case. In situations where the hazard quotient yields a value above one, a more refined modeling or site-specific analysis may be required.

3. Results for Noncancer 8-Hour Chronic Health Impacts

Benzene and toluene are the only substances in gas station emissions with eight-hour chronic RELs. However, noncancer eight-hour chronic health impacts are not included in this Guidance for the following reasons:

The scenarios in this Guidance are modeled as continuous sources, which means the emissions are spread evenly over the course of an entire year and a person is assumed to be exposed to those levels. Therefore, no adjustments are made to the modeled benzene and toluene concentrations.

Benzene's eight-hour noncancer REL is the same as its annual chronic REL, so risk results from benzene will be the same.

The eight-hour chronic HI will not exceed one before the potential cancer risk is significantly elevated.

4. Results for Noncancer Acute Health Impacts

Results of modeling acute HI for each of the seven gas station control configurations with all six meteorological data sets are located in Appendices I (rural acute HI) and J (urban acute HI). *Figure 10* (next page) shows the contribution of each substance to the total acute HI for Scenario 1 of this Guidance. Benzene is the driving substance, contributing 100 percent. *Figure 11* (next page) shows the contribution of each emission source to the total acute HI for Scenario 1. Loading is the driving emissions source, contributing 69 percent.

Figure 10. Contribution to Acute Health Impacts by Substance - Scenario 1

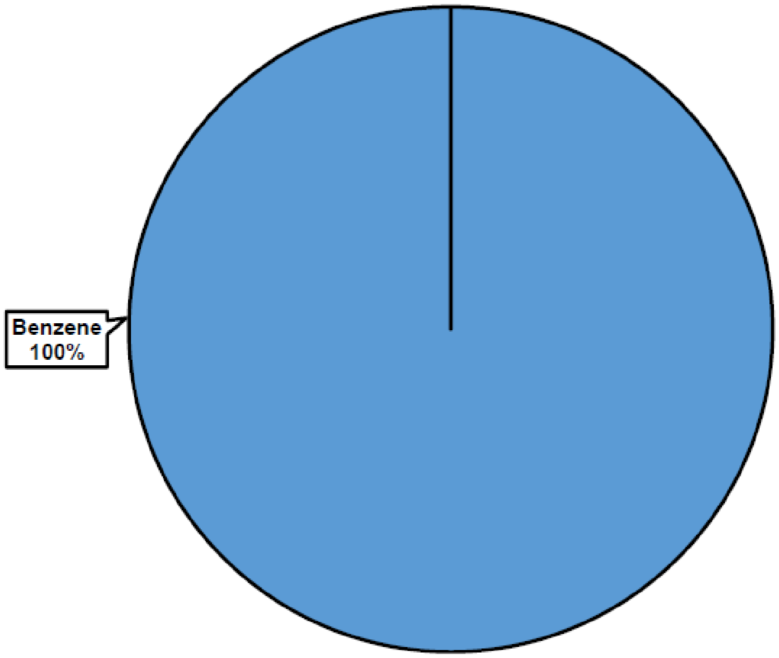
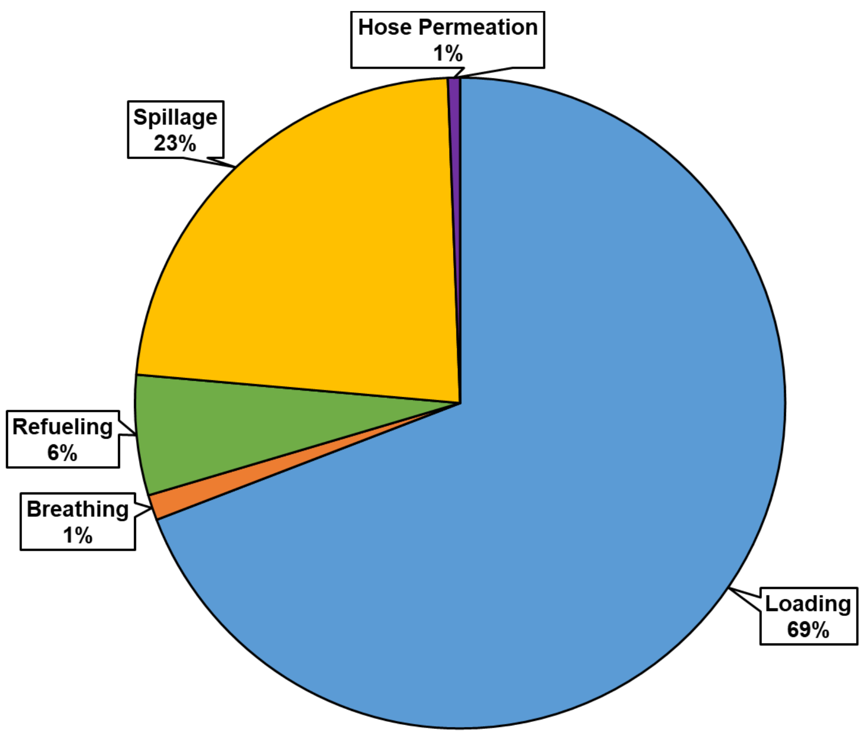


Figure 11. Contribution to Acute Health Impacts by Emission Source - Scenario 1



Results of modeling acute HI for each of the seven gas station vapor control configurations with all six meteorological data sets are located in *Appendix I* and *Appendix J*. Tables in *Appendix I* show acute health impacts for rural meteorological data sets and those in *Appendix J* show acute health impacts for urban meteorological data sets. The acute health impacts vary with the extent of control equipment with Scenario 1 being the lowest risk and Scenario 7 showing the highest risk. Acute health impacts are evaluated starting at a distance of 10 meters (m). In situations where the property boundary is located less than 10 m from the edge of the canopy, a site-specific HRA may be warranted as the screening tables and tools do not provide risk values for distances less than 10 m.

Table 25 (next page) shows the highest risk in each land use category for Scenario 1, as most gas stations use that configuration.

Table 25: Scenario 1 (EVR Phase I and EVR Phase II) - Acute Hazard Index[1]

Grid Distance (meters)[2]	Rural[3]		Urban[3]	
	Loading (8,800 gal)[4]	Dispensing (1,000 gal)[5]	Loading (8,800 gal)[4]	Dispensing (1,000 gal)[5]
10	0.55	0.33	0.43	0.22
20	0.35	0.23	0.31	0.13
30	0.26	0.15	0.23	0.09
40	0.25	0.15	0.18	0.07
50	0.21	0.11	0.14	0.05
60	0.19	0.10	0.11	0.04
70	0.17	0.09	0.09	0.03
80	0.15	0.07	0.07	0.03
90	0.13	0.06	0.06	0.02
100	0.12	0.06	0.04	0.02
120	0.10	0.05	0.03	0.01
140	0.08	0.04	0.03	0.01
160	0.07	0.03	0.02	0.01
180	0.06	0.03	0.02	0.01
200	0.05	0.02	0.02	0.01
220	0.05	0.02	0.02	0.01
240	0.04	0.02	0.01	0.01
260	0.04	0.02	0.01	0.01
280	0.04	0.02	0.01	0.00
300	0.03	0.01	0.01	0.00
350	0.03	0.01	0.01	0.00
400	0.02	0.01	0.01	0.00
450	0.02	0.01	0.01	0.00
500	0.02	0.01	0.01	0.00
600	0.01	0.01	0.00	0.00
700	0.01	0.00	0.00	0.00
800	0.01	0.00	0.00	0.00
900	0.01	0.00	0.00	0.00
1000	0.01	0.00	0.00	0.00

1. Risk results do not include building downwash.
2. All receptor distances are measured from the edge of the canopy. In situations where the property boundary is located less than 10 m from the edge of the canopy, a site-specific HRA may be warranted.
3. Meteorological data sets: Rural - Redding; Urban - San Jose.
4. Per 8,800 gallons dispensed.
5. Per 1,000 gallons dispensed.

The procedure below outlines how to apply the tables in *Appendix I* (rural) and *Appendix J* (urban) to determine the rural and urban acute hazard indices from individual gas stations. The acute hazard index values in *Appendix I* and *Appendix J* are based on gas stations with a maximum loading volume of 8,800 gallons per hour and maximum dispensing volume of 1,000 gallons per hour. The actual hazard indices must be scaled to account for actual throughputs.

1. Determine the hourly gasoline throughput at the facility. Note: Appendix M includes a survey form that may be used to obtain this information.
2. Select the control scenario used by the gas station. A list of the gas station control scenarios used in this Guidance can be found in *Section II.A.7*.
3. Determine if the facility is characterized as being located in a rural or urban area. If a facility designation is unknown, assume rural as the default.
4. Determine the most representative meteorological data set for the facility location. If the most representative meteorological data set is unknown, assume Redding as the default to be the most health protective.
5. Determine the location of the nearest receptor to the facility. If the distance to the nearest receptor is unknown, assume 10 meters as the default.
6. Use *Appendix* I (Rural) or *Appendix* J (Urban) to determine the acute hazard index. Select the table for the applicable gas station control scenario chosen in Step 2. Then, use the information gathered in steps 3 through 5 to select the appropriate "Loading" and "Dispensing" values. The loading risk is based on a delivery throughput of 8,800 gallons per hour and the dispensing risk is based on 1,000 gallons per hour dispensed.
7. Calculate the estimated acute HI for loading and dispensing by scaling the anticipated volumes relative to a gas station with a maximum hourly loading throughput of 8,800 gallon per hour and maximum hourly dispensing throughput of 1,000 gallon per hour as follows:

Equation 8. Facility Loading Acute Hazard Index

$$\textbf{Facility Loading Acute Hazard Index} = \frac{\textbf{Loading throughput in} \left(\frac{\textbf{gal}}{\textbf{hour}}\right)}{\textbf{8,800} \left(\frac{\textbf{gal}}{\textbf{hour}}\right)} \textbf{ x Hazard Index from Appendix J or K}$$

Equation 9. Facility Dispensing Acute Hazard Index

$$\textbf{Facility Dispensing Acute Hazard Index} = \frac{\textbf{Dispensing throughput} \left(\frac{\textbf{gal}}{\textbf{hour}}\right)}{\textbf{1,000} \left(\frac{\textbf{gal}}{\textbf{hour}}\right)} \textbf{ x Hazard Index from Appendix J or K}$$

8. Determine the estimated acute hazard index for the gas station by adding the loading acute hazard index to the dispensing hazard index.

K. Modeling Parameters Causing Uncertainty

A health risk assessment (HRA) requires the integration of many variables and assumptions. The estimated concentrations and potential health risks produced by a risk assessment are based on assumptions, many of which are designed to be health protective so that potential risks to individuals are not underestimated. HRAs consist of three components: (1) emission inventory, (2) air dispersion modeling, and (3) risk assessment. There are uncertainties and limitations with the results based on the assumptions used in each component. This section will focus on the uncertainty associated with the modeling parameters.

In developing modeling parameters for gas stations, the unique intermittent process of fueling vehicles may create uncertainties in the modeling calculations. Vehicle traffic within the gas station may cause turbulence uncertainties. Temperature differences between gasoline vapors and air may create buoyancy effects. Density differences between gasoline vapors and air may also cause uncertainty in the calculations.

The movement of vehicles within a gas station is random and intermittent, and the shape of the vehicles moving through the gas station is highly variable. This creates turbulence that may impact the dispersion of the emissions from the gas station. When vehicles move within the station boundary, the movement may contribute to entrain the ground level material to higher altitude.

Buoyant forces may have some influence on spillage losses since the gasoline liquid released may be warmer than the ambient air. The temperature of the pavement the spill lands on can be above or below the ambient air temperature. The heat transferred to or from the spill will also affect evaporative vapor temperature and the buoyancy of the vapors.

Gasoline vapors are heavier than air. Therefore, it is important to know whether the AERMOD model adequately calculates the dispersion of gasoline vapors at gas stations. In the previous guidelines (CARB, 1997), emitted gasoline vapors were determined to be neutrally buoyant up to 30 million gallons per year based on emissions. As the control methods have improved and the resultant emissions have decreased since 1997, the analysis should still be valid. The results of the analysis indicate that gasoline vapors emitted from the gas stations can be modeled as neutrally buoyant gases using the AERMOD model.

For the purposes of this Guidance, emissions have been quantified for routine sources (i.e., recurring, predictable sources) of emissions from gas stations. Gas stations may have other emission sources such as soil remediation or combustion processes. If activities such as these are routine for a particular station, then a sitespecific HRA should be considered. In accordance with AB 2588 risk assessment procedures, intermittent sources (e.g., vehicle exhaust and mobile source emissions) are not included in this analysis. If these additional emissions are added, an increased cancer risk would result. Consequently, if CARB identifies additional routine sources of emissions at gas stations, these sources will be added to future updates to the Technical Guidance.

III.References

AB 617, 2017. Assembly Bill 617, Garcia, C., Chapter 136, Statutes of 2017, modified the California Health and Safety Code, amending § 40920.6, § 42400, and § 42402, and adding § 39607.1, § 40920.8, § 42411, § 42705.5, and § 44391.2 dated July 26, 2017. Available at: *Bill Text - AB-617 Nonvehicular air pollution: criteria air pollutants and toxic air contaminants.*

AB 2588, 1987. Assembly Bill 2588, Air Toxics "Hot Spots" Information and Assessment Act of 1987, California Health and Safety Code §44300-44394. Available at: *PART 6. AIR TOXICS "HOT SPOTS" INFORMATION AND ASSESSMENT*, Accessed March 2019

Auer, 1978. Auer, Jr., A. H. Correlation of Land use and Cover with Meteorological Anomalies, Journal of Applied Meteorology, pp 636-654. Available at: *Correlation of Land Use and Cover with Meteorological Anomalies in: Journal of Applied Meteorology and Climatology Volume 17 Issue 5 (1978) (ametsoc.org)*, Accessed October 2018

CAPCOA, 1997. California Air Pollution Control Officers Association, Air Toxics Hot Spots Program, Gasoline Service Station Industrywide Risk Assessment Guidelines, November 1997. Available at: *Guidance Document: 1998-02-27 CAPCOA "Hot Spots" Gasoline Service Station Industrywide Risk Assessment Guidelines*

CARB, 1988. Benzene Airborne Toxic Control Measure (ATCM) for Retail Service Stations. Available at: *Rulemaking: Final Reg Order Benzene ATCM Measure For Retail Service Stations (ca.gov)*, Accessed March 2019

CARB, 2007. California Air Resources Board, Reid Vapor Pressure Requirements. Available at: *Gasoline Reid Vapor Pressure Requirements | California Air Resources Board*.

CARB, 2013a. California Air Resources Board, Revised Emission Factors for Gas Marketing Operations at California Gas Dispensing Facilities dated December 23, 2013. Available at: *Gasoline Dispensing Facility Emission Factors | California Air Resources Board*, Accessed October 2018

CARB, 2013b. California Air Resources Board, Attachment 1 - Revised Emission Factors for Phase II Vehicle Fueling at California Gas Dispensing Facilities dated December 23, 2013. Available at: *Gasoline Dispensing Facility Emission Factors | California Air Resources Board*, Accessed October 2018

CARB, 2015a. California Air Resources Board, Certification procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities (CP-201) dated April 23, 2015. Available at: *Vapor Recovery Certification Procedure CP - 201*. Accessed January 2019

CARB, 2015b. California Air Resources Board, Certification procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities Using Aboveground Storage Tanks dated April 23, 2015. Available at: *AST CP-206 Certification Procedure for Vapor*

Recovery Systems at Gasoline Dispensing Facilities Using Aboveground Storage Tanks, Accessed January 2019

CARB, 2016. California Air Resources Board, Unofficial Electronic Version of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions dated October 2018. Available at: *Unofficial Electronic Version of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (2018) (ca.gov)*, Accessed September 2019

CARB, 2017. California Air Resources Board, References: Consolidated List for Speciation Profiles retrieved May 11, 2017. Available at: *Consolidated List for Speciation Profiles | California Air Resources Board*, Accessed October 2018

CARB, 2018. California Air Resources Board, Community Air Protection Blueprint for Selecting Communities, Preparing Community Emission Reduction Programs, Identifying Statewide Strategies, and Conducting Community Air Monitoring dated April 2019. Available at: *Community Air Protection Blueprint | California Air Resources Board*.

DOF, 2017. California Department of Finance, Tables of January 2017 City Population Ranked by Size, Numeric and Percent Change retrieved September 14, 2017. Available at: *E-1 Population Estimates for Cities, Counties, and the State — January 1, 2020 and 2021 (ca.gov)*, Accessed October 2018

HSC, 1987. Assembly Bill 2588, Chapter 1252, Statutes of 1987, in California Health and Safety Code § 44365(b).

OEHHA, 2015. Office of Environmental Health Hazard Assessment, The Air Toxics Hot Spots Program, Guidance Manual for Preparation of Health Risk Assessments, February 2015. Available at: *Notice of Adoption of Air Toxics Hot Spots Program Guidance Manual for the Preparation of Health Risk Assessments 2015 - OEHHA (ca.gov)*.

OEHHA, 2018. Office of Environmental Health Hazard Assessment, Chemical Database. Available at: *Chemicals - OEHHA*, Accessed October 2018

RMP, 2015. California Air Resources Board and California Air Pollution Control Officers Association, Risk Management Guidance for Stationary Sources of Air Toxics, July 2015. Available at: *Microsoft Word - FINAL RISK MANAGEMENT GUIDANCE 9.23.15.docx (ca.gov)*.

U.S. DOT, 2019. U.S Department of Transportation, Gross Weight Limit for Interstate Highway System, retrieved January 29, 2019. Available at: *Commercial Vehicle Size and Weight Program - Freight Professional Development - FHWA Freight Management and Operations (dot.gov)*, Accessed January 2019

U.S. EPA, 2017a. United States Environmental Protection Agency, Vehicle Refueling Emissions, Refueling Emission Inventories and Regulatory Policy, August 2017. Available at: *Vehicle Refueling Emissions Inventories and Regulatory Policy (Glenn Passavant, Ingevity Corporation) (epa.gov)*.

U.S. EPA, 2017b. United States Environmental Protection Agency, 40 CFR Part 51, Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter. Available at: *2017 Appendix W Final Rule | US EPA*.

U.S. EPA, 2018. United States Environmental Protection Agency, Users Guide for the AMS/EPA Regulatory Model (AERMOD), April 2018. Available at: *User's Guide for the AMS/EPA Regulatory Model (AERMOD)*.

IV.List of Appendices

Appendix A: Speciation of Gasoline

The most recent summer liquid speciation profile (OG692) was generated based on the composite of previous profile OG690 and the fuel analysis of four summer grade E10 samples collected during the CARB Light Duty Surveillance Program Series 19 (VSP19). The most recent winter liquid speciation profile (OG694) was generated based on the fuel analysis of eight winter grade E10 samples collected during the VSP19. Both vapor profiles were developed by using vapor-liquid equilibrium theory applied to the liquid profiles. Spillage emissions were developed using the liquid speciation profile while the emissions from the remaining emission sources (loading, breathing, fueling, and hose permeation) were calculated using the vapor speciation profile. This is because the gasoline drips onto the ground in liquid form where it is assumed to evaporate into the air, whereas the other emission releases originate from the vapor in the headspace of the underground storage tanks. For additional information, please see the Consolidated List for Speciation Profiles (CARB, 2017). The substances with OEHHA health risk factors are shown below with their respective weight concentrations in each profile.

Table A1. Summer and Winter E10 Gas Weight Percentages

Substance[1]	CAS	Summer Speciation Profile		Winter Speciation Profile	
		OG691 - Vapor (%)[2]	OG692 - Liquid (%)[2]	OG695 - Vapor (%)[2]	OG694 -Liquid (%)[2]
Benzene	71432	0.549442	0.701959	0.322244	0.715126
Ethyl Benzene	100414	0.141423	1.414346	0.057327	1.104252
n-Hexane	110543	2.169322	1.891804	1.32391	1.805029
Naphthalene	91203	0.000597	0.205096	0.000224	0.12885
Propylene (propene)	115071	N/A	N/A	0.003594	0.000122
Toluene	108883	1.346700	5.803067	0.775147	5.375481
m-Xylene[3]	108383	0.267533	3.491298	0.138782	3.101961
o-Xylene[3]	95476	0.125055	1.959565	0.064221	1.740102
p-Xylene[3]	106423	0.116709	1.461854	0.061281	1.280616
Xylenes[3]	1330207	0.509297	6.912717	0.264284	6.122679

1. Percentages are provided for those substances with OEHHA health values.
2. The weight percentages are as presented in each speciation profile.
3. Propylene is only present in winter gasoline.
4. m-Xylene, o-Xylene, and p-Xylene are combined into a single category of Xylenes as they have the same OEHHA health value. They are shaded in the table to represent this grouping.

To estimate concentrations of individual substances in the annual emission factors, we used both summer and winter speciation. The speciation apportionment of summer and winter fuels used is based on the 2012 Board of Equalization throughput data used in 2013 emission factor document (CARB, 2013).

The weighted annual average percent equation is:

Equation A1. Annual Average Substance Weight Percentage

$$\textbf{\textit{Annual Average Substance Weight}}\ \% = \left(\textbf{\textit{Summer Fuel Substance Weight}}\ \%\ \boldsymbol{x} \left(\frac{\mathbf{59.2}}{\mathbf{100}}\right)\right) + \left(\textbf{\textit{Winter Fuel Substance Weight}}\ \%\ \boldsymbol{x} \left(\frac{\mathbf{40.8}}{\mathbf{100}}\right)\right)$$

For example:

$$\textbf{\textit{Annual Average Weight}}\ \%_{\textbf{\textit{Benzene,Liquid}}} = (\mathbf{0.702})\boldsymbol{x}\left(\frac{\mathbf{59.2}}{\mathbf{100}}\right) + (\mathbf{0.715})\boldsymbol{x}\left(\frac{\mathbf{40.8}}{\mathbf{100}}\right) = \mathbf{0.707}$$

Table A2 shows the weighted annual averages by substance for liquid and vapor and *Table A3* shows the speciation of summer gas.

Table A2. Speciated Mix Weight Percentages (59.2% Summer, 40.8% Winter)

Substance	CAS	Speciated Mix (Weight Percent)[1]	
		Vapor	Liquid
Benzene	71432	0.457	0.707
Ethyl Benzene	100414	0.107	1.29
n-Hexane	110543	1.82	1.86
Naphthalene	91203	0.000445	0.174
Propylene (propene)	115071	0.00147	0.0000498
Toluene	108883	1.11	5.63
Xylenes	1330207	0.409	6.59

1. These values were rounded to three significant digits for demonstration purposes only. In the actual calculations, the values were not rounded until the final step.

Table A3. Summer Speciation for Substances with OEHHA Acute Health Values

Substance	CAS	Summer Speciation (Weight Percent)[1]	
		Vapor	Liquid
Benzene	71432	0.549	0.702
Toluene	108883	1.35	5.80
Xylenes	1330207	0.509	6.91

1. These values were rounded to three significant digits for demonstration purposes only. In the actual calculations, the values were not rounded until the final step.

1. Toxic Substances Potentially Associated with Emissions from Gas Stations

In addition to the seven substances with associated OEHHA health values addressed in this Guidance (see *Table A2* on the previous page for a list of the seven substances), there are many other toxic substances in gasoline. Table A4 lists toxic substances currently covered by the Air Toxics "Hot Spots" program that may be associated with liquid and/or vapor gasoline emissions from operations at gas stations, based on CARB's speciation profiles found at: *Consolidated List for Speciation Profiles | California Air Resources Board*. Although most of the additional substances (beyond the seven addressed throughout this document) do not currently have OEHHA health values and have not been quantified in this Guidance, they should be considered for AB2588 emission inventory reporting purposes. The current weight percentages can be found in *Section IV.A.2* of this appendix.

Table A4. Toxic Substances Potentially Associated with Liquid and Vapor Emissions from Gasoline, Based on CARB's Speciation Profiles[1]

Toxic Substances Potentially Associated with Liquid and Vapor Emissions from Gasoline, Based on CARB's Speciation Profiles
Benzene
n-Butyl alcohol
Cumene
Cyclohexane
Ethyl benzene
n-Hexane
Isoprene
Naphthalene
Propylene (propene)
Toluene
Trimethylbenzenes[2]
Trimethylpentanes[3]
Xylenes (o-,m-,p-, and mixed xylenes)
Others[4]

1. The table includes the seven substances addressed in this Guidance: Benzene, Ethyl Benzene, n-Hexane, Naphthalene, Propylene (propene), Toluene, and Xylenes (which have OEHHA health values and dominate the emissions of concern from gas stations), as well as other toxic substances for which emissions can be quantified based on CARB's speciation profiles
2. Trimethylbenzenes include, but are not limited to 1,2,4-Trimethylbenzene
3. Trimethylpentanes include, but are not limited to 2,2,4-Trimethylpentane
4. There may be other fuel additives or components which could possibly be present in (or released from) some gasoline fuel and are AB2588 substances, but are not currently included in CARB's speciation profiles or not currently expected to contribute significantly to public health impacts, but bear mentioning for completeness. Examples of such possible substances include but are not limited to: t-Butyl alcohol, Dichlorobenzenes, Ethylene dibromide, Ethylene dichloride, Formaldehyde (and possibly other aldehydes), and Styrene

Table A5 below lists additional toxic substances that may be associated with emissions from gas stations that use a combustion device (such as an afterburner or flaring) to burn off excess gasoline vapors (CARB 2016). While this practice is no longer common, it is mentioned here for completeness.

Table A5. Additional Toxics Potentially Associated with Emissions Where Gasoline and/or Gasoline Vapors are Combusted or Flared at the Facility[1]

Toxics Potentially Associated with Emissions Where Gasoline and/or Gasoline Vapors are Combusted or Flared at the Facility
Aldehydes[1]
1,3-Butadiene
Dichlorobenzenes
Metal compounds[2]
Methyl- Nitro-Naphthalenes Naphthalenes
Polycyclic Aromatic Hydrocarbons (PAH)[3]
Polychlorinated dibenzo-dioxins
Polychlorinated dibenzofurans

1. Including but not limited to Acrolein, Acetaldehyde, Formaldehyde, Glutaraldehyde.
2. Metal compounds include compounds of Arsenic, Beryllium, Cadmium, Chromium (elemental, hexavalent, and trivalent), Copper, Lead, Manganese, Mercury, Nickel, Selenium, Vanadium, and Zinc.
3. Including but not limited to Benzo(a)Pyrene and other listed PAH compounds.

2. Weight Percentages for Toxic Substances Potentially Associated with Liquid and Vapor Emissions from Gasoline

Table A6 through Table A9 contain the weight percentages from the current Organic Gas (OG) speciation profiles for both summer and winter gasoline fuel (i.e., liquid and headspace vapor) for the toxic substances found in *Table A4*. The complete speciation profiles can be found on CARB's website at: *Consolidated List for Speciation Profiles | California Air Resources Board*. Check this website prior to using data from the tables to ensure use of the most up-to-date speciation profiles.

Table A6. OG Speciation Profile for E10 Summer Liquid Gasoline Fuel (OG692)[1]

Species Name	Weight Percentage (%)
1,2,3-trimethylbenzene	0.453559
1,2,4-trimethylbenzene	1.952473
1,3,5-trimethylbenzene	0.663528
2,2,3-trimethylpentane	0.035508
2,2,4-trimethylpentane	3.361002
2,3,3-trimethylpentane	0.485739
2,3,4-trimethylpentane	1.166969
benzene	0.701959
cyclohexane	0.878691
ethylbenzene	1.414346
isoprene	0.009837
m-xylene	3.491298
naphthalene	0.205096
n-hexane	1.891804
o-xylene	1.959565
p-xylene	1.461854
toluene	5.803067

1. This table only includes the weight percentages for the toxic substances in Table A4. The complete speciation profile can be found at *Consolidated List for Speciation Profiles | California Air Resources Board*.

Table A7. OG Speciation Profile for Headspace Vapor of E10 Summer Gasoline Fuel (OG691)[1]

Species Name	Weight Percentage (%)
1,2,3-trimethylbenzene	0.007058
1,2,4-trimethylbenzene	0.039799
1,3,5-trimethylbenzene	0.015565
2,2,3-trimethylpentane	0.020857
2,2,4-trimethylpentane	1.543471
2,3,3-trimethylpentane	0.080524
2,3,4-trimethylpentane	0.253597
benzene	0.549442
cyclohexane	0.350661
ethylbenzene	0.141423
isoprene	0.026761
m-xylene	0.267533
naphthalene	0.000597
n-hexane	2.169322
o-xylene	0.125055
p-xylene	0.116709
toluene	1.346700

1. This table only includes the weight percentages for the toxic substances in Table A4. The complete speciation profile can be found at *Consolidated List for Speciation Profiles | California Air Resources Board*.

Table A8. OG Speciation Profile for E10 Winter Liquid Gasoline Fuel (OG694)[1]

Species Name	Weight Percentage (%)
1,2,3-trimethylbenzene	0.405016
1,2,4-trimethylbenzene	1.761372
1,3,5-trimethylbenzene	0.603280
2,2,3-trimethylpentane	0.062778
2,2,4-trimethylpentane	2.813663
2,3,3-trimethylpentane	0.481009
2,3,4-trimethylpentane	1.060418
benzene	0.715126
cyclohexane	0.992171
ethylbenzene	1.104252
isoprene	0.009091
m-xylene	3.101961
naphthalene	0.128850
n-butyl alcohol	0.021967
n-hexane	1.805029
o-xylene	1.740102
propylene (propene)	0.000122
p-xylene	1.280616
toluene	5.375481

1. This table only includes the weight percentages for the toxic substances in Table A4. The complete speciation profile can be found at *Consolidated List for Speciation Profiles | California Air Resources Board*.

Table A9. OG Speciation Profile for Headspace Vapor of E10 Winter Gasoline Fuel (OG695)[1]

Species Name	Weight Percentage (%)
1,2,3-trimethylbenzene	0.003736
1,2,4-trimethylbenzene	0.021732
1,3,5-trimethylbenzene	0.008526
2,2,3-trimethylpentane	0.010611
2,2,4-trimethylpentane	0.711446
2,3,3-trimethylpentane	0.068845
2,3,4-trimethylpentane	0.153135
benzene	0.322244
cyclohexane	0.452826
ethylbenzene	0.057327
isoprene	0.019916
isopropylbenzene (cumene)	0.001576
m-xylene	0.138782
naphthalene	0.000224
n-butyl alcohol	0.001570
n-hexane	1.323910
o-xylene	0.064221
propylene (propene)	0.003594
p-xylene	0.061281
toluene	0.775147

1. This table only includes the weight percentages for the toxic substances in Table A4. The complete speciation profile can be found at *Consolidated List for Speciation Profiles | California Air Resources Board*.

Appendix B: Annual Emissions

By scenario, *Table 9* (*Section II.B.3*) emission factors are applied to substance percentages in *Table A2* of *Section IV.A* to calculate annual scenario substance emissions. All emission sources use vapor emission substance percentages except spillage, which uses the liquid emission substance percentages.

The one-million-gallon substance/source/scenario annual emissions equation is:

Equation B1. Annual Emissions for a One-Million-Gallon Gas Station

$$\boldsymbol{Annual\ Emissions}_{\ Substance,Source,Scenario}\left(\frac{lb}{year}\right) = \frac{Substance\ Weight\ \%}{100}\ x\ \boldsymbol{Source\ Emission\ Factor}_{Scenario}\left(\frac{lb}{kgal}\right)\ x\ 1000\ \frac{kgal}{million\ gal}\ x\ \frac{1\ million\ gal}{year}$$

For example:

$$\boldsymbol{Annual\ Emissions}_{Benzene,Loading,Scenario\ 1}\left(\frac{lb}{year}\right) = \frac{0.456745}{100}\ x\ 0.15\ \frac{lb}{kgal}\ x\ 1000\ \frac{kgal}{million\ gal}\ x\ \frac{1}{year} = \ 0.685\ lb/year$$

Tables B1 through B7 show the annual emission inputs for each scenario for one-million-gallon annual throughput by pollutant.

Table B1: Scenario 1 (EVR Phase I and EVR Phase II) - Annual Emissions[1,2]

Substance	Phase I Loading (vapor) (lb/year)	Phase II Breathing (vapor) (lb/year)	Phase II Fueling (vapor) (lb/year)	Phase II Spillage (liquid) (lb/year)	Phase II Hose Permeation (vapor) (lb/year)
Benzene	0.685	0.110	0.406	1.70	0.0411
Ethyl Benzene	0.161	0.0257	0.0951	3.09	0.00964
n-Hexane	2.74	0.438	1.62	4.46	0.164
Naphthalene	0.000667	0.000107	0.000395	0.418	4.00E-05
Propylene (propene)	0.00220	0.000352	0.00130	0.000119	0.000132
Toluene	1.67	0.267	0.989	13.5	0.100
Xylenes	0.614	0.0982	0.364	15.8	0.0368

1. These values were rounded to three significant digits.
2. These emissions values were estimated for one-million-gallon annual throughput.

Table B2. Scenario 2 (EVR Phase I and Pre-EVR Phase II) - Annual Emissions[1,2]

Substance	Phase I Loading (vapor) (lb/year)	Phase II Breathing (vapor) (lb/year)	Phase II Fueling (vapor) (lb/year)	Phase II Spillage (liquid) (lb/year)	Phase II Hose Permeation (vapor) (lb/year)
Benzene	0.685	0.420	2.32	2.97	0.0411
Ethyl Benzene	0.161	0.0985	0.544	5.41	0.00964
n-Hexane	2.74	1.68	9.26	7.80	0.164
Naphthalene	0.000667	0.000409	0.00226	0.731	4.00E-05
Propylene (propene)	0.00220	0.00135	0.00744	0.000209	0.000132
Toluene	1.67	1.02	5.65	23.6	0.100
Xylenes	0.614	0.377	2.08	27.7	0.0368

1. These values were rounded to three significant digits.
2. These emissions values were estimated for one-million-gallon annual throughput.

Table B3. Scenario 3 (EVR Phase I - ORVR Vehicles Only) - Annual Emissions[1,2]

Substance	Phase I Loading (vapor) (lb/year)	Phase II Breathing (vapor) (lb/year)	Phase II Fueling (vapor) (lb/year)	Phase II Spillage (liquid) (lb/year)	Phase II Hose Permeation (vapor) (lb/year)
Benzene	0.685	3.47	1.92	4.31	0.0411
Ethyl Benzene	0.161	0.814	0.450	7.86	0.00964
n-Hexane	2.74	13.9	7.66	11.3	0.164
Naphthalene	0.000667	0.00338	0.00187	1.06	4.00E-05
Propylene (propene)	0.00220	0.0111	0.00616	0.000304	0.000132
Toluene	1.67	8.46	4.68	34.3	0.100
Xylenes	0.614	3.11	1.72	40.2	0.0368

1. These values were rounded to three significant digits.
2. These emissions values were estimated for one-million-gallon annual throughput.

Table B4. Scenario 4 (EVR Phase I) - Annual Emissions[1,2]

Substance	Phase I Loading (vapor) (lb/year)	Phase II Breathing (vapor) (lb/year)	Phase II Fueling (vapor) (lb/year)	Phase II Spillage (liquid) (lb/year)	Phase II Hose Permeation (vapor) (lb/year)
Benzene	0.685	3.47	8.11	4.31	0.0411
Ethyl Benzene	0.161	0.814	1.90	7.86	0.00964
n-Hexane	2.74	13.9	32.4	11.3	0.164
Naphthalene	0.000667	0.00338	0.00790	1.06	4.00E-05
Propylene (propene)	0.0022	0.0111	0.0261	0.000304	0.000132
Toluene	1.67	8.46	19.8	34.3	0.100
Xylenes	0.614	3.11	7.27	40.2	0.0368

1. These values were rounded to three significant digits.
2. These emissions values were estimated for one-million-gallon annual throughput.

Table B5. Scenario 5 (Pre-EVR Phase I and Pre-EVR Phase II) - Annual Emissions[1,2]

Substance	Phase I Loading (vapor) (lb/year)	Phase II Breathing (vapor) (lb/year)	Phase II Fueling (vapor) (lb/year)	Phase II Spillage (liquid) (lb/year)	Phase II Hose Permeation (vapor) (lb/year)
Benzene	1.74	0.420	2.32	2.97	0.0411
Ethyl Benzene	0.407	0.0985	0.544	5.41	0.00964
n-Hexane	6.93	1.68	9.26	7.80	0.164
Naphthalene	0.00169	0.000409	0.00226	0.731	4.00E-05
Propylene (propene)	0.00557	0.00135	0.00744	0.000209	0.000132
Toluene	4.23	1.02	5.65	23.6	0.100
Xylenes	1.56	0.377	2.08	27.7	0.0368

1. These values were rounded to three significant digits.
2. These emissions values were estimated for one-million-gallon annual throughput.

Table B6. Scenario 6 (Pre-EVR Phase I - ORVR Only) - Annual Emissions[1,2]

Substance	Phase I Loading (vapor) (lb/year)	Phase II Breathing (vapor) (lb/year)	Phase II Fueling (vapor) (lb/year)	Phase II Spillage (liquid) (lb/year)	Phase II Hose Permeation (vapor) (lb/year)
Benzene	1.74	3.47	1.92	4.31	0.0411
Ethyl Benzene	0.407	0.814	0.450	7.86	0.00964
n-Hexane	6.93	13.9	7.66	11.3	0.164
Naphthalene	0.00169	0.00338	0.00187	1.06	4.00E-05
Propylene (propene)	0.00557	0.0111	0.00616	0.000304	0.000132
Toluene	4.23	8.46	4.68	34.3	0.100
Xylenes	1.56	3.11	1.72	40.2	0.0368

1. These values were rounded to three significant digits.
2. These emissions values were estimated for one-million-gallon annual throughput.

Table B7. Scenario 7 (Pre-EVR Phase I) - Annual Emissions[1,2]

Substance	Phase I Loading (vapor) (lb/year)	Phase II Breathing (vapor) (lb/year)	Phase II Fueling (vapor) (lb/year)	Phase II Spillage (liquid) (lb/year)	Phase II Hose Permeation (vapor) (lb/year)
Benzene	1.74	3.47	8.11	4.31	0.0411
Ethyl Benzene	0.407	0.814	1.90	7.86	0.00964
n-Hexane	6.93	13.9	32.4	11.3	0.164
Naphthalene	0.00169	0.00338	0.00790	1.06	4.00E-05
Propylene (propene)	0.00557	0.0111	0.0261	0.000304	0.000132
Toluene	4.23	8.46	19.8	34.3	0.100
Xylenes	1.56	3.11	7.27	40.2	0.0368

1. These values were rounded to three significant digits.
2. These emissions values were estimated for one-million-gallon annual throughput.

Appendix C: Maximum Hourly Emissions

To calculate the maximum hourly emissions, maximum hourly bulk transfer volume and maximum hourly dispensing volume are required. The Phase I loading emission factor uses the maximum hourly bulk transfer volume and the Phase II emission factors use the maximum hourly dispensing volume. The summer fuel speciation was used to estimate the maximum hourly emissions since the air toxics content is generally higher and the maximum hourly throughput is expected to occur during summer season.

1. Phase I Loading Operation

The Phase I operation of Loading varies by the bulk transfer volume. A fuel delivery creates the maximum hourly loading emissions. The maximum legal gas delivery volume is a truck pulling two 4,400-gallon tankers. One 8,800-gallon loading event is considered to be the maximum hourly loading delivery for most gas stations.

2. Phase II Dispensing Operations

The Phase II operations of Breathing, Fueling, Spillage, and Hose Permeation vary by dispensing volume. Hourly emission factors are presented per one-thousand-gallon per hour throughput for ease of calculations.

Table 9 of *Section II.B.3* emission factors are applied to summer weight percentages in *Table A3* of *Section IV.A* to calculate maximum hourly emissions for each substance per scenario. Benzene, xylenes, and toluene have acute health values (OEHHA, 2018a). All emission sources use vapor emission substance percentages except spillage, which uses the liquid emission substance percentages.

The calculation for maximum hourly emissions for each substance, source, and scenario is below:

Equation C1. Maximum Hourly Emissions

$$\boldsymbol{Maximum\ Hourly\ Emissions_{Substance,Source,Scenario}\left(\frac{lb}{hour}\right) = \frac{Substance\ Weight\ \%}{100}\ x\ Source\ Emission\ Factor_{Scenario}\left(\frac{lb}{kgal}\right)\ x\ Maximum\ Hourly\ Throughput\left(\frac{kgal}{hour}\right)}$$

For example:

$$\boldsymbol{Maximum\ Hourly\ Emissions_{Benzene,Loading,Scenario\ 1}\left(\frac{lb}{hour}\right) = \frac{0.549442}{100}\ x\ 0.15\ \frac{lb}{kgal}\ x\ 8.8\ \frac{kgal}{hour} = 0.00725\ \frac{lb}{hour}}$$

Tables C1 through C7 show the Phase I EVR maximum hourly pollutant emissions based on 8,800 gallons/hr and Phase II EVR hourly pollutant emissions based on 1,000 gallons/hr. The Phase II emission rates should be scaled by the actual hourly throughputs to estimate acute health impacts.

Table C1. Scenario 1 (EVR Phase I and EVR Phase II) - Maximum Hourly Emissions[1,2]

Substance	Phase I Hourly Emissions (lb/hr)	Phase II Hourly Emissions (lb/hr)			
	Loading	Breathing	Fueling	Spillage	Hose Permeation
Benzene	0.00725	1.32E-4	4.88E-4	1.68E-3	4.94E-5
Toluene	0.0178	3.23E-4	1.20E-3	1.39E-2	1.21E-4
Xylenes	0.00672	1.22E-4	4.52E-4	1.66E-2	4.58E-5

1. These values were rounded to three significant digits.
2. These emissions values were estimated for 8,800 gallons per hour loaded (Phase I) and 1,000 gallons per hour dispensed (Phase II).

Table C2. Scenario 2 (EVR Phase I and Pre-EVR Phase II) - Maximum Hourly Emissions[1,2]

Substance	Phase I Hourly Emissions (lb/hr)	Phase II Hourly Emissions (lb/hr)			
	Loading	Breathing	Fueling	Spillage	Hose Permeation
Benzene	0.00725	5.05E-4	2.79E-3	2.95E-3	4.94E-5
Toluene	0.0178	1.24E-3	6.84E-3	2.44E-2	1.21E-4
Xylenes	0.00672	4.69E-4	2.59E-3	2.90E-2	4.58E-5

1. These values were rounded to three significant digits.
2. These emissions values were estimated for 8,800 gallons per hour loaded (Phase I) and 1,000 gallons per hour dispensed (Phase II).

Table C3. Scenario 3 (EVR Phase I - ORVR Vehicles Only) - Maximum Hourly Emissions[1,2]

Substance	Phase I Hourly Emissions (lb/hr)	Phase II Hourly Emissions (lb/hr)			
	Loading	Breathing	Fueling	Spillage	Hose Permeation
Benzene	0.00725	4.18E-3	2.31E-3	4.28E-3	4.94E-5
Toluene	0.0178	1.02E-2	5.66E-3	3.54E-2	1.21E-4
Xylenes	0.00672	3.87E-3	2.14E-3	4.22E-2	4.58E-5

1. These values were rounded to three significant digits.
2. These emissions values were estimated for 8,800 gallons per hour loaded (Phase I) and 1,000 gallons per hour dispensed (Phase II).

Table C4. Scenario 4 (EVR Phase I) - Maximum Hourly Emissions[1,2]

Substance	Phase I Hourly Emissions (lb/hr)	Phase II Hourly Emissions (lb/hr)			
	Loading	Breathing	Fueling	Spillage	Hose Permeation
Benzene	0.00725	4.18E-3	9.76E-3	4.28E-3	4.94E-5
Toluene	0.0178	1.02E-2	2.39E-2	3.54E-2	1.21E-4
Xylenes	0.00672	3.87E-3	9.05E-3	4.22E-2	4.58E-5

1. These values were rounded to three significant digits.
2. These emissions values were estimated for 8,800 gallons per hour loaded (Phase I) and 1,000 gallons per hour dispensed (Phase II).

Table C5. Scenario 5 (Pre-EVR Phase I and Pre-EVR Phase II) - Maximum Hourly Emissions[1,2]

Substance	Phase I Hourly Emissions (lb/hr)	Phase II Hourly Emissions (lb/hr)			
	Loading	Breathing	Fueling	Spillage	Hose Permeation
Benzene	0.0184	5.05E-4	2.79E-3	2.95E-3	4.94E-5
Toluene	0.0450	1.24E-3	6.84E-3	2.44E-2	1.21E-4
Xylenes	0.0170	4.69E-4	2.59E-3	2.90E-2	4.58E-5

1. These values were rounded to three significant digits.
2. These emissions values were estimated for 8,800 gallons per hour loaded (Phase I) and 1,000 gallons per hour dispensed (Phase II).

Table C6. Scenario 6 (Pre-EVR Phase I - ORVR Only) - Maximum Hourly Emissions[1,2]

Substance	Phase I Hourly Emissions (lb/hr)	Phase II Hourly Emissions (lb/hr)			
	Loading	Breathing	Fueling	Spillage	Hose Permeation
Benzene	0.0184	4.18E-3	2.31E-3	4.28E-3	4.94E-5
Toluene	0.0450	1.02E-2	5.66E-3	3.54E-2	1.21E-4
Xylenes	0.0170	3.87E-3	2.14E-3	4.22E-2	4.58E-5

1. These values were rounded to three significant digits.
2. These emissions values were estimated for 8,800 gallons per hour loaded (Phase I) and 1,000 gallons per hour dispensed (Phase II).

Table C7. Scenario 7 (Pre-EVR Phase I) - Maximum Hourly Emissions[1,2]

Substance	Phase I Hourly Emissions (lb/hr)	Phase II Hourly Emissions (lb/hr)			
	Loading	Breathing	Fueling	Spillage	Hose Permeation
Benzene	0.0184	4.18E-3	9.76E-3	4.28E-3	4.94E-5
Xylenes	0.0170	3.87E-3	9.05E-3	4.22E-2	4.58E-5
Xylenes	0.0170	3.87E-3	9.05E-3	4.22E-2	4.58E-5

1. These values were rounded to three significant digits.
2. These emissions values were estimated for 8,800 gallons per hour loaded (Phase I) and 1,000 gallons per hour dispensed (Phase II).

Appendix D: Summary of Modeling Parameter and Assumptions for a Single Gas Station

The assumptions and modeling parameters used in preparing emissions inventories and risk assessments for individual gas stations are outlined below. Downwind concentrations were determined using the United States Environmental Protection Agency's (U.S. EPA) AERMOD dispersion model. The methodology used to estimate risk are from OEHHA's February 2015 Risk Assessment Guidelines.

1. Operation Schedule

Assumptions:

- Daily emissions are emitted variably on an 85/15 schedule (85 percent between 6 AM to 8 PM and 15 percent between 8 PM and 6 AM). *Table D1* below shows the variable emissions scenario used in the modeling.

Table D1. Variable Emissions Scenario for AERMOD Input File

Hour of Day	Variable Emission Rate (Factor)
6 AM to 8 PM (Hours 6-19)	1.46
8 PM to 6 AM (Hours 1-5 and 20-24)	0.36

- Maximum hourly emissions for loading assume a maximum delivery of 8800 gallons in one hour. The maximum hourly emissions for breathing, fueling, spillage, and hose permeation vary by the throughput of the gas station (see Table 10 in *Section II.B.4.c*.

2. Gas Station Scenarios

Assumptions:

- Only gas stations with underground storage tanks (UST) are included in this update. The implementation of enhanced vapor recovery (EVR) on gas stations with aboveground storage tanks (AST) is still in process. Emission factors for gas stations with ASTs have not been revised. Thus, the emission factors in the 1997 Guidelines should continue to be used for gas stations with ASTs.
- All USTs at gas stations are equipped with submerged fill tubes.
- All gas stations with USTs have pressure/vacuum (P/V) valves on the UST vent.
- All Phase II vapor recovery systems were properly installed using CARB-certified vapor recovery systems.
- Emissions from assist systems are equal to balance systems.

Table D2 (next page) shows the seven gas station configurations, or scenarios, used in the modeling.

Table D2. Current Gas Station Configurations[1]

Scenario Number	Control Equipment
1	EVR Phase I and EVR Phase II
2	EVR Phase I and pre-EVR Phase II
3	EVR Phase I (ORVR Vehicles Only)
4	EVR Phase I
5	Pre-EVR Phase I and pre-EVR Phase II
6	Pre-EVR Phase I (ORVR Vehicles Only)
7	Pre-EVR Phase I

1. Phase II emission factors are based on the volume of fuel dispensed to ORVR and Non-ORVR vehicles at California gas stations.

3. Exposure Parameters

Table D3 and *Table D4* below show the exposure parameters used in the risk assessment modeling.

Table D3. Summary of Exposure Parameters

Risk Scenario	Exposure Duration			Breathing Rate (DBR)	Fraction of Time at Home	Pathway Evaluated
	Days per Year	Hours per Day	Years			
30-year Residential Cancer Risk	350	24	30	RMP (95th percentile DBRs for age bins less than 2 years and 80th percentile DBRs for age bins greater than 2 years)	1 for age bins less than 16 years 0.73 for age bins greater than 16 years	Inhalation Only
25-year Worker Cancer Risk	250	8	25	8-hour moderate intensity BRs	Not applied (All age bins use 1)	

Table D4. Age Bin Exposure Duration Distribution

Risk Scenario	Age Bins					Total
	3rd Trimester	0<2	2<16	16<30	16-70	
30-year Residential Cancer Risk	0.25 years	2 years	14 years	14 years	N/A[1]	30 years
25-year Worker Cancer Risk	N/A	N/A	N/A	N/A	25 years	25 years

1. Not-applicable (N/A)

4. Modeling Parameters

Table D5 through Table D8 show the dispersion modeling parameters used in the risk assessment modeling. *Table D5* below shows general modeling parameters including the AERMOD version and dispersion coefficient information.

Table D5. General Modeling Parameters

Parameter	Value
Dispersion Model	AERMOD 18081
Dispersion Coefficients	Rural: Redding meteorology Urban: San Jose meteorology (population 100,000)
Control Options	Flat Terrain
Building Downwash	Not modeled
Gas Station Throughput	3 million gallons per year
Substances (see Table D7 for emission rates)	Benzene, Ethyl Benzene, Napthalene, n-Hexane, Propylene, Toluene, Xylenes
Gas Station Canopy Dimensions	13 meters x 13 meters x 4 meters
Sources (see and Table D7and Table D8 for source parameters)	Point: Loading, Breathing Volume: Fueling, Hose Permeation, Spillage
Source Locations	All sources located under center of canopy
Gas Station Location	(0,0)

Table D6 below shows the emission rates for each substance and emission source for Scenario 1 (EVR Phase I and EVR Phase II) at a three-million-gallon station.

Table D6. Substance Emission Rates - Scenario 1 (EVR Phase I and EVR Phase II)

Substance	Emission Rates (lb/year)				
	Loading	Breathing	Fueling	Spillage	Hose Permeation
Benzene	2.055353	0.328857	1.21718	5.09278	0.123321207
Ethyl Benzene	0.482003	0.077121	0.285442	9.27236	0.028920195
n-Hexane	8.209773	1.313564	4.861827	13.3661	0.492586353
Naphthalene	0.002002	0.00032	0.001185	1.25271	0.00012
Propylene (propene)	0.006599	0.001056	0.003908	0.000358	0.000395916
Toluene	5.010779	0.801725	2.967383	40.526	0.300646722
Xylenes	1.841993	0.294719	1.090828	47.4507	0.110519559

The substance emission rates were calculated using the annual emission rates for each substance and scenario for a one-million-gallon station found in Table B1 through Table B7 of *Appendix B*. These annual emission rates were multiplied by three to get the emission rate for a three-million-gallon station using the following equation:

Equation D1. Substance Emission Rates for a Three-Million-Gallon Station

$$\textit{Emission Rate}_{Substance,Source,Scenario} = \textit{Annual Emission Rate}_{Substance,Source,Scenario}\left(\frac{lb/year}{million\ gal}\right) x\ 3\ million\ gal$$

The model included two point sources. The two point sources consist of one loading and one breathing source. *Table D7* below shows the parameters for these two sources.

Table D7. Point Sources Parameters

Parameter	Loading	Breathing
Unit Rate Emission Factor (g/s)	1	1
Release Height (m)	3.66	3.66
Temperature (K)	291	289
Stack Diameter (m)	0.0508	0.0508
Exit Velocity (m/s)	0.001	0.001

Table D8 below shows the source parameters for the three volume sources in the gas station model (i.e., fueling, spillage, and hose permeation source).

Table D8. Volume Sources Parameters

Parameter	Fueling	Spillage	Hose Permeation
Height (m)	4	4	4
Width (m)	13	13	13
Length (m)	13	13	13
Sigma y[1] (dimensionless)	3.02	3.02	3.02
Sigma z[2] (dimensionless)	1.86	1.86	1.86
Release Height (m)	1.5	1	1.5

1. Sigma y is defined as the initial lateral dimension (length in meters/4.3).
2. Sigma z is defined as the initial vertical dimension (height in meters/2.15).

Table D9 below shows the parameters for the receptor grid.

Table D9. Receptor Grid Parameters

Parameter	Value
Flagpole Height	1.2 meters
Grid Type	Polar
Initial Ring Distance	10 meters from the edge of the canopy
Additional Ring Distance	10-100 every 10 meters 100-300 every 20 meters 300-500 every 50 meters 500-1,000 every 100 meters
No. of direction radials	72 from 10-90 meters 36 from 100-1,000 meters
Starting radial degree	0
Direction increment (clockwise)	5 degrees from 10-90 meters 10 degrees from 100-1,000 meters

5. Meteorological Data

Table D10 below shows the different meteorological data stations used in the risk assessment modeling. The meteorological data sets were processed with the low wind option (i.e., ADJ_U*) using District or CARB procedures. Site-specific assessments may use other meteorological data provided by the District or CARB, or prepared by a third-party using district-approved methodology.

Table D10. Meteorological Data Parameters

Meteorological Data Station	Period	Average Wind Speed (m/s)	Calms (%)	AERMET Version	Years	Processing Agency
KFAT (Fresno)	24 hours	5.58	1.73	16216	2010-2014	SJVAPCD
	6 AM-8 PM	5.55	1.39			
	8 PM-6 AM	5.62	2.19			
KSJC (San Jose)	24 hours	6.21	1.21	18081	2013-2017	BAAQMD
	6 AM-8 PM	7.16	1.03			
	8 PM-6 AM	4.88	1.46			
KSAN (San Diego)	24 hours	5.46	0.99	16216	2010-2014	SDCAPCD
	6 AM-8 PM	6.51	0.65			
	8 PM-6 AM	3.99	1.46			
KRDD (Redding)	24 hours	5.71	1.16	18081	2013-2017	CARB
	6 AM-8 PM	6.41	1.02			
	8 PM-6 AM	4.73	1.36			
KWJF (Lancaster)	24 hours	10.07	4.37	18081	2013-2017	CARB
	6 AM-8 PM	9.25	2.72			
	8 PM-6 AM	10.66	5.55			
KONT (Ontario)	24 hours	5.60	2.91	16216	2012-2016	SCAQMD
	6 AM-8 PM	6.52	2.12			
	8 PM-6 AM	4.33	4.03			

6. Site-Specific Data Considerations: Variations and Uncertainties

If the screening methodology results identify a significant risk, stakeholders or District staff may want to consider site-specific information when evaluating gas stations. Examples of parameters that may impact the emissions and risks from an individual gas station include:

- Actual locations of pump islands and vent pipes relative to the property lines.
- Use of actual building dimensions and location for applying building downwash effects.
- Use of site-specific meteorological data.

- Use of specific emissions profiles (hours of operation, time of day emissions occur in relation to actual weather data).
- Presence of new or updated health values since this document was published.
- Presence of on-site or off-site sensitive receptors.
- Presence of new routine or predictable emission sources identified by CARB.

Appendix E: Analysis of Building Downwash

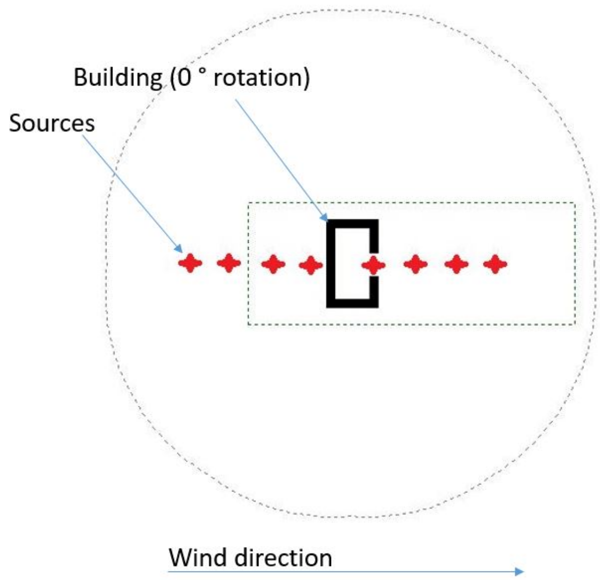
Buildings are typically located within the property of a gas station (e.g., mini mart, carwash, and fast food restaurant). The presence of a building near emission sources of a gas station may expose nearby residents to the effects of building downwash which can potentially enhance their exposure to toxic pollutants. Building downwash occurs due to the entrainment of a plume from a point source in the wake of a building, resulting in the "downwash" of the plume to the ground. This effect can increase the ground-level concentrations downwind of the source. To assess the impacts of building downwash at gas stations, this analysis simulates gas station emissions near a building using the AERMOD air dispersion model. The AERMOD air dispersion modeling results are used to evaluate the effect building downwash has on ground-level concentrations downwind from the building. The results of this analysis may be used to assist with risk management decisions in determining if a site-specific health risk assessment is warranted.

1. Approach

The AERMOD air dispersion model (dated 18081) and meteorological data from six locations (i.e., Fresno, Lancaster, Ontario, Redding, San Diego, and San Jose) are used to perform the analysis. The meteorological data sets are selected to represent a range of meteorological conditions around the state. The source parameters are assumed to be based on a gas station with underground storage tanks and enhanced vapor recovery (EVR) with Phase I and Phase II controls listed in *Table D2* of *Appendix D*.

The magnitude of the effects of building downwash on air dispersion modeling depend on multiple site-specific variables. Building size and orientation, source location and emission parameters, meteorology, and receptor location can all impact the modeling results. To examine how these variables can impact the modeling results, this analysis simulates the source emissions at various distances upwind and downwind from a building positioned in the average wind direction of each meteorological data set. *Figure E1* (next page) shows the modeling schematic for building downwash. The sources are placed in five meter (m) increments upwind and downwind from the building's boundary out to 25 m in both directions. In addition, the source emissions are simulated without a building present to provide a baseline for comparison.

Figure E1. Schematic of Building Downwash Modeling Domain

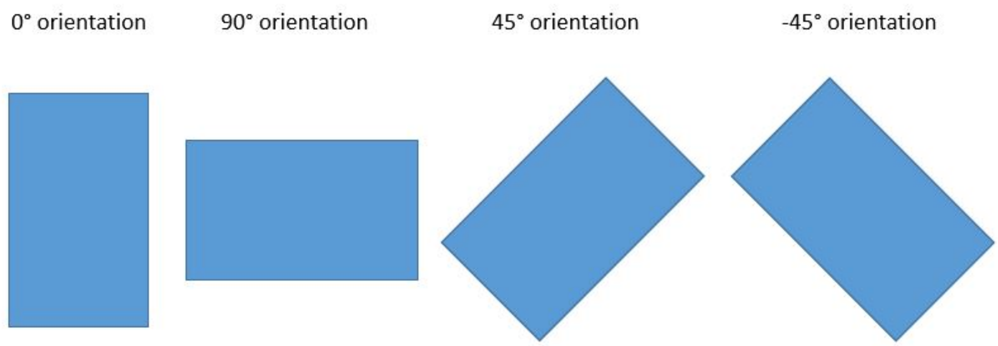


Since buildings can influence air dispersion both upwind and downwind of an emission source, point sources were placed every five meters, both upwind and downwind from the building up to a distance of 25 m in either direction. The 25 m distance is used to confirm that buildings outside the building zone of influence do not have significant building downwash effects. The building zone of influence is defined as five times the shorter of either the building height, or the building width, projected in the direction of the wind. The dotted rectangle in *Figure E1* represents the building zone of influence in the wind direction pictured. The dotted circle in *Figure E1* represents the building zone of influence of all building rotations.

A 10 m long by 5 m wide by 4 m high building is used to be consistent with the building used in the 1997 Guidelines[53]. In addition, due to the variability of a gas station facility layout, the downwash impact from building orientation is examined by rotating the building in 45 degree increments to the sources. *Figure E2* (next page) shows the building orientations used in the building downwash analysis.

53 California Air Pollution Control Officers Association, Air Toxics Hot Spots Program, Gasoline Service Station Industrywide Risk Assessment Guidelines, November 1997, available at: *Guidance Document: 1998-02-27 CAPCOA "Hot Spots" Gasoline Service Station Industrywide Risk Assessment Guidelines*.

Figure E2. Schematic of Building Orientation



The Building Profile Input Program (BPIP) is used for calculating downwash values for input into AERMOD. Since building downwash algorithms do not apply to volume or area sources, only point sources were considered for this analysis. For gas stations, only the pressure vacuum (P/V) vent valve is treated as a point source. Both loading and breathing emissions are emitted from the storage tank P/V vent valve. Loading emissions occur when a fuel tanker truck unloads gas to the USTs at the gas station. Breathing emissions occur due to temperature and pressure changes within the UST vapor space. Since loading and breathing have similar source parameters, one point source is used to represent both the loading and breathing source emissions combined. Variable emission rates are not used.

Cartesian receptor grids are used for this analysis. A 200 m by 70 m refined grid with 5 m spacing is placed downwind from the building starting at the upwind edge of the building. A second coarse grid (340 m by 70 m with 20 m spacing) extended out from the first grid to ensure a grid of sufficient size is used to capture all building downwash effects. Details of the inputs used can be found in the AERMOD input files in *Section IV.E.5* of this appendix.

2. Summary of Modeling Parameters

Table E1 (next page) summarizes the modeling parameters used in this analysis. *Table E2* (next page) summarizes the meteorological data set used in this analysis.

Table E1. Modeling Parameters for Building Downwash Analysis

Modeling Parameters	Values or Description
Dispersion Model	AERMOD 18081
Control Options	Non-Regulatory Defaults, Flat Terrain
Source Type	Point
Dispersion Coefficients	Urban (population 100,000) • Fresno • Ontario • San Jose • San Diego Rural • Redding • Lancaster
Receptor Flagpole Height	1.2 meters
Stack Parameters	• Stack Diameter: 0.0508 meters • Stack Height: 3.66 meters • Stack Exhaust Temperature: 291 K • Stack Exhaust Flow Rate: 0.001 meters/second
Stack Emission Rate	A unit emission rate of 1 gram/second is used and scaled using the actual emission rates.
Time Emission Emitted	24 hours per day, 365 days per year
Building Size	10 meters long x 5 meters wide x 4 meters high
Averaging Output	Period and maximum 1-hour concentrations

Table E2. Meteorological Data

Meteorological Data Station	Average Wind Speed (m/s)	Years	Processing Agency	Angle of Rotation (degrees)
Redding (KRDD)	2.94	2013-2017	CARB	(+) 71
Lancaster (KWJF)	5.18	2013-2017	CARB	(-) 7
Fresno (KFAT)	2.87	2010-2014	SJVAPCD	(+) 48
Ontario (KONT)	2.88	2012-2016	SCAQMD	(-)11
San Jose (KSJC)	3.19	2013-2017	BAAQMD	(+) 15
San Diego (KSAN)	2.81	2010-2014	SDCAPCD	(+) 24

3. Method for Data Analysis

In order to provide a simple screening approach which accounts for the impact from building downwash, each scenario in the analysis is evaluated at each receptor location. To do this, the concentrations affected by downwash are divided by the concentrations without the building present using the AERMOD air dispersion results. Comparing the building downwash concentrations against the no-building downwash concentrations may vary by building orientation and distance between source and receptor. To simplify the many different scenario results, building downwash factors are calculated at each receptor and aggregated by distance in 5 m increments up to 100 m and 10 m increments after 100 m by calculating the distance between the source and receptor and rounding to the nearest increment. For example, if the distance between the source and receptor was 23 m, it would be rounded to 25 m. The respective building downwash factor would then be evaluated at that 25 m distance. At each of these receptor distances, the average building downwash factor are determined. The building downwash factor, or the ratio of the concentrations with a building compared to the value without a building, is shown in *Equation E1*.

Equation E1. Building Downwash Factor

$$\textbf{\textit{Building Downwash Factor}} = \frac{\textbf{\textit{Concentration with Building Downwash}}}{\textbf{\textit{Concentration without Building Downwash}}}$$

Although health risks are not directly calculated in this analysis, the building downwash factors are related to the type of averaging period used from the air dispersion analysis. For building downwash factors calculated using period concentrations, the factors are associated with cancer and chronic risks while maximum one hour concentrations are associated with acute risks. The results of cancer and acute health risk by distance are shown in Appendices G through J.

For the purposes of this Guidance, conservative screening adjustment factors were developed to estimate the effects of building downwash on potential cancer risk and acute HI for different receptor distances. The maximum factors at every receptor distance were used to create distance bins that could then be used to adjust the risk results. *Table E3* below shows the distance bins. These adjustment factors only apply to loading and fueling impacts. Cancer risk and acute HI have slightly different distance bins.

Table E3. Maximum Factors by Distance

Cancer Risk		Acute HI	
Distance (meters)	**Factor**	**Distance (meters)**	**Factor**
0 - 50	2.2	0 - 60	5.6
>50 - 100	1.9	>60 - 150	6.5
>100 - 200	1.7	>150 - 200	5.1
>200 - 300	1.2	>200 - 300	2.5
>300	1.0	>300	1.0

Table E4 (next page) shows the source contribution of loading and breathing to the cancer risk and acute HI.

Table E4. Percent Contribution to Risk from Loading and Breathing[1,2]

Control Scenario	Cancer Risk Contribution[1]	Acute HI Contribution[2]
Scenario 1	20.6%	70.4%
Scenario 2	32.5%	49.7%
Scenario 3	13.6%	55.6%
Scenario 4	21.5%	38.0%
Scenario 5	23.5%	70.6%
Scenario 6	37.6%	71.1%
Scenario 7	25.5%	54.7%

1. Control scenarios are the same as those defined in the industrywide guidance.
2. Contributions based on averages across all meteorological data sets.

To calculate the building downwash adjustment factor for total cancer risk or acute HI impacted by building downwash, the maximum factors for each distance bin were multiplied by the source contribution of loading and breathing to overall cancer risk or acute HI. This is shown using the following equations below. *Equation E2* is used to calculate the building downwash adjustment factor. Total cancer risk is represented by a value of one. *Equation E3* is used to calculate the percent increase of total risk from the building downwash adjustment.

Equation E2. Building Downwash Adjustment

$$\boldsymbol{Y = (1 - C) * X + (C * F * X)}$$

Where:

$X = Cancer\ risk\ without\ building\ downwash$
$Y = Building\ downwash\ adjusted\ cancer\ risk$
$C = Risk\ contribution\ from\ Loading\ and\ Breathing$ (*Table E4*)
$F = Max\ factor\ for\ cancer\ risk$ (*Table E3*)

Equation E3. Building Downwash Percent Increase

$$\%\ \boldsymbol{Increase = Final\ Building\ Downwash\ Factor = \frac{Y - X}{X}}$$

Where:

$X = Cancer\ risk\ without\ building\ downwash\ (from\ Appendix\ G\ or\ H)$
$Y = Building\ downwash\ adjusted\ cancer\ risk\ (Equation\ E2)$

For example, if a receptor at a distance between 0 and 50 m is operating under control scenario 1, the building downwash adjustment factor of 1.25, found in *Table E5* below, would be calculated by the following:

$$\boldsymbol{Y = (1 - C) * X + (C * F * X) = (1 - 0.206)X + (0.206 * 2.2 * X) = 1.25X}$$

$F = Max\ factor\ for\ cancer\ risk\ at\ 0\ to\ 50\ m\ = 2.2$ (*Table E3*)
$C = Risk\ contribution\ from\ Loading\ and\ Breathing\ for\ Scenario\ 1 = 0.206$ (*Table E4*)

$$\% \, Increase = Final \, Building \, Downwash \, Factor = \frac{Y - X}{X} = \frac{1.25X - X}{X} = 25\%$$

$\mathbf{25\% \, increase \, is \, equivalent \, to \, a \, building \, downwash \, factor \, of \, 1.25}$ (*Table E5*)

For the building configuration used in this analysis, *Table E5* and *Table E6* below show the final building downwash multipliers, based on Equation E2 and E3, which should be used to adjust the risk results calculated in the guidance document for building downwash considerations. These factors have also been integrated into the spreadsheet tool.

Table E5. Building Downwash Adjustment Factors for Cancer Risk

Receptor Distance[2]	Scenario[1] 1	Scenario[1] 2	Scenario[1] 3	Scenario[1] 4	Scenario[1] 5	Scenario[1] 6	Scenario[1] 7
0 m - 50 m	1.25	1.40	1.15	1.25	1.30	1.45	1.30
>50 m - 100 m	1.20	1.30	1.10	1.20	1.20	1.35	1.25
>100 m - 200 m	1.15	1.25	1.10	1.15	1.15	1.25	1.20
>200 m - 300 m	1.05	1.05	1.05	1.05	1.05	1.10	1.05
>300 m	1.00	1.00	1.00	1.00	1.00	1.00	1.00

1. A list of the gas station control scenarios used in the Guidance can be found in *Section II.A.7*.
2. Receptors are located up to 1000 m from the emission source. Receptors are placed in five-meter increments from 20 m to 100 m and 10 m increments from 100 m to 1000 m.

Table E6. Building Downwash Adjustment Factors for Acute Health Impacts

Receptor Distance[2]	Scenario[1] 1	Scenario[1] 2	Scenario[1] 3	Scenario[1] 4	Scenario[1] 5	Scenario[1] 6	Scenario[1] 7
0 m - 60 m	4.25	3.30	3.55	2.75	4.25	4.25	3.50
>60 m - 150 m	4.85	2.73	3.06	2.09	3.88	3.91	3.01
>150 m - 200 m	3.90	3.05	3.30	2.55	3.90	3.90	3.25
>200 m - 300 m	2.05	1.75	1.85	1.55	2.05	2.05	1.80
>300 m	1.00	1.00	1.00	1.00	1.00	1.00	1.00

1. A list of the gas station control scenarios used in the Guidance can be found in *Section II.A.7*.
2. Receptors are located up to 1000 m from the emission source. Receptors are placed in five-meter increments from 20 m to 100 m and 10 m increments from 100 m to 1000 m.

For screening purposes, the building downwash adjustment factors in *Table E5* and *Table E6* must be combined with the cancer risk and noncancer health impact values to determine building downwash values at individual gas stations. Building downwash values can be generated using the spreadsheet tools available at: *Gasoline Service Station Industrywide Risk Assessment Guidance | California Air Resources Board*.

Equation E4. Facility Cancer Risk with Building Downwash

$$\textit{Facility Cancer Risk}_{\textit{Building Downwash}} = \textit{Cancer Risk from Appendix H or I (chances per million)} \; x \; \left(\frac{\textit{Annual Throughput}}{\textit{1 million gal}}\right) x \; \textit{Adjustment Factor from}$$ *Table E5*

Equation E5. Facility Loading Acute Hazard Index with Building Downwash

$$\textit{Facility Hazard Index}_{\textit{Building Downwash}} = \textit{Acute Hazard Index from Appendix J or K} \; x \; \left(\frac{\textit{Hourly Loading Throughput}}{\textit{8800 gal}}\right) x \; \textit{Adjustment Factor from}$$ *Table E6*

Equation E6. Facility Dispensing Acute Hazard Index with Building Downwash

$$\textit{Facility Hazard Index}_{\textit{Building Downwash}} = \textit{Hazard Index from Appendix J or K (chances per million)} \; x \; \left(\frac{\textit{Hourly Dispensing Throughput}}{\textit{1000 gal}}\right) x \; \textit{Adjustment Factor from}$$ *Table E6*

4. Results

The results of the building downwash analysis show that the magnitude of the effects of building downwash on dispersion modeling depend on multiple site-specific variables. Building size and orientation, source location and emission parameters, meteorology, and receptor location can all impact the modeling results. Therefore, stakeholders or District staff should consider site-specific information when evaluating effects of building downwash at gas stations.

Using building downwash in the screening analysis should be considered on a case-by-case basis for each station under review. The building downwash adjustments provided in *Section IV.E.3* above are only applicable to a limited range of gas station configurations. This building size and shape is commonly found at gas stations; however, many other size and shape combinations exist. If the gas station under review has a significantly different building size or shape, a site-specific analysis is recommended to account for building downwash effects.

Pressure vacuum (P/V) vent valve location should also be considered when deciding whether to include building downwash in the analysis. Based on AERMOD and BPIP, if the P/V valve is further away than five times the smallest building dimension, building downwash will not have any impact on the dispersion. For example, in the scenarios modeled for this analysis, the smallest building dimension was the height of 4 m, and when the point source was located at a distance greater than 20 meters (4 m x 5) from the building (up or downwind) no effects were seen.

Building downwash used in the screening analysis may generate high-risk results which may warrant further refinements using a site-specific risk assessment. However, if the risk is below District risk thresholds, further evaluation is likely not required. If risk results generated exceed screening risk values, a site-specific risk assessment should be conducted to account for site-specific conditions.

Figure E3 through *Figure E6* on the following pages illustrate the variation that building downwash effects can have depending on the various site-specific variables (e.g., building orientation, meteorology, receptor location, etc.). A factor of 1.0 indicates that no noticeable impact was observed. *Figure E3* (next page) shows all the factors for cancer risk and demonstrates that there is no discernable pattern between building downwash scenarios, except that the ratios eventually converge at a distance of approximately 300 m. *Figure E4* shows the maximum cancer risk factors for all the scenarios at every receptor distance. *Figure E5* shows all the factors for acute HI and demonstrates that there is no discernable pattern between building downwash scenarios. *Figure E6* shows the maximum acute HI factors for all the scenarios at every receptor distance.

Figure E3. Building vs. No Building Effects for Annual Average Concentrations (All Building Scenarios)

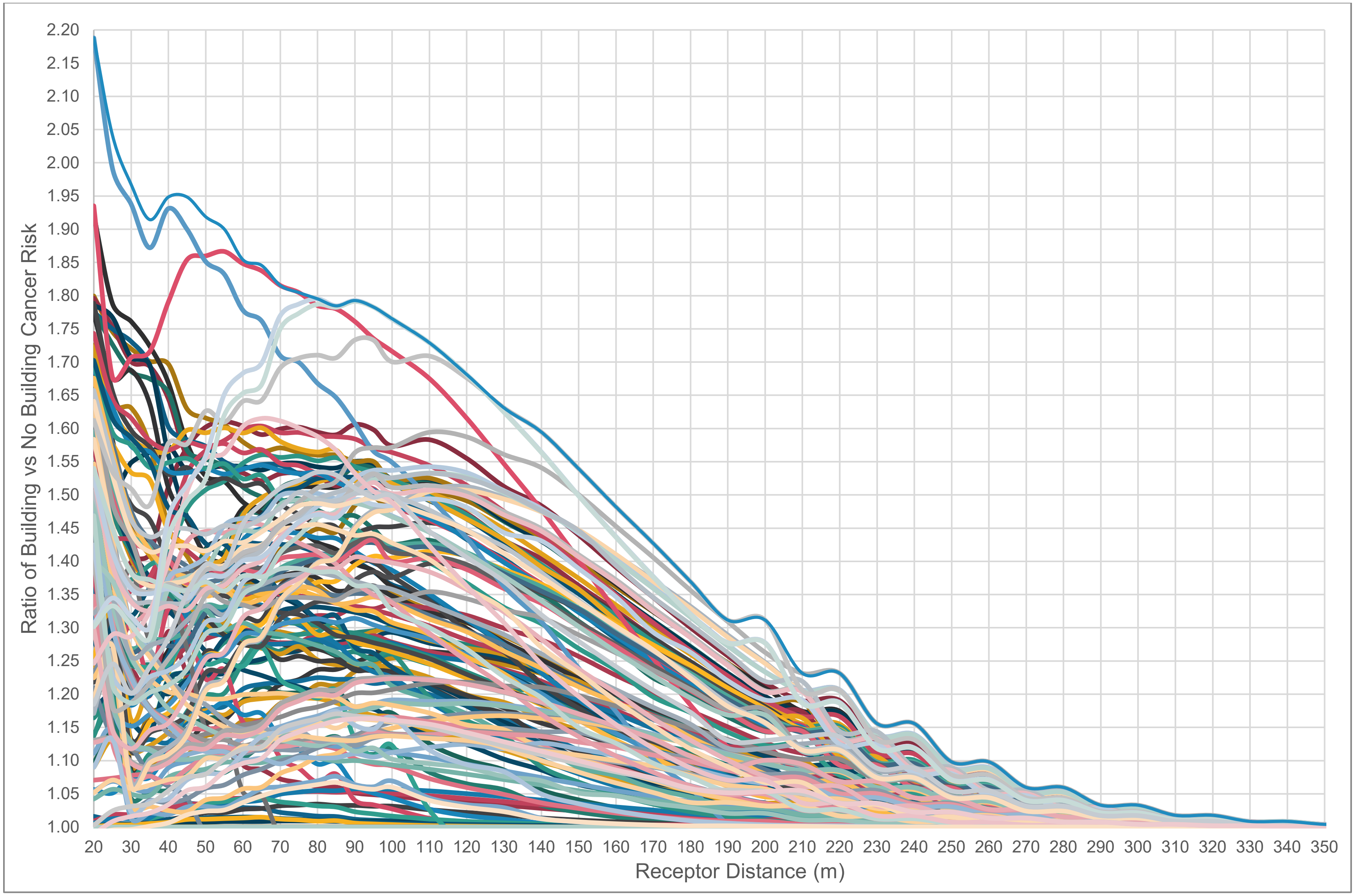


Figure E4. Building vs. No Building Effects for Annual Average Concentrations (Maximum Values)

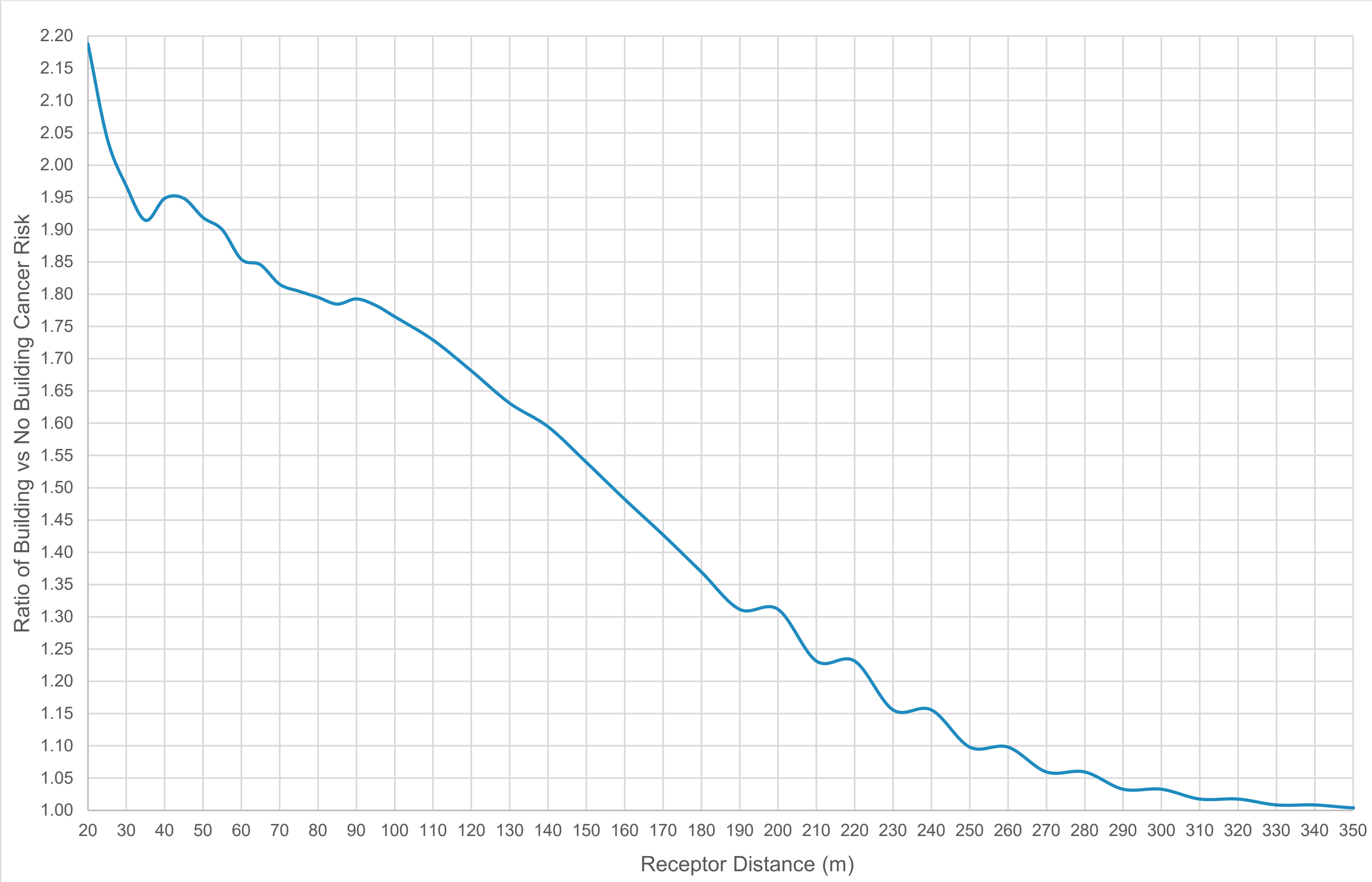


Figure E5. Building vs. No Building Effects for Maximum 1-Hour Concentrations (All Building Scenarios)

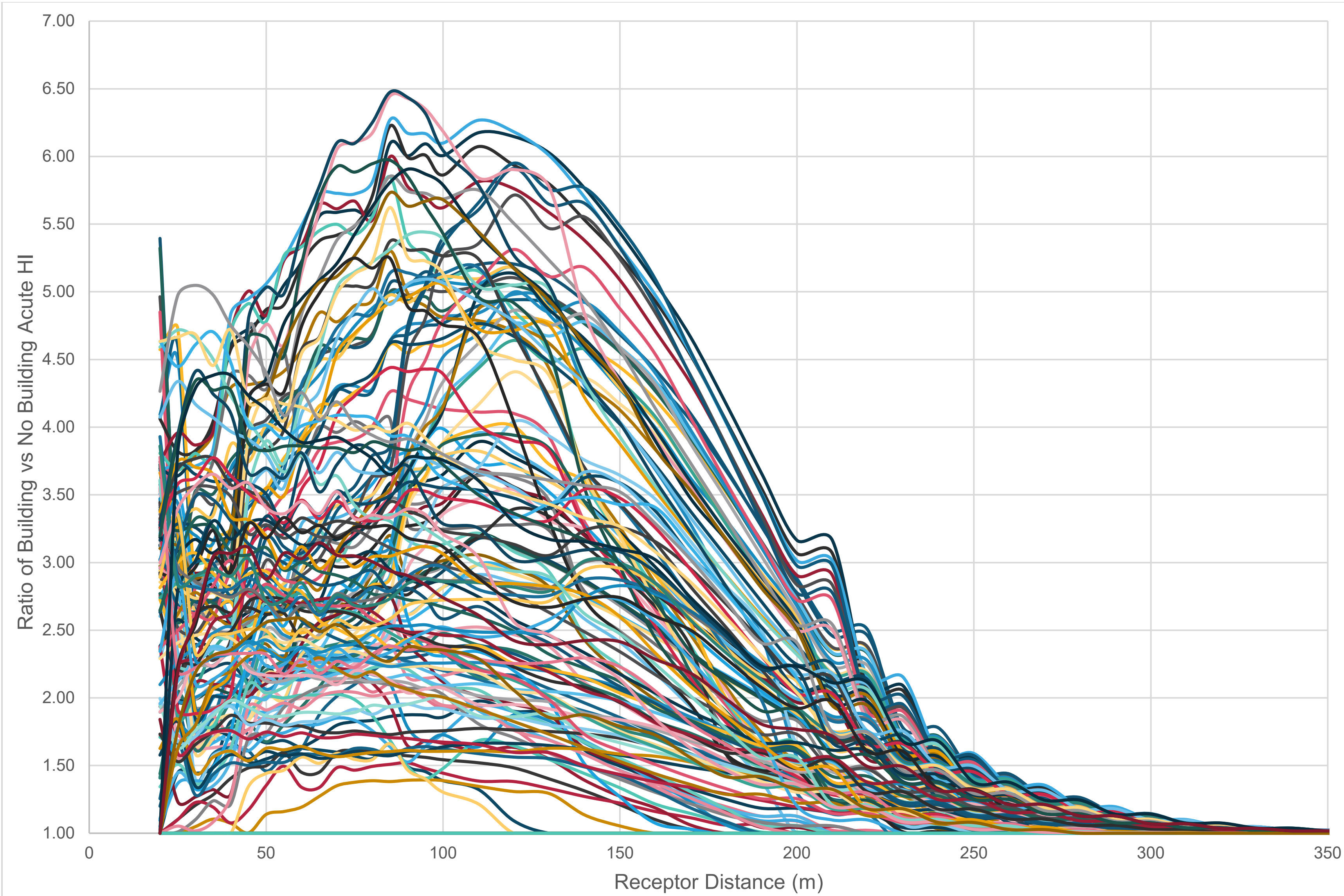
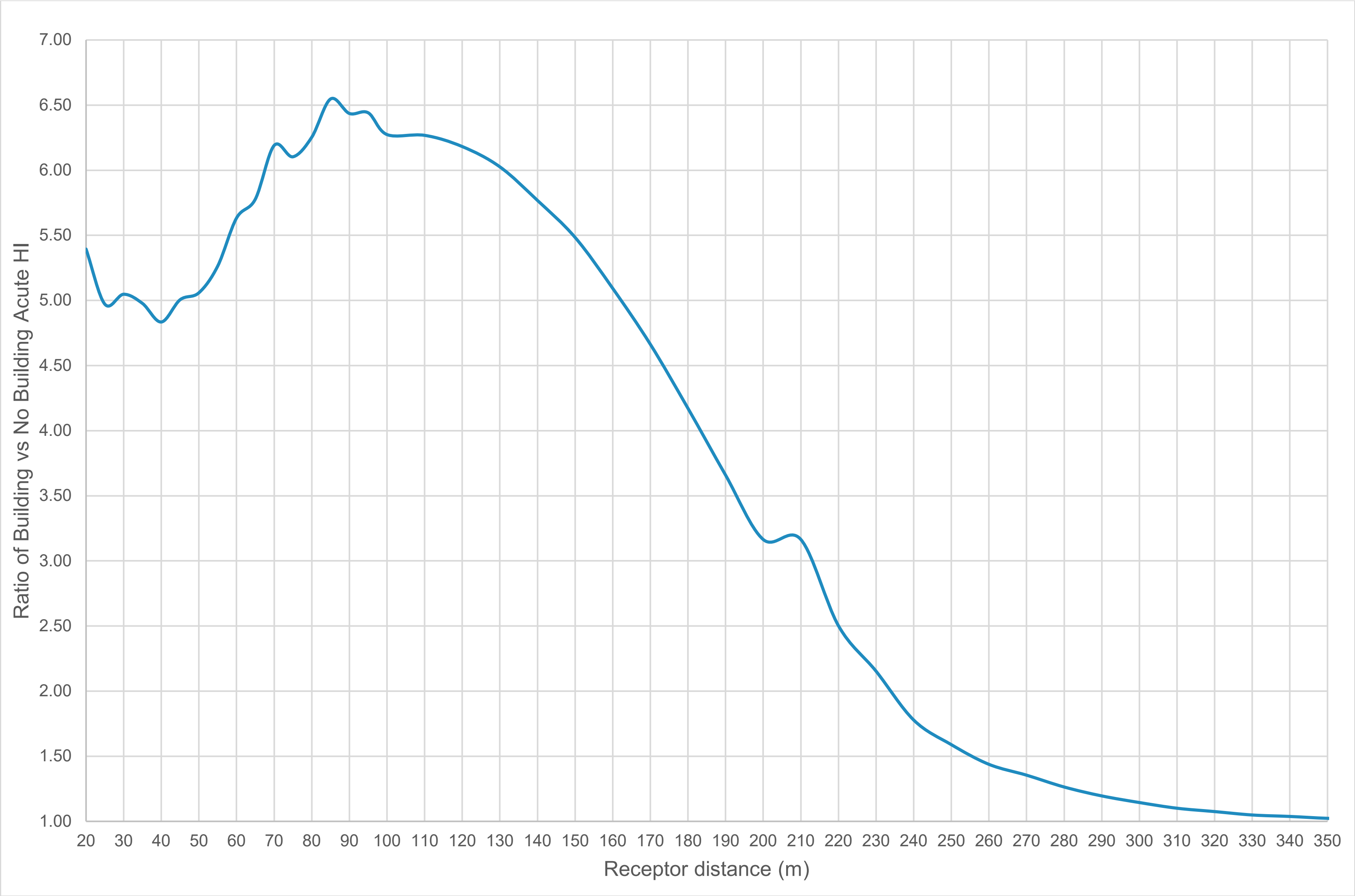


Figure E6. Building vs. No Building Effects for Maximum 1-Hour Concentrations (Maximum Values)



The maximum observed factor from building downwash for cancer risk is 2.2 (at 20 meters with Ontario meteorological data). The maximum observed factor for acute HI is 6.55 (at 85 meters with Ontario meteorological data). Table E7 through Table E18 show the maximum factors for various meteorological data and building orientations for both potential cancer risk and acute HI.

a) Building Downwash Tables for Cancer and Chronic Health Impacts

Table E7. Building Downwash Maximum Factors for Cancer Risk (Redding)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	1.17 @ 85 m
	90°	No impact
	45°	1.51 @ 120 m
	-45°	1.51 @ 120 m
Upwind 5 m	0°	1.59 @ 110 m
	90°	1.41 @ 90 m
	45°	1.54 @ 110 m
	-45°	1.53 @ 110 m
Upwind 0 m	0°	1.53 @ 110 m
	90°	1.58 @ 20 m
	45°	1.53 @ 20 m
	-45°	1.53 @ 20 m
Downwind 5 m	0°	1.53 @ 20 m
	90°	1.54 @ 20 m
	45°	1.66 @ 20 m
	-45°	1.64 @ 20 m
Downwind 10 m	0°	1.76 @ 90 m
	90°	1.62 @ 65 m
	45°	1.80 @ 80 m
	-45°	1.79 @ 90 m
Downwind 15 m	0°	1.53 @ 80 m
	90°	1.07 @ 85 m
	45°	1.17 @ 85 m
	-45°	1.16 @ 90 m
Downwind 20 m	All rotations	No impact
Downwind 25 m	All rotations	No impact

Table E8. Building Downwash Maximum Factors for Cancer Risk (Lancaster)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
wind 10 m	0°	1.14 @ 25 m
	90°	No impact
	45°	1.27 @ 25 m
	-45°	1.25 @ 25 m
Upwind 5 m	0°	1.43 @ 20 m
	90°	1.35 @ 20 m
	45°	1.46 @ 20 m
	-45°	1.47 @ 20 m
Upwind 0 m	0°	1.48 @ 20 m
	90°	1.55 @ 20 m
	45°	1.51 @ 20 m
	-45°	1.50 @ 20 m
Downwind 5 m	0°	1.49 @ 20 m
	90°	1.50 @ 20 m
	45°	1.62 @ 20 m
	-45°	1.63 @ 20 m
Downwind 10 m	0°	1.65 @ 20 m
	90°	1.46 @ 60 m
	45°	1.50 @ 75 m
	-45°	1.49 @ 80 m
Downwind 15 m	0°	1.38 @ 80 m
	90°	1.16 @ 90 m
	45°	1.23 @ 100 m
	-45°	1.22 @ 100 m
Downwind 20 m	0°	1.25 @ 95 m
	90°	1.07 @ 110 m
	45°	1.17 @ 100 m
	-45°	1.17 @ 100 m
Downwind 25 m	All rotations	No impact

Table E9. Building Downwash Maximum Factors for Cancer Risk (Fresno)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	1.31 @ 85 m
	90°	No impact
	45°	1.53 @ 85 m
	-45°	1.46 @ 110 m
Upwind 5 m	0°	1.60 @ 65 m
	90°	1.45 @ 65 m
	45°	1.56 @ 65 m
	-45°	1.53 @ 90 m
Upwind 0 m	0°	1.70 @ 20 m
	90°	1.79 @ 20 m
	45°	1.74 @ 20 m
	-45°	1.69 @ 20 m
Downwind 5 m	0°	1.70 @ 20 m
	90°	1.70 @ 20 m
	45°	1.63 @ 20 m
	-45°	1.63 @ 20 m
Downwind 10 m	0°	1.38 @ 20 m
	90°	1.19 @ 55 m
	45°	No impact
	-45°	No impact
Downwind 15 m	All rotations	No impact
Downwind 20 m	All rotations	No impact
Downwind 25 m	All rotations	No impact

Table E10. Building Downwash Maximum Factors for Cancer Risk (Ontario)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	0°	1.15 @ 20 m
	90°	No impact
	45°	No impact
	-45°	No impact
Upwind 10 m	0°	1.40 @ 20 m
	90°	No impact
	45°	1.41 @ 110 m
	-45°	1.40 @ 110 m
Upwind 5 m	0°	1.94 @ 20 m
	90°	1.31 @ 20 m
	45°	1.53 @ 20 m
	-45°	1.47 @ 20 m
Upwind 0 m	0°	2.18 @ 20 m
	90°	1.62 @ 20 m
	45°	1.60 @ 20 m
	-45°	1.57 @ 20 m
Downwind 5 m	0°	2.19 @ 20 m
	90°	1.60 @ 20 m
	45°	1.67 @ 20 m
	-45°	1.68 @ 20 m
Downwind 10 m	0°	1.52 @ 55 m
	90°	1.15 @ 75 m
	45°	1.13 @ 75 m
	-45°	1.10 @ 20 m
Downwind 15 m	0°	1.21 @ 20 m
	90°	No impact
	45°	No impact
	-45°	No impact
Downwind 20 m	0°	1.20 @ 95 m
	90°	No impact
	45°	No impact
	-45°	No impact
Downwind 25 m	All rotations	No impact

Table E11. Building Downwash Maximum Factors for Cancer Risk (San Jose)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	1.17 @ 25 m
	90°	No impact
	45°	1.28 @ 25 m
	-45°	1.31 @ 25 m
Upwind 5 m	0°	1.51 @ 20 m
	90°	1.37 @ 90 m
	45°	1.51 @ 20 m
	-45°	1.54 @ 20 m
Upwind 0 m	0°	1.64 @ 20 m
	90°	1.69 @ 20 m
	45°	1.64 @ 20 m
	-45°	1.67 @ 20 m
Downwind 5 m	0°	1.65 @ 20 m
	90°	1.64 @ 20 m
	45°	1.72 @ 20 m
	-45°	1.70 @ 20 m
Downwind 10 m	0°	1.57 @ 20 m
	90°	1.33 @ 60 m
	45°	1.31 @ 75 m
	-45°	1.20 @ 80 m
Downwind 15 m	0°	1.20 @ 70 m
	90°	No impact
	45°	No impact
	-45°	No impact
Downwind 20 m	All rotations	No impact
Downwind 25 m	All rotations	No impact

Table E12. Building Downwash Maximum Factors for Cancer Risk (San Diego)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	1.21 @ 85 m
	90°	No impact
	45°	1.50 @ 85 m
	-45°	1.53 @ 110 m
Upwind 5 m	0°	1.61 @ 65 m
	90°	1.43 @ 65 m
	45°	1.54 @ 65 m
	-45°	1.72 @ 90 m
Upwind 0 m	0°	1.80 @ 20 m
	90°	1.92 @ 20 m
	45°	1.80 @ 20 m
	-45°	1.85 @ 20 m
Downwind 5 m	0°	1.78 @ 20 m
	90°	1.79 @ 20 m
	45°	1.73 @ 20 m
	-45°	1.77 @ 20 m
Downwind 10 m	0°	1.29 @ 20 m
	90°	No impact
	45°	No impact
	-45°	No impact
Downwind 15 m	All rotations	No impact
Downwind 20 m	All rotations	No impact
Downwind 25 m	All rotations	No impact

b) Building Downwash Tables for Acute Health Impacts

Table E13. Building Downwash Maximum Factors for Acute Health Impacts (Redding)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	2.90 @ 25 m
	90°	No impact
	45°	3.44 @ 25 m
	-45°	3.35 @ 25 m
Upwind 5 m	0°	3.36 @ 20 m
	90°	3.78 @ 20 m
	45°	3.93 @ 20 m
	-45°	3.86 @ 20 m
Upwind 0 m	0°	3.72 @ 25 m
	90°	3.75 @ 25 m
	45°	3.77 @ 30 m
	-45°	3.77 @ 35 m
Downwind 5 m	0°	4.34 @ 25 m
	90°	4.72 @ 25 m
	45°	4.70 @ 35 m
	-45°	4.72 @ 40 m
Downwind 10 m	0°	5.05 @ 30 m
	90°	3.65 @ 35 m
	45°	4.41 @ 30 m
	-45°	4.34 @ 30 m
Downwind 15 m	0°	4.38 @ 40 m
	90°	2.59 @ 60 m
	45°	3.33 @ 55 m
	-45°	3.15 @ 65 m
Downwind 20 m	0°	3.23 @ 50 m
	90°	No impact
	45°	2.96 @ 70 m
	-45°	2.70 @ 70 m
Downwind 25 m	All rotations	No impact

Table E14. Building Downwash Maximum Factors for Acute Health Impacts (Lancaster)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	1.66 @ 25 m
	90°	No impact
	45°	1.83 @ 25 m
	-45°	1.84 @ 25 m
Upwind 5 m	0°	1.87 @ 40 m
	90°	2.38 @ 20 m
	45°	2.00 @ 20 m
	-45°	2.01 @ 100 m
Upwind 0 m	0°	2.38 @ 35 m
	90°	2.47 @ 35 m
	45°	2.33 @ 40 m
	-45°	2.35 @ 40 m
Downwind 5 m	0°	2.52 @ 40 m
	90°	2.91 @ 35 m
	45°	3.02 @ 20 m
	-45°	3.07 @ 30 m
Downwind 10 m	0°	3.06 @ 30 m
	90°	3.01 @ 40 m
	45°	3.49 @ 30 m
	-45°	3.32 @ 30 m
Downwind 15 m	0°	3.31 @ 50 m
	90°	2.35 @ 50 m
	45°	2.75 @ 50 m
	-45°	2.79 @ 45 m
Downwind 20 m	0°	2.78 @ 50 m
	90°	1.95 @ 50 m
	45°	2.44 @ 50 m
	-45°	2.55 @ 65 m
Downwind 25 m	All rotations	No impact

Table E15. Building Downwash Maximum Factors for Acute Health Impacts (Fresno)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	4.04 @ 120 m
	90°	No impact
	45°	4.78 @ 140 m
	-45°	4.41 @ 120 m
Upwind 5 m	0°	4.86 @ 120 m
	90°	3.56 @ 20 m
	45°	5.00 @ 120 m
	-45°	4.64 @ 120 m
Upwind 0 m	0°	5.95 @ 120 m
	90°	4.01 @ 120 m
	45°	5.71 @ 120 m
	-45°	5.31 @ 120 m
Downwind 5 m	0°	5.91 @ 120 m
	90°	3.94 @ 120 m
	45°	5.14 @ 120 m
	-45°	4.87 @ 110 m
Downwind 10 m	0°	3.39 @ 120 m
	90°	2.22 @ 70 m
	45°	1.94 @ 110 m
	-45°	2.03 @ 70 m
Downwind 15 m	0°	2.19 @ 75 m
	90°	No impact
	45°	No impact
	-45°	No impact
Downwind 20 m	All rotations	No impact
Downwind 25 m	All rotations	No impact

Table E16. Building Downwash Maximum Factors for Acute Health Impacts (Ontario)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	5.18 @ 110 m
	90°	No impact
	45°	4.77 @ 110 m
	-45°	5.05 @ 100 m
Upwind 5 m	0°	5.37 @ 85 m
	90°	4.44 @ 85 m
	45°	5.09 @ 95 m
	-45°	5.44 @ 95 m
Upwind 0 m	0°	6.55 @ 85 m
	90°	5.62 @ 85 m
	45°	5.85 @ 85 m
	-45°	6.45 @ 85 m
Downwind 5 m	0°	6.47 @ 85 m
	90°	5.97 @ 85 m
	45°	5.91 @ 90 m
	-45°	5.73 @ 85 m
Downwind 10 m	0°	5.25 @ 75 m
	90°	2.75 @ 85 m
	45°	2.27 @ 75 m
	-45°	2.24 @ 85 m
Downwind 15 m	0°	3.15 @ 85 m
	90°	1.66 @ 85 m
	45°	2.12 @ 80 m
	-45°	2.05 @ 90 m
Downwind 20 m	All rotations	No impact
Downwind 25 m	All rotations	No impact

Table E17. Building Downwash Maximum Factors for Acute Health Impacts (San Jose)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	2.97 @ 25 m
	90°	No impact
	45°	2.99 @ 110 m
	-45°	3.15 @ 25 m
Upwind 5 m	0°	3.24 @ 20 m
	90°	3.33 @ 20 m
	45°	3.55 @ 20 m
	-45°	3.73 @ 20 m
Upwind 0 m	0°	3.89 @ 110 m
	90°	3.20 @ 85 m
	45°	3.65 @ 110 m
	-45°	3.68 @ 110 m
Downwind 5 m	0°	3.96 @ 110 m
	90°	3.61 @ 20 m
	45°	3.99 @ 100 m
	-45°	3.82 @ 110 m
Downwind 10 m	0°	3.64 @ 110 m
	90°	2.38 @ 85 m
	45°	2.35 @ 100 m
	-45°	2.48 @ 100 m
Downwind 15 m	0°	1.98 @ 110 m
	90°	1.39 @ 95 m
	45°	1.61 @ 75 m
	-45°	1.52 @ 90 m
Downwind 20 m	0°	1.63 @ 75 m
	90°	1.17 @ 60 m
	45°	1.37 @ 85 m
	-45°	1.43 @ 85 m
Downwind 25 m	All rotations	No impact

Table E18. Building Downwash Maximum Factors for Acute Health Impacts (San Diego)

Source Location and Distance From Building	Building Orientation	Maximum Factor Value and Receptor Distance
Upwind 25 m	All Rotations	No impact
Upwind 20 m	All Rotations	No impact
Upwind 15 m	All Rotations	No impact
Upwind 10 m	0°	4.98 @ 120 m
	90°	No impact
	45°	4.94 @ 120 m
	-45°	4.81 @ 120 m
Upwind 5 m	0°	5.10 @ 120 m
	90°	4.85 @ 20 m
	45°	5.39 @ 20 m
	-45°	5.32 @ 20 m
Upwind 0 m	0°	6.18 @ 110 m
	90°	5.30 @ 85 m
	45°	6.22 @ 85 m
	-45°	6.00 @ 85 m
Downwind 5 m	0°	6.27 @ 85 m
	90°	5.85 @ 85 m
	45°	5.18 @ 120 m
	-45°	5.18 @ 120 m
Downwind 10 m	0°	4.56 @ 55 m
	90°	2.27 @ 45 m
	45°	2.32 @ 75 m
	-45°	2.42 @ 75 m
Downwind 15 m	0°	1.82 @ 40 m
	90°	No impact
	45°	No impact
	-45°	No impact
Downwind 20 m	All rotations	No impact
Downwind 25 m	All rotations	No impact

c) Zone of Impact Tables

Building downwash zone of impact is defined as the distance after which there is no noticeable impact from the building. The zone of impact varied, depending on downwash scenario, from 120 m to 330 m for acute HI and from 35 m to 270 m for cancer risk. *Table E19* and *Table E20* on the following pages show the zone of impact distance for each met, building orientation, and source location.

Table E19. Zone of Impact for Cancer Risk

Source Location and Distance From Building	Building Orientation	Red	Lan	Fres	Ont	SJ	SD
Upwind 25	All rotations	No impacts					
Upwind 20	All rotations	No impacts					
Upwind 15	0°	NA	NA	NA	35	NA	NA
	90°	NA	NA	NA	NA	NA	NA
	45°	NA	NA	NA	NA	NA	NA
	-45°	NA	NA	NA	NA	NA	NA
Upwind 10	0°	140	110	160	110	140	150
	90°	NA	NA	NA	NA	NA	NA
	45°	290	250	270	270	250	270
	-45°	290	250	270	270	250	270
Upwind 5	0°	290	250	270	210	250	270
	90°	230	190	210	NA	190	230
	45°	290	250	270	270	250	270
	-45°	290	250	270	270	250	270
Upwind 0	0°	280	240	260	200	240	260
	90°	220	190	200	200	190	220
	45°	280	240	260	260	240	260
	-45°	280	240	260	260	240	260
Downwind 5	0°	260	220	240	190	220	260
	90°	210	160	180	180	170	190
	45°	250	210	230	230	210	250
	-45°	250	210	230	230	210	230
Downwind 10	0°	270	250	90	65	230	95
	90°	210	190	100	130	170	NA
	45°	270	250	NA	170	230	NA
	-45°	270	250	NA	160	230	NA
Downwind 15	0°	270	270	NA	45	180	130
	90°	110	180	NA	NA	NA	NA
	45°	210	240	NA	NA	NA	NA
	-45°	220	240	NA	NA	NA	NA
Downwind 20	0°	NA	220	NA	40	NA	NA
	90°	NA	150	NA	NA	NA	NA
	45°	NA	220	NA	NA	NA	NA
	-45°	NA	220	NA	NA	NA	NA
Downwind 25	All rotations	No impact					

1. NA means that there is no impact at any distance for this source location and building orientation.

Table E20. Zone of Impact for Acute Health Impacts (meters)[1]

Source Location and Distance From Building	Building Orientation	Red	Lan	Fres	Ont	SJ	SD
Upwind 25	All rotations	No impacts					
Upwind 20	All rotations	No impacts					
Upwind 15	0°	NA	NA	NA	170	NA	NA
	90°	NA	NA	NA	NA	NA	NA
	45°	NA	NA	NA	NA	NA	NA
	-45°	NA	NA	NA	NA	NA	NA
Upwind 10	0°	230	190	250	230	200	230
	90°	NA	NA	NA	NA	NA	NA
	45°	330	290	330	330	310	330
	-45°	330	310	330	330	310	330
Upwind 5	0°	330	310	330	270	310	330
	90°	270	270	270	270	250	270
	45°	330	290	330	330	310	330
	-45°	330	310	330	330	310	330
Upwind 0	0°	320	300	320	280	320	320
	90°	260	260	260	260	240	280
	45°	320	300	320	320	300	320
	-45°	320	300	320	320	300	320
Downwind 5	0°	320	320	320	280	320	320
	90°	270	250	270	250	250	270
	45°	330	290	310	310	310	330
	-45°	330	310	310	310	310	310
Downwind 10	0°	310	310	230	230	270	250
	90°	250	250	180	190	210	210
	45°	310	290	210	210	250	250
	-45°	310	310	190	210	250	250
Downwind 15	0°	330	330	190	170	230	130
	90°	260	260	NA	120	160	NA
	45°	320	300	NA	220	170	NA
	-45°	320	320	NA	190	220	NA
Downwind 20	0°	280	280	NA	170	160	NA
	90°	NA	240	NA	NA	130	NA
	45°	260	280	NA	NA	160	NA
	-45°	260	280	NA	NA	180	NA
Downwind 25	All rotations	No impact					

1. NA means that there is no impact at any distance for this source location and building orientation.

5. AERMOD Input File - Cancer Risk

```
** AERMOD Input Produced by:
** AERMOD View Ver. 9.6.0
** Lakes Environmental Software Inc.
** Date: 6/7/2019
****************************************
**
****************************************
** AERMOD Control Pathway
****************************************
**
CO STARTING
  TITLEONE Redding 45 Degree 10X5X4
  MODELOPT CONC FLAT
  AVERTIME 1 PERIOD
  POLLUTID OTHER
  FLAGPOLE 1.20
  RUNORNOT RUN
  ERRORFIL Redding45.err
CO FINISHED
**
****************************************
** AERMOD Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION UP0        POINT        0.000      0.000       0.0
   LOCATION UP05       POINT       -5.000      0.000       0.0
   LOCATION UP10       POINT      -10.000      0.000       0.0
   LOCATION UP15       POINT      -15.000      0.000       0.0
   LOCATION DOWN0      POINT        8.000      0.000       0.0
   LOCATION DOWN05     POINT       13.000      0.000       0.0
   LOCATION DOWN10     POINT       18.000      0.000       0.0
   LOCATION DOWN15     POINT       23.000      0.000       0.0
** Source Parameters **
   SRCPARAM UP0          1.0   3.660  291.000  0.00100   0.051
   SRCPARAM UP05         1.0   3.660  291.000  0.00100   0.051
   SRCPARAM UP10         1.0   3.660  291.000  0.00100   0.051
   SRCPARAM UP15         1.0   3.660  291.000  0.00100   0.051
   SRCPARAM DOWN0        1.0   3.660  291.000  0.00100   0.051
   SRCPARAM DOWN05       1.0   3.660  291.000  0.00100   0.051
   SRCPARAM DOWN10       1.0   3.660  291.000  0.00100   0.051
   SRCPARAM DOWN15       1.0   3.660  291.000  0.00100   0.051

** Building Downwash **
   BUILDHGT UP0       4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP0       4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP0       4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP0       4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP0       4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP0       4.00   4.00   4.00   4.00   4.00   4.00

   BUILDHGT UP05      4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP05      4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP05      0.00   0.00   0.00   0.00   0.00   4.00
   BUILDHGT UP05      4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP05      4.00   4.00   4.00   4.00   4.00   4.00
   BUILDHGT UP05      0.00   0.00   0.00   0.00   0.00   4.00

   BUILDHGT UP10      0.00   0.00   0.00   0.00   4.00   4.00
   BUILDHGT UP10      4.00   4.00   4.00   4.00   4.00   0.00
   BUILDHGT UP10      0.00   0.00   0.00   0.00   0.00   0.00
   BUILDHGT UP10      0.00   0.00   0.00   0.00   4.00   4.00
```

BUILDHGT UP10	4.00	4.00	4.00	4.00	4.00	0.00
BUILDHGT UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT UP15	0.00	0.00	0.00	0.00	0.00	4.00
BUILDHGT UP15	4.00	4.00	4.00	4.00	0.00	0.00
BUILDHGT UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN0	4.00	4.00	4.00	4.00	4.00	4.00
BUILDHGT DOWN0	4.00	4.00	4.00	4.00	4.00	4.00
BUILDHGT DOWN0	4.00	4.00	4.00	4.00	4.00	4.00
BUILDHGT DOWN0	4.00	4.00	4.00	4.00	4.00	4.00
BUILDHGT DOWN0	4.00	4.00	4.00	4.00	4.00	4.00
BUILDHGT DOWN0	4.00	4.00	4.00	4.00	4.00	4.00
BUILDHGT DOWN05	0.00	0.00	0.00	0.00	0.00	4.00
BUILDHGT DOWN05	4.00	4.00	4.00	4.00	4.00	4.00
BUILDHGT DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN05	0.00	0.00	0.00	0.00	0.00	4.00
BUILDHGT DOWN05	4.00	4.00	4.00	4.00	4.00	4.00
BUILDHGT DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN10	4.00	4.00	4.00	4.00	4.00	0.00
BUILDHGT DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN15	0.00	4.00	4.00	4.00	4.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP0	11.06	11.18	10.95	10.40	10.40	10.96
BUILDWID UP0	11.18	11.06	10.61	9.83	8.76	7.42
BUILDWID UP0	5.85	5.86	7.42	8.76	9.84	10.61
BUILDWID UP0	11.06	11.18	10.95	10.40	10.40	10.96
BUILDWID UP0	11.18	11.06	10.61	9.83	8.76	7.42
BUILDWID UP0	5.85	5.86	7.42	8.76	9.84	10.61
BUILDWID UP05	11.06	11.18	10.95	10.40	10.40	10.96
BUILDWID UP05	11.18	11.06	10.61	9.83	8.76	7.42
BUILDWID UP05	0.00	0.00	0.00	0.00	0.00	10.61
BUILDWID UP05	11.06	11.18	10.95	10.40	10.40	10.96
BUILDWID UP05	11.18	11.06	10.61	9.83	8.76	7.42
BUILDWID UP05	0.00	0.00	0.00	0.00	0.00	10.61
BUILDWID UP10	0.00	0.00	0.00	0.00	10.40	10.96
BUILDWID UP10	11.18	11.06	10.61	9.83	8.76	0.00
BUILDWID UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP10	0.00	0.00	0.00	0.00	10.40	10.96
BUILDWID UP10	11.18	11.06	10.61	9.83	8.76	0.00
BUILDWID UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	10.96
BUILDWID UP15	11.18	11.06	10.61	9.83	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN0	11.06	11.18	10.95	10.40	10.40	10.96
BUILDWID DOWN0	11.18	11.06	10.61	9.83	8.76	7.42

```
BUILDWID DOWN0     5.85   5.86   7.42   8.76   9.84  10.61
BUILDWID DOWN0    11.06  11.18  10.95  10.40  10.40  10.96
BUILDWID DOWN0    11.18  11.06  10.61   9.83   8.76   7.42
BUILDWID DOWN0     5.85   5.86   7.42   8.76   9.84  10.61

BUILDWID DOWN05    0.00   0.00   0.00   0.00   0.00  10.96
BUILDWID DOWN05   11.18  11.06  10.61   9.83   8.76   7.42
BUILDWID DOWN05    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN05    0.00   0.00   0.00   0.00   0.00  10.96
BUILDWID DOWN05   11.18  11.06  10.61   9.83   8.76   7.42
BUILDWID DOWN05    0.00   0.00   0.00   0.00   0.00   0.00

BUILDWID DOWN10    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN10   11.18  11.06  10.61   9.83   8.76   0.00
BUILDWID DOWN10    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN10    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN10    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN10    0.00   0.00   0.00   0.00   0.00   0.00

BUILDWID DOWN15    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN15    0.00  11.06  10.61   9.83   8.76   0.00
BUILDWID DOWN15    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN15    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN15    0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN15    0.00   0.00   0.00   0.00   0.00   0.00

BUILDLEN UP0     9.83   8.76   7.42   5.85   5.86   7.42
BUILDLEN UP0     8.76   9.84  10.61  11.06  11.18  10.95
BUILDLEN UP0    10.40  10.40  10.96  11.18  11.06  10.61
BUILDLEN UP0     9.83   8.76   7.42   5.85   5.86   7.42
BUILDLEN UP0     8.76   9.84  10.61  11.06  11.18  10.95
BUILDLEN UP0    10.40  10.40  10.96  11.18  11.06  10.61

BUILDLEN UP05    9.83   8.76   7.42   5.85   5.86   7.42
BUILDLEN UP05    8.76   9.84  10.61  11.06  11.18  10.95
BUILDLEN UP05    0.00   0.00   0.00   0.00   0.00  10.61
BUILDLEN UP05    9.83   8.76   7.42   5.85   5.86   7.42
BUILDLEN UP05    8.76   9.84  10.61  11.06  11.18  10.95
BUILDLEN UP05    0.00   0.00   0.00   0.00   0.00  10.61

BUILDLEN UP10    0.00   0.00   0.00   0.00   5.86   7.42
BUILDLEN UP10    8.76   9.84  10.61  11.06  11.18   0.00
BUILDLEN UP10    0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP10    0.00   0.00   0.00   0.00   5.86   7.42
BUILDLEN UP10    8.76   9.84  10.61  11.06  11.18   0.00
BUILDLEN UP10    0.00   0.00   0.00   0.00   0.00   0.00

BUILDLEN UP15    0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP15    0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP15    0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP15    0.00   0.00   0.00   0.00   0.00   7.42
BUILDLEN UP15    8.76   9.84  10.61  11.06   0.00   0.00
BUILDLEN UP15    0.00   0.00   0.00   0.00   0.00   0.00

BUILDLEN DOWN0     9.83   8.76   7.42   5.85   5.86   7.42
BUILDLEN DOWN0     8.76   9.84  10.61  11.06  11.18  10.95
BUILDLEN DOWN0    10.40  10.40  10.96  11.18  11.06  10.61
BUILDLEN DOWN0     9.83   8.76   7.42   5.85   5.86   7.42
BUILDLEN DOWN0     8.76   9.84  10.61  11.06  11.18  10.95
BUILDLEN DOWN0    10.40  10.40  10.96  11.18  11.06  10.61

BUILDLEN DOWN05    0.00   0.00   0.00   0.00   0.00   7.42
BUILDLEN DOWN05    8.76   9.84  10.61  11.06  11.18  10.95
BUILDLEN DOWN05    0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN DOWN05    0.00   0.00   0.00   0.00   0.00   7.42
BUILDLEN DOWN05    8.76   9.84  10.61  11.06  11.18  10.95
BUILDLEN DOWN05    0.00   0.00   0.00   0.00   0.00   0.00
```

BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	8.76	9.84	10.61	11.06	11.18	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	9.84	10.61	11.06	11.18	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP0	-2.87	-2.12	-1.30	-0.44	-0.44	-1.29
XBADJ	UP0	-2.11	-2.86	-3.53	-4.09	-4.52	-4.82
XBADJ	UP0	-4.97	-5.42	-6.12	-6.64	-6.96	-7.07
XBADJ	UP0	-6.96	-6.64	-6.12	-5.42	-5.42	-6.13
XBADJ	UP0	-6.65	-6.97	-7.08	-6.97	-6.65	-6.13
XBADJ	UP0	-5.42	-4.99	-4.84	-4.54	-4.10	-3.54
XBADJ	UP05	-2.00	-0.41	1.20	2.78	3.40	3.04
XBADJ	UP05	2.59	2.06	1.47	0.83	0.17	-0.49
XBADJ	UP05	0.00	0.00	0.00	0.00	0.00	-7.07
XBADJ	UP05	-7.83	-8.35	-8.62	-8.63	-9.25	-10.46
XBADJ	UP05	-11.35	-11.90	-12.08	-11.90	-11.35	-10.46
XBADJ	UP05	0.00	0.00	0.00	0.00	0.00	-3.54
XBADJ	UP10	0.00	0.00	0.00	0.00	7.23	7.37
XBADJ	UP10	7.29	6.98	6.47	5.76	4.87	0.00
XBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP10	0.00	0.00	0.00	0.00	-13.08	-14.79
XBADJ	UP10	-16.05	-16.82	-17.08	-16.82	-16.05	0.00
XBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	-19.12
XBADJ	UP15	-20.75	-21.74	-22.08	-21.74	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN0	-4.26	-4.85	-5.30	-5.58	-6.56	-8.22
XBADJ	DOWN0	-9.63	-10.74	-11.53	-11.97	-12.04	-11.75
XBADJ	DOWN0	-11.10	-10.56	-10.12	-9.38	-8.35	-7.07
XBADJ	DOWN0	-5.57	-3.91	-2.12	-0.27	0.70	0.80
XBADJ	DOWN0	0.86	0.91	0.92	0.91	0.86	0.80
XBADJ	DOWN0	0.70	0.16	-0.84	-1.80	-2.71	-3.54
XBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	-12.55
XBADJ	DOWN05	-14.33	-15.67	-16.53	-16.89	-16.74	-16.08
XBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	5.13
XBADJ	DOWN05	5.56	5.83	5.92	5.83	5.56	5.13
XBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	-19.02	-20.59	-21.53	-21.82	-21.44	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	-25.51	-26.53	-26.74	-26.14	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00

```
   XBADJ    DOWN15          0.00     0.00     0.00     0.00     0.00     0.00

   YBADJ    UP0        -1.44    -1.06    -0.65    -0.23     0.21     0.64
   YBADJ    UP0         1.05     1.43     1.76     2.05     2.26     2.41
   YBADJ    UP0         2.49     2.49     2.42     2.27     2.05     1.77
   YBADJ    UP0         1.44     1.06     0.65     0.23    -0.21    -0.64
   YBADJ    UP0        -1.05    -1.43    -1.77    -2.05    -2.26    -2.41
   YBADJ    UP0        -2.49    -2.49    -2.42    -2.27    -2.05    -1.77

   YBADJ    UP05       -6.37    -5.76    -4.98    -4.06    -3.00    -1.86
   YBADJ    UP05       -0.66     0.56     1.77     2.91     3.97     4.91
   YBADJ    UP05        0.00     0.00     0.00     0.00     0.00     6.77
   YBADJ    UP05        6.37     5.76     4.98     4.06     3.00     1.86
   YBADJ    UP05        0.66    -0.56    -1.77    -2.91    -3.97    -4.91
   YBADJ    UP05        0.00     0.00     0.00     0.00     0.00    -6.77

   YBADJ    UP10        0.00     0.00     0.00     0.00    -6.21    -4.36
   YBADJ    UP10       -2.37    -0.31     1.77     3.78     5.68     0.00
   YBADJ    UP10        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    UP10        0.00     0.00     0.00     0.00     6.21     4.36
   YBADJ    UP10        2.37     0.31    -1.77    -3.78    -5.68     0.00
   YBADJ    UP10        0.00     0.00     0.00     0.00     0.00     0.00

   YBADJ    UP15        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    UP15        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    UP15        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    UP15        0.00     0.00     0.00     0.00     0.00     6.86
   YBADJ    UP15        4.08     1.17    -1.77    -4.65     0.00     0.00
   YBADJ    UP15        0.00     0.00     0.00     0.00     0.00     0.00

   YBADJ    DOWN0         6.44     6.45     6.27     5.90     5.36     4.64
   YBADJ    DOWN0         3.79     2.82     1.76     0.66    -0.47    -1.59
   YBADJ    DOWN0        -2.65    -3.63    -4.51    -5.25    -5.82    -6.23
   YBADJ    DOWN0        -6.44    -6.45    -6.27    -5.90    -5.36    -4.64
   YBADJ    DOWN0        -3.79    -2.82    -1.76    -0.66     0.47     1.59
   YBADJ    DOWN0         2.65     3.63     4.51     5.25     5.82     6.23

   YBADJ    DOWN05        0.00     0.00     0.00     0.00     0.00     7.14
   YBADJ    DOWN05        5.50     3.69     1.76    -0.21    -2.18    -4.09
   YBADJ    DOWN05        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN05        0.00     0.00     0.00     0.00     0.00    -7.14
   YBADJ    DOWN05       -5.50    -3.69    -1.76     0.21     2.18     4.09
   YBADJ    DOWN05        0.00     0.00     0.00     0.00     0.00     0.00

   YBADJ    DOWN10        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN10        7.21     4.56     1.76    -1.08    -3.89     0.00
   YBADJ    DOWN10        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN10        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN10        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN10        0.00     0.00     0.00     0.00     0.00     0.00

   YBADJ    DOWN15        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN15        0.00     5.42     1.76    -1.95    -5.60     0.00
   YBADJ    DOWN15        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN15        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN15        0.00     0.00     0.00     0.00     0.00     0.00
   YBADJ    DOWN15        0.00     0.00     0.00     0.00     0.00     0.00

   SRCGROUP DOWN0    DOWN0
   SRCGROUP DOWN05   DOWN05
   SRCGROUP DOWN10   DOWN10
   SRCGROUP DOWN15   DOWN15
   SRCGROUP UP0      UP0
   SRCGROUP UP05     UP05
   SRCGROUP UP10     UP10
   SRCGROUP UP15     UP15
SO FINISHED
**
```

```
****************************************
** AERMOD Receptor Pathway
****************************************
**
**
RE STARTING
  GRIDCART UCART1 STA
           XYINC 0.00 41 5.00 -35.00 15 5.00
           FLAG  1  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  1  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  1  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  1  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  1  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  1  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  1  1.20  1.20  1.20  1.20  1.20
           FLAG  2  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  2  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  2  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  2  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  2  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  2  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  2  1.20  1.20  1.20  1.20  1.20
           FLAG  3  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  3  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  3  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  3  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  3  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  3  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  3  1.20  1.20  1.20  1.20  1.20
           FLAG  4  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  4  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  4  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  4  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  4  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  4  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  4  1.20  1.20  1.20  1.20  1.20
           FLAG  5  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  5  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  5  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  5  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  5  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  5  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  5  1.20  1.20  1.20  1.20  1.20
           FLAG  6  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  6  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  6  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  6  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  6  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  6  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  6  1.20  1.20  1.20  1.20  1.20
           FLAG  7  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  7  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  7  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  7  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  7  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  7  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  7  1.20  1.20  1.20  1.20  1.20
           FLAG  8  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  8  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  8  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  8  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  8  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  8  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  8  1.20  1.20  1.20  1.20  1.20
           FLAG  9  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  9  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  9  1.20  1.20  1.20  1.20  1.20  1.20
           FLAG  9  1.20  1.20  1.20  1.20  1.20  1.20
```

```
          FLAG   9    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   9    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   9    1.20   1.20   1.20   1.20   1.20
          FLAG   10   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   10   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   10   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   10   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   10   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   10   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   10   1.20   1.20   1.20   1.20   1.20
          FLAG   11   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   11   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   11   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   11   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   11   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   11   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   11   1.20   1.20   1.20   1.20   1.20
          FLAG   12   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   12   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   12   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   12   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   12   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   12   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   12   1.20   1.20   1.20   1.20   1.20
          FLAG   13   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   13   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   13   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   13   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   13   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   13   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   13   1.20   1.20   1.20   1.20   1.20
          FLAG   14   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   14   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   14   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   14   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   14   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   14   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   14   1.20   1.20   1.20   1.20   1.20
          FLAG   15   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   15   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   15   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   15   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   15   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   15   1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   15   1.20   1.20   1.20   1.20   1.20
GRIDCART UCART1 END
GRIDCART UCART2 STA
          XYINC 200.00 18 20.00 -35.00 15 5.00
          FLAG   1    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   1    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   1    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   2    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   2    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   2    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   3    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   3    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   3    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   4    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   4    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   4    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   5    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   5    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   5    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   6    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   6    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   6    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   7    1.20   1.20   1.20   1.20   1.20   1.20
          FLAG   7    1.20   1.20   1.20   1.20   1.20   1.20
```

```
             FLAG   7    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  10    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  10    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  10    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  11    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  11    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  11    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  12    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  12    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  12    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  13    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  13    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  13    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  14    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  14    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  14    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  15    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  15    1.20    1.20    1.20    1.20    1.20    1.20
             FLAG  15    1.20    1.20    1.20    1.20    1.20    1.20
   GRIDCART UCART2 END
RE FINISHED
**
******************************************
** AERMOD Meteorology Pathway
******************************************
**
**
ME STARTING
   SURFFILE Redding_2013-2017.sfc
   PROFFILE Redding_2013-2017.PFL
   SURFDATA 24257 2013 REDDING/AAF
   UAIRDATA 24225 2013 MEDFORD/JACKSON_COUNTY_ARPT
   PROFBASE 151.5 METERS
   WDROTATE 71.00
ME FINISHED
**
******************************************
** AERMOD Output Pathway
******************************************
**
**
OU STARTING
   RECTABLE ALLAVE 1ST
   RECTABLE 1 1ST
** Auto-Generated Plotfiles
   PLOTFILE 1 DOWN0 1ST REDDING45.AD\01H1G001.PLT 31
   PLOTFILE 1 DOWN05 1ST REDDING45.AD\01H1G002.PLT 32
   PLOTFILE 1 DOWN10 1ST REDDING45.AD\01H1G003.PLT 33
   PLOTFILE 1 DOWN15 1ST REDDING45.AD\01H1G004.PLT 34
   PLOTFILE 1 UP0 1ST REDDING45.AD\01H1G005.PLT 35
   PLOTFILE 1 UP05 1ST REDDING45.AD\01H1G006.PLT 36
   PLOTFILE 1 UP10 1ST REDDING45.AD\01H1G007.PLT 37
   PLOTFILE 1 UP15 1ST REDDING45.AD\01H1G008.PLT 38
   PLOTFILE PERIOD DOWN0 REDDING45.AD\PE00G001.PLT 39
   PLOTFILE PERIOD DOWN05 REDDING45.AD\PE00G002.PLT 40
   PLOTFILE PERIOD DOWN10 REDDING45.AD\PE00G003.PLT 41
   PLOTFILE PERIOD DOWN15 REDDING45.AD\PE00G004.PLT 42
   PLOTFILE PERIOD UP0 REDDING45.AD\PE00G005.PLT 43
   PLOTFILE PERIOD UP05 REDDING45.AD\PE00G006.PLT 44
   PLOTFILE PERIOD UP10 REDDING45.AD\PE00G007.PLT 45
   PLOTFILE PERIOD UP15 REDDING45.AD\PE00G008.PLT 46
   SUMMFILE Redding45.sum
```

OU FINISHED
**
****
** Project Parameters
****
** PROJCTN CoordinateSystemUTM
** DESCPTN UTM: Universal Transverse Mercator
** DATUM   North American Datum 1983
** DTMRGN   CONUS
** UNITS   m
** ZONE   10
** ZONEINX 0
**

6. AERMOD Input File - Acute Health Impacts

```
** AERMOD Input Produced by:
** AERMOD View Ver. 9.6.0
** Lakes Environmental Software Inc.
** Date: 6/7/2019
** File: C:\Users\yrubin\Desktop\Redding\Redding90\Redding90.ADI
**
****************************************
**
**
****************************************
** AERMOD Control Pathway
****************************************
**
**
CO STARTING
   TITLEONE S:\Industrywide Guidelines\GDF\2018 Building Sensitivity\Building Do
   MODELOPT CONC FLAT
   AVERTIME 1 PERIOD
   POLLUTID OTHER
   FLAGPOLE 1.20
   RUNORNOT RUN
   ERRORFIL Redding90.err
CO FINISHED
**
****************************************
** AERMOD Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION UP0         POINT        0.000       0.000        0.0
   LOCATION UP05        POINT       -5.000       0.000        0.0
   LOCATION UP10        POINT      -10.000       0.000        0.0
   LOCATION UP15        POINT      -15.000       0.000        0.0
   LOCATION DOWN0       POINT       10.000       0.000        0.0
   LOCATION DOWN05      POINT       15.000       0.000        0.0
   LOCATION DOWN10      POINT       20.000       0.000        0.0
   LOCATION DOWN15      POINT       25.000       0.000        0.0
** Source Parameters **
   SRCPARAM UP0           1.0    3.660   291.000   0.00100     0.051
   SRCPARAM UP05          1.0    3.660   291.000   0.00100     0.051
   SRCPARAM UP10          1.0    3.660   291.000   0.00100     0.051
   SRCPARAM UP15          1.0    3.660   291.000   0.00100     0.051
   SRCPARAM DOWN0         1.0    3.660   291.000   0.00100     0.051
   SRCPARAM DOWN05        1.0    3.660   291.000   0.00100     0.051
   SRCPARAM DOWN10        1.0    3.660   291.000   0.00100     0.051
   SRCPARAM DOWN15        1.0    3.660   291.000   0.00100     0.051

** Building Downwash **
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00

   BUILDHGT UP05       0.00    0.00    0.00    0.00    4.00    4.00
   BUILDHGT UP05       4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP05       4.00    0.00    0.00    0.00    0.00    0.00
   BUILDHGT UP05       0.00    0.00    0.00    0.00    4.00    4.00
   BUILDHGT UP05       4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP05       4.00    0.00    0.00    0.00    0.00    0.00
```

```
BUILDHGT UP10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT UP10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT UP10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT UP10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT UP10      4.00   4.00   4.00   4.00   4.00   0.00
BUILDHGT UP10      0.00   0.00   0.00   0.00   0.00   0.00

BUILDHGT UP15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT UP15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT UP15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT UP15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT UP15      0.00   4.00   4.00   4.00   0.00   0.00
BUILDHGT UP15      0.00   0.00   0.00   0.00   0.00   0.00

BUILDHGT DOWN0      4.00   4.00   4.00   4.00   4.00   4.00
BUILDHGT DOWN0      4.00   4.00   4.00   4.00   4.00   4.00
BUILDHGT DOWN0      4.00   4.00   4.00   4.00   4.00   4.00
BUILDHGT DOWN0      4.00   4.00   4.00   4.00   4.00   4.00
BUILDHGT DOWN0      4.00   4.00   4.00   4.00   4.00   4.00
BUILDHGT DOWN0      4.00   4.00   4.00   4.00   4.00   4.00

BUILDHGT DOWN05      0.00   0.00   0.00   0.00   4.00   4.00
BUILDHGT DOWN05      4.00   4.00   4.00   4.00   4.00   4.00
BUILDHGT DOWN05      4.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN05      0.00   0.00   0.00   0.00   4.00   4.00
BUILDHGT DOWN05      4.00   4.00   4.00   4.00   4.00   4.00
BUILDHGT DOWN05      4.00   0.00   0.00   0.00   0.00   0.00

BUILDHGT DOWN10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN10      4.00   4.00   4.00   4.00   4.00   0.00
BUILDHGT DOWN10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN10      0.00   0.00   0.00   0.00   0.00   0.00

BUILDHGT DOWN15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN15      0.00   4.00   4.00   4.00   0.00   0.00
BUILDHGT DOWN15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDHGT DOWN15      0.00   0.00   0.00   0.00   0.00   0.00

BUILDWID UP0      10.72   11.11   11.16   10.87   10.26   9.33
BUILDWID UP0      8.12   6.66   5.00   6.66   8.12   9.33
BUILDWID UP0      10.26   10.87   11.16   11.11   10.72   10.00
BUILDWID UP0      10.72   11.11   11.16   10.87   10.26   9.33
BUILDWID UP0      8.12   6.66   5.00   6.66   8.12   9.33
BUILDWID UP0      10.26   10.87   11.16   11.11   10.72   10.00

BUILDWID UP05      0.00   0.00   0.00   0.00   10.26   9.33
BUILDWID UP05      8.12   6.66   5.00   6.66   8.12   9.33
BUILDWID UP05      10.26   0.00   0.00   0.00   0.00   0.00
BUILDWID UP05      0.00   0.00   0.00   0.00   10.26   9.33
BUILDWID UP05      8.12   6.66   5.00   6.66   8.12   9.33
BUILDWID UP05      10.26   0.00   0.00   0.00   0.00   0.00

BUILDWID UP10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID UP10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID UP10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID UP10      0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID UP10      8.12   6.66   5.00   6.66   8.12   0.00
BUILDWID UP10      0.00   0.00   0.00   0.00   0.00   0.00

BUILDWID UP15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID UP15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID UP15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID UP15      0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID UP15      0.00   6.66   5.00   6.66   0.00   0.00
```

```
BUILDWID UP15        0.00   0.00   0.00   0.00   0.00   0.00

BUILDWID DOWN0       10.72  11.11  11.16  10.87  10.26   9.33
BUILDWID DOWN0        8.12   6.66   5.00   6.66   8.12   9.33
BUILDWID DOWN0       10.26  10.87  11.16  11.11  10.72  10.00
BUILDWID DOWN0       10.72  11.11  11.16  10.87  10.26   9.33
BUILDWID DOWN0        8.12   6.66   5.00   6.66   8.12   9.33
BUILDWID DOWN0       10.26  10.87  11.16  11.11  10.72  10.00

BUILDWID DOWN05       0.00   0.00   0.00   0.00  10.26   9.33
BUILDWID DOWN05       8.12   6.66   5.00   6.66   8.12   9.33
BUILDWID DOWN05      10.26   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN05       0.00   0.00   0.00   0.00  10.26   9.33
BUILDWID DOWN05       8.12   6.66   5.00   6.66   8.12   9.33
BUILDWID DOWN05      10.26   0.00   0.00   0.00   0.00   0.00

BUILDWID DOWN10       0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN10       8.12   6.66   5.00   6.66   8.12   0.00
BUILDWID DOWN10       0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN10       0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN10       0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN10       0.00   0.00   0.00   0.00   0.00   0.00

BUILDWID DOWN15       0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN15       0.00   6.66   5.00   6.66   0.00   0.00
BUILDWID DOWN15       0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN15       0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN15       0.00   0.00   0.00   0.00   0.00   0.00
BUILDWID DOWN15       0.00   0.00   0.00   0.00   0.00   0.00

BUILDLEN UP0          6.66   8.12   9.33  10.26  10.87  11.16
BUILDLEN UP0         11.11  10.72  10.00  10.72  11.11  11.16
BUILDLEN UP0         10.87  10.26   9.33   8.12   6.66   5.00
BUILDLEN UP0          6.66   8.12   9.33  10.26  10.87  11.16
BUILDLEN UP0         11.11  10.72  10.00  10.72  11.11  11.16
BUILDLEN UP0         10.87  10.26   9.33   8.12   6.66   5.00

BUILDLEN UP05         0.00   0.00   0.00   0.00  10.87  11.16
BUILDLEN UP05        11.11  10.72  10.00  10.72  11.11  11.16
BUILDLEN UP05        10.87   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP05         0.00   0.00   0.00   0.00  10.87  11.16
BUILDLEN UP05        11.11  10.72  10.00  10.72  11.11  11.16
BUILDLEN UP05        10.87   0.00   0.00   0.00   0.00   0.00

BUILDLEN UP10         0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP10         0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP10         0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP10         0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP10        11.11  10.72  10.00  10.72  11.11   0.00
BUILDLEN UP10         0.00   0.00   0.00   0.00   0.00   0.00

BUILDLEN UP15         0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP15         0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP15         0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP15         0.00   0.00   0.00   0.00   0.00   0.00
BUILDLEN UP15         0.00  10.72  10.00  10.72   0.00   0.00
BUILDLEN UP15         0.00   0.00   0.00   0.00   0.00   0.00

BUILDLEN DOWN0        6.66   8.12   9.33  10.26  10.87  11.16
BUILDLEN DOWN0       11.11  10.72  10.00  10.72  11.11  11.16
BUILDLEN DOWN0       10.87  10.26   9.33   8.12   6.66   5.00
BUILDLEN DOWN0        6.66   8.12   9.33  10.26  10.87  11.16
BUILDLEN DOWN0       11.11  10.72  10.00  10.72  11.11  11.16
BUILDLEN DOWN0       10.87  10.26   9.33   8.12   6.66   5.00

BUILDLEN DOWN05       0.00   0.00   0.00   0.00  10.87  11.16
BUILDLEN DOWN05      11.11  10.72  10.00  10.72  11.11  11.16
BUILDLEN DOWN05      10.87   0.00   0.00   0.00   0.00   0.00
```

```
BUILDLEN DOWN05      0.00    0.00    0.00    0.00   10.87   11.16
BUILDLEN DOWN05     11.11   10.72   10.00   10.72   11.11   11.16
BUILDLEN DOWN05     10.87    0.00    0.00    0.00    0.00    0.00

BUILDLEN DOWN10      0.00    0.00    0.00    0.00    0.00    0.00
BUILDLEN DOWN10     11.11   10.72   10.00   10.72   11.11    0.00
BUILDLEN DOWN10      0.00    0.00    0.00    0.00    0.00    0.00
BUILDLEN DOWN10      0.00    0.00    0.00    0.00    0.00    0.00
BUILDLEN DOWN10      0.00    0.00    0.00    0.00    0.00    0.00
BUILDLEN DOWN10      0.00    0.00    0.00    0.00    0.00    0.00

BUILDLEN DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
BUILDLEN DOWN15      0.00   10.72   10.00   10.72    0.00    0.00
BUILDLEN DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
BUILDLEN DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
BUILDLEN DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
BUILDLEN DOWN15      0.00    0.00    0.00    0.00    0.00    0.00

XBADJ    UP0      -2.46   -2.35   -2.17   -1.92   -1.61   -1.25
XBADJ    UP0      -0.86   -0.43    0.00   -0.43   -0.86   -1.25
XBADJ    UP0      -1.61   -1.92   -2.17   -2.35   -2.46   -2.50
XBADJ    UP0      -4.20   -5.77   -7.17   -8.34   -9.27   -9.91
XBADJ    UP0     -10.25  -10.28  -10.00  -10.28  -10.25   -9.91
XBADJ    UP0      -9.27   -8.34   -7.17   -5.77   -4.20   -2.50

XBADJ    UP05      0.00    0.00    0.00    0.00    2.22    3.08
XBADJ    UP05      3.84    4.49    5.00    4.49    3.84    3.08
XBADJ    UP05      2.22    0.00    0.00    0.00    0.00    0.00
XBADJ    UP05      0.00    0.00    0.00    0.00  -13.10  -14.24
XBADJ    UP05    -14.95  -15.21  -15.00  -15.21  -14.95  -14.24
XBADJ    UP05    -13.10    0.00    0.00    0.00    0.00    0.00

XBADJ    UP10      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    UP10      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    UP10      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    UP10      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    UP10    -19.65  -20.13  -20.00  -20.13  -19.65    0.00
XBADJ    UP10      0.00    0.00    0.00    0.00    0.00    0.00

XBADJ    UP15      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    UP15      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    UP15      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    UP15      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    UP15      0.00  -25.05  -25.00  -25.05    0.00    0.00
XBADJ    UP15      0.00    0.00    0.00    0.00    0.00    0.00

XBADJ    DOWN0    -4.20   -5.77   -7.17   -8.34   -9.27   -9.91
XBADJ    DOWN0   -10.25  -10.28  -10.00  -10.28  -10.25   -9.91
XBADJ    DOWN0    -9.27   -8.34   -7.17   -5.77   -4.20   -2.50
XBADJ    DOWN0    -2.46   -2.35   -2.17   -1.92   -1.61   -1.25
XBADJ    DOWN0    -0.86   -0.43    0.00   -0.43   -0.86   -1.25
XBADJ    DOWN0    -1.61   -1.92   -2.17   -2.35   -2.46   -2.50

XBADJ    DOWN05    0.00    0.00    0.00    0.00  -13.10  -14.24
XBADJ    DOWN05  -14.95  -15.21  -15.00  -15.21  -14.95  -14.24
XBADJ    DOWN05  -13.10    0.00    0.00    0.00    0.00    0.00
XBADJ    DOWN05    0.00    0.00    0.00    0.00    2.22    3.08
XBADJ    DOWN05    3.84    4.49    5.00    4.49    3.84    3.08
XBADJ    DOWN05    2.22    0.00    0.00    0.00    0.00    0.00

XBADJ    DOWN10    0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    DOWN10  -19.65  -20.13  -20.00  -20.13  -19.65    0.00
XBADJ    DOWN10    0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    DOWN10    0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    DOWN10    0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    DOWN10    0.00    0.00    0.00    0.00    0.00    0.00

XBADJ    DOWN15    0.00    0.00    0.00    0.00    0.00    0.00
```

```
XBADJ    DOWN15      0.00   -25.05   -25.00   -25.05    0.00    0.00
XBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
XBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00

YBADJ    UP0       -4.92   -4.70   -4.33   -3.83   -3.21   -2.50
YBADJ    UP0       -1.71   -0.87    0.00    0.87    1.71    2.50
YBADJ    UP0        3.21    3.83    4.33    4.70    4.92    5.00
YBADJ    UP0        4.92    4.70    4.33    3.83    3.21    2.50
YBADJ    UP0        1.71    0.87    0.00   -0.87   -1.71   -2.50
YBADJ    UP0       -3.21   -3.83   -4.33   -4.70   -4.92   -5.00

YBADJ    UP05       0.00    0.00    0.00    0.00   -6.43   -5.00
YBADJ    UP05      -3.42   -1.74    0.00    1.74    3.42    5.00
YBADJ    UP05       6.43    0.00    0.00    0.00    0.00    0.00
YBADJ    UP05       0.00    0.00    0.00    0.00    6.43    5.00
YBADJ    UP05       3.42    1.74    0.00   -1.74   -3.42   -5.00
YBADJ    UP05      -6.43    0.00    0.00    0.00    0.00    0.00

YBADJ    UP10       0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    UP10       0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    UP10       0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    UP10       0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    UP10       5.13    2.60    0.00   -2.60   -5.13    0.00
YBADJ    UP10       0.00    0.00    0.00    0.00    0.00    0.00

YBADJ    UP15       0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    UP15       0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    UP15       0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    UP15       0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    UP15       0.00    3.47    0.00   -3.47    0.00    0.00
YBADJ    UP15       0.00    0.00    0.00    0.00    0.00    0.00

YBADJ    DOWN0       4.92    4.70    4.33    3.83    3.21    2.50
YBADJ    DOWN0       1.71    0.87    0.00   -0.87   -1.71   -2.50
YBADJ    DOWN0      -3.21   -3.83   -4.33   -4.70   -4.92   -5.00
YBADJ    DOWN0      -4.92   -4.70   -4.33   -3.83   -3.21   -2.50
YBADJ    DOWN0      -1.71   -0.87    0.00    0.87    1.71    2.50
YBADJ    DOWN0       3.21    3.83    4.33    4.70    4.92    5.00

YBADJ    DOWN05      0.00    0.00    0.00    0.00    6.43    5.00
YBADJ    DOWN05      3.42    1.74    0.00   -1.74   -3.42   -5.00
YBADJ    DOWN05     -6.43    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN05      0.00    0.00    0.00    0.00   -6.43   -5.00
YBADJ    DOWN05     -3.42   -1.74    0.00    1.74    3.42    5.00
YBADJ    DOWN05      6.43    0.00    0.00    0.00    0.00    0.00

YBADJ    DOWN10      0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN10      5.13    2.60    0.00   -2.60   -5.13    0.00
YBADJ    DOWN10      0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN10      0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN10      0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN10      0.00    0.00    0.00    0.00    0.00    0.00

YBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN15      0.00    3.47    0.00   -3.47    0.00    0.00
YBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00
YBADJ    DOWN15      0.00    0.00    0.00    0.00    0.00    0.00

SRCGROUP DOWN0    DOWN0
SRCGROUP DOWN05   DOWN05
SRCGROUP DOWN10   DOWN10
SRCGROUP DOWN15   DOWN15
SRCGROUP UP0      UP0
SRCGROUP UP05     UP05
```

```
   SRCGROUP UP10     UP10
   SRCGROUP UP15     UP15
SO FINISHED
**
*******************************************
** AERMOD Receptor Pathway
*******************************************
**
**
RE STARTING
   GRIDCART UCART1 STA
              XYINC 0.00 41 5.00 -35.00 15 5.00
              FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   1   1.20   1.20   1.20   1.20   1.20
              FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   2   1.20   1.20   1.20   1.20   1.20
              FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   3   1.20   1.20   1.20   1.20   1.20
              FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   4   1.20   1.20   1.20   1.20   1.20
              FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   5   1.20   1.20   1.20   1.20   1.20
              FLAG   6   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   6   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   6   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   6   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   6   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   6   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   6   1.20   1.20   1.20   1.20   1.20
              FLAG   7   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7   1.20   1.20   1.20   1.20   1.20
              FLAG   8   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8   1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8   1.20   1.20   1.20   1.20   1.20
```

```
      FLAG   9   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   9   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   9   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   9   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   9   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   9   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   9   1.20   1.20   1.20   1.20   1.20
      FLAG  10   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  10   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  10   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  10   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  10   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  10   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  10   1.20   1.20   1.20   1.20   1.20
      FLAG  11   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  11   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  11   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  11   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  11   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  11   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  11   1.20   1.20   1.20   1.20   1.20
      FLAG  12   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  12   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  12   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  12   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  12   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  12   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  12   1.20   1.20   1.20   1.20   1.20
      FLAG  13   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  13   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  13   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  13   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  13   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  13   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  13   1.20   1.20   1.20   1.20   1.20
      FLAG  14   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  14   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  14   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  14   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  14   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  14   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  14   1.20   1.20   1.20   1.20   1.20
      FLAG  15   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  15   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  15   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  15   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  15   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  15   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG  15   1.20   1.20   1.20   1.20   1.20
GRIDCART UCART1 END
GRIDCART UCART2 STA
      XYINC 200.00 18 20.00 -35.00 15 5.00
      FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   1   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   2   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   3   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   4   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   5   1.20   1.20   1.20   1.20   1.20   1.20
      FLAG   6   1.20   1.20   1.20   1.20   1.20   1.20
```

```
              FLAG   6    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   6    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   7    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   8    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   9    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   9    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG   9    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  10    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  10    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  10    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  11    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  11    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  11    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  12    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  12    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  12    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  13    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  13    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  13    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  14    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  14    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  14    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  15    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  15    1.20   1.20   1.20   1.20   1.20   1.20
              FLAG  15    1.20   1.20   1.20   1.20   1.20   1.20
   GRIDCART UCART2 END
RE FINISHED
**
*******************************************
** AERMOD Meteorology Pathway
*******************************************
**
**
ME STARTING
   SURFFILE Redding_2013-2017.sfc
   PROFFILE Redding_2013-2017.PFL
   SURFDATA 24257 2013 REDDING/AAF
   UAIRDATA 24225 2013 MEDFORD/JACKSON_COUNTY_ARPT
   PROFBASE 151.5 METERS
   WDROTATE 71.00
ME FINISHED
**
*******************************************
** AERMOD Output Pathway
*******************************************
**
**
OU STARTING
   RECTABLE ALLAVE 1ST
   RECTABLE 1 1ST
** Auto-Generated Plotfiles
   PLOTFILE 1 DOWN0 1ST REDDING90.AD\01H1G001.PLT 31
   PLOTFILE 1 DOWN05 1ST REDDING90.AD\01H1G002.PLT 32
   PLOTFILE 1 DOWN10 1ST REDDING90.AD\01H1G003.PLT 33
   PLOTFILE 1 DOWN15 1ST REDDING90.AD\01H1G004.PLT 34
   PLOTFILE 1 UP0 1ST REDDING90.AD\01H1G005.PLT 35
   PLOTFILE 1 UP05 1ST REDDING90.AD\01H1G006.PLT 36
   PLOTFILE 1 UP10 1ST REDDING90.AD\01H1G007.PLT 37
   PLOTFILE 1 UP15 1ST REDDING90.AD\01H1G008.PLT 38
   PLOTFILE PERIOD DOWN0 REDDING90.AD\PE00G001.PLT 39
   PLOTFILE PERIOD DOWN05 REDDING90.AD\PE00G002.PLT 40
   PLOTFILE PERIOD DOWN10 REDDING90.AD\PE00G003.PLT 41
   PLOTFILE PERIOD DOWN15 REDDING90.AD\PE00G004.PLT 42
   PLOTFILE PERIOD UP0 REDDING90.AD\PE00G005.PLT 43
```

```
   PLOTFILE PERIOD UP05 REDDING90.AD\PE00G006.PLT 44
   PLOTFILE PERIOD UP10 REDDING90.AD\PE00G007.PLT 45
   PLOTFILE PERIOD UP15 REDDING90.AD\PE00G008.PLT 46
   SUMMFILE Redding90.sum
OU FINISHED
**
******************************************
** Project Parameters
******************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    North American Datum 1983
** DTMRGN   CONUS
** UNITS    m
** ZONE     10
** ZONEINX  0
**

**
******************************************
** AERMOD Input Produced by:
** AERMOD View Ver. 9.6.0
** Lakes Environmental Software Inc.
** Date: 6/7/2019
**
******************************************
**
******************************************
** AERMOD Control Pathway
******************************************
**
CO STARTING
   TITLEONE S:\Industrywide Guidelines\GDF\2018 Building Sensitivity\Building Do
   MODELOPT CONC FLAT
   AVERTIME 1 PERIOD
   POLLUTID OTHER
   FLAGPOLE 1.20
   RUNORNOT RUN
   ERRORFIL Redding225.err
CO FINISHED
**
******************************************
** AERMOD Source Pathway
******************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION UP0         POINT        0.000      0.000       0.0
   LOCATION UP05        POINT       -5.000      0.000       0.0
   LOCATION UP10        POINT      -10.000      0.000       0.0
   LOCATION UP15        POINT      -15.000      0.000       0.0
   LOCATION DOWN0       POINT        8.000      0.000       0.0
   LOCATION DOWN05      POINT       13.000      0.000       0.0
   LOCATION DOWN10      POINT       18.000      0.000       0.0
   LOCATION DOWN15      POINT       23.000      0.000       0.0
** Source Parameters **
   SRCPARAM UP0          1.0   3.660  291.000  0.00100    0.051
   SRCPARAM UP05         1.0   3.660  291.000  0.00100    0.051
   SRCPARAM UP10         1.0   3.660  291.000  0.00100    0.051
   SRCPARAM UP15         1.0   3.660  291.000  0.00100    0.051
```

```
SRCPARAM DOWN0          1.0    3.660   291.000   0.00100     0.051
SRCPARAM DOWN05         1.0    3.660   291.000   0.00100     0.051
SRCPARAM DOWN10         1.0    3.660   291.000   0.00100     0.051
SRCPARAM DOWN15         1.0    3.660   291.000   0.00100     0.051

** Building Downwash **
BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00

BUILDHGT UP05       0.00    0.00    0.00    0.00    0.00    4.00
BUILDHGT UP05       4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP05       4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP05       0.00    0.00    0.00    0.00    0.00    4.00
BUILDHGT UP05       4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP05       4.00    4.00    4.00    4.00    4.00    4.00

BUILDHGT UP10       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT UP10       4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP10       4.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT UP10       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT UP10       4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP10       4.00    0.00    0.00    0.00    0.00    0.00

BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT UP15       0.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00

BUILDHGT DOWN0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT DOWN0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT DOWN0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT DOWN0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT DOWN0        4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT DOWN0        4.00    4.00    4.00    4.00    4.00    4.00

BUILDHGT DOWN05       0.00    0.00    0.00    0.00    0.00    4.00
BUILDHGT DOWN05       4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT DOWN05       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN05       0.00    0.00    0.00    0.00    0.00    4.00
BUILDHGT DOWN05       4.00    4.00    4.00    4.00    4.00    4.00
BUILDHGT DOWN05       0.00    0.00    0.00    0.00    0.00    0.00

BUILDHGT DOWN10       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN10       4.00    4.00    4.00    4.00    4.00    0.00
BUILDHGT DOWN10       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN10       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN10       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN10       0.00    0.00    0.00    0.00    0.00    0.00

BUILDHGT DOWN15       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN15       4.00    4.00    4.00    4.00    0.00    0.00
BUILDHGT DOWN15       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN15       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN15       0.00    0.00    0.00    0.00    0.00    0.00
BUILDHGT DOWN15       0.00    0.00    0.00    0.00    0.00    0.00

BUILDWID UP0       9.83    8.76    7.42    5.85    5.86    7.42
BUILDWID UP0       8.76    9.84   10.61   11.06   11.18   10.95
BUILDWID UP0      10.40   10.40   10.96   11.18   11.06   10.61
BUILDWID UP0       9.83    8.76    7.42    5.85    5.86    7.42
BUILDWID UP0       8.76    9.84   10.61   11.06   11.18   10.95
BUILDWID UP0      10.40   10.40   10.96   11.18   11.06   10.61
```

BUILDWID UP05	0.00	0.00	0.00	0.00	0.00	7.42
BUILDWID UP05	8.76	9.84	10.61	11.06	11.18	10.95
BUILDWID UP05	10.40	10.40	10.96	11.18	11.06	10.61
BUILDWID UP05	0.00	0.00	0.00	0.00	0.00	7.42
BUILDWID UP05	8.76	9.84	10.61	11.06	11.18	10.95
BUILDWID UP05	10.40	10.40	10.96	11.18	11.06	10.61
BUILDWID UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP10	8.76	9.84	10.61	11.06	11.18	10.95
BUILDWID UP10	10.40	0.00	0.00	0.00	0.00	0.00
BUILDWID UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP10	8.76	9.84	10.61	11.06	11.18	10.95
BUILDWID UP10	10.40	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	9.84	10.61	11.06	11.18	10.95
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN0	9.83	8.76	7.42	5.85	5.86	7.42
BUILDWID DOWN0	8.76	9.84	10.61	11.06	11.18	10.95
BUILDWID DOWN0	10.40	10.40	10.96	11.18	11.06	10.61
BUILDWID DOWN0	9.83	8.76	7.42	5.85	5.86	7.42
BUILDWID DOWN0	8.76	9.84	10.61	11.06	11.18	10.95
BUILDWID DOWN0	10.40	10.40	10.96	11.18	11.06	10.61
BUILDWID DOWN05	0.00	0.00	0.00	0.00	0.00	7.42
BUILDWID DOWN05	8.76	9.84	10.61	11.06	11.18	10.95
BUILDWID DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN05	0.00	0.00	0.00	0.00	0.00	7.42
BUILDWID DOWN05	8.76	9.84	10.61	11.06	11.18	10.95
BUILDWID DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN10	8.76	9.84	10.61	11.06	11.18	0.00
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	8.76	9.84	10.61	11.06	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN UP0	11.06	11.18	10.95	10.40	10.40	10.96
BUILDLEN UP0	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN UP0	5.85	5.86	7.42	8.76	9.84	10.61
BUILDLEN UP0	11.06	11.18	10.95	10.40	10.40	10.96
BUILDLEN UP0	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN UP0	5.85	5.86	7.42	8.76	9.84	10.61
BUILDLEN UP05	0.00	0.00	0.00	0.00	0.00	10.96
BUILDLEN UP05	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN UP05	5.85	5.86	7.42	8.76	9.84	10.61
BUILDLEN UP05	0.00	0.00	0.00	0.00	0.00	10.96
BUILDLEN UP05	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN UP05	5.85	5.86	7.42	8.76	9.84	10.61
BUILDLEN UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN UP10	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN UP10	5.85	0.00	0.00	0.00	0.00	0.00
BUILDLEN UP10	0.00	0.00	0.00	0.00	0.00	0.00

BUILDLEN	UP10	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN	UP10	5.85	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	11.06	10.61	9.83	8.76	7.42
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN0	11.06	11.18	10.95	10.40	10.40	10.96
BUILDLEN	DOWN0	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN	DOWN0	5.85	5.86	7.42	8.76	9.84	10.61
BUILDLEN	DOWN0	11.06	11.18	10.95	10.40	10.40	10.96
BUILDLEN	DOWN0	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN	DOWN0	5.85	5.86	7.42	8.76	9.84	10.61
BUILDLEN	DOWN05	0.00	0.00	0.00	0.00	0.00	10.96
BUILDLEN	DOWN05	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN	DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN05	0.00	0.00	0.00	0.00	0.00	10.96
BUILDLEN	DOWN05	11.18	11.06	10.61	9.83	8.76	7.42
BUILDLEN	DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	11.18	11.06	10.61	9.83	8.76	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	11.18	11.06	10.61	9.83	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP0	-6.97	-6.65	-6.13	-5.42	-4.99	-4.84
XBADJ	UP0	-4.54	-4.10	-3.54	-2.87	-2.12	-1.30
XBADJ	UP0	-0.44	-0.44	-1.29	-2.11	-2.86	-3.53
XBADJ	UP0	-4.09	-4.52	-4.82	-4.97	-5.42	-6.12
XBADJ	UP0	-6.64	-6.96	-7.07	-6.96	-6.64	-6.12
XBADJ	UP0	-5.42	-5.42	-6.13	-6.65	-6.97	-7.08
XBADJ	UP05	0.00	0.00	0.00	0.00	0.00	-0.51
XBADJ	UP05	0.16	0.82	1.46	2.05	2.58	3.03
XBADJ	UP05	3.39	2.78	1.21	-0.40	-2.00	-3.53
XBADJ	UP05	0.00	0.00	0.00	0.00	0.00	-10.45
XBADJ	UP05	-11.34	-11.89	-12.07	-11.89	-11.34	-10.45
XBADJ	UP05	-9.25	-8.64	-8.63	-8.36	-7.84	-7.08
XBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP10	4.86	5.75	6.46	6.98	7.28	7.36
XBADJ	UP10	7.22	0.00	0.00	0.00	0.00	0.00
XBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP10	-16.04	-16.81	-17.07	-16.81	-16.04	-14.78
XBADJ	UP10	-13.08	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	-21.73	-22.07	-21.73	-20.74	-19.11
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN0	-8.36	-9.39	-10.13	-10.57	-11.12	-11.76
XBADJ	DOWN0	-12.05	-11.98	-11.54	-10.75	-9.63	-8.22

XBADJ	DOWN0	-6.56	-5.58	-5.29	-4.85	-4.25	-3.53
XBADJ	DOWN0	-2.70	-1.79	-0.82	0.17	0.71	0.81
XBADJ	DOWN0	0.87	0.92	0.93	0.92	0.87	0.81
XBADJ	DOWN0	0.71	-0.28	-2.13	-3.92	-5.58	-7.08
XBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	-16.09
XBADJ	DOWN05	-16.75	-16.90	-16.54	-15.67	-14.33	-12.55
XBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	5.14
XBADJ	DOWN05	5.57	5.84	5.93	5.84	5.57	5.14
XBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	-21.45	-21.83	-21.54	-20.60	-19.03	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	-26.15	-26.75	-26.54	-25.52	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP0	-2.05	-2.26	-2.41	-2.49	-2.49	-2.42
YBADJ	UP0	-2.27	-2.05	-1.77	-1.44	-1.06	-0.65
YBADJ	UP0	-0.23	0.21	0.64	1.05	1.43	1.77
YBADJ	UP0	2.05	2.26	2.41	2.49	2.49	2.42
YBADJ	UP0	2.27	2.05	1.77	1.44	1.06	0.65
YBADJ	UP0	0.23	-0.21	-0.64	-1.05	-1.43	-1.77
YBADJ	UP05	0.00	0.00	0.00	0.00	0.00	-4.92
YBADJ	UP05	-3.98	-2.92	-1.77	-0.57	0.65	1.85
YBADJ	UP05	2.99	4.04	4.97	5.75	6.35	6.77
YBADJ	UP05	0.00	0.00	0.00	0.00	0.00	4.92
YBADJ	UP05	3.98	2.92	1.77	0.57	-0.65	-1.85
YBADJ	UP05	-2.99	-4.04	-4.97	-5.75	-6.35	-6.77
YBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP10	-5.69	-3.79	-1.77	0.29	2.36	4.35
YBADJ	UP10	6.20	0.00	0.00	0.00	0.00	0.00
YBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP10	5.69	3.79	1.77	-0.29	-2.36	-4.35
YBADJ	UP10	-6.20	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	4.66	1.77	-1.16	-4.07	-6.85
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	DOWN0	5.83	5.25	4.51	3.64	2.65	1.58
YBADJ	DOWN0	0.46	-0.67	-1.78	-2.83	-3.80	-4.65
YBADJ	DOWN0	-5.37	-5.91	-6.28	-6.46	-6.45	-6.23
YBADJ	DOWN0	-5.83	-5.25	-4.51	-3.64	-2.65	-1.58
YBADJ	DOWN0	-0.46	0.67	1.78	2.83	3.80	4.65
YBADJ	DOWN0	5.37	5.91	6.28	6.46	6.45	6.23
YBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	4.08
YBADJ	DOWN05	2.17	0.20	-1.78	-3.70	-5.51	-7.15
YBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	-4.08
YBADJ	DOWN05	-2.17	-0.20	1.78	3.70	5.51	7.15
YBADJ	DOWN05	0.00	0.00	0.00	0.00	0.00	0.00

```
   YBADJ    DOWN10          0.00    0.00    0.00    0.00    0.00    0.00
   YBADJ    DOWN10          3.88    1.07   -1.78   -4.57   -7.22    0.00
   YBADJ    DOWN10          0.00    0.00    0.00    0.00    0.00    0.00
   YBADJ    DOWN10          0.00    0.00    0.00    0.00    0.00    0.00
   YBADJ    DOWN10          0.00    0.00    0.00    0.00    0.00    0.00
   YBADJ    DOWN10          0.00    0.00    0.00    0.00    0.00    0.00

   YBADJ    DOWN15          0.00    0.00    0.00    0.00    0.00    0.00
   YBADJ    DOWN15          5.59    1.94   -1.78   -5.44    0.00    0.00
   YBADJ    DOWN15          0.00    0.00    0.00    0.00    0.00    0.00
   YBADJ    DOWN15          0.00    0.00    0.00    0.00    0.00    0.00
   YBADJ    DOWN15          0.00    0.00    0.00    0.00    0.00    0.00
   YBADJ    DOWN15          0.00    0.00    0.00    0.00    0.00    0.00

   SRCGROUP DOWN0    DOWN0
   SRCGROUP DOWN05   DOWN05
   SRCGROUP DOWN10   DOWN10
   SRCGROUP DOWN15   DOWN15
   SRCGROUP UP0      UP0
   SRCGROUP UP05     UP05
   SRCGROUP UP10     UP10
   SRCGROUP UP15     UP15
SO FINISHED
**
*******************************************
** AERMOD Receptor Pathway
*******************************************
**
**
RE STARTING
   GRIDCART UCART1 STA
            XYINC 0.00 41 5.00 -35.00 15 5.00
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   1    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20
            FLAG   6    1.20    1.20    1.20    1.20    1.20    1.20
```

FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	
FLAG	14	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	14	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	14	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	14	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	14	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	14	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	14	1.20	1.20	1.20	1.20	1.20	
FLAG	15	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	15	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	15	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	15	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	15	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	15	1.20	1.20	1.20	1.20	1.20	1.20

```
         FLAG  15    1.20    1.20    1.20    1.20    1.20
   GRIDCART UCART1 END
   GRIDCART UCART2 STA
         XYINC 200.00 18 20.00 -35.00 15 5.00
         FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   6    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   6    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   6    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   7    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   7    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   7    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  10    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  10    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  10    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  11    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  11    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  11    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  12    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  12    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  12    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  13    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  13    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  13    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  14    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  14    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  14    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  15    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  15    1.20    1.20    1.20    1.20    1.20    1.20
         FLAG  15    1.20    1.20    1.20    1.20    1.20    1.20
   GRIDCART UCART2 END
RE FINISHED
**
****************************************
** AERMOD Meteorology Pathway
****************************************
**
**
ME STARTING
   SURFFILE Redding_2013-2017.sfc
   PROFFILE Redding_2013-2017.PFL
   SURFDATA 24257 2013 REDDING/AAF
   UAIRDATA 24225 2013 MEDFORD/JACKSON_COUNTY_ARPT
   PROFBASE 151.5 METERS
   WDROTATE 71.00
ME FINISHED
**
****************************************
** AERMOD Output Pathway
```

```
*****************************************
**
**
OU STARTING
  RECTABLE ALLAVE 1ST
  RECTABLE 1 1ST
** Auto-Generated Plotfiles
  PLOTFILE 1 DOWN0 1ST REDDING225.AD\01H1G001.PLT 31
  PLOTFILE 1 DOWN05 1ST REDDING225.AD\01H1G002.PLT 32
  PLOTFILE 1 DOWN10 1ST REDDING225.AD\01H1G003.PLT 33
  PLOTFILE 1 DOWN15 1ST REDDING225.AD\01H1G004.PLT 34
  PLOTFILE 1 UP0 1ST REDDING225.AD\01H1G005.PLT 35
  PLOTFILE 1 UP05 1ST REDDING225.AD\01H1G006.PLT 36
  PLOTFILE 1 UP10 1ST REDDING225.AD\01H1G007.PLT 37
  PLOTFILE 1 UP15 1ST REDDING225.AD\01H1G008.PLT 38
  PLOTFILE PERIOD DOWN0 REDDING225.AD\PE00G001.PLT 39
  PLOTFILE PERIOD DOWN05 REDDING225.AD\PE00G002.PLT 40
  PLOTFILE PERIOD DOWN10 REDDING225.AD\PE00G003.PLT 41
  PLOTFILE PERIOD DOWN15 REDDING225.AD\PE00G004.PLT 42
  PLOTFILE PERIOD UP0 REDDING225.AD\PE00G005.PLT 43
  PLOTFILE PERIOD UP05 REDDING225.AD\PE00G006.PLT 44
  PLOTFILE PERIOD UP10 REDDING225.AD\PE00G007.PLT 45
  PLOTFILE PERIOD UP15 REDDING225.AD\PE00G008.PLT 46
  SUMMFILE Redding225.sum
OU FINISHED
**
*****************************************
** Project Parameters
*****************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    North American Datum 1983
** DTMRGN   CONUS
** UNITS    m
** ZONE     10
** ZONEINX  0
**

** AERMOD Input Produced by:
** AERMOD View Ver. 9.6.0
** Lakes Environmental Software Inc.
** Date: 6/10/2019
**
*****************************************
**
*****************************************
** AERMOD Control Pathway
*****************************************
**
CO STARTING
  TITLEONE S:\Industrywide Guidelines\GDF\2018 Building Sensitivity\Building Do
  MODELOPT CONC FLAT
  AVERTIME 1 PERIOD
  POLLUTID OTHER
  FLAGPOLE 1.20
  RUNORNOT RUN
  ERRORFIL ReddingNoRotation.err
CO FINISHED
**
*****************************************
** AERMOD Source Pathway
*****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
  LOCATION UP0         POINT          0.000       0.000          0.0
```

```
   LOCATION UP05        POINT        -5.000        0.000         0.0
   LOCATION UP10        POINT       -10.000        0.000         0.0
   LOCATION UP15        POINT       -15.000        0.000         0.0
   LOCATION DOWN0       POINT         5.000        0.000         0.0
   LOCATION DOWN05      POINT        10.000        0.000         0.0
   LOCATION DOWN10      POINT        15.000        0.000         0.0
   LOCATION DOWN15      POINT        20.000        0.000         0.0
** Source Parameters **
   SRCPARAM UP0          1.0    3.660   291.000   0.00100    0.051
   SRCPARAM UP05         1.0    3.660   291.000   0.00100    0.051
   SRCPARAM UP10         1.0    3.660   291.000   0.00100    0.051
   SRCPARAM UP15         1.0    3.660   291.000   0.00100    0.051
   SRCPARAM DOWN0        1.0    3.660   291.000   0.00100    0.051
   SRCPARAM DOWN05       1.0    3.660   291.000   0.00100    0.051
   SRCPARAM DOWN10       1.0    3.660   291.000   0.00100    0.051
   SRCPARAM DOWN15       1.0    3.660   291.000   0.00100    0.051

** Building Downwash **
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP0        4.00    4.00    4.00    4.00    4.00    4.00

   BUILDHGT UP05       0.00    0.00    4.00    4.00    4.00    4.00
   BUILDHGT UP05       4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP05       4.00    4.00    4.00    0.00    0.00    0.00
   BUILDHGT UP05       0.00    0.00    4.00    4.00    4.00    4.00
   BUILDHGT UP05       4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP05       4.00    4.00    4.00    0.00    0.00    0.00

   BUILDHGT UP10       0.00    0.00    0.00    0.00    0.00    4.00
   BUILDHGT UP10       4.00    0.00    0.00    0.00    4.00    4.00
   BUILDHGT UP10       0.00    0.00    0.00    0.00    0.00    0.00
   BUILDHGT UP10       0.00    0.00    0.00    0.00    0.00    4.00
   BUILDHGT UP10       4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT UP10       0.00    0.00    0.00    0.00    0.00    0.00

   BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00
   BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00
   BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00
   BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00
   BUILDHGT UP15       4.00    4.00    4.00    4.00    4.00    0.00
   BUILDHGT UP15       0.00    0.00    0.00    0.00    0.00    0.00

   BUILDHGT DOWN0      4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN0      4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN0      4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN0      4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN0      4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN0      4.00    4.00    4.00    4.00    4.00    4.00

   BUILDHGT DOWN05     0.00    0.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN05     4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN05     4.00    4.00    4.00    0.00    0.00    0.00
   BUILDHGT DOWN05     0.00    0.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN05     4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN05     4.00    4.00    4.00    0.00    0.00    0.00

   BUILDHGT DOWN10     0.00    0.00    0.00    0.00    0.00    4.00
   BUILDHGT DOWN10     4.00    4.00    4.00    4.00    4.00    4.00
   BUILDHGT DOWN10     0.00    0.00    0.00    0.00    0.00    0.00
   BUILDHGT DOWN10     0.00    0.00    0.00    0.00    0.00    4.00
   BUILDHGT DOWN10     4.00    0.00    0.00    0.00    4.00    4.00
   BUILDHGT DOWN10     0.00    0.00    0.00    0.00    0.00    0.00

   BUILDHGT DOWN15     0.00    0.00    0.00    0.00    0.00    0.00
```

BUILDHGT DOWN15	4.00	4.00	4.00	4.00	4.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDHGT DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP0	6.66	8.12	9.33	10.26	10.87	11.16
BUILDWID UP0	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID UP0	10.87	10.26	9.33	8.12	6.66	5.00
BUILDWID UP0	6.66	8.12	9.33	10.26	10.87	11.16
BUILDWID UP0	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID UP0	10.87	10.26	9.33	8.12	6.66	5.00
BUILDWID UP05	0.00	0.00	9.33	10.26	10.87	11.16
BUILDWID UP05	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID UP05	10.87	10.26	9.33	0.00	0.00	0.00
BUILDWID UP05	0.00	0.00	9.33	10.26	10.87	11.16
BUILDWID UP05	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID UP05	10.87	10.26	9.33	0.00	0.00	0.00
BUILDWID UP10	0.00	0.00	0.00	0.00	0.00	11.16
BUILDWID UP10	11.11	0.00	0.00	0.00	11.11	11.16
BUILDWID UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP10	0.00	0.00	0.00	0.00	0.00	11.16
BUILDWID UP10	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID UP15	11.11	10.72	10.00	10.72	11.11	0.00
BUILDWID UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN0	6.66	8.12	9.33	10.26	10.87	11.16
BUILDWID DOWN0	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID DOWN0	10.87	10.26	9.33	8.12	6.66	5.00
BUILDWID DOWN0	6.66	8.12	9.33	10.26	10.87	11.16
BUILDWID DOWN0	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID DOWN0	10.87	10.26	9.33	8.12	6.66	5.00
BUILDWID DOWN05	0.00	0.00	9.33	10.26	10.87	11.16
BUILDWID DOWN05	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID DOWN05	10.87	10.26	9.33	0.00	0.00	0.00
BUILDWID DOWN05	0.00	0.00	9.33	10.26	10.87	11.16
BUILDWID DOWN05	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID DOWN05	10.87	10.26	9.33	0.00	0.00	0.00
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	11.16
BUILDWID DOWN10	11.11	10.72	10.00	10.72	11.11	11.16
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	11.16
BUILDWID DOWN10	11.11	0.00	0.00	0.00	11.11	11.16
BUILDWID DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	11.11	10.72	10.00	10.72	11.11	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDWID DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN UP0	10.72	11.11	11.16	10.87	10.26	9.33
BUILDLEN UP0	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN UP0	10.26	10.87	11.16	11.11	10.72	10.00
BUILDLEN UP0	10.72	11.11	11.16	10.87	10.26	9.33
BUILDLEN UP0	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN UP0	10.26	10.87	11.16	11.11	10.72	10.00

BUILDLEN	UP05	0.00	0.00	11.16	10.87	10.26	9.33
BUILDLEN	UP05	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN	UP05	10.26	10.87	11.16	0.00	0.00	0.00
BUILDLEN	UP05	0.00	0.00	11.16	10.87	10.26	9.33
BUILDLEN	UP05	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN	UP05	10.26	10.87	11.16	0.00	0.00	0.00
BUILDLEN	UP10	0.00	0.00	0.00	0.00	0.00	9.33
BUILDLEN	UP10	8.12	0.00	0.00	0.00	8.12	9.33
BUILDLEN	UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP10	0.00	0.00	0.00	0.00	0.00	9.33
BUILDLEN	UP10	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN	UP10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	UP15	8.12	6.66	5.00	6.66	8.12	0.00
BUILDLEN	UP15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN0	10.72	11.11	11.16	10.87	10.26	9.33
BUILDLEN	DOWN0	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN	DOWN0	10.26	10.87	11.16	11.11	10.72	10.00
BUILDLEN	DOWN0	10.72	11.11	11.16	10.87	10.26	9.33
BUILDLEN	DOWN0	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN	DOWN0	10.26	10.87	11.16	11.11	10.72	10.00
BUILDLEN	DOWN05	0.00	0.00	11.16	10.87	10.26	9.33
BUILDLEN	DOWN05	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN	DOWN05	10.26	10.87	11.16	0.00	0.00	0.00
BUILDLEN	DOWN05	0.00	0.00	11.16	10.87	10.26	9.33
BUILDLEN	DOWN05	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN	DOWN05	10.26	10.87	11.16	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	9.33
BUILDLEN	DOWN10	8.12	6.66	5.00	6.66	8.12	9.33
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	9.33
BUILDLEN	DOWN10	8.12	0.00	0.00	0.00	8.12	9.33
BUILDLEN	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	8.12	6.66	5.00	6.66	8.12	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
BUILDLEN	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP0	-4.92	-4.70	-4.33	-3.83	-3.21	-2.50
XBADJ	UP0	-1.71	-0.87	0.00	-0.87	-1.71	-2.50
XBADJ	UP0	-3.21	-3.83	-4.33	-4.70	-4.92	-5.00
XBADJ	UP0	-5.79	-6.41	-6.83	-7.04	-7.04	-6.83
XBADJ	UP0	-6.41	-5.79	-5.00	-5.79	-6.41	-6.83
XBADJ	UP0	-7.04	-7.04	-6.83	-6.41	-5.79	-5.00
XBADJ	UP05	0.00	0.00	-1.83	-0.62	0.62	1.83
XBADJ	UP05	2.99	4.06	5.00	4.06	2.99	1.83
XBADJ	UP05	0.62	-0.62	-1.83	0.00	0.00	0.00
XBADJ	UP05	0.00	0.00	-9.33	-10.26	-10.87	-11.16
XBADJ	UP05	-11.11	-10.72	-10.00	-10.72	-11.11	-11.16
XBADJ	UP05	-10.87	-10.26	-9.33	0.00	0.00	0.00
XBADJ	UP10	0.00	0.00	0.00	0.00	0.00	6.16
XBADJ	UP10	7.69	0.00	0.00	0.00	7.69	6.16
XBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP10	0.00	0.00	0.00	0.00	0.00	-15.49

XBADJ	UP10	-15.81	-15.64	-15.00	-15.64	-15.81	-15.49
XBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	UP15	-20.50	-20.56	-20.00	-20.56	-20.50	0.00
XBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN0	-5.79	-6.41	-6.83	-7.04	-7.04	-6.83
XBADJ	DOWN0	-6.41	-5.79	-5.00	-5.79	-6.41	-6.83
XBADJ	DOWN0	-7.04	-7.04	-6.83	-6.41	-5.79	-5.00
XBADJ	DOWN0	-4.92	-4.70	-4.33	-3.83	-3.21	-2.50
XBADJ	DOWN0	-1.71	-0.87	0.00	-0.87	-1.71	-2.50
XBADJ	DOWN0	-3.21	-3.83	-4.33	-4.70	-4.92	-5.00
XBADJ	DOWN05	0.00	0.00	-9.33	-10.26	-10.87	-11.16
XBADJ	DOWN05	-11.11	-10.72	-10.00	-10.72	-11.11	-11.16
XBADJ	DOWN05	-10.87	-10.26	-9.33	0.00	0.00	0.00
XBADJ	DOWN05	0.00	0.00	-1.83	-0.62	0.62	1.83
XBADJ	DOWN05	2.99	4.06	5.00	4.06	2.99	1.83
XBADJ	DOWN05	0.62	-0.62	-1.83	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	-15.49
XBADJ	DOWN10	-15.81	-15.64	-15.00	-15.64	-15.81	-15.49
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	6.16
XBADJ	DOWN10	7.69	0.00	0.00	0.00	7.69	6.16
XBADJ	DOWN10	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	-20.50	-20.56	-20.00	-20.56	-20.50	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
XBADJ	DOWN15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP0	-2.46	-2.35	-2.17	-1.92	-1.61	-1.25
YBADJ	UP0	-0.86	-0.43	0.00	0.43	0.86	1.25
YBADJ	UP0	1.61	1.92	2.17	2.35	2.46	2.50
YBADJ	UP0	2.46	2.35	2.17	1.92	1.61	1.25
YBADJ	UP0	0.86	0.43	0.00	-0.43	-0.86	-1.25
YBADJ	UP0	-1.61	-1.92	-2.17	-2.35	-2.46	-2.50
YBADJ	UP05	0.00	0.00	-6.50	-5.75	-4.82	-3.75
YBADJ	UP05	-2.57	-1.30	0.00	1.30	2.57	3.75
YBADJ	UP05	4.82	5.75	6.50	0.00	0.00	0.00
YBADJ	UP05	0.00	0.00	6.50	5.75	4.82	3.75
YBADJ	UP05	2.57	1.30	0.00	-1.30	-2.57	-3.75
YBADJ	UP05	-4.82	-5.75	-6.50	0.00	0.00	0.00
YBADJ	UP10	0.00	0.00	0.00	0.00	0.00	-6.25
YBADJ	UP10	-4.28	0.00	0.00	0.00	4.28	6.25
YBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP10	0.00	0.00	0.00	0.00	0.00	6.25
YBADJ	UP10	4.28	2.17	0.00	-2.17	-4.28	-6.25
YBADJ	UP10	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	UP15	5.99	3.04	0.00	-3.04	-5.99	0.00
YBADJ	UP15	0.00	0.00	0.00	0.00	0.00	0.00
YBADJ	DOWN0	2.46	2.35	2.17	1.92	1.61	1.25
YBADJ	DOWN0	0.86	0.43	0.00	-0.43	-0.86	-1.25

```
  YBADJ    DOWN0         -1.61   -1.92   -2.17   -2.35   -2.46   -2.50
  YBADJ    DOWN0         -2.46   -2.35   -2.17   -1.92   -1.61   -1.25
  YBADJ    DOWN0         -0.86   -0.43    0.00    0.43    0.86    1.25
  YBADJ    DOWN0          1.61    1.92    2.17    2.35    2.46    2.50

  YBADJ    DOWN05         0.00    0.00    6.50    5.75    4.82    3.75
  YBADJ    DOWN05         2.57    1.30    0.00   -1.30   -2.57   -3.75
  YBADJ    DOWN05        -4.82   -5.75   -6.50    0.00    0.00    0.00
  YBADJ    DOWN05         0.00    0.00   -6.50   -5.75   -4.82   -3.75
  YBADJ    DOWN05        -2.57   -1.30    0.00    1.30    2.57    3.75
  YBADJ    DOWN05         4.82    5.75    6.50    0.00    0.00    0.00

  YBADJ    DOWN10         0.00    0.00    0.00    0.00    0.00    6.25
  YBADJ    DOWN10         4.28    2.17    0.00   -2.17   -4.28   -6.25
  YBADJ    DOWN10         0.00    0.00    0.00    0.00    0.00    0.00
  YBADJ    DOWN10         0.00    0.00    0.00    0.00    0.00   -6.25
  YBADJ    DOWN10        -4.28    0.00    0.00    0.00    4.28    6.25
  YBADJ    DOWN10         0.00    0.00    0.00    0.00    0.00    0.00

  YBADJ    DOWN15         0.00    0.00    0.00    0.00    0.00    0.00
  YBADJ    DOWN15         5.99    3.04    0.00   -3.04   -5.99    0.00
  YBADJ    DOWN15         0.00    0.00    0.00    0.00    0.00    0.00
  YBADJ    DOWN15         0.00    0.00    0.00    0.00    0.00    0.00
  YBADJ    DOWN15         0.00    0.00    0.00    0.00    0.00    0.00
  YBADJ    DOWN15         0.00    0.00    0.00    0.00    0.00    0.00

  SRCGROUP DOWN0    DOWN0
  SRCGROUP DOWN05   DOWN05
  SRCGROUP DOWN10   DOWN10
  SRCGROUP DOWN15   DOWN15
  SRCGROUP UP0      UP0
  SRCGROUP UP05     UP05
  SRCGROUP UP10     UP10
  SRCGROUP UP15     UP15
SO FINISHED
**
******************************************
** AERMOD Receptor Pathway
******************************************
**
**
RE STARTING
  GRIDCART UCART1 STA
              XYINC 0.00 41 5.00 -35.00 15 5.00
              FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   1    1.20    1.20    1.20    1.20    1.20
              FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   2    1.20    1.20    1.20    1.20    1.20
              FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   3    1.20    1.20    1.20    1.20    1.20
              FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
              FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
```

FLAG	4	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	4	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	4	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	4	1.20	1.20	1.20	1.20	1.20	
FLAG	5	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	5	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	5	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	5	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	5	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	5	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	5	1.20	1.20	1.20	1.20	1.20	
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	6	1.20	1.20	1.20	1.20	1.20	
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	7	1.20	1.20	1.20	1.20	1.20	
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	8	1.20	1.20	1.20	1.20	1.20	
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	9	1.20	1.20	1.20	1.20	1.20	
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	10	1.20	1.20	1.20	1.20	1.20	
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	11	1.20	1.20	1.20	1.20	1.20	
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	12	1.20	1.20	1.20	1.20	1.20	
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	1.20
FLAG	13	1.20	1.20	1.20	1.20	1.20	
FLAG	14	1.20	1.20	1.20	1.20	1.20	1.20

```
            FLAG   14    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   14    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   14    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   14    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   14    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   14    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20
   GRIDCART UCART1 END
   GRIDCART UCART2 STA
            XYINC 200.00 18 20.00 -35.00 15 5.00
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   1    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   2    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   3    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   4    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   5    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   6    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   6    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   6    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   7    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   7    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   7    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   8    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   9    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   10    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   10    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   10    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   11    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   11    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   11    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   12    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   12    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   12    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   13    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   13    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   13    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   14    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   14    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   14    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
            FLAG   15    1.20    1.20    1.20    1.20    1.20    1.20
   GRIDCART UCART2 END
RE FINISHED
**
*******************************************
** AERMOD Meteorology Pathway
*******************************************
**
```

```
**
ME STARTING
   SURFFILE Redding_2013-2017.sfc
   PROFFILE Redding_2013-2017.PFL
   SURFDATA 24257 2013 REDDING/AAF
   UAIRDATA 24225 2013 MEDFORD/JACKSON_COUNTY_ARPT
   PROFBASE 151.5 METERS
   WDROTATE 71.00
ME FINISHED
**
****************************************
** AERMOD Output Pathway
****************************************
**
**
OU STARTING
   RECTABLE ALLAVE 1ST
   RECTABLE 1 1ST
** Auto-Generated Plotfiles
   PLOTFILE 1 DOWN0 1ST REDDINGNOROTATION.AD\01H1G001.PLT 31
   PLOTFILE 1 DOWN05 1ST REDDINGNOROTATION.AD\01H1G002.PLT 32
   PLOTFILE 1 DOWN10 1ST REDDINGNOROTATION.AD\01H1G003.PLT 33
   PLOTFILE 1 DOWN15 1ST REDDINGNOROTATION.AD\01H1G004.PLT 34
   PLOTFILE 1 UP0 1ST REDDINGNOROTATION.AD\01H1G005.PLT 35
   PLOTFILE 1 UP05 1ST REDDINGNOROTATION.AD\01H1G006.PLT 36
   PLOTFILE 1 UP10 1ST REDDINGNOROTATION.AD\01H1G007.PLT 37
   PLOTFILE 1 UP15 1ST REDDINGNOROTATION.AD\01H1G008.PLT 38
   PLOTFILE PERIOD DOWN0 REDDINGNOROTATION.AD\PE00G001.PLT 39
   PLOTFILE PERIOD DOWN05 REDDINGNOROTATION.AD\PE00G002.PLT 40
   PLOTFILE PERIOD DOWN10 REDDINGNOROTATION.AD\PE00G003.PLT 41
   PLOTFILE PERIOD DOWN15 REDDINGNOROTATION.AD\PE00G004.PLT 42
   PLOTFILE PERIOD UP0 REDDINGNOROTATION.AD\PE00G005.PLT 43
   PLOTFILE PERIOD UP05 REDDINGNOROTATION.AD\PE00G006.PLT 44
   PLOTFILE PERIOD UP10 REDDINGNOROTATION.AD\PE00G007.PLT 45
   PLOTFILE PERIOD UP15 REDDINGNOROTATION.AD\PE00G008.PLT 46
   SUMMFILE ReddingNoRotation.sum
OU FINISHED
**
****************************************
** Project Parameters
****************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    North American Datum 1983
** DTMRGN   CONUS
** UNITS    m
** ZONE     10
** ZONEINX  0
**
```

Appendix F: Wind Roses for Meteorological Data Sets

1. 24-Hour Wind Roses

Figure F1. Fresno (Urban) - 24-Hour Wind Rose

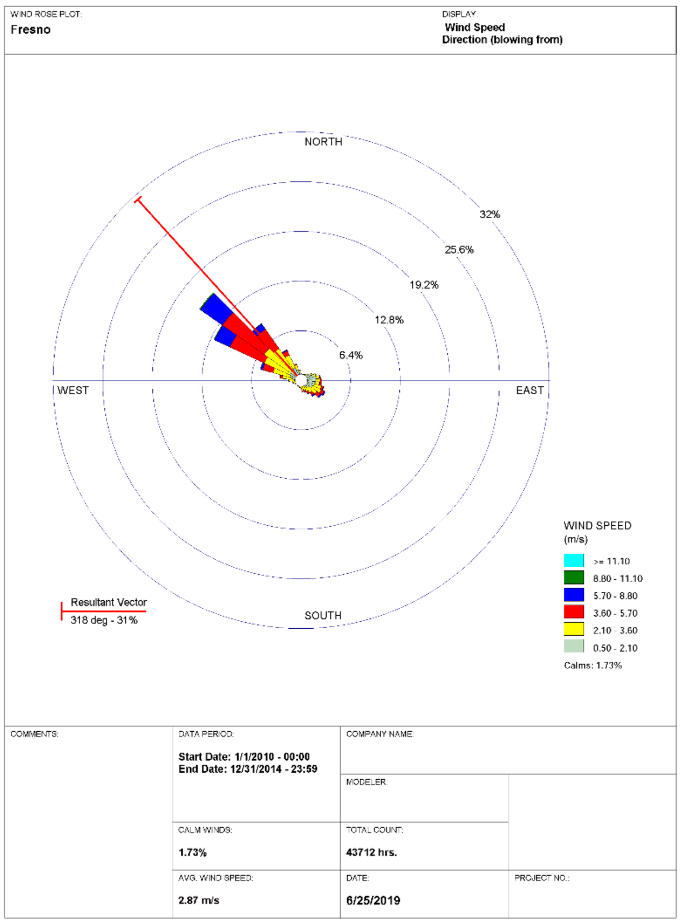


Figure F2. San Jose (Urban) - 24-Hour Wind Rose

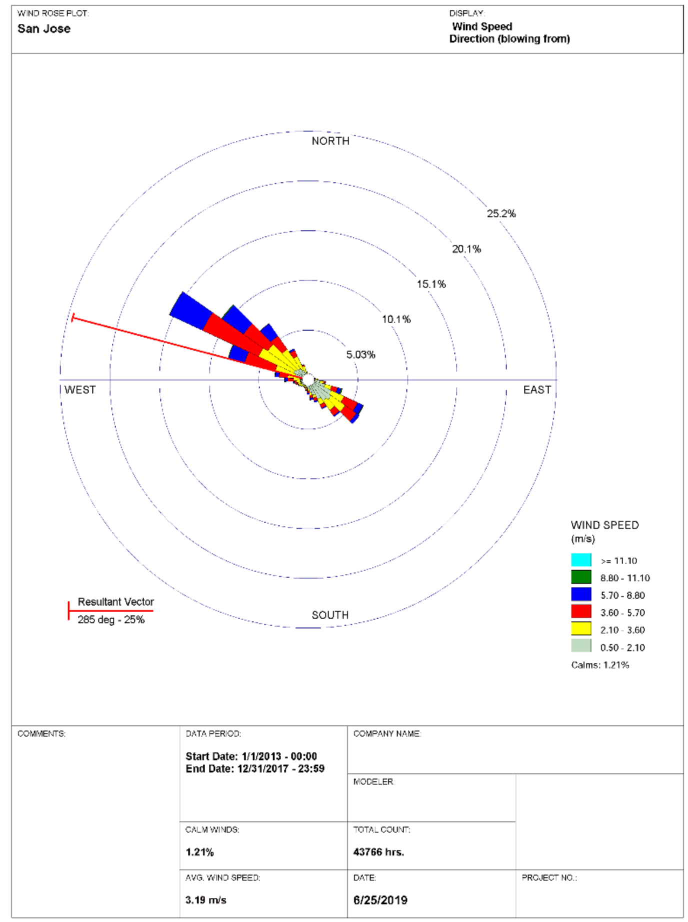


Figure F3. San Diego (Urban) - 24-Hour Wind Rose

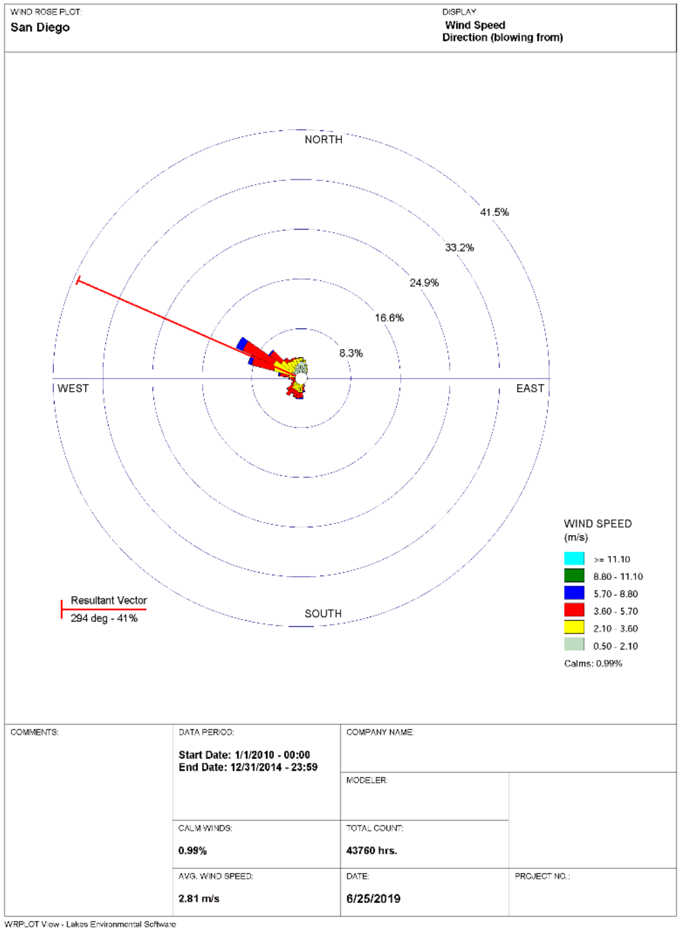


Figure F4. Ontario (Urban) - 24-Hour Wind Rose

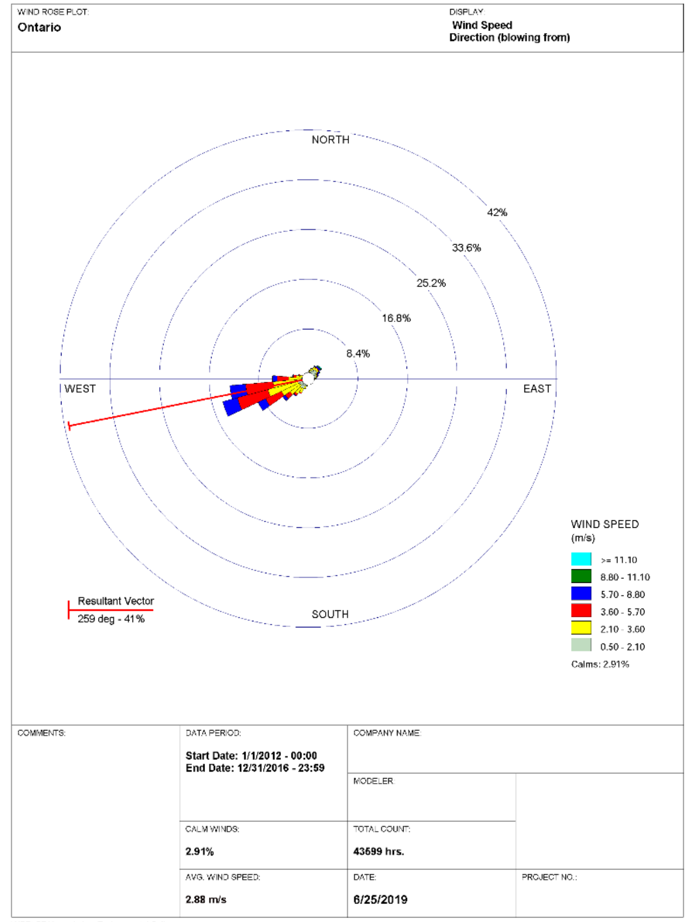


Figure F5. Redding (Rural) - 24-Hour Wind Rose

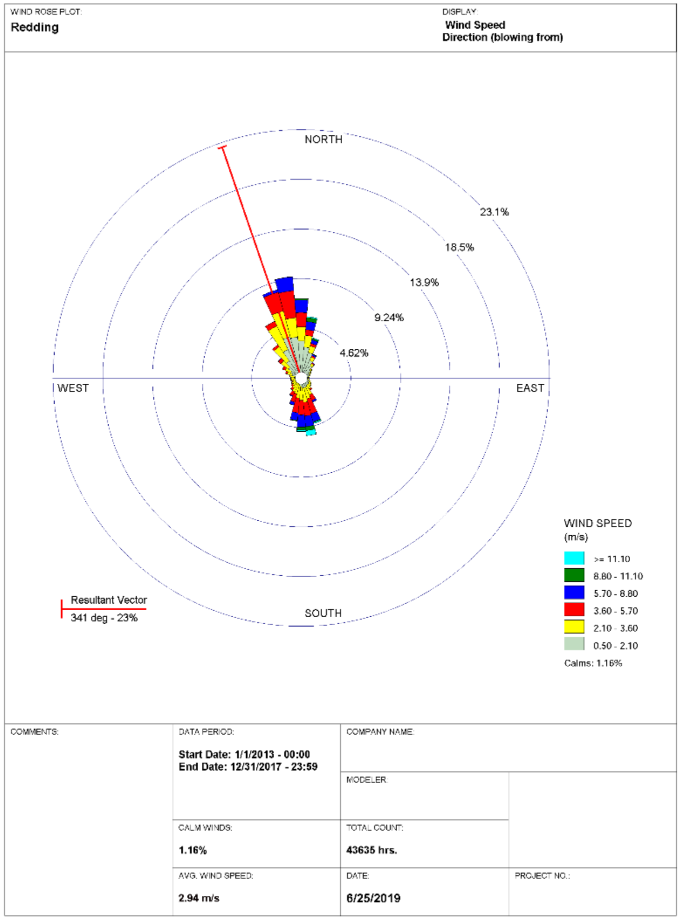
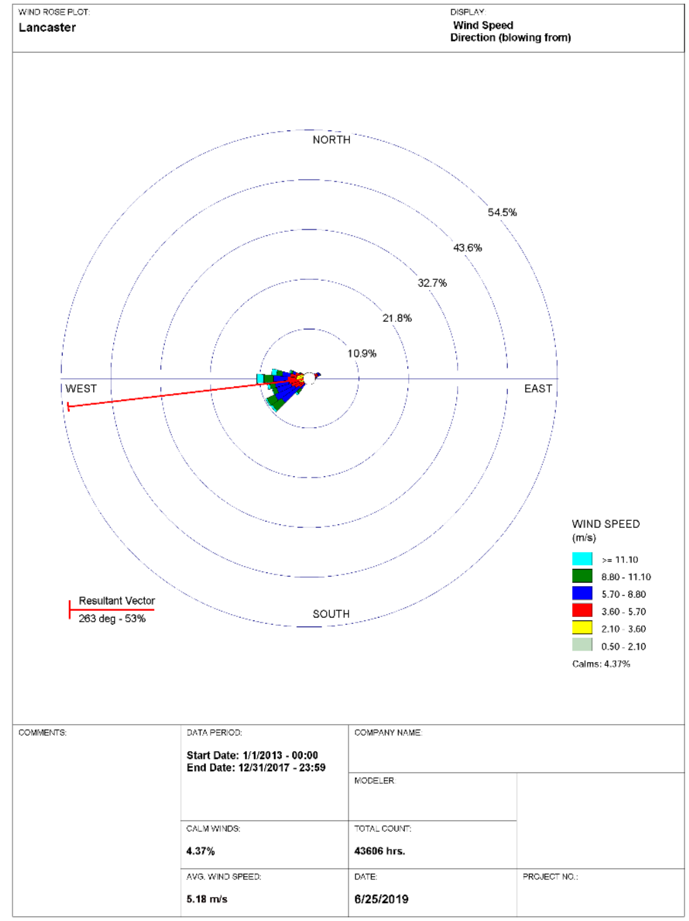


Figure F6. Lancaster (Rural) - 24-Hour Wind Rose



2. Daytime Wind Roses (6AM - 8PM)

Figure F7. Fresno (Urban) - Daytime Wind Rose

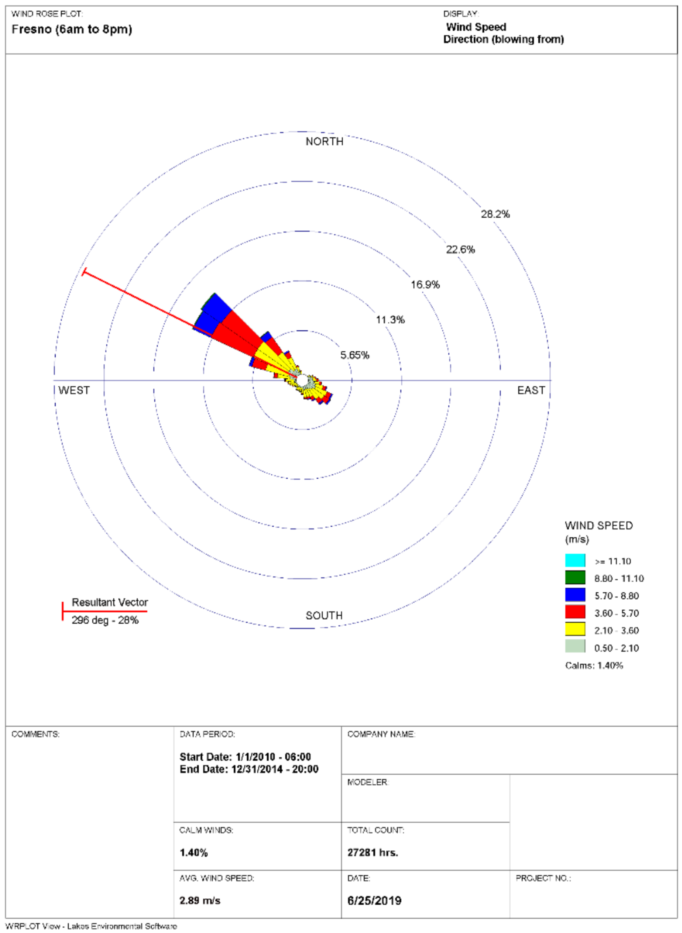


Figure F8. San Jose (Urban) - Daytime Wind Rose

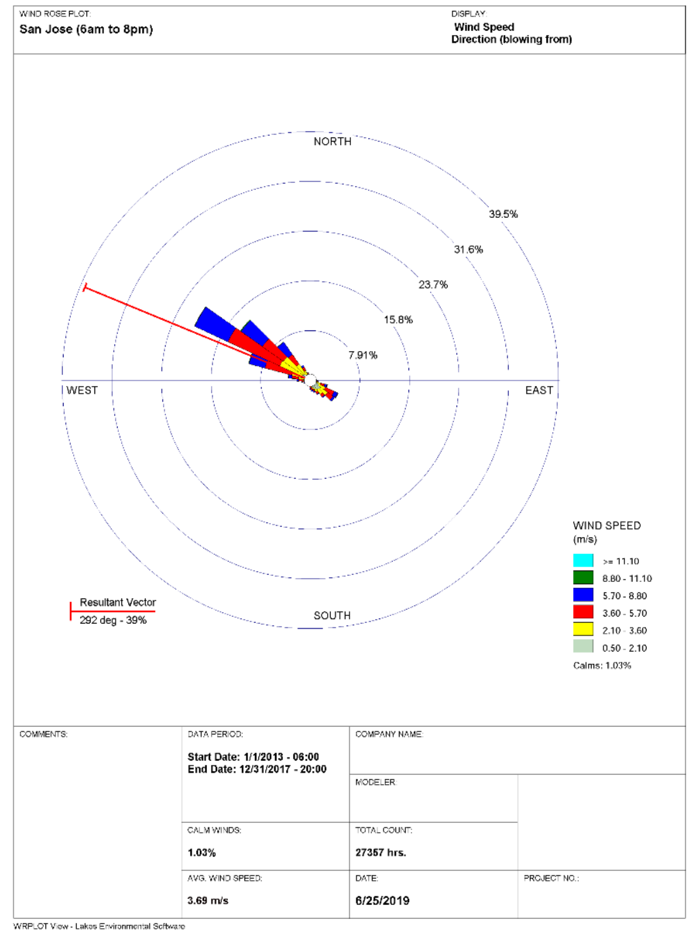


Figure F9. San Diego (Urban) - Daytime Wind Rose

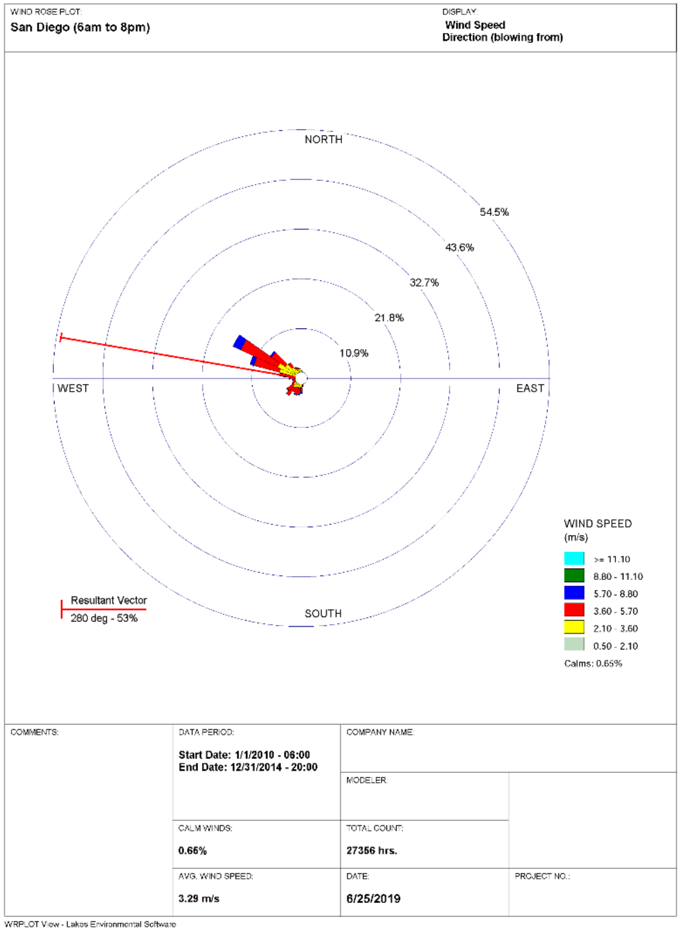


Figure F10. Ontario (Urban) - Daytime Wind Rose

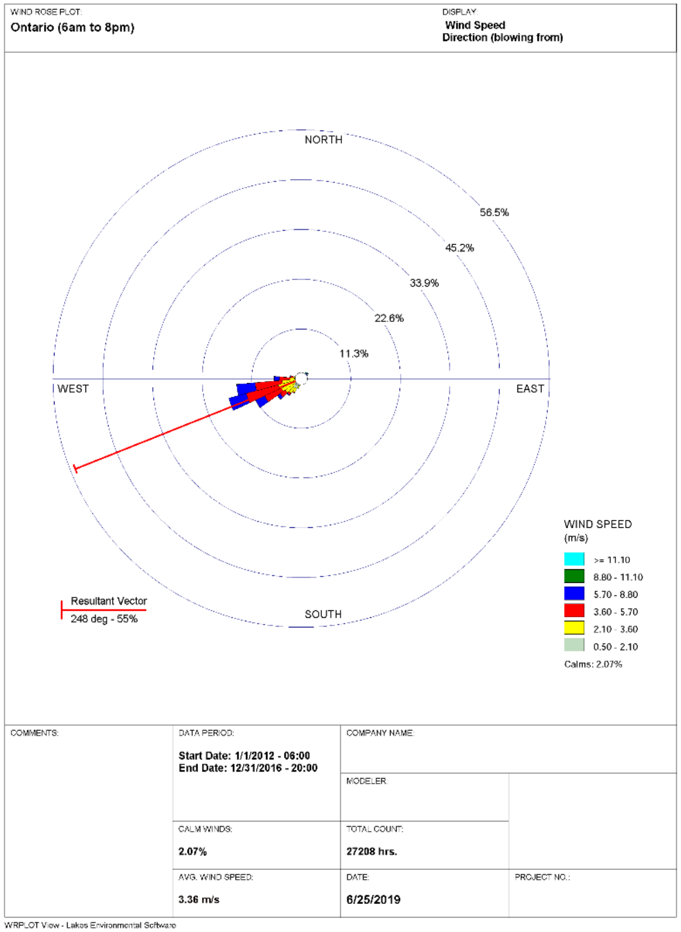


Figure F11. Redding (Rural) - Daytime Wind Rose

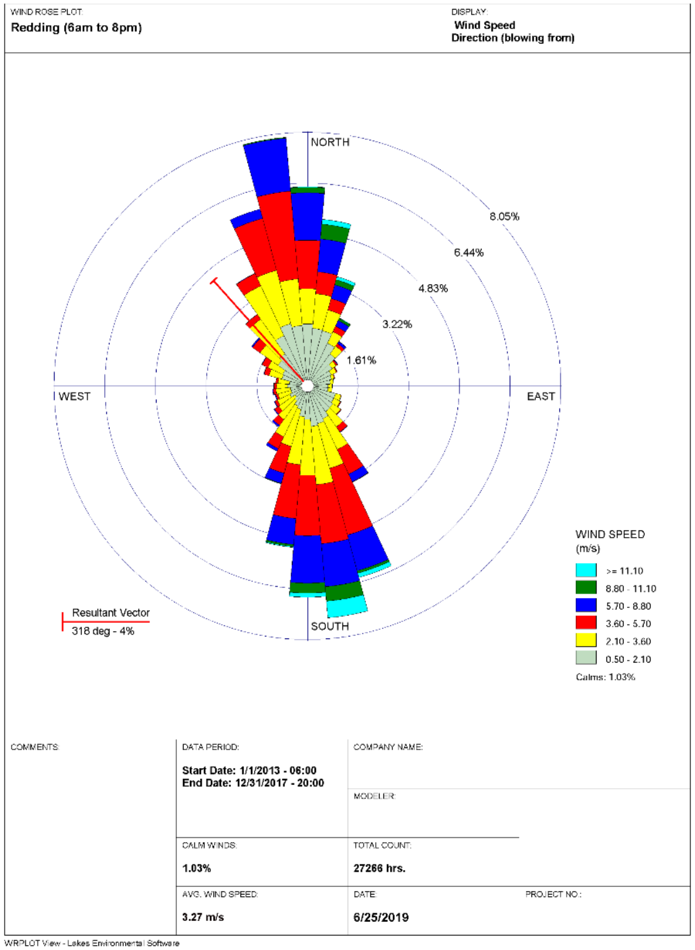
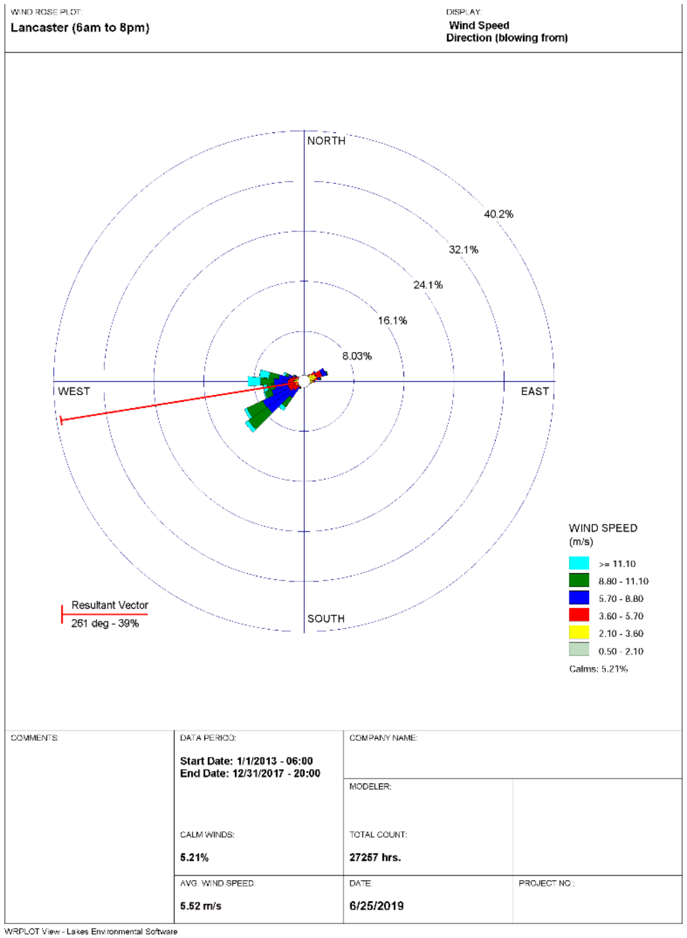


Figure F12. Lancaster (Rural) - Daytime Wind Rose



3. Nighttime Wind Roses (8PM - 6AM)

Figure F13. Fresno (Urban) - Nighttime Wind Rose

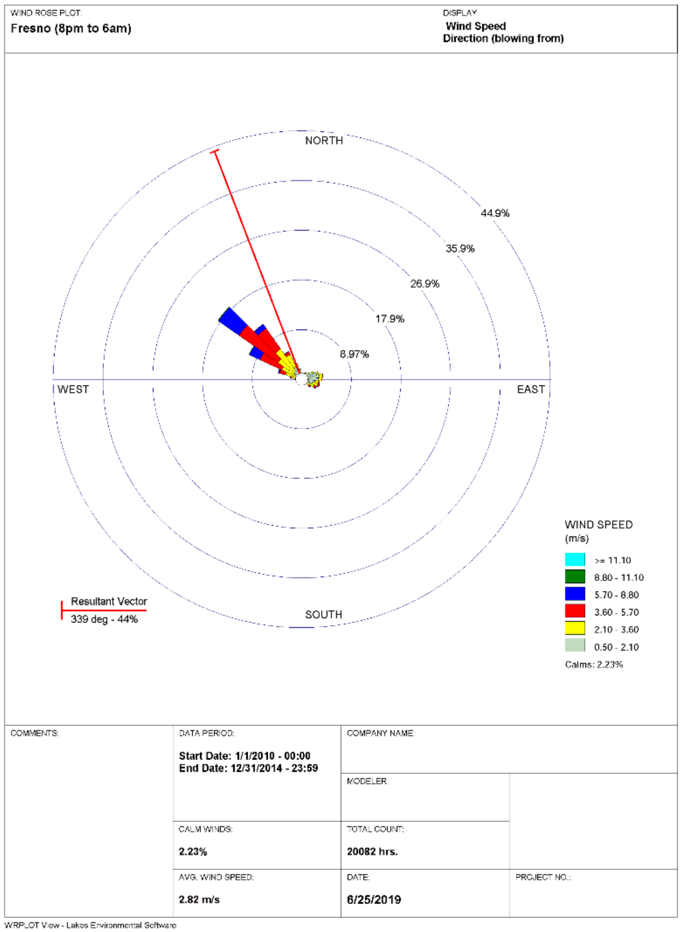


Figure F14. San Jose (Urban) - Nighttime Wind Rose

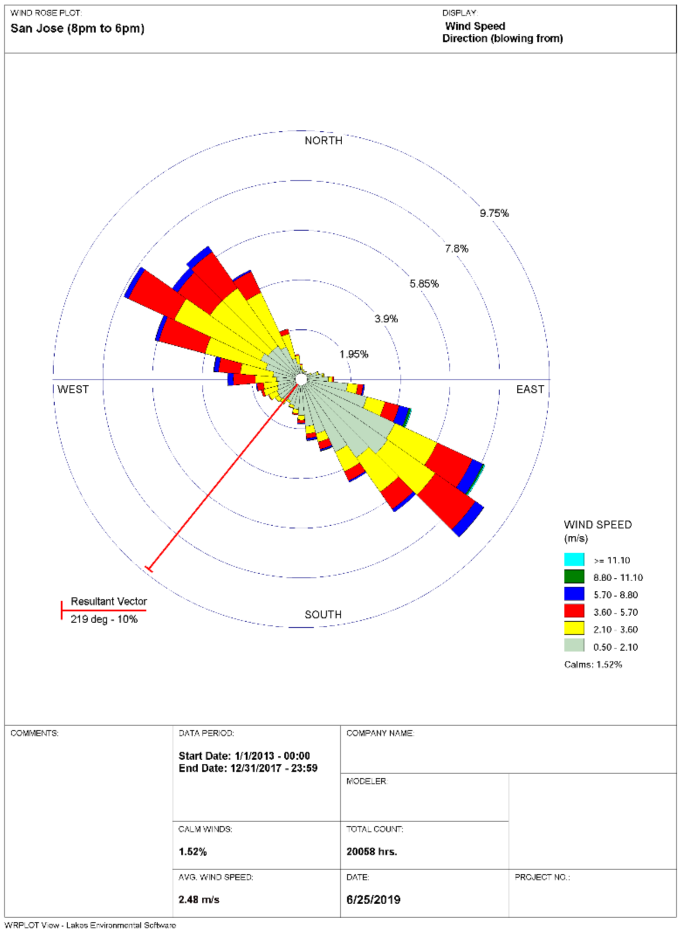


Figure F15. San Diego (Urban) - Nighttime Wind Rose

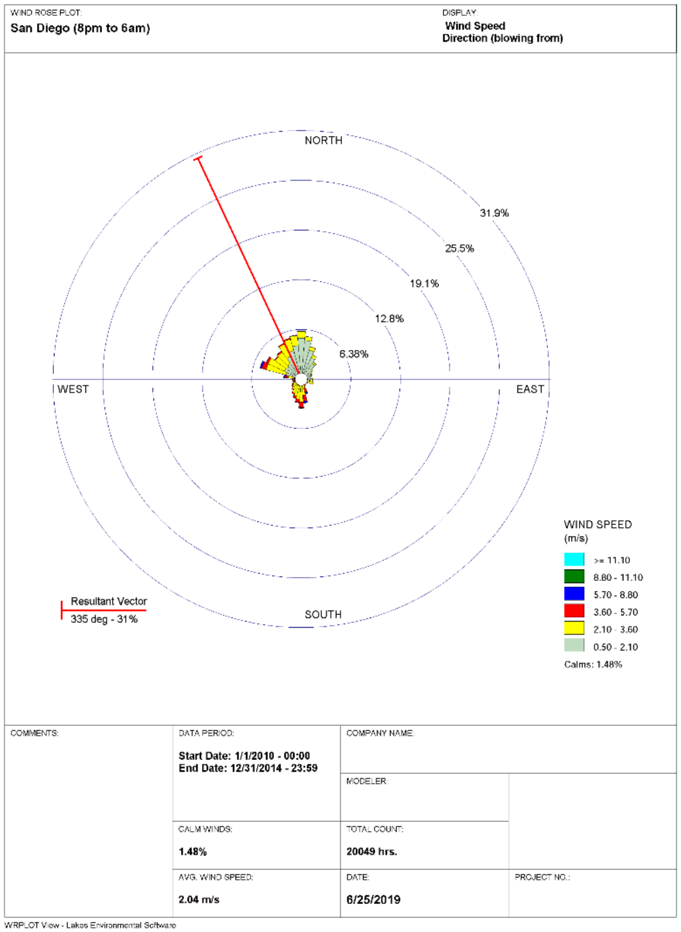


Figure F16. Ontario (Urban) - Nighttime Wind Rose

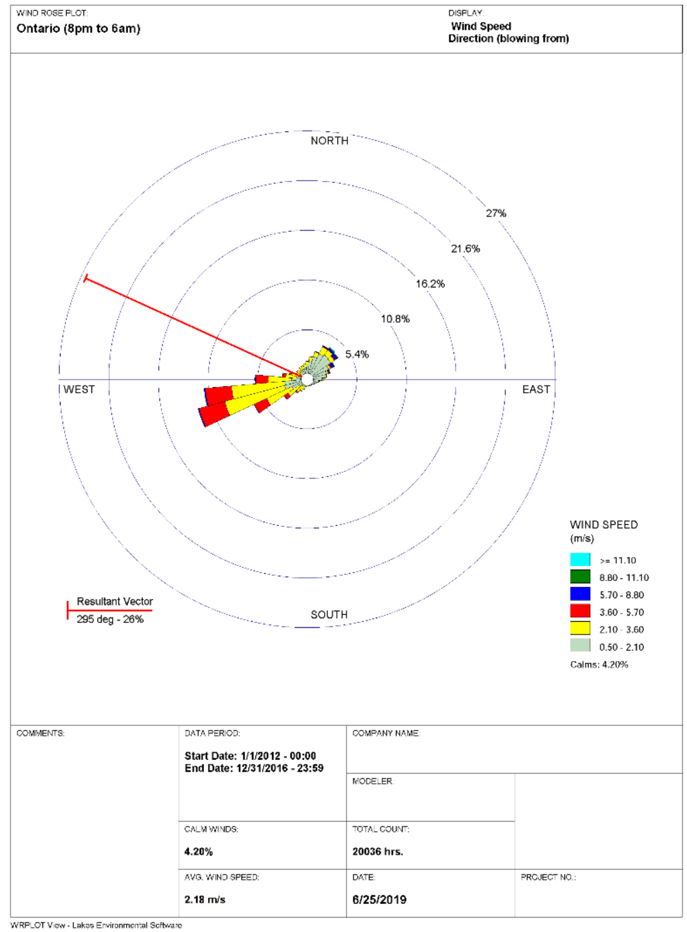


Figure F17. Redding (Rural) - Nighttime Wind Rose

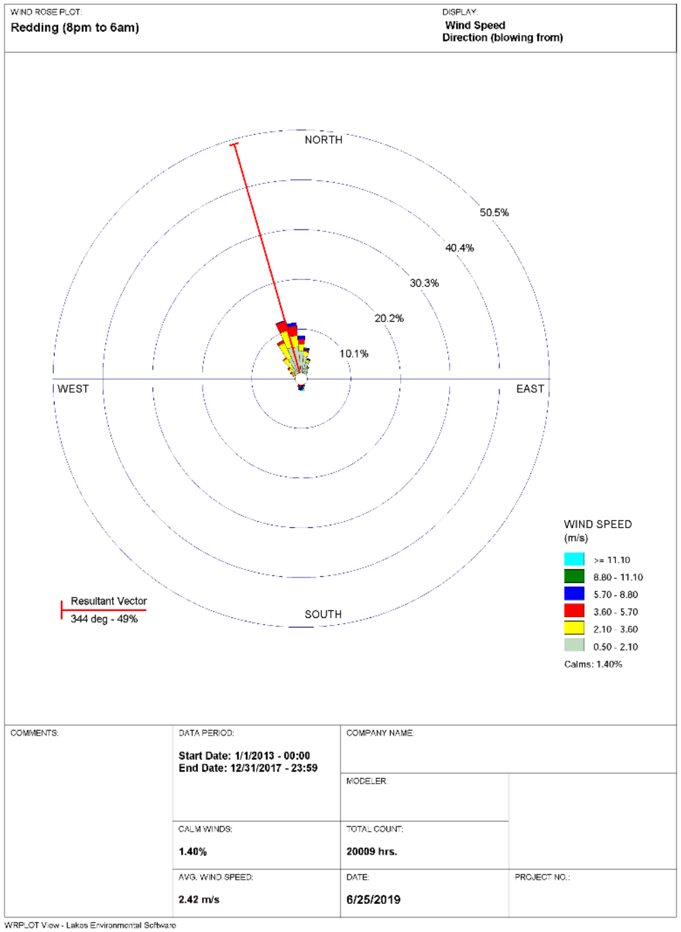
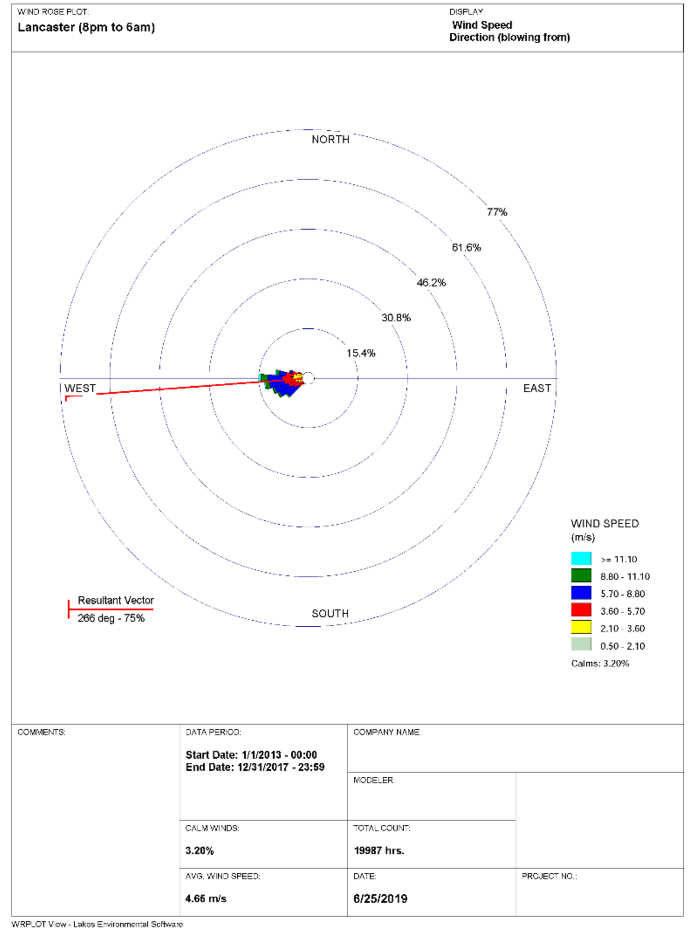


Figure F18. Lancaster (Rural) - Nighttime Wind Rose



Appendix G: Residential Cancer Risks: Tables by Scenario

Table G1. Scenario 1 (EVR Phase I and EVR Phase II) - Maximum Residential Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	8.86	6.07	7.02	7.45	6.40	7.64
20	4.94	3.46	3.85	4.23	3.42	4.55
30	3.15	2.23	2.42	2.72	2.12	2.99
40	2.19	1.56	1.67	1.89	1.46	2.11
50	1.62	1.15	1.23	1.40	1.07	1.57
60	1.25	0.89	0.94	1.08	0.82	1.21
70	0.99	0.71	0.75	0.86	0.65	0.96
80	0.81	0.58	0.61	0.70	0.53	0.79
90	0.68	0.48	0.51	0.59	0.44	0.66
100	0.57	0.40	0.43	0.50	0.38	0.56
120	0.43	0.30	0.32	0.37	0.28	0.41
140	0.33	0.24	0.25	0.29	0.22	0.32
160	0.27	0.19	0.20	0.23	0.18	0.26
180	0.22	0.16	0.17	0.19	0.14	0.21
200	0.19	0.13	0.14	0.16	0.12	0.18
220	0.16	0.11	0.12	0.14	0.10	0.15
240	0.14	0.10	0.10	0.12	0.09	0.13
260	0.12	0.08	0.09	0.11	0.08	0.11
280	0.11	0.07	0.08	0.09	0.07	0.10
300	0.09	0.07	0.07	0.08	0.06	0.09
350	0.07	0.05	0.05	0.06	0.05	0.07
400	0.06	0.04	0.04	0.05	0.04	0.05
450	0.05	0.03	0.04	0.04	0.03	0.04
500	0.04	0.03	0.03	0.04	0.03	0.04
600	0.03	0.02	0.02	0.03	0.02	0.03
700	0.02	0.02	0.02	0.02	0.01	0.02
800	0.02	0.01	0.01	0.02	0.01	0.02
900	0.01	0.01	0.01	0.01	0.01	0.01
1000	0.01	0.01	0.01	0.01	0.01	0.01

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table G2. Scenario 2 (EVR Phase I and Pre-EVR Phase II) - Maximum Residential Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	19.10	13.16	14.99	15.98	13.64	16.51
20	10.55	7.41	8.15	8.99	7.22	9.72
30	6.69	4.76	5.12	5.75	4.47	6.35
40	4.64	3.31	3.52	4.00	3.06	4.46
50	3.42	2.45	2.58	2.95	2.25	3.31
60	2.63	1.88	1.98	2.28	1.73	2.55
70	2.09	1.50	1.57	1.81	1.37	2.03
80	1.71	1.22	1.28	1.48	1.12	1.66
90	1.43	1.01	1.07	1.24	0.93	1.38
100	1.20	0.85	0.90	1.05	0.79	1.17
120	0.90	0.64	0.67	0.79	0.59	0.87
140	0.70	0.50	0.53	0.61	0.46	0.68
160	0.56	0.40	0.42	0.49	0.37	0.54
180	0.46	0.33	0.35	0.41	0.30	0.45
200	0.39	0.27	0.29	0.34	0.26	0.37
220	0.33	0.23	0.25	0.29	0.22	0.32
240	0.29	0.20	0.21	0.25	0.19	0.27
260	0.25	0.18	0.19	0.22	0.16	0.24
280	0.22	0.16	0.17	0.20	0.14	0.21
300	0.20	0.14	0.15	0.17	0.13	0.19
350	0.15	0.11	0.11	0.13	0.10	0.14
400	0.12	0.09	0.09	0.11	0.08	0.11
450	0.10	0.07	0.07	0.09	0.06	0.09
500	0.08	0.06	0.06	0.07	0.05	0.08
600	0.06	0.04	0.05	0.05	0.04	0.06
700	0.05	0.03	0.03	0.04	0.03	0.04
800	0.04	0.03	0.03	0.03	0.02	0.03
900	0.03	0.02	0.02	0.03	0.02	0.03
1000	0.03	0.02	0.02	0.02	0.02	0.02

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table G3. Scenario 3 (EVR Phase I - ORVR Only) - Maximum Residential Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	27.68	18.74	22.39	23.52	20.49	23.66
20	15.86	10.97	12.53	13.68	11.18	14.51
30	10.23	7.19	7.96	8.88	7.01	9.68
40	7.18	5.07	5.51	6.22	4.82	6.88
50	5.32	3.77	4.05	4.61	3.54	5.13
60	4.11	2.92	3.11	3.56	2.72	3.98
70	3.28	2.33	2.47	2.84	2.16	3.18
80	2.69	1.90	2.01	2.32	1.77	2.60
90	2.25	1.59	1.68	1.94	1.47	2.16
100	1.90	1.34	1.42	1.65	1.25	1.83
120	1.42	1.00	1.06	1.23	0.93	1.37
140	1.11	0.78	0.83	0.96	0.73	1.07
160	0.89	0.63	0.66	0.78	0.58	0.85
180	0.74	0.52	0.55	0.64	0.48	0.70
200	0.62	0.43	0.46	0.54	0.40	0.59
220	0.53	0.37	0.39	0.46	0.34	0.50
240	0.46	0.32	0.34	0.40	0.30	0.43
260	0.40	0.28	0.30	0.35	0.26	0.38
280	0.35	0.25	0.26	0.31	0.23	0.33
300	0.31	0.22	0.23	0.27	0.20	0.29
350	0.24	0.17	0.18	0.21	0.16	0.23
400	0.19	0.14	0.14	0.17	0.12	0.18
450	0.16	0.11	0.12	0.14	0.10	0.15
500	0.13	0.09	0.10	0.12	0.08	0.12
600	0.10	0.07	0.07	0.09	0.06	0.09
700	0.08	0.05	0.05	0.07	0.05	0.07
800	0.06	0.04	0.04	0.05	0.04	0.05
900	0.05	0.03	0.04	0.04	0.03	0.04
1000	0.04	0.03	0.03	0.04	0.03	0.04

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table G4. Scenario 4 (EVR Phase I) - Maximum Residential Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	43.43	29.69	34.57	36.59	31.57	37.31
20	24.46	17.04	19.09	20.95	16.98	22.42
30	15.66	11.06	12.07	13.50	10.58	14.82
40	10.93	7.76	8.33	9.42	7.27	10.47
50	8.08	5.75	6.11	6.97	5.34	7.79
60	6.23	4.44	4.69	5.38	4.10	6.03
70	4.96	3.54	3.73	4.29	3.26	4.80
80	4.07	2.89	3.04	3.51	2.66	3.93
90	3.40	2.41	2.53	2.93	2.22	3.27
100	2.87	2.02	2.14	2.48	1.88	2.77
120	2.15	1.51	1.60	1.86	1.40	2.07
140	1.68	1.18	1.25	1.45	1.09	1.61
160	1.35	0.95	1.00	1.17	0.88	1.29
180	1.11	0.78	0.82	0.96	0.72	1.06
200	0.93	0.65	0.69	0.81	0.61	0.89
220	0.80	0.56	0.59	0.69	0.52	0.75
240	0.69	0.48	0.51	0.60	0.45	0.65
260	0.60	0.42	0.45	0.53	0.39	0.57
280	0.53	0.37	0.39	0.46	0.34	0.50
300	0.47	0.33	0.35	0.41	0.31	0.44
350	0.37	0.26	0.27	0.32	0.24	0.34
400	0.29	0.20	0.21	0.26	0.19	0.27
450	0.24	0.17	0.18	0.21	0.15	0.22
500	0.20	0.14	0.15	0.18	0.13	0.18
600	0.15	0.10	0.11	0.13	0.09	0.13
700	0.11	0.08	0.08	0.10	0.07	0.10
800	0.09	0.06	0.07	0.08	0.06	0.08
900	0.07	0.05	0.05	0.07	0.05	0.07
1000	0.06	0.04	0.05	0.05	0.04	0.06

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table G5. Scenario 5 (Pre-EVR Phase I and Pre-EVR Phase II) - Maximum Residential Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	20.62	14.08	16.44	17.39	15.01	17.72
20	11.62	8.09	9.08	9.96	8.08	10.66
30	7.44	5.25	5.74	6.42	5.04	7.04
40	5.19	3.69	3.96	4.48	3.46	4.98
50	3.84	2.73	2.91	3.32	2.54	3.71
60	2.96	2.11	2.23	2.56	1.95	2.87
70	2.36	1.68	1.77	2.04	1.55	2.29
80	1.93	1.37	1.45	1.67	1.27	1.87
90	1.61	1.14	1.20	1.39	1.05	1.56
100	1.36	0.96	1.02	1.18	0.89	1.32
120	1.02	0.72	0.76	0.89	0.67	0.98
140	0.80	0.56	0.59	0.69	0.52	0.76
160	0.64	0.45	0.48	0.56	0.42	0.61
180	0.53	0.37	0.39	0.46	0.34	0.50
200	0.44	0.31	0.33	0.39	0.29	0.42
220	0.38	0.26	0.28	0.33	0.25	0.36
240	0.33	0.23	0.24	0.29	0.21	0.31
260	0.29	0.20	0.21	0.25	0.19	0.27
280	0.25	0.18	0.19	0.22	0.16	0.24
300	0.22	0.16	0.17	0.20	0.15	0.21
350	0.17	0.12	0.13	0.15	0.11	0.16
400	0.14	0.10	0.10	0.12	0.09	0.13
450	0.11	0.08	0.08	0.10	0.07	0.10
500	0.10	0.07	0.07	0.08	0.06	0.09
600	0.07	0.05	0.05	0.06	0.04	0.06
700	0.05	0.04	0.04	0.05	0.03	0.05
800	0.04	0.03	0.03	0.04	0.03	0.04
900	0.04	0.02	0.03	0.03	0.02	0.03
1000	0.03	0.02	0.02	0.03	0.02	0.03

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table G6. Scenario 6 (Pre-EVR Phase I - ORVR Only) - Maximum Residential Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	29.19	19.65	23.84	24.91	21.85	24.86
20	16.93	11.65	13.45	14.65	12.03	15.44
30	10.98	7.69	8.58	9.55	7.57	10.37
40	7.72	5.44	5.95	6.70	5.21	7.40
50	5.74	4.06	4.38	4.97	3.83	5.53
60	4.44	3.15	3.36	3.84	2.94	4.29
70	3.54	2.51	2.67	3.07	2.34	3.43
80	2.90	2.06	2.18	2.51	1.91	2.80
90	2.43	1.72	1.81	2.10	1.59	2.34
100	2.06	1.44	1.54	1.78	1.35	1.98
120	1.54	1.08	1.15	1.33	1.01	1.48
140	1.20	0.84	0.89	1.04	0.78	1.15
160	0.97	0.68	0.72	0.84	0.63	0.92
180	0.80	0.56	0.59	0.69	0.52	0.76
200	0.67	0.47	0.50	0.58	0.43	0.64
220	0.57	0.40	0.42	0.50	0.37	0.54
240	0.50	0.35	0.37	0.43	0.32	0.47
260	0.43	0.30	0.32	0.38	0.28	0.41
280	0.38	0.27	0.28	0.33	0.25	0.36
300	0.34	0.24	0.25	0.30	0.22	0.32
350	0.26	0.18	0.19	0.23	0.17	0.24
400	0.21	0.15	0.15	0.18	0.13	0.19
450	0.17	0.12	0.13	0.15	0.11	0.16
500	0.14	0.10	0.11	0.13	0.09	0.13
600	0.11	0.07	0.08	0.09	0.07	0.10
700	0.08	0.06	0.06	0.07	0.05	0.07
800	0.07	0.05	0.05	0.06	0.04	0.06
900	0.05	0.04	0.04	0.05	0.03	0.05
1000	0.05	0.03	0.03	0.04	0.03	0.04

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table G7. Scenario 7 (Pre-EVR Phase I) - Maximum Residential Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	44.95	30.61	36.03	38.00	32.93	38.52
20	25.53	17.72	20.02	21.92	17.83	23.36
30	16.41	11.56	12.69	14.17	11.15	15.51
40	11.48	8.13	8.77	9.91	7.67	10.99
50	8.50	6.04	6.44	7.34	5.63	8.19
60	6.56	4.67	4.95	5.66	4.33	6.34
70	5.23	3.72	3.93	4.52	3.44	5.06
80	4.28	3.04	3.20	3.69	2.81	4.13
90	3.58	2.53	2.67	3.08	2.34	3.44
100	3.03	2.13	2.26	2.62	1.98	2.92
120	2.27	1.59	1.69	1.96	1.48	2.18
140	1.77	1.24	1.31	1.53	1.15	1.69
160	1.42	1.00	1.06	1.23	0.93	1.36
180	1.17	0.82	0.87	1.02	0.76	1.12
200	0.99	0.69	0.73	0.85	0.64	0.93
220	0.84	0.59	0.62	0.73	0.54	0.80
240	0.73	0.51	0.54	0.63	0.47	0.69
260	0.64	0.45	0.47	0.55	0.41	0.60
280	0.56	0.39	0.41	0.49	0.36	0.53
300	0.50	0.35	0.37	0.44	0.32	0.47
350	0.39	0.27	0.28	0.34	0.25	0.36
400	0.31	0.22	0.23	0.27	0.20	0.28
450	0.25	0.18	0.19	0.22	0.16	0.23
500	0.21	0.15	0.16	0.18	0.13	0.19
600	0.16	0.11	0.11	0.14	0.10	0.14
700	0.12	0.08	0.09	0.10	0.08	0.11
800	0.10	0.07	0.07	0.08	0.06	0.09
900	0.08	0.05	0.06	0.07	0.05	0.07
1000	0.07	0.05	0.05	0.06	0.04	0.06

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Appendix H: Worker Cancer Risks: Tables by Scenario

Table H1. Scenario 1 (EVR Phase I and EVR Phase II) - Maximum Worker Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	0.73	0.50	0.58	0.61	0.53	0.63
20	0.41	0.29	0.32	0.35	0.28	0.38
30	0.26	0.18	0.20	0.22	0.18	0.25
40	0.18	0.13	0.14	0.16	0.12	0.17
50	0.13	0.10	0.10	0.12	0.09	0.13
60	0.10	0.07	0.08	0.09	0.07	0.10
70	0.08	0.06	0.06	0.07	0.05	0.08
80	0.07	0.05	0.05	0.06	0.04	0.07
90	0.06	0.04	0.04	0.05	0.04	0.05
100	0.05	0.03	0.04	0.04	0.03	0.05
120	0.04	0.02	0.03	0.03	0.02	0.03
140	0.03	0.02	0.02	0.02	0.02	0.03
160	0.02	0.02	0.02	0.02	0.01	0.02
180	0.02	0.01	0.01	0.02	0.01	0.02
200	0.02	0.01	0.01	0.01	0.01	0.01
220	0.01	0.01	0.01	0.01	0.01	0.01
240	0.01	0.01	0.01	0.01	0.01	0.01
260	0.01	0.01	0.01	0.01	0.01	0.01
280	0.01	0.01	0.01	0.01	0.01	0.01
300	0.01	0.01	0.01	0.01	0.01	0.01
350	0.01	0.00	0.00	0.01	0.00	0.01
400	0.00	0.00	0.00	0.00	0.00	0.00
450	0.00	0.00	0.00	0.00	0.00	0.00
500	0.00	0.00	0.00	0.00	0.00	0.00
600	0.00	0.00	0.00	0.00	0.00	0.00
700	0.00	0.00	0.00	0.00	0.00	0.00
800	0.00	0.00	0.00	0.00	0.00	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table H2. Scenario 2 (EVR Phase I and Pre-EVR Phase II) - Maximum Worker Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	1.58	1.09	1.24	1.32	1.13	1.36
20	0.87	0.61	0.67	0.74	0.60	0.80
30	0.55	0.39	0.42	0.47	0.37	0.52
40	0.38	0.27	0.29	0.33	0.25	0.37
50	0.28	0.20	0.21	0.24	0.19	0.27
60	0.22	0.16	0.16	0.19	0.14	0.21
70	0.17	0.12	0.13	0.15	0.11	0.17
80	0.14	0.10	0.11	0.12	0.09	0.14
90	0.12	0.08	0.09	0.10	0.08	0.11
100	0.10	0.07	0.07	0.09	0.07	0.10
120	0.07	0.05	0.06	0.06	0.05	0.07
140	0.06	0.04	0.04	0.05	0.04	0.06
160	0.05	0.03	0.03	0.04	0.03	0.04
180	0.04	0.03	0.03	0.03	0.03	0.04
200	0.03	0.02	0.02	0.03	0.02	0.03
220	0.03	0.02	0.02	0.02	0.02	0.03
240	0.02	0.02	0.02	0.02	0.02	0.02
260	0.02	0.01	0.02	0.02	0.01	0.02
280	0.02	0.01	0.01	0.02	0.01	0.02
300	0.02	0.01	0.01	0.01	0.01	0.02
350	0.01	0.01	0.01	0.01	0.01	0.01
400	0.01	0.01	0.01	0.01	0.01	0.01
450	0.01	0.01	0.01	0.01	0.01	0.01
500	0.01	0.00	0.01	0.01	0.00	0.01
600	0.01	0.00	0.00	0.00	0.00	0.00
700	0.00	0.00	0.00	0.00	0.00	0.00
800	0.00	0.00	0.00	0.00	0.00	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table H3. Scenario 3 (EVR Phase I - ORVR Only) - Maximum Worker Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	2.28	1.55	1.85	1.94	1.69	1.95
20	1.31	0.90	1.03	1.13	0.92	1.20
30	0.84	0.59	0.66	0.73	0.58	0.80
40	0.59	0.42	0.45	0.51	0.40	0.57
50	0.44	0.31	0.33	0.38	0.29	0.42
60	0.34	0.24	0.26	0.29	0.22	0.33
70	0.27	0.19	0.20	0.23	0.18	0.26
80	0.22	0.16	0.17	0.19	0.15	0.21
90	0.19	0.13	0.14	0.16	0.12	0.18
100	0.16	0.11	0.12	0.14	0.10	0.15
120	0.12	0.08	0.09	0.10	0.08	0.11
140	0.09	0.06	0.07	0.08	0.06	0.09
160	0.07	0.05	0.05	0.06	0.05	0.07
180	0.06	0.04	0.05	0.05	0.04	0.06
200	0.05	0.04	0.04	0.04	0.03	0.05
220	0.04	0.03	0.03	0.04	0.03	0.04
240	0.04	0.03	0.03	0.03	0.02	0.04
260	0.03	0.02	0.02	0.03	0.02	0.03
280	0.03	0.02	0.02	0.03	0.02	0.03
300	0.03	0.02	0.02	0.02	0.02	0.02
350	0.02	0.01	0.01	0.02	0.01	0.02
400	0.02	0.01	0.01	0.01	0.01	0.01
450	0.01	0.01	0.01	0.01	0.01	0.01
500	0.01	0.01	0.01	0.01	0.01	0.01
600	0.01	0.01	0.01	0.01	0.01	0.01
700	0.01	0.00	0.00	0.01	0.00	0.01
800	0.00	0.00	0.00	0.00	0.00	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table H4. Scenario 4 (EVR Phase I) - Maximum Worker Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	3.59	2.45	2.85	3.02	2.61	3.08
20	2.02	1.41	1.58	1.73	1.40	1.85
30	1.29	0.91	1.00	1.11	0.87	1.22
40	0.90	0.64	0.69	0.78	0.60	0.86
50	0.67	0.47	0.50	0.58	0.44	0.64
60	0.51	0.37	0.39	0.44	0.34	0.50
70	0.41	0.29	0.31	0.35	0.27	0.40
80	0.34	0.24	0.25	0.29	0.22	0.32
90	0.28	0.20	0.21	0.24	0.18	0.27
100	0.24	0.17	0.18	0.20	0.16	0.23
120	0.18	0.12	0.13	0.15	0.12	0.17
140	0.14	0.10	0.10	0.12	0.09	0.13
160	0.11	0.08	0.08	0.10	0.07	0.11
180	0.09	0.06	0.07	0.08	0.06	0.09
200	0.08	0.05	0.06	0.07	0.05	0.07
220	0.07	0.05	0.05	0.06	0.04	0.06
240	0.06	0.04	0.04	0.05	0.04	0.05
260	0.05	0.03	0.04	0.04	0.03	0.05
280	0.04	0.03	0.03	0.04	0.03	0.04
300	0.04	0.03	0.03	0.03	0.03	0.04
350	0.03	0.02	0.02	0.03	0.02	0.03
400	0.02	0.02	0.02	0.02	0.02	0.02
450	0.02	0.01	0.01	0.02	0.01	0.02
500	0.02	0.01	0.01	0.01	0.01	0.02
600	0.01	0.01	0.01	0.01	0.01	0.01
700	0.01	0.01	0.01	0.01	0.01	0.01
800	0.01	0.01	0.01	0.01	0.00	0.01
900	0.01	0.00	0.00	0.01	0.00	0.01
1000	0.01	0.00	0.00	0.00	0.00	0.00

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table H5. Scenario 5 (Pre-EVR Phase I and Pre-EVR Phase II) - Maximum Worker Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	1.70	1.16	1.36	1.44	1.46	1.46
20	0.96	0.67	0.75	0.82	0.88	0.88
30	0.61	0.43	0.47	0.53	0.58	0.58
40	0.43	0.30	0.33	0.37	0.41	0.41
50	0.32	0.23	0.24	0.27	0.31	0.31
60	0.24	0.17	0.18	0.21	0.24	0.24
70	0.19	0.14	0.15	0.17	0.19	0.19
80	0.16	0.11	0.12	0.14	0.15	0.15
90	0.13	0.09	0.10	0.11	0.13	0.13
100	0.11	0.08	0.08	0.10	0.11	0.11
120	0.08	0.06	0.06	0.07	0.08	0.08
140	0.07	0.05	0.05	0.06	0.06	0.06
160	0.05	0.04	0.04	0.05	0.05	0.05
180	0.04	0.03	0.03	0.04	0.04	0.04
200	0.04	0.03	0.03	0.03	0.03	0.03
220	0.03	0.02	0.02	0.03	0.03	0.03
240	0.03	0.02	0.02	0.02	0.03	0.03
260	0.02	0.02	0.02	0.02	0.02	0.02
280	0.02	0.01	0.02	0.02	0.02	0.02
300	0.02	0.01	0.01	0.02	0.02	0.02
350	0.01	0.01	0.01	0.01	0.01	0.01
400	0.01	0.01	0.01	0.01	0.01	0.01
450	0.01	0.01	0.01	0.01	0.01	0.01
500	0.01	0.01	0.01	0.01	0.01	0.01
600	0.01	0.00	0.00	0.01	0.01	0.01
700	0.00	0.00	0.00	0.00	0.00	0.00
800	0.00	0.00	0.00	0.00	0.00	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table H6. Scenario 6 (Pre-EVR Phase I - ORVR Only) - Maximum Worker Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	2.41	1.62	1.97	2.06	1.80	2.05
20	1.40	0.96	1.11	1.21	0.99	1.27
30	0.91	0.63	0.71	0.79	0.62	0.86
40	0.64	0.45	0.49	0.55	0.43	0.61
50	0.47	0.33	0.36	0.41	0.32	0.46
60	0.37	0.26	0.28	0.32	0.24	0.35
70	0.29	0.21	0.22	0.25	0.19	0.28
80	0.24	0.17	0.18	0.21	0.16	0.23
90	0.20	0.14	0.15	0.17	0.13	0.19
100	0.17	0.12	0.13	0.15	0.11	0.16
120	0.13	0.09	0.09	0.11	0.08	0.12
140	0.10	0.07	0.07	0.09	0.06	0.10
160	0.08	0.06	0.06	0.07	0.05	0.08
180	0.07	0.05	0.05	0.06	0.04	0.06
200	0.06	0.04	0.04	0.05	0.04	0.05
220	0.05	0.03	0.03	0.04	0.03	0.04
240	0.04	0.03	0.03	0.04	0.03	0.04
260	0.04	0.03	0.03	0.03	0.02	0.03
280	0.03	0.02	0.02	0.03	0.02	0.03
300	0.03	0.02	0.02	0.02	0.02	0.03
350	0.02	0.02	0.02	0.02	0.01	0.02
400	0.02	0.01	0.01	0.02	0.01	0.02
450	0.01	0.01	0.01	0.01	0.01	0.01
500	0.01	0.01	0.01	0.01	0.01	0.01
600	0.01	0.01	0.01	0.01	0.01	0.01
700	0.01	0.00	0.00	0.01	0.00	0.01
800	0.01	0.00	0.00	0.00	0.00	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Table H7. Scenario 7 (Pre-EVR Phase I) - Maximum Worker Cancer Risk (chances per million)[1,2]

Grid Distance (meters)[2]	Rural		Urban			
	Redding	Lancaster	Fresno	Ontario	San Diego	San Jose
10	3.71	2.53	2.97	3.14	2.72	3.18
20	2.11	1.46	1.65	1.81	1.47	1.93
30	1.35	0.95	1.05	1.17	0.92	1.28
40	0.95	0.67	0.72	0.82	0.63	0.91
50	0.70	0.50	0.53	0.61	0.46	0.68
60	0.54	0.39	0.41	0.47	0.36	0.52
70	0.43	0.31	0.32	0.37	0.28	0.42
80	0.35	0.25	0.26	0.30	0.23	0.34
90	0.30	0.21	0.22	0.25	0.19	0.28
100	0.25	0.18	0.19	0.22	0.16	0.24
120	0.19	0.13	0.14	0.16	0.12	0.18
140	0.15	0.10	0.11	0.13	0.10	0.14
160	0.12	0.08	0.09	0.10	0.08	0.11
180	0.10	0.07	0.07	0.08	0.06	0.09
200	0.08	0.06	0.06	0.07	0.05	0.08
220	0.07	0.05	0.05	0.06	0.04	0.07
240	0.06	0.04	0.04	0.05	0.04	0.06
260	0.05	0.04	0.04	0.05	0.03	0.05
280	0.05	0.03	0.03	0.04	0.03	0.04
300	0.04	0.03	0.03	0.04	0.03	0.04
350	0.03	0.02	0.02	0.03	0.02	0.03
400	0.03	0.02	0.02	0.02	0.02	0.02
450	0.02	0.01	0.02	0.02	0.01	0.02
500	0.02	0.01	0.01	0.02	0.01	0.02
600	0.01	0.01	0.01	0.01	0.01	0.01
700	0.01	0.01	0.01	0.01	0.01	0.01
800	0.01	0.01	0.01	0.01	0.00	0.01
900	0.01	0.00	0.00	0.01	0.00	0.01
1000	0.01	0.00	0.00	0.00	0.00	0.00

1. Per million gallons dispensed.
2. All receptor distances are measured from the edge of the canopy.

Appendix I: Rural Acute Health Impacts: Tables by Scenario

Table I1. Scenario 1 (EVR Phase I and EVR Phase II) - Rural Acute Hazard Index[1,2,3,4]

Grid Distance (meters)[2]	Redding		Lancaster	
	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)
10	0.55	0.33	0.51	0.33
20	0.35	0.23	0.36	0.25
30	0.26	0.15	0.27	0.18
40	0.25	0.15	0.24	0.16
50	0.21	0.11	0.22	0.13
60	0.19	0.10	0.19	0.11
70	0.17	0.09	0.17	0.09
80	0.15	0.07	0.16	0.08
90	0.13	0.06	0.14	0.07
100	0.12	0.06	0.13	0.06
120	0.10	0.05	0.11	0.05
140	0.08	0.04	0.09	0.04
160	0.07	0.03	0.08	0.04
180	0.06	0.03	0.07	0.03
200	0.05	0.02	0.06	0.03
220	0.05	0.02	0.05	0.02
240	0.04	0.02	0.05	0.02
260	0.04	0.02	0.04	0.02
280	0.04	0.02	0.04	0.02
300	0.03	0.01	0.04	0.02
350	0.03	0.01	0.03	0.01
400	0.02	0.01	0.03	0.01
450	0.02	0.01	0.02	0.01
500	0.02	0.01	0.02	0.01
600	0.01	0.01	0.02	0.01
700	0.01	0.00	0.01	0.01
800	0.01	0.00	0.01	0.00
900	0.01	0.00	0.01	0.00
1000	0.01	0.00	0.01	0.00

1. Hazard index is determined by adding the loading and dispensing values.
2. All receptor distances are measured from the edge of the canopy.
3. Per 8,800 gallons loading; can be scaled for alternate hourly volumes.
4. Per 1,000 gallons dispensed; can be scaled for alternate hourly volumes. Dispensing includes breathing, fueling, spillage, and hose permeation.

Table I2. Scenario 2 (EVR Phase I and Pre-EVR Phase II) - Rural Acute Hazard Index[1,2,3,4]

Grid Distance (meters)[2]	Redding		Lancaster	
	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)
10	0.55	0.84	0.51	0.83
20	0.34	0.62	0.36	0.64
30	0.26	0.39	0.27	0.47
40	0.25	0.38	0.24	0.40
50	0.21	0.29	0.22	0.33
60	0.19	0.26	0.19	0.28
70	0.17	0.22	0.17	0.24
80	0.15	0.19	0.16	0.21
90	0.13	0.17	0.14	0.19
100	0.12	0.15	0.13	0.17
120	0.10	0.12	0.11	0.13
140	0.08	0.10	0.09	0.11
160	0.07	0.08	0.08	0.10
180	0.06	0.07	0.07	0.08
200	0.05	0.06	0.06	0.07
220	0.05	0.06	0.05	0.06
240	0.04	0.05	0.05	0.06
260	0.04	0.05	0.04	0.05
280	0.04	0.04	0.04	0.05
300	0.03	0.04	0.04	0.04
350	0.03	0.03	0.03	0.04
400	0.02	0.03	0.03	0.03
450	0.02	0.02	0.02	0.03
500	0.02	0.02	0.02	0.02
600	0.01	0.01	0.02	0.02
700	0.01	0.01	0.01	0.01
800	0.01	0.01	0.01	0.01
900	0.01	0.01	0.01	0.01
1000	0.01	0.01	0.01	0.01

1. Hazard index is determined by adding the loading and dispensing values.
2. All receptor distances are measured from the edge of the canopy.
3. Per 8,800 gallons loading; can be scaled for alternate hourly volumes.
4. Per 1,000 gallons dispensed; can be scaled for alternate hourly volumes. Dispensing includes breathing, fueling, spillage, and hose permeation.

Table I3. Scenario 3 (EVR Phase I - ORVR Only) - Rural Acute Hazard Index[1,2,3,4]

Grid Distance (meters)[2]	Redding		Lancaster	
	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)
10	0.55	1.25	0.51	1.23
20	0.34	0.89	0.36	0.93
30	0.26	0.58	0.27	0.68
40	0.25	0.56	0.24	0.59
50	0.21	0.44	0.22	0.50
60	0.19	0.40	0.19	0.43
70	0.17	0.34	0.17	0.37
80	0.15	0.30	0.16	0.32
90	0.13	0.26	0.14	0.29
100	0.12	0.23	0.13	0.26
120	0.10	0.19	0.11	0.21
140	0.08	0.16	0.09	0.18
160	0.07	0.13	0.08	0.15
180	0.06	0.12	0.07	0.13
200	0.05	0.10	0.06	0.11
220	0.05	0.09	0.05	0.10
240	0.04	0.08	0.05	0.09
260	0.04	0.07	0.04	0.08
280	0.04	0.07	0.04	0.08
300	0.03	0.06	0.04	0.07
350	0.03	0.05	0.03	0.06
400	0.02	0.04	0.03	0.05
450	0.02	0.03	0.02	0.04
500	0.02	0.03	0.02	0.04
600	0.01	0.02	0.02	0.03
700	0.01	0.02	0.01	0.02
800	0.01	0.02	0.01	0.02
900	0.01	0.01	0.01	0.02
1000	0.01	0.01	0.01	0.01

1. Hazard index is determined by adding the loading and dispensing values.
2. All receptor distances are measured from the edge of the canopy.
3. Per 8,800 gallons loading; can be scaled for alternate hourly volumes.
4. Per 1,000 gallons dispensed; can be scaled for alternate hourly volumes. Dispensing includes breathing, fueling, spillage, and hose permeation.

Table I4. Scenario 4 (EVR Phase I) - Rural Acute Hazard Index[1,2,3,4]

Grid Distance (meters)[2]	Redding		Lancaster	
	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)
10	0.52	2.24	0.48	2.24
20	0.34	1.60	0.36	1.66
30	0.27	1.17	0.27	1.22
40	0.25	0.99	0.24	1.05
50	0.21	0.77	0.22	0.88
60	0.19	0.69	0.19	0.75
70	0.17	0.59	0.17	0.65
80	0.15	0.51	0.16	0.57
90	0.13	0.45	0.14	0.50
100	0.12	0.40	0.13	0.45
120	0.10	0.32	0.11	0.36
140	0.08	0.27	0.09	0.30
160	0.07	0.23	0.08	0.26
180	0.06	0.20	0.07	0.22
200	0.05	0.17	0.06	0.20
220	0.05	0.15	0.05	0.18
240	0.04	0.14	0.05	0.16
260	0.04	0.12	0.04	0.14
280	0.04	0.11	0.04	0.13
300	0.03	0.10	0.04	0.12
350	0.03	0.08	0.03	0.10
400	0.02	0.07	0.03	0.08
450	0.02	0.06	0.02	0.07
500	0.02	0.05	0.02	0.06
600	0.01	0.04	0.02	0.05
700	0.01	0.03	0.01	0.04
800	0.01	0.03	0.01	0.03
900	0.01	0.02	0.01	0.03
1000	0.01	0.02	0.01	0.02

1. Hazard index is determined by adding the loading and dispensing values.
2. All receptor distances are measured from the edge of the canopy.
3. Per 8,800 gallons loading; can be scaled for alternate hourly volumes.
4. Per 1,000 gallons dispensed; can be scaled for alternate hourly volumes. Dispensing includes breathing, fueling, spillage, and hose permeation.

Table I5. Scenario 5 (Pre-EVR Phase I and Pre-EVR Phase II) - Rural Acute Hazard Index[1,2,3,4]

Grid Distance (meters)[2]	Redding		Lancaster	
	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)
10	1.40	0.84	1.30	0.83
20	0.90	0.59	0.91	0.64
30	0.67	0.39	0.68	0.47
40	0.63	0.38	0.61	0.40
50	0.53	0.29	0.55	0.33
60	0.48	0.26	0.49	0.28
70	0.42	0.22	0.44	0.24
80	0.37	0.19	0.40	0.21
90	0.33	0.17	0.36	0.19
100	0.30	0.15	0.33	0.17
120	0.25	0.12	0.27	0.13
140	0.21	0.10	0.23	0.11
160	0.18	0.08	0.20	0.10
180	0.16	0.07	0.17	0.08
200	0.14	0.06	0.15	0.07
220	0.12	0.06	0.14	0.06
240	0.11	0.05	0.12	0.06
260	0.10	0.05	0.11	0.05
280	0.09	0.04	0.10	0.05
300	0.08	0.04	0.09	0.04
350	0.07	0.03	0.08	0.04
400	0.06	0.03	0.07	0.03
450	0.05	0.02	0.06	0.03
500	0.04	0.02	0.05	0.02
600	0.03	0.01	0.04	0.02
700	0.03	0.01	0.03	0.01
800	0.02	0.01	0.03	0.01
900	0.02	0.01	0.02	0.01
1000	0.02	0.01	0.02	0.01

1. Hazard index is determined by adding the loading and dispensing values.
2. All receptor distances are measured from the edge of the canopy.
3. Per 8,800 gallons loading; can be scaled for alternate hourly volumes.
4. Per 1,000 gallons dispensed; can be scaled for alternate hourly volumes. Dispensing includes breathing, fueling, spillage, and hose permeation.

Table I6. Scenario 6 (Pre-EVR Phase I - ORVR Only) - Rural Acute Hazard Index[1,2,3,4]

Grid Distance (meters)[2]	Redding		Lancaster	
	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)
10	1.40	1.25	1.30	1.23
20	0.90	0.87	0.91	0.93
30	0.67	0.58	0.68	0.68
40	0.63	0.56	0.61	0.59
50	0.53	0.44	0.55	0.50
60	0.48	0.40	0.49	0.43
70	0.42	0.34	0.44	0.37
80	0.37	0.30	0.40	0.32
90	0.33	0.26	0.36	0.29
100	0.30	0.23	0.33	0.26
120	0.25	0.19	0.27	0.21
140	0.21	0.16	0.23	0.18
160	0.18	0.13	0.20	0.15
180	0.16	0.12	0.17	0.13
200	0.14	0.10	0.15	0.11
220	0.12	0.09	0.14	0.10
240	0.11	0.08	0.12	0.09
260	0.10	0.07	0.11	0.08
280	0.09	0.07	0.10	0.08
300	0.08	0.06	0.09	0.07
350	0.07	0.05	0.08	0.06
400	0.06	0.04	0.07	0.05
450	0.05	0.03	0.06	0.04
500	0.04	0.03	0.05	0.04
600	0.03	0.02	0.04	0.03
700	0.03	0.02	0.03	0.02
800	0.02	0.02	0.03	0.02
900	0.02	0.01	0.02	0.02
1000	0.02	0.01	0.02	0.01

1. Hazard index is determined by adding the loading and dispensing values.
2. All receptor distances are measured from the edge of the canopy.
3. Per 8,800 gallons loading; can be scaled for alternate hourly volumes.
4. Per 1,000 gallons dispensed; can be scaled for alternate hourly volumes. Dispensing includes breathing, fueling, spillage, and hose permeation.

Table I7. Scenario 7 (Pre-EVR Phase I) - Rural Acute Hazard Index[1,2,3,4]

Grid Distance (meters)[2]	Redding		Lancaster	
	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)	Loading[3] (8,800 gal)	Dispensing[4] (1,000 gal)
10	1.40	2.20	1.30	2.18
20	0.85	1.60	0.91	1.66
30	0.67	1.03	0.68	1.22
40	0.63	0.99	0.61	1.05
50	0.53	0.77	0.55	0.88
60	0.48	0.69	0.49	0.75
70	0.42	0.59	0.44	0.65
80	0.37	0.51	0.40	0.57
90	0.33	0.45	0.36	0.50
100	0.30	0.40	0.33	0.45
120	0.25	0.32	0.27	0.36
140	0.21	0.27	0.23	0.30
160	0.18	0.23	0.20	0.26
180	0.16	0.20	0.17	0.22
200	0.14	0.17	0.15	0.20
220	0.12	0.15	0.14	0.18
240	0.11	0.14	0.12	0.16
260	0.10	0.12	0.11	0.14
280	0.09	0.11	0.10	0.13
300	0.08	0.10	0.09	0.12
350	0.07	0.08	0.08	0.10
400	0.06	0.07	0.07	0.08
450	0.05	0.06	0.06	0.07
500	0.04	0.05	0.05	0.06
600	0.03	0.04	0.04	0.05
700	0.03	0.03	0.03	0.04
800	0.02	0.03	0.03	0.03
900	0.02	0.02	0.02	0.03
1000	0.02	0.02	0.02	0.02

1. Hazard index is determined by adding the loading and dispensing values.
2. All receptor distances are measured from the edge of the canopy.
3. Per 8,800 gallons loading; can be scaled for alternate hourly volumes.
4. Per 1,000 gallons dispensed; can be scaled for alternate hourly volumes. Dispensing includes breathing, fueling, spillage, and hose permeation.

Appendix J: Urban Acute Health Impacts: Tables by Scenario

Table J1. Scenario 1 (EVR Phase I and EVR Phase II) - Urban Acute Hazard Index[1,2,3]

Grid Distance (meters)[3]	Fresno		Ontario		San Diego		San Jose	
	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)
10	0.43	0.21	0.40	0.20	0.33	0.15	0.43	0.22
20	0.29	0.12	0.30	0.12	0.21	0.09	0.31	0.13
30	0.16	0.06	0.15	0.06	0.12	0.04	0.23	0.09
40	0.15	0.05	0.14	0.05	0.10	0.04	0.18	0.07
50	0.10	0.04	0.11	0.04	0.08	0.03	0.14	0.05
60	0.08	0.03	0.08	0.03	0.06	0.02	0.11	0.04
70	0.07	0.02	0.07	0.02	0.05	0.02	0.09	0.03
80	0.05	0.02	0.05	0.02	0.04	0.01	0.07	0.03
90	0.05	0.02	0.04	0.02	0.03	0.01	0.06	0.02
100	0.04	0.01	0.04	0.01	0.02	0.01	0.04	0.02
120	0.03	0.01	0.03	0.01	0.02	0.01	0.03	0.01
140	0.02	0.01	0.02	0.01	0.01	0.01	0.03	0.01
160	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01
180	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.01
200	0.01	0.01	0.01	0.00	0.01	0.00	0.02	0.01
220	0.01	0.01	0.01	0.00	0.01	0.00	0.02	0.01
240	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.01
260	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.01
280	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00
300	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00
350	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
400	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
450	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
500	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
800	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1. The units for Loading are per 8,800 gallons dispensed.
2. The units for Dispensing are per 1,000 gallons dispensed.
3. All grid distances are measured from the end of the canopy.

Table J2. Scenario 2 (EVR Phase I and Pre-EVR Phase II) - Urban Acute Hazard Index [1,2,3]

Grid Distance (meters)[3]	Fresno		Ontario		San Diego		San Jose	
	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)
10	0.43	0.54	0.40	0.53	0.33	0.39	0.43	0.57
20	0.29	0.32	0.30	0.32	0.21	0.22	0.30	0.37
30	0.16	0.16	0.15	0.15	0.12	0.11	0.23	0.24
40	0.15	0.14	0.14	0.14	0.10	0.10	0.18	0.19
50	0.10	0.10	0.11	0.10	0.08	0.07	0.14	0.14
60	0.08	0.08	0.08	0.08	0.06	0.05	0.11	0.11
70	0.07	0.06	0.07	0.06	0.05	0.05	0.09	0.09
80	0.05	0.05	0.05	0.05	0.04	0.04	0.07	0.07
90	0.05	0.04	0.04	0.04	0.03	0.03	0.06	0.06
100	0.04	0.04	0.04	0.03	0.02	0.02	0.04	0.05
120	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.04
140	0.02	0.02	0.02	0.02	0.01	0.02	0.03	0.03
160	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.03
180	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02
200	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
220	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
240	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
260	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
280	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
300	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
350	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01
400	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01
450	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
500	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
800	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1. The units for Loading are per 8,800 gallons dispensed.
2. The units for Dispensing are per 1,000 gallons dispensed.
3. All grid distances are measured from the end of the canopy.

Table J3. Scenario 3 (EVR Phase I - ORVR Only) - Urban Acute Hazard Index[1,2,3]

Grid Distance (meters)[3]	Fresno		Ontario		San Diego		San Jose	
	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)
10	0.43	0.84	0.40	0.82	0.33	0.62	0.43	0.87
20	0.29	0.52	0.30	0.51	0.21	0.36	0.30	0.58
30	0.27	0.27	0.29	0.24	0.19	0.19	0.26	0.39
40	0.15	0.24	0.14	0.23	0.10	0.16	0.18	0.30
50	0.12	0.17	0.11	0.17	0.08	0.12	0.14	0.23
60	0.08	0.13	0.08	0.13	0.06	0.09	0.11	0.18
70	0.07	0.11	0.07	0.10	0.05	0.08	0.09	0.14
80	0.05	0.09	0.05	0.08	0.04	0.06	0.07	0.12
90	0.05	0.07	0.04	0.07	0.03	0.05	0.06	0.10
100	0.04	0.06	0.04	0.06	0.02	0.04	0.04	0.08
120	0.03	0.05	0.03	0.04	0.02	0.03	0.03	0.06
140	0.02	0.04	0.02	0.03	0.01	0.03	0.03	0.05
160	0.02	0.03	0.02	0.03	0.01	0.02	0.02	0.04
180	0.01	0.03	0.01	0.02	0.01	0.02	0.02	0.04
200	0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.03
220	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.03
240	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02
260	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02
280	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
300	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.02
350	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.01
400	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.01
450	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.01
500	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01
600	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
700	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
800	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1. The units for Loading are per 8,800 gallons dispensed.
2. The units for Dispensing are per 1,000 gallons dispensed.
3. All grid distances are measured from the end of the canopy.

Table J4. Scenario 4 (EVR Phase I) - Urban Acute Hazard Index[1,2,3]

Grid Distance (meters)[3]	Fresno		Ontario		San Diego		San Jose	
	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)
10	0.41	1.49	0.40	1.44	0.33	1.08	0.43	1.54
20	0.29	0.90	0.30	0.88	0.21	0.62	0.30	1.01
30	0.16	0.47	0.15	0.42	0.12	0.33	0.23	0.66
40	0.15	0.40	0.14	0.39	0.10	0.27	0.18	0.52
50	0.10	0.28	0.11	0.29	0.08	0.20	0.14	0.39
60	0.08	0.22	0.08	0.22	0.06	0.16	0.11	0.30
70	0.07	0.18	0.07	0.17	0.05	0.13	0.09	0.24
80	0.05	0.14	0.05	0.14	0.04	0.10	0.07	0.20
90	0.05	0.12	0.04	0.12	0.03	0.09	0.06	0.16
100	0.04	0.10	0.04	0.10	0.02	0.07	0.04	0.13
120	0.03	0.08	0.03	0.07	0.02	0.05	0.03	0.11
140	0.02	0.06	0.02	0.06	0.01	0.04	0.03	0.09
160	0.02	0.05	0.02	0.05	0.01	0.04	0.02	0.07
180	0.01	0.05	0.01	0.04	0.01	0.03	0.02	0.06
200	0.01	0.04	0.01	0.03	0.01	0.03	0.02	0.05
220	0.01	0.04	0.01	0.03	0.01	0.02	0.02	0.05
240	0.01	0.03	0.01	0.03	0.01	0.02	0.01	0.04
260	0.01	0.03	0.01	0.02	0.01	0.02	0.01	0.04
280	0.01	0.03	0.01	0.02	0.01	0.02	0.01	0.03
300	0.01	0.02	0.01	0.02	0.00	0.02	0.01	0.03
350	0.01	0.02	0.00	0.02	0.00	0.01	0.01	0.03
400	0.01	0.02	0.00	0.01	0.00	0.01	0.01	0.02
450	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.02
500	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.02
600	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01
700	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01
800	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
900	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

1. The units for Loading are per 8,800 gallons dispensed.
2. The units for Dispensing are per 1,000 gallons dispensed.
3. All grid distances are measured from the end of the canopy.

Table J5. Scenario 5 (Pre-EVR Phase I and Pre-EVR Phase II) - Urban Acute Hazard Index[1,2,3]

Grid Distance (meters)[3]	Fresno		Ontario		San Diego		San Jose	
	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)
10	1.08	0.54	1.02	0.53	0.84	0.39	1.09	0.57
20	0.75	0.32	0.75	0.32	0.54	0.22	0.80	0.34
30	0.41	0.16	0.37	0.15	0.31	0.11	0.59	0.24
40	0.37	0.14	0.36	0.14	0.26	0.10	0.45	0.19
50	0.26	0.10	0.28	0.10	0.19	0.07	0.35	0.14
60	0.21	0.08	0.21	0.08	0.15	0.05	0.27	0.11
70	0.17	0.06	0.17	0.06	0.12	0.05	0.22	0.09
80	0.14	0.05	0.14	0.05	0.10	0.04	0.18	0.07
90	0.12	0.04	0.11	0.04	0.08	0.03	0.15	0.06
100	0.09	0.04	0.10	0.03	0.06	0.02	0.11	0.05
120	0.07	0.03	0.07	0.03	0.05	0.02	0.09	0.04
140	0.05	0.02	0.06	0.02	0.04	0.02	0.07	0.03
160	0.04	0.02	0.04	0.02	0.03	0.01	0.06	0.03
180	0.04	0.02	0.04	0.01	0.03	0.01	0.05	0.02
200	0.03	0.01	0.03	0.01	0.02	0.01	0.04	0.02
220	0.03	0.01	0.03	0.01	0.02	0.01	0.04	0.02
240	0.03	0.01	0.02	0.01	0.02	0.01	0.03	0.02
260	0.02	0.01	0.02	0.01	0.02	0.01	0.03	0.01
280	0.02	0.01	0.02	0.01	0.01	0.01	0.03	0.01
300	0.02	0.01	0.02	0.01	0.01	0.01	0.03	0.01
350	0.02	0.01	0.01	0.01	0.01	0.00	0.02	0.01
400	0.01	0.01	0.01	0.00	0.01	0.00	0.02	0.01
450	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.01
500	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.01
600	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00
700	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
800	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1. The units for Loading are per 8,800 gallons dispensed.
2. The units for Dispensing are per 1,000 gallons dispensed.
3. All grid distances are measured from the end of the canopy.

Table J6. Scenario 6 (Pre-EVR Phase I-ORVR Only) - Urban Acute Hazard Index[1,2,3]

Grid Distance (meters)[3]	Fresno		Ontario		San Diego		San Jose	
	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)
10	1.08	0.84	1.02	0.82	0.84	0.62	1.09	0.87
20	0.75	0.52	0.75	0.51	0.54	0.36	0.80	0.55
30	0.41	0.27	0.37	0.24	0.31	0.19	0.59	0.39
40	0.37	0.24	0.36	0.23	0.26	0.16	0.45	0.30
50	0.26	0.17	0.28	0.17	0.19	0.12	0.35	0.23
60	0.21	0.13	0.21	0.13	0.15	0.09	0.27	0.18
70	0.17	0.11	0.17	0.10	0.12	0.08	0.22	0.14
80	0.14	0.09	0.14	0.08	0.10	0.06	0.18	0.12
90	0.12	0.07	0.11	0.07	0.08	0.05	0.15	0.10
100	0.09	0.06	0.10	0.06	0.06	0.04	0.11	0.08
120	0.07	0.05	0.07	0.04	0.05	0.03	0.09	0.06
140	0.05	0.04	0.06	0.03	0.04	0.03	0.07	0.05
160	0.04	0.03	0.04	0.03	0.03	0.02	0.06	0.04
180	0.04	0.03	0.04	0.02	0.03	0.02	0.05	0.04
200	0.03	0.02	0.03	0.02	0.02	0.02	0.04	0.03
220	0.03	0.02	0.03	0.02	0.02	0.01	0.04	0.03
240	0.03	0.02	0.02	0.01	0.02	0.01	0.03	0.02
260	0.02	0.02	0.02	0.01	0.02	0.01	0.03	0.02
280	0.02	0.01	0.02	0.01	0.01	0.01	0.03	0.02
300	0.02	0.01	0.02	0.01	0.01	0.01	0.03	0.02
350	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01
400	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
450	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
500	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01
600	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01
700	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
800	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
900	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1. The units for Loading are per 8,800 gallons dispensed.
2. The units for Dispensing are per 1,000 gallons dispensed.
3. All grid distances are measured from the end of the canopy.

Table J7. Scenario 7 (Pre-EVR Phase I) - Urban Acute Hazard Index[1,2,3]

Grid Distance (meters)[3]	Fresno		Ontario		San Diego		San Jose	
	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)	Loading (8,800 gal)	Dispensing (1,000 gal)
10	1.08	1.47	1.02	1.44	0.84	1.08	1.09	1.54
20	0.75	0.90	0.75	0.88	0.54	0.62	0.76	1.01
30	0.41	0.46	0.37	0.42	0.31	0.33	0.59	0.66
40	0.37	0.40	0.36	0.39	0.26	0.27	0.45	0.52
50	0.26	0.28	0.28	0.29	0.19	0.20	0.35	0.39
60	0.21	0.22	0.21	0.22	0.15	0.16	0.27	0.30
70	0.17	0.18	0.17	0.17	0.12	0.13	0.22	0.24
80	0.14	0.14	0.14	0.14	0.10	0.10	0.18	0.20
90	0.12	0.12	0.11	0.12	0.08	0.09	0.15	0.16
100	0.09	0.10	0.10	0.10	0.06	0.07	0.11	0.13
120	0.07	0.08	0.07	0.07	0.05	0.05	0.09	0.10
140	0.05	0.06	0.06	0.06	0.04	0.04	0.07	0.09
160	0.04	0.05	0.04	0.05	0.03	0.04	0.06	0.07
180	0.04	0.05	0.04	0.04	0.03	0.03	0.05	0.06
200	0.03	0.04	0.03	0.03	0.02	0.03	0.04	0.05
220	0.03	0.04	0.03	0.03	0.02	0.02	0.04	0.05
240	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.04
260	0.02	0.03	0.02	0.02	0.02	0.02	0.03	0.04
280	0.02	0.03	0.02	0.02	0.01	0.02	0.03	0.03
300	0.02	0.02	0.02	0.02	0.01	0.02	0.03	0.03
350	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.03
400	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02
450	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
500	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
600	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
700	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01
800	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01
900	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

1. The units for Loading are per 8,800 gallons dispensed.
2. The units for Dispensing are per 1,000 gallons dispensed.
3. All grid distances are measured from the end of the canopy.

Appendix K: AERMOD Input File - Annual Emissions

```
**AERMOD INPUT FILE CREATED BY HARP VERSION 18159
**DATE CREATED: 10/11/2018 8:35:01 AM
**
CO STARTING
  TITLEONE GASOLINE DISPENSING-SCENARIO 1 WITH 4MX13MX3M, 2 POINT & 3 VOLUME
  TITLETWO REDDING MET
  MODELOPT CONC FLAT
  AVERTIME 1 PERIOD
  POLLUTID OTHER
  RUNORNOT RUN
  FLAGPOLE 1.2
  ERRORFIL "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\1 RURAL REDDING_AERMOD.ERR"
CO FINISHED
**
**SOURCES
SO STARTING
**SOURCES LOCATIONS
  LOCATION Load01 POINT 0 0 0
  LOCATION Breath01 POINT 0 0 0
  LOCATION Fuel01 VOLUME 0 0 0
  LOCATION Spill01 VOLUME 0 0 0
  LOCATION Hose01 VOLUME 0 0 0
**SOURCES PARAMETERS
  SRCPARAM Load01 1 3.66 291 0.001 0.0508
  SRCPARAM Breath01 1 3.66 291 0.001 0.0508
  SRCPARAM Fuel01 1 1.5 3.02 1.86
  SRCPARAM Spill01 1 1 3.02 1.86
  SRCPARAM Hose01 1 1.5 3.02 1.86
  EMISFACT Load01 HROFDY 0.36 0.36 0.36 0.36 0.36 1.46
  EMISFACT Load01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Load01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Load01 HROFDY 1.46 0.36 0.36 0.36 0.36 0.36

  EMISFACT Breath01 HROFDY 0.36 0.36 0.36 0.36 0.36 1.46
  EMISFACT Breath01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Breath01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Breath01 HROFDY 1.46 0.36 0.36 0.36 0.36 0.36

  EMISFACT Fuel01 HROFDY 0.36 0.36 0.36 0.36 0.36 1.46
  EMISFACT Fuel01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Fuel01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Fuel01 HROFDY 1.46 0.36 0.36 0.36 0.36 0.36

  EMISFACT Spill01 HROFDY 0.36 0.36 0.36 0.36 0.36 1.46
  EMISFACT Spill01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Spill01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Spill01 HROFDY 1.46 0.36 0.36 0.36 0.36 0.36

  EMISFACT Hose01 HROFDY 0.36 0.36 0.36 0.36 0.36 1.46
  EMISFACT Hose01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Hose01 HROFDY 1.46 1.46 1.46 1.46 1.46 1.46
  EMISFACT Hose01 HROFDY 1.46 0.36 0.36 0.36 0.36 0.36

  SRCGROUP Load01 Load01
  SRCGROUP Breath01 Breath01
  SRCGROUP Fuel01 Fuel01
  SRCGROUP Spill01 Spill01
  SRCGROUP Hose01 Hose01
SO FINISHED
**
**RECEPTORS
RE STARTING
**POLAR RECEPTORS
  GRIDPOLR GRID5 STA
  GRIDPOLR GRID5 ORIG 0 0
  GRIDPOLR GRID5 DIST 19 29 39 49 59 69 79 89 99
  GRIDPOLR GRID5 GDIR 72 0 5
**
```

```
  GRIDPOLR GRID10 STA
  GRIDPOLR GRID10 ORIG 0 0
  GRIDPOLR GRID10 DIST 109 129 149 169 189 209 229 249 269 289 309 359 409 459 509 609 709 809 909 1009
  GRIDPOLR GRID10 GDIR 36 0 10
**
RE FINISHED
**
**MET PATHWAY
ME STARTING
ME SURFFILE "S:\Industrywide Guidelines\GDF\Draft Guideline Modeling\Redding_2013-2017.sfc"
ME PROFFILE "S:\Industrywide Guidelines\GDF\Draft Guideline Modeling\Redding_2013-2017.PFL"
ME SURFDATA 24257 2013
ME UAIRDATA 24225 2013
ME SITEDATA 0 2013
ME PROFBASE 151.5
ME FINISHED
**
**OUTPUT PATHWAY
OU STARTING
  RECTABLE ALLAVE 1ST
  RECTABLE 1 1ST
  PLOTFILE 1 Load01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRLoad01.PLT" 31
  PLOTFILE 1 Breath01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRBreath01.PLT" 32
  PLOTFILE 1 Fuel01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRFuel01.PLT" 33
  PLOTFILE 1 Spill01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRSpill01.PLT" 34
  PLOTFILE 1 Hose01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRHose01.PLT" 35
  PLOTFILE PERIOD Load01 "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\PERIODLoad01.PLT" 36
  PLOTFILE PERIOD Breath01 "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\PERIODBreath01.PLT"
37
  PLOTFILE PERIOD Fuel01 "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\PERIODFuel01.PLT" 38
  PLOTFILE PERIOD Spill01 "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\PERIODSpill01.PLT" 39
  PLOTFILE PERIOD Hose01 "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\PERIODHose01.PLT" 40
OU FINISHED
```

Appendix L: AERMOD Input File - Maximum Hourly Emissions

```
**AERMOD INPUT FILE CREATED BY HARP VERSION 18159
**DATE CREATED: 10/11/2018 8:44:06 AM
**
CO STARTING
  TITLEONE GASOLINE DISPENSING-SCENARIO 1 WITH 4MX13MX3M, 2 POINT & 3 VOLUME
  TITLETWO REDDING MET
  MODELOPT CONC FLAT
  AVERTIME 1 PERIOD
  POLLUTID OTHER
  RUNORNOT RUN
  FLAGPOLE 1.2
  ERRORFIL "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\1 RURAL REDDING_AERMOD.ERR"
CO FINISHED
**
**SOURCES
SO STARTING
**SOURCES LOCATIONS
  LOCATION Load01 POINT 0 0 0
  LOCATION Breath01 POINT 0 0 0
  LOCATION Fuel01 VOLUME 0 0 0
  LOCATION Spill01 VOLUME 0 0 0
  LOCATION Hose01 VOLUME 0 0 0
**SOURCES PARAMETERS
  SRCPARAM Load01 1 3.66 291 0.001 0.0508
  SRCPARAM Breath01 1 3.66 291 0.001 0.0508
  SRCPARAM Fuel01 1 1.5 3.02 1.86
  SRCPARAM Spill01 1 1 3.02 1.86
  SRCPARAM Hose01 1 1.5 3.02 1.86
  EMISFACT Load01 HROFDY 1 1 1 1 1 1
  EMISFACT Load01 HROFDY 1 1 1 1 1 1
  EMISFACT Load01 HROFDY 1 1 1 1 1 1
  EMISFACT Load01 HROFDY 1 1 1 1 1 1

  EMISFACT Breath01 HROFDY 1 1 1 1 1 1
  EMISFACT Breath01 HROFDY 1 1 1 1 1 1
  EMISFACT Breath01 HROFDY 1 1 1 1 1 1
  EMISFACT Breath01 HROFDY 1 1 1 1 1 1

  EMISFACT Fuel01 HROFDY 1 1 1 1 1 1
  EMISFACT Fuel01 HROFDY 1 1 1 1 1 1
  EMISFACT Fuel01 HROFDY 1 1 1 1 1 1
  EMISFACT Fuel01 HROFDY 1 1 1 1 1 1

  EMISFACT Spill01 HROFDY 1 1 1 1 1 1
  EMISFACT Spill01 HROFDY 1 1 1 1 1 1
  EMISFACT Spill01 HROFDY 1 1 1 1 1 1
  EMISFACT Spill01 HROFDY 1 1 1 1 1 1

  EMISFACT Hose01 HROFDY 1 1 1 1 1 1
  EMISFACT Hose01 HROFDY 1 1 1 1 1 1
  EMISFACT Hose01 HROFDY 1 1 1 1 1 1
  EMISFACT Hose01 HROFDY 1 1 1 1 1 1

  SRCGROUP Load01 Load01
  SRCGROUP Breath01 Breath01
  SRCGROUP Fuel01 Fuel01
  SRCGROUP Spill01 Spill01
  SRCGROUP Hose01 Hose01
SO FINISHED
**
**RECEPTORS
RE STARTING
**POLAR RECEPTORS
  GRIDPOLR GRID5 STA
  GRIDPOLR GRID5 ORIG 0 0
  GRIDPOLR GRID5 DIST 19 29 39 49 59 69 79 89 99
  GRIDPOLR GRID5 GDIR 72 0 5
```

```
**
  GRIDPOLR GRID10 STA
  GRIDPOLR GRID10 ORIG 0 0
  GRIDPOLR GRID10 DIST 109 129 149 169 189 209 229 249 269 289 309 359 409 459 509 609 709 809 909 1009
  GRIDPOLR GRID10 GDIR 36 0 10

**
RE FINISHED
**
**MET PATHWAY
ME STARTING
ME SURFFILE "S:\Industrywide Guidelines\GDF\Draft Guideline Modeling\Redding_2013-2017.sfc"
ME PROFFILE "S:\Industrywide Guidelines\GDF\Draft Guideline Modeling\Redding_2013-2017.PFL"
ME SURFDATA 24257 2013
ME UAIRDATA 24225 2013
ME SITEDATA 0 2013
ME PROFBASE 151.5
ME FINISHED
**
**OUTPUT PATHWAY
OU STARTING
  RECTABLE ALLAVE 1ST
  RECTABLE 1 1ST
  PLOTFILE 1 Load01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRLoad01.PLT" 31
  PLOTFILE 1 Breath01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRBreath01.PLT" 32
  PLOTFILE 1 Fuel01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRFuel01.PLT" 33
  PLOTFILE 1 Spill01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRSpill01.PLT" 34
  PLOTFILE 1 Hose01 1ST "S:\Industrywide Guidelines\GDF\Draft Guidelines\1 RURAL REDDING\plt\MAX1HRHose01.PLT" 35
OU FINISHED
```

Appendix M: Gas Station Information Form

[District Name & Address]
Industrywide Toxic Emissions Inventory Survey
Gasoline Service Station

Dear Permit Holder:

Pursuant to sections 42303 and 40701(g) of the California Health & Safety Code, we hereby request that you provide the following information. It will be used to estimate your station's gasoline vapor emissions and potential health impacts. Please return the form to the district by [date]. If you have any questions, please call [district contact person] at [telephone number]. Thank you for your cooperation.

Gas station permit holder's name: ____________________

Gas station name: ____________________

Air Pollution Control District permit number: ____________________

Person filling out this form: (print) ____________________

Title: ____________________

Signature: ____________________

Phone number: ____________________

Gas station address: ____________________

City: ____________________ Zip: ____________________

Number of gallons of gasoline dispensed during last calendar year: ____________ gallons

Maximum hourly gallons: ____________ gallons

Distance from the edge of the station to edge of the nearest: Residential building ______ feet

Commercial building ________ feet

Storage tank type (check): ❑ Underground ❑ Aboveground

Type of vapor recovery equipment used (check):

❑ Phase I: ❑ Phase II:

❑ Pre-EVR ❑ Uncontrolled

❑ EVR ❑ Pre-EVR ❑ EVR

If applicable, select the type of Phase II EVR control system:

❑ Balance System ❑ Assist System