# South Coast Air Quality Management District

# RISK ASSESSMENT PROCEDURES for Rules 1401, 1401.1, and 212

**Version 9.0**

**October 31, 2024**

# Preface

This document describes the Risk Assessment Procedures, pursuant to Rule 1401(e)(1), for preparing health risk assessments (HRAs) under Rule 1401 - New Source Review of Toxic Air Contaminants, Rule 1401.1 - Requirements for New and Relocated Facilities Near Schools, and Rule 212 – Standards for Approving Permits and Issuing Public Notice. This is intended to be a "living" document, which staff will update periodically, as necessary. Please note that these Risk Assessment Procedures should not be used for AB 2588/Rule 1402, which has its own procedures. The major revisions to this document (Version 9.0) from the previous version (Version 8.1) include:

- Reorganization and streamlining of contents to align with the new HRA Tool (available online) that replaced the previous Excel Risk Tool;
- Adding the emission factors and speciation profiles for E85 gasoline dispensing facilities and Mobile Fuelers (refer to Appendix VII);
- Updating the emission factors and speciation profiles for gasoline dispensing facilities and mobile fuelers to be consistent with the latest CARB and CAPCOA Industrywide risk assessment guidance (refer to Appendix VII);
- Updating the meteorological data for all screening HRAs (refer to Appendix III);
- Updating the list of TACs approved by OEHHA subject to Rule 1401; and
- Deleting the Attachment containing hard copy tables, as these are no longer needed with the new web-based HRA Tool, which incorporates all the necessary information.

# TABLE OF CONTENTS

## INTRODUCTION

Risk Assessment Procedures were originally developed by South Coast Air Quality Management District (South Coast AQMD) staff for the adoption of Rule 1401 - New Source Review of Toxic Air Contaminants, in June 1990. Since that time, the Risk Assessment Procedures have been revised several times to reflect updated health risk assessment methodologies approved by the California Office of Environmental Health Hazard Assessment (OEHHA).

The purpose of this document is to:

- Assist users in conducting health risk assessments for purposes of determining compliance with South Coast AQMD rules and regulations or other requirements such as CEQA;
- Provide background and information on how screening Tier 1 and Tier 2 HRAs were developed; and
- Provide information on how to use the HRA Tool.

Pursuant to Rule 1401(e)(1), these Risk Assessment Procedures describe the methodology to be used for preparing health risk assessments under Rule 1401, Rule 1401.1 – Requirements for New and Relocated Facilities Near Schools, and Rule 212 – Standards for Approving Permits and Issuing Public Notice. This document is intended to be a "living" document that will be updated as necessary. The HRA Tool automates these Risk Assessment Procedures for Tier 1, 2, or 3 HRAs. Please note that the risk assessment procedures for Rules 1401 and 1402 generally follow the health risk assessment methodologies approved by OEHHA with some slight differences. The risk assessment procedures for AB 2588/Rule 1402 are published in a separate document titled "AB 2588 and Rule 1402 Supplemental Guidelines" available on South Coast AQMD's AB 2588 webpage[1] and the HRA Tool should not be used for AB 2588/Rule 1402 HRAs.

### Background

There are four steps involved in the health risk assessment process: 1) hazard identification, 2) exposure assessment, 3) dose-response assessment, and 4) risk characterization. Each step is briefly discussed below.

#### *Hazard Identification*

For toxic air contaminant (TAC) sources, hazard identification involves determining the type of adverse health effect associated with exposure of the pollutant of concern emitted by a facility, including whether a pollutant is considered a human carcinogen or a potential human carcinogen.

#### *Exposure Assessment*

The purpose of exposure assessment is to estimate the extent of public exposure to emitted substances for potential cancer, non-cancer health hazards for chronic and acute, and repeated 8-hour exposures. This involves estimation of long-term (annual), short-term (1-hour maximum), and 8-hour average exposure levels.

[1] South Coast AQMD's AB 2588 webpage is available at https://www.aqmd.gov/home/rules-compliance/compliance/toxic-hot-spots-ab-2588.

### *Dose-Response Assessment*

Dose-response assessment is the process of characterizing the relationship between exposure to a chemical by its modeled concentration. Dose can be calculated as follows:

Dose = Concentration x Exposure

### *Risk Characterization*

This is the final step of the health risk assessment in which the information from exposure assessment and dose-response assessment are combined to assess total health risks to the surrounding community.

## South Coast AQMD Rule 1401 History

Rule 1401, adopted June 1, 1990 and amended December 7, 1990, specified limits for Maximum Individual Cancer Risk (MICR) and excess cancer cases for new, relocated, or modified equipment which emits carcinogenic air contaminants. The rule was amended July 10, 1998 to include non-carcinogenic compounds. The rule was amended on March 17, 2000 to remove the requirement to assess cumulative risk from emissions from units permitted after 1990 that are located within 100 meters of the new equipment under evaluation for permit. Additionally, the rule has been amended several times to change the list of regulated compounds (both additions and deletions). Rule 1401 was amended on June 5, 2015 to incorporate the most recent OEHHA Risk Assessment Guidelines[2] (2015 OEHHA Guidelines) for calculating health risks.

## Requirements

These Risk Assessment Procedures describe the methodology for determining cancer and non-cancer health risks for equipment subject to Rules 1401, 1401.1, and 212, and may also be used when estimating health risks for other requirements such as CEQA. Please note that South Coast AQMD's AB 2588/Rule 1402 risk assessment procedures are in a separate document titled "AB 2588 and Rule 1402 Supplemental Guidelines" available on South Coast AQMD's AB 2588 webpage[1]. When using these Risk Assessment Procedures for purposes other than in support of a South Coast AQMD permit, it is highly recommended that the user contact staff of the respective programs to ensure the procedures described here meet program requirements.

In general, Rules 1401, 1401.1, and 212 apply if there are TAC emissions from new, relocated, or modified equipment. Details regarding applicability of these rules to facilities or equipment can be found within each rule at South Coast AQMD's website[3].

Under Rule 1401, the following requirements must be met before a permit is granted for affected equipment:

---

[2] OEHHA's Air Toxics Hot Spots Program Guidance Manual for the Preparation of Risk Assessments, released on March 6, 2015 is available at: https://oehha.ca.gov/air/crnr/notice-adoption-air-toxics-hot-spots-program-guidance-manual-preparation-health-risk-0

[3] South Coast AQMD's rules webpage is available at http://www.aqmd.gov/home/regulations/rules/scaqmd-rule-book.

- The cumulative increase in MICR, which is the sum of calculated MICR for all TACs emitted from a permit unit, shall not exceed:
  - one in one million (1.0 x $10^{-6}$) if the permit unit is not constructed with Best Available Control Technology for Toxics (T-BACT); or
  - ten in one million (10 x $10^{-6}$) if the permit unit is constructed with T-BACT;

- The cumulative cancer burden from all TACs emitted from the permit unit shall not exceed 0.5; and

- The cumulative increase in Chronic Hazard Index (HIC), the 8-hour Chronic Hazard Index (HIC8), and the Acute Hazard Index (HIA) from all TACs emitted from a permit unit shall not exceed 1.0 for any target organ system, or an alternate hazard index level deemed to be safe.

Rule 1401.1 is designed to be more health protective for school children than Rule 1401 by establishing more stringent health risk requirements related to facility-wide cancer risk and non-cancer HIA and HIC for new and relocated facilities emitting TACs near schools, thereby reducing the exposure of toxic emissions to school children. For new facilities, the rule requires the facility-wide cancer risk to be less than one in one million at any school or school under construction within 500 feet of the facility. If there are no schools within 500 feet, the same health risk thresholds apply at any school or school under construction within 500 to 1,000 feet unless there is a residential or sensitive receptor within 150 feet of the facility. For relocating facilities, the facility must demonstrate, for each school or school under construction within 500 feet of the facility, that either: 1) the health risk at the school from the facility in its new location is no greater than the health risk at that same school when the facility was at its previous location, or 2) the facility-wide cancer risk at the school does not exceed one in one million. Unlike other South Coast AQMD risk-based rules, the required health risk thresholds of Rule 1401.1 do not change based on whether or not the source is equipped with T-BACT.

Rule 212 also applies to Rule 1401 exempt sources. Rule 212 (c)(3) requires public notification if the MICR, based on these Risk Assessment Procedures, exceeds one in one million, due to a project's proposed construction, modification, or relocation for facilities with more than one permitted equipment unless the applicant can show the total facility-wide MICR is below ten in a million. For facilities with a single permitted piece of equipment, the MICR level must not exceed ten in a million. The circulation and distribution of the public notifications must meet the criteria in Rule 212.

## OVERVIEW

These Risk Assessment Procedures provide several tiers for preparing a health risk assessment, from a quick look-up table (Tier 1 HRA) to a detailed health risk assessment (Tier 4 HRA) involving the use of an air quality dispersion modeling analysis. Permit applicants may use any of the HRA tiers to demonstrate compliance with the health risk limits of Rule 1401 or Rule 1401.1. The applicant should include a copy of the health risk assessment, including input and output files, and all electronic modeling files, with the permit application.

The tiers are designed to be used in order of increasing complexity with each higher tier providing a more refined estimate of risk than the lower tier. If compliance cannot be demonstrated using one tier, the permit applicant may proceed to the next tier or limit the emissions so that compliance can be demonstrated. A permit applicant who can show compliance by using a lower tier does not need to perform an analysis for the higher tiers. In general, for most permits a detailed analysis is not required. The different HRA tiers are:

- Tier 1 HRA: Screening Emission Levels
- Tier 2 HRA: Screening Risk Assessment
- Tier 3 HRA: Screening Dispersion Modeling
- Tier 4 HRA: Detailed Health Risk Assessment

Please note that the 2015 OEHHA Guidelines[2] "Tier" approach differs from these Risk Assessment Procedures "Tier" HRAs. The OEHHA Tiers refer to the incorporation of stochastic modeling for the facility and population specific exposure parameters. In contrast, the HRA Tiers in this document refer to increasing complexity for deriving pollutant concentrations based on facility emissions. Regulatory compliance may be demonstrated with any HRA Tiers described in this document.

## PRELIMINARY TASKS

Before conducting any of the HRA Tiers, three preliminary tasks must be performed:

1. **Determine if the permitting action or equipment is exempt from the provisions of Rule 1401.** Exemptions are granted for:
   - Permit renewal or change of ownership;
   - Modifications with no increase in health risk;
   - Functionally identical equipment replacement;
   - Equipment previously exempt under Rule 219 - Equipment not Requiring a Written Permit Pursuant to Regulation II and filing for a permit to operate within one year of removing the Rule 219 exemption;
   - Modifications to terminate research projects; and
   - Emergency internal combustion engines (ICEs) exempt under Rule 1304 - Exemptions.

   An additional exemption is granted for demonstrations of contemporaneous emission reductions such that no receptor experiences a total increase in MICR of greater than one in one million and the contemporaneous reduction occurs within 100 meters of the equipment.
   If the equipment falls under one of these exemptions, no further health risk assessment is required.

2. **Identify the TACs emitted by the source**. The health risk assessment must include all TACs emitted by the source which are listed in Rule 1401 when the permit application was deemed complete by South Coast AQMD staff (refer to Rule 1401 Table I). For permit applications deemed complete prior to December 1, 2024, please refer to the first table in Attachment N for a list the TACs subject to Rules 1401, 1401.1 and Rule 212. For permit applications deemed complete on and after December 1, 2024, please refer to Table I of

the version of Rule 1401 that is in effect on the deemed complete date of the permit application.

Please be advised that certain entries in Rule 1401 Table I refer to groups of compounds, such as chromium (hexavalent) and chromium compounds. While some individual compounds within these groups are specifically listed, this does not represent an exhaustive list. Therefore, it is important to verify whether any TACs emitted by the source fall under these compound categories and enter those emissions, as appropriate.

If no TACs listed in the applicable version of Rule 1401 are emitted by the equipment, no further risk assessment is required. Note that there are some TACs listed in Rule 1401 Table I that do not have corresponding health values on the Consolidated Table of OEHHA and California Air Resources Board (CARB) Approved Risk Assessment Health Values[4] (Consolidated OEHHA/CARB Health Table). Therefore, the HRA Tool does not include these compounds and even if emissions for these compounds are entered, no health risks will be calculated.

3. **Estimate the quantity of emissions from the source.** The appropriate emission estimation technique depends on the type of source. Techniques include emission testing, a mass balance or other engineering calculation, South Coast AQMD approved source tests, or emission factors for specific types of processes. The emissions used for the health risk assessment should be post-control emissions (that is, reductions in emissions due to enforceable controls and permit conditions should be taken into account). South Coast AQMD Engineering and Permitting staff should be consulted regarding approved techniques for identifying TACs and estimating emissions for specific sources. Additionally, there is an Emissions Calculator spreadsheet that has been developed to incorporate standard emission factors for specific equipment types or sources. TAC emissions can be calculated using this Emissions Calculator spreadsheet and inputs into the HRA Tool can be created.

   South Coast AQMD also has a broader mandate to ensure that permits are not granted to facilities which may endanger public health (California Health and Safety Code Section 41700). In addition, under Rule 212(c)(3)[5], the applicant may be required to evaluate other compounds that are determined to be potentially toxic. Therefore, an applicant may be required to evaluate health risks from compounds not listed in Rule 1401 Table I as part of the permitting process if they are a concern for a specific source. These may include substances with irritant effects or other adverse health effects.

## DEFINITIONS

Before proceeding, it is important to understand some of the terms used when performing a health risk assessment. These terms are commonly used throughout these Risk Assessment Procedures. CARB and the California Air Pollution Control Officers Association (CAPCOA) have released

---

[4] The Consolidated Table of OEHHA/CARB Approved Risk Assessment Health Values is available at: https://www.arb.ca.gov/toxics/healthval/contable.pdf.

[5] Rule 212 is available on South Coast AQMD's website at https://www.aqmd.gov/docs/default-source/rule-book/reg-ii/rule-212.pdf.

Risk Management Guidance for Stationary Sources of Air Toxics[6] (CARB/CAPCOA Guidance) that includes recommendations on implementation of many of the parameters defined and used within these Risk Assessment Procedures. One important item to note is that these Risk Assessment Procedures are generally consistent with the 2015 OEHHA Guidelines and the CARB/CAPCOA Guidance, except the allowance for spatial averaging of concentrations. South Coast AQMD does not allow for spatial averaging of concentrations when conducting an HRA.

**Dispersion Factor ($\chi$/Q)**

The concentration of a contaminant decreases with distance away from the site of release and spreads out or "disperses." $\chi$/Q are numerical estimates of the amount of dispersion that occurs under specific conditions. The amount of dispersion depends on the distance traveled, the height of release, and meteorological conditions such as wind speed and atmospheric stability. The dispersion factors for the screening risk assessment procedure give the estimated annual average ground-level concentration ($\mu g/m^3$) resulting from a source emitting one ton/year of a TAC. For a more detailed explanation of derivation of $\chi$/Q for each meteorological station, please refer to Appendix III.

**Molecular Weight Adjustment Factor (MWAF)**

MWAFs should be used when calculating cancer risk. For most of the metal TACs, the OEHHA cancer potency factor applies to the weight of the toxic metal atom contained in the overall compound. This ensures that the cancer potency factor is applied only to the fraction of the overall weight of the emissions that are associated with health effects of the metal.

For most of the Hot Spots toxic metals, the OEHHA cancer potency factors, acute and chronic Reference Exposure Levels (RELs) apply to the weight of the toxic metal atom contained in the overall compound. Some of the Hot Spots compounds contain various elements along with the toxic metal atom (e.g., "Nickel hydroxide," CAS number 12054-48-7, has a formula of H2NiO2). Therefore, an adjustment to the reported pounds of the overall compound is needed before applying the OEHHA cancer potency factor for "Nickel and compounds" to such a compound. This ensures that the cancer potency factor, acute or chronic REL is applied only to the fraction of the overall weight of the emissions that are associated with health effects of the metal. In other cases, the metal TACs are already reported as the metal atom equivalent (e.g., CAS 7440-02-0, "Nickel"), and these cases do not use any further molecular weight adjustment. The appropriate MWAF to be used along with the OEHHA cancer potency factors, acute and chronic RELs for metal TACs can be found in the MWAF column of the Consolidated OEHHA/CARB Health Table.

**Cancer Potency (CP) Factor**

The CP factor is a measure of the cancer potency of a carcinogen. Cancer potency describes the potential risk of developing cancer per unit of average daily dose over a 70-year lifetime. The CP factors in these Risk Assessment Procedures were approved by the state Scientific Review Panel and prepared by OEHHA. The CP can be found in the Consolidated OEHHA/CARB Health Table. The most updated CP at the time the HRA is conducted should be used.

**Reference Exposure Level (REL)**

[6] The CARB/CAPCOA Risk Management Guidance for Stationary Sources of Air Toxics, dated July 23, 2015 is available at: https://ww2.arb.ca.gov/sites/default/files/classic/toxics/rma/rmgssat.pdf.

The concentration level at or below which no adverse non-cancer health effects are anticipated for a specified exposure duration is termed the REL. RELs are based on the most sensitive, relevant, adverse health effect reported in the medical and toxicological literature. RELs are designed to protect the most sensitive individuals in the population by the inclusion of margins of safety. Since margins of safety are incorporated to address data gaps and uncertainties, exceeding the REL does not automatically indicate an adverse health impact. The RELs can be found in the Consolidated OEHHA/CARB Health Table. The most updated REL at the time the HRA is conducted should be used.

**Multi-Pathway (MP) Adjustment Factor**
The MP adjustment factor is used for substances that may contribute to health risk from exposure pathways other than inhalation. These substances deposit on the ground in particulate form and contribute to risk through ingestion of soil or backyard garden vegetables or through other routes. The MP adjustment factor estimates the total health risk in comparison to a given inhalation risk. Appendix I provides a detailed explanation of how MP adjustment factors were developed. These factors allow sources that emit multi-pathway pollutants to use screening Tier 1, 2, or 3 HRA rather than proceeding directly to preparing a detailed Tier 4 HRA.

**Daily Breathing Rate (DBR)**
Exposure to airborne chemicals occurs through inhalation and subsequent absorption into the body, potentially resulting in adverse health effects depending on toxicological properties of the chemical and other exposure parameters. For residential exposures, the breathing rates are determined for specific age groups (i.e., third trimester, 0-2, 2-16, and 16-30 years). For residential exposures, the high end DBR (e.g., 95th percentile) for children from the third trimester through age 2, and 80th percentile DBR for all other ages should be used. For worker exposures, it is assumed that the working age begins at 16 years and that exposures to facility emissions occur during the work shift, which is typically up to eight hours per day during work days.

**Age Sensitivity Factor (ASF)**
Scientific data have shown that young animals are more sensitive than adult animals to exposure to many carcinogens. Therefore, OEHHA developed ASFs to take into account the increased sensitivity to carcinogens during early-in-life exposure. An ASF of 10 for exposures that occur from the third trimester of pregnancy to 2 years and an ASF of 3 for exposures that occur from 2 years through 15 years of age should be used.

**Exposure Duration (ED)**
A 30-year ED (residency time) should be used for residential and sensitive receptor locations. A 25-year ED should be used for off-site workers (i.e., receptor locations in commercial or industrial areas).

**Fraction of Time Spent at Home (FAH)**
OEHHA and CARB have evaluated information from activity patterns databases to estimate the percentage of the day that people are at home. This information is used to adjust cancer risk from a facility's emissions, assuming that exposure to the facility's emissions are not occurring away from home. The FAH factor does not apply for workers since the worker is assumed to be present at the work site 100 percent of the work day. For Tier 1, 2, and 3 HRA screening purposes, the

FAH is assumed to be 1 for ages third trimester to 16. As a default, children are assumed to attend a daycare or school in close proximity to their home and no discount should be taken for time spent outside of the area affected by the facility's emissions. People older than age 16 are assumed to spend only 73 percent of their time at home.

**Exposure Frequency (EF)**
EF is the number of days per year of exposure for the given scenario (i.e. residential, worker). The OEHHA recommendation of 350 days/year for residential exposure (applicable to 30-year risk assessments) and 250 days/year for worker exposure should be used. This equates to EF = 0.96 for residential exposure and EF = 0.68 for worker exposure.

**Averaging Time (AT)**
AT is the lifetime exposure period OEHHA used to develop the cancer potency values. CP factors are developed as estimates of cancer risk from exposure to a lifetime dose (i.e. 70 years) of a carcinogen. Since cancer risks are calculated on a yearly basis to account for age-specific factors (e.g., ASF, DBR, etc.) the CP factor must be divided by its original 70-year AT in the risk equation to generate an annual CP factor to be used in the cancer risk calculations. For AT, the OEHHA recommendation of 70 years should be used.

**Worker Adjustment Factor (WAF)**
In health risk assessments, long-term averages are typically used for cancer risk calculations for residents and workers. Therefore, for an off-site worker, the long-term average should represent what the worker breathes during their work shift. However, the long-term averages calculated from AERMOD typically represent exposures for receptors that were present 24 hours a day and seven days a week which is the schedule of a residential receptor. When modeling a non-continuously emitting source (e.g., operating for eight hours per day and five days per week), the long-term concentration has to be adjusted so that it is only based on the hours when the off-site worker is present. WAF is the ratio between residential exposure and source's schedule. The WAF varies based on the operating schedule of the source and depends on the number of hours per day of operation as well as the number of days per week. Consistent with South Coast AQMD's practice, the WAF can vary between 1.0 (assuming continuous operation) and 4.2 (assuming eight hour per day and five day per week operation). For screening purposes, the off-site worker schedule is assumed to always overlap with the facility's operating schedule, which would mean the Discount Factor is equal to 1. Although the Discount Factor is not used in these Risk Assessment Procedures, this term is described here to provide clarity in reference to OEHHA's approved health risk assessment procedures. Although the HRA Tool was developed with dispersion factors from continuous operations, it allows users to enter the actual hours of operation of a non-continuous source. The operating hours are only used to calculate the WAF and do not affect or adjust the TAC emissions. Note that Tier 1, 2, or 3 HRAs conducted using the HRA Tool are considered screening HRAs. Given the conservatism built into the other modeling parameters in the screening HRAs, applying the WAF is an acceptable approach. However, when conducting Tier 4 HRAs or HRAs for AB 2588/Rule 1402, this is not an acceptable approach. The user needs to use the appropriate options within AERMOD to accurately model the facility's operations.

**Combined Exposure Factor (CEF)**

The CEF for each exposure type (residential, worker, or short-term) combines default exposure parameters for DBR, ASF, ED, FAH, EF, and AT into a single value. Previous Attachment N Tables 4.1A through 4.1E and 4.2 A through D provide a breakdown of the various parameters used to develop the different CEF summarized in the table below.

# Tier 1 HRA: Screening Emission Levels

A Tier 1 HRA is the most conservative screening HRA that requires the user to input the equipment's TAC emissions into the HRA Tool to be compared to screening levels. The screening levels are based on the most conservative concentrations from the different source types used for Tier 2 HRAs to develop pollutant emission thresholds which are not expected to produce a MICR greater than one in one million nor a hazard index greater than one. The equations used to calculate health risks are described in Tier 2 HRA section.

Tier 1 HRAs can be used by applicants to determine whether or not a higher Tier HRA will be required when applying for a permit. It can also be used by applicants and South Coast AQMD staff to determine whether a permit is required based on Rule 219(e)(2).

A Tier 1 HRA may be used for multiple pollutants since the Multiple Pollutant Screening Level Procedure (described below) is programmed into the HRA Tool. In order to use the HRA Tool to perform a Tier 1 HRA, the user first needs to determine the maximum annual emissions (for TACs with cancer and non-cancer 8-hour and chronic health impacts) and determine the maximum hourly emissions (for TACs with non-cancer acute health impacts). Once those TAC emissions are entered into the HRA Tool, the HRA Tool will calculate the appropriate screening index.

**MULTIPLE POLLUTANT SCREENING LEVEL PROCEDURE**

1. To calculate the Pollutant Screening Index for each TAC ($PSI_{TAC}$), for each carcinogenic and/or 8-hour or chronic compound, divide the maximum annual emissions (in pounds per year) of each TAC ($Q_{lbpy}$) by the Annual Pollutant Screening Level ($PSL_{TAC,\ Annual}$) in pounds per year. For each acute compound, divide the maximum hourly emission (in pounds per hour, $Q_{lbph}$) of each TAC by the Hourly Pollutant Screening Level ($PSL_{TAC,\ Hourly}$).

   $$PSI_{TAC,\ Cancer,\ 8\text{-}hr,\ or\ Chronic} = Q_{lbpy,TAC} / PSL_{TAC,\ Annual}$$

   $$PSI_{TAC,\ Acute} = Q_{lbph,TAC} / PSL_{TAC,\ Hourly}$$

2. To calculate the Application Screening Index (ASI), sum up the individual Pollutant Screening Indices for all chronic, 8-hour and carcinogenic pollutants ($PSI_P$) and, separately, for all acute TACs.

   $$ASI_{cancer,8\text{-}hr,chronic} = PSI_{TAC1,cancer,8\text{-}hr,chronic} + PSI_{TAC2,cancer,8\text{-}hr,chronic} + PSI_{TAC3,cancer,8\text{-}hr,chronic} + \ldots$$

   $$ASI_{acute} = PSI_{TAC1,acute} + PSI_{TAC2,acute} + PSI_{TAC3,acute} + \ldots$$

3. Neither the $ASI_{cancer,8\text{-}hr,chronic}$ , nor the $ASI_{acute}$ can exceed one.

# Tier 2 HRA: Screening Risk Assessment

A Tier 2 HRA is a screening risk assessment which includes calculating the health risks from a source for cancer risk, cancer burden, HIA, HIC8, and HIC. If the estimated health risks from the Tier 2 HRA are below Rule 1401 limits, then compliance is demonstrated and a more detailed evaluation is not necessary.

**If the Tier 2 HRA results in health risks that exceed the applicable health risk limits or the user feels that a more detailed evaluation is warranted, the user has the option of conducting a more detailed analysis using Tier 3 or 4 HRA.**

To perform a Tier 2 HRA, the following information is needed:

- **Maximum annual emissions** of each carcinogen and non-cancer 8-hour and chronic TAC, and the **maximum hourly emissions** of each non-cancer acute TAC;
- The **distance** from the source to the nearest off-site residential and worker receptor(s);
- Certain source characteristics, such as **stack height** and/or **building dimensions**;
- **Operating schedule** of the source; and
- **Geographic location** of the source (e.g., city).

In order to perform a Tier 2 HRA, it is necessary to identify the nearest receptor location. For the purpose of calculating the MICR, HIC8 and HIC, a receptor is any location outside the boundaries of the facility at which a person could experience repeated, continuous exposure. For the purpose of calculating the HIA, a receptor is any location outside the boundaries of the facility at which a person could experience exposure over a short timeframe. Receptor locations include residential, commercial and industrial areas, and other locations where sensitive receptors may be located. Residential receptor locations include current residential land uses and areas which may be developed for residential uses in the future, given existing or planned zoning. Commercial or industrial receptor locations include areas zoned for manufacturing, light or heavy industry, office or retail activity. Sensitive receptor locations include any residence including private homes, condominiums, apartments, and living quarters; schools, including preschools and daycare centers; health facilities such as hospitals, retirement homes, nursing homes, long term care hospitals, and hospices; prisons, dormitories, or similar live-in housing, where children, chronically ill individuals, or other sensitive persons could be exposed to TACs.

When identifying receptor locations to calculate cancer risk, HIC8 or HIC, the potential for chronic (long-term) exposure should be considered. Land uses at which it is not possible for individuals to be exposed on a long-term basis such as roadways or highways should not be used. When identifying receptor locations to calculate HIA, all off-site locations where there is the potential for acute exposure should be considered (i.e. fenceline receptor). Refer to Rule 1401 for more information regarding receptor locations to be considered.

For residential receptors, the cancer risk is calculated in individual age bins (e.g., third trimester, 0-2 years, etc.) rather than a single lifetime calculation, whereas, for off-site worker, the default assumption is that working age begins at 16 years.

## EQUATIONS USED TO CALCULATE MAXIMUM INDIVIDUAL CANCER RISK (MICR)

The HRA Tool relies on the following equations to calculate MICR.

**MICR = Cancer Potency (CP) x Dose (D) x $10^{-6}$**

Where:

**Dose = Concentration x Exposure**

**Concentration = GLC = ($Q_{tpy}$ x $\chi$/Q) x MWAF**

**$CEF_R$ = ($Exposure_{0.25\text{-}0}$ + $Exposure_{0\text{-}2}$ + $Exposure_{2\text{-}16}$ + $Exposure_{16\text{-}30}$) x $EF_R$ / AT**

**$Exposure_{AgeBin}$ = $DBR_{AgeBin}$ x $ED_{AgeBin}$ x $ASF_{AgeBin}$ x $FAH_{AgeBin}$**

**$Exposure_R$ = $CEF_R$ x $MP_R$**

**$CEF_W$ = $DBR_W$ x $ED_W$ x $EF_W$ / AT**

**$Exposure_W$ = $CEF_W$ x $MP_W$ x WAF**

Therefore, the MICR can be summarized into the following equations:

**$MICR_R$ = CP x $Q_{tpy}$ x $\chi$/Q x MWAF x $CEF_R$ x $MP_R$ x $10^{-6}$**

**$MICR_W$ = CP x $Q_{tpy}$ x $\chi$/Q x MWAF x $CEF_W$ x $MP_W$ x WAF x $10^{-6}$**

In order to use the HRA Tool, users will need to have the following data to either enter into the HRA Tool or to assist in selecting the appropriate parameters to be used in the Tier 2 HRA.

### Estimate Annual Emissions ($Q_{tpy}$)

The maximum annual emissions of the TAC in tons/year ($Q_{tpy}$) must be estimated. The emission rate must be expressed in tons/year because the $\chi$/Q are expressed in tons/year. Note that the HRA Tool requires the hourly and annual emissions be entered in pounds per hour and pounds per year, respectively. The HRA Tool will adjust those emissions to tons per year to calculate the health risks.

### Determining Release Type

Determining whether the source is best characterized as a point source or a volume source is needed to determine the source type to select in the HRA Tool:

- A **point source** is one that releases its emissions through a stack (designed with acceptable stack height). If the point source has a rain cap that obstructs exhaust flows or a horizontal release, a Tier 3 or 4 HRA is required.
- A **volume source** includes emissions that are unrestricted by any physical means (e.g. pipes or vents and/or vacuum or fan), including releases inside of a building or as fugitive emissions.

For sources that have both point and volume releases, use the source type that will result in the highest health risks or apportion the emissions between the point and volume sources.

**Determine Release Height**

For a **point source**, determine the **stack height**, which is the height from ground level to the top of the stack.

**Acceptable Stack Height**. Although a taller stack provides better dispersion, there are limits to the degree to which this factor can be incorporated into the risk assessment. Rule 1401 specifies that the stack height used to determine risk shall not exceed the "Acceptable Stack Height" for the permit unit. Acceptable stack height is defined as 2.5 times the height of the equipment or 2.5 times the height of the building housing the equipment and may not exceed 65 meters (213 feet), unless the applicant demonstrates to the satisfaction of South Coast AQMD staff that a greater height is necessary. For example, for a building that is 14 feet high, the acceptable stack height is 35 feet, measured from ground level.

For a **volume source**, determine the **building height**, which is the distance from ground level to the top of the building in which the source is located, and the **floor area**, which is the dimensions (length x width) of the building in which the source is located.

An **area source** is similar to a volume source in that the emissions take place over an area (as opposed to a point such as from a stack). However, in an area source, the pollutants are released at a uniform height. Examples of area sources are storage piles, slag dumps, lagoons or ponds, and liquid spills. Toxic hydrocarbon emissions from open top and floating roof storage tanks are also often treated as elevated area sources. Use Tier 3 or 4 HRA for area sources.

**Identifying the Appropriate Meteorological Station**

Using the meteorological data tab in the HRA Tool, determine the Source/Receptor Area (SRA) and select the meteorological site most appropriate to use. Additional information on how to select the appropriate SRA can be found on South Coast AQMD's website at https://www.aqmd.gov/home/air-quality/meteorological-data/data-for-aermod.

**Identifying Type of Receptor and Distance from Receptor**

Identify the nearest receptor locations. Receptor locations are off-site locations where persons may be exposed to emissions of one or more TACs from the source. Receptor locations include residential, commercial, and industrial land use areas, and other locations where sensitive populations may be located. For all receptor locations, the distance should be measured from the source to the edge of the property line of the nearest receptor.

**Residential receptor locations** include current residential land uses and areas that may be developed for residential uses in the future, based on existing and planned zoning.

**Worker receptor locations** include areas zoned for manufacturing, light or heavy industry, retail activity, or other locations that are regular work sites.

**Sensitive receptor locations** include any residence including private homes, condominiums, apartments, and living quarters, schools, preschools, daycare centers and health facilities such as hospitals, retirement and nursing homes, long term care hospitals, hospices in addition to prisons, dormitories, or similar live-in housing.

When identifying receptor locations to calculate MICR, the potential for chronic (long-term) exposure should be considered. Land uses at which it is not possible for individuals to be exposed on a long-term basis, either presently or in the future, should not be considered receptor locations for purposes of calculating MICR. Examples of such locations include flood channels or roadways.

**For a point source, the receptor distance is the distance from the center of the stack to the property line of the nearest receptor location.**

**For a volume source, the receptor distance is the distance from the edge of the building to the property line of the nearest receptor location.**

Experience shows that in most cases, the receptor distance will be 50 meters or more. However, the Tier 2 HRA's minimum distance is set at 25 meters. The 25-meter distance should be used for circumstances in which there is a receptor located very close to the source, for example, a residence located with a business, another business adjacent to the facility, or a sensitive receptor located less than 50 meters from the source. Note that if a distance less than 25 meters is entered into the HRA Tool, the results at 25 meters will be reported. Likewise, if a distance of more than 1,000 meters is entered into the HRA Tool, the results at 1,000 meters will be reported.

**If the closest receptor location is a worker receptor, then the MICR must also be calculated for the closest residential or sensitive receptor. The greater of the two MICR values is used to determine compliance with the health risk limits.**

**Parameters Built Into the HRA Tool**

The HRA Tool utilizes the most updated MWAF, CP, and REL, as appropriate, from the Consolidated OEHHA/CARB Health Table for the selected TACs. Additionally, the HRA Tool incorporates the $\chi/Q$, CEF, and MP adjustment factors. The CEF for each exposure type (residential, worker, or short-term) combines default exposure parameters for DBR, ASF, ED, FAH, EF, and AT into a single value.

Although the HRA Tool allows a user to input the operating schedule (in hours/day and days/week), note that this is only used to calculate the WAF and does not adjust the emissions entered. For sources operating and emitting continuously (24 hours per day and seven days per week), the worker is assumed to breathe the long-term annual concentration during their work shift and no adjustments are necessary when estimating the cancer risk. In these cases, the WAF is equal to one. For non-continuous sources operating, the appropriate WAF is calculated using the following equation:

$$WAF = (H_{residential} / H_{source}) \times (D_{residential} / D_{source})$$

Where;

WAF = Worker adjustment factor
$H_{residential}$ = The number of hours per day the long-term concentration is based on (always 24 hours)
$H_{source}$ = The number of hours per day the source operates
$D_{residential}$ = The number of days the per week the long-term residential concentration is based on (always seven days)
$D_{source}$ = The number of days per week the source operates

Note that consistent with South Coast AQMD's practice, the WAF is capped at 4.2, which is the equivalent of operating eight hours per day and five days per week.

Although the 2015 OEHHA Guidelines allow the use of a discount factor (DF) when assessing inhalation cancer health impacts, if the off-site worker's schedule partially overlaps with the source's emission schedule, the DF should only be used when there are limits on the hours of operation specified in the permit. Since South Coast AQMD permits do not typically include limits on the hours of operation, it is not appropriate to apply the DF when calculating the health impacts.

**MICRs for Multiple TACs**

If the source emits more than one TAC, the total MICR must be calculated by summing the MICRs for each of the TACs emitted by the source.

## METHODOLOGY FOR CALCULATING CANCER BURDEN

The cancer burden is the estimated increase in the occurrence of cancer cases in a population as a result of exposures to TAC emissions from the equipment over a 70-year exposure duration. The cancer burden for a population unit (city, census tract, sub-area or grid) is the product of the number of persons in the population and the estimated individual risk from TACs. The cancer burden only needs to be calculated if the resulting MICR from a 30-year exposure duration is greater than one in one million.

The following methodology was used in the HRA Tool to calculate cancer burden:

- Re-calculate total MICR from all TACs from a single source using a 70-year exposure duration, as is required in the 2015 OEHHA Guidelines[7].
- Estimate the distance at which the MICR from a 70-year exposure duration falls below one in one million. This distance can be estimated by back-calculating the distance that would result in a MICR of one in one million.
- Define a zone of impact in the shape of a circle and calculate the area of this circle. The radius (r) of this circle is the distance between the source and the point at which the cancer risk falls below one in one million.
- Estimate the residential population within this zone of impact based on census data or a worst-case estimate. Generally, the residential population within South Coast AQMD's jurisdiction is less than 4,000 persons/$km^2$, but some areas are as high as 7,000 persons/$km^2$. For areas where census data is available, it should be used. Where there is no census data, 7,000 persons/$km^2$ should be used for the areas with high population densities and 4,000 persons/$km^2$

[7] OEHHA, 2015. Section 8, "Risk Characterization for Carcinogens and Noncarcinogens and the Requirements for Hot Spots Risk Assessments." Available at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf.

should be used for areas with low population densities (such as locations along the Pacific Ocean). Where the population densities are unknown, use 7,000 persons/$km^2$.

- Calculate the cancer burden by multiplying the total residential population in the zone of impact by the maximum individual cancer risk.

## METHODOLOGY FOR CALCULATING HIC, HIC8, AND HIA

Some TACs have the potential to cause non-cancer health risk due to short-term (acute) or long-term (chronic) exposures. The health risk assessment for those TACs must estimate HIA, HIC8, and/or HIC as applicable.

The REL is used as an indicator of potential adverse non-cancer health effects. An inhalation REL is a concentration level ($\mu g/m^3$) at which no adverse health effects are anticipated. Inhalation RELs are provided in the Consolidated OEHHA/CARB Health Table.

When a health impact calculation is performed for a single substance, it is called the Hazard Quotient (HQ). When several TACs affect the same organ system in the body (e.g., respiratory system, nervous system, reproductive system), there can be a cumulative effect on the target organ. In these cases, the sum of the HQs of all chemicals emitted that impact the same target organ, called total HI, is evaluated. The Target Organs Tables for each TAC are available on CARB's website[8].

Detailed procedures for calculating the total HI are provided in the 2015 OEHHA Guidelines. The equations used to calculate the HIC, HIC8, and HIA per target organ are as follows:

$$\text{Total HIC}_{\text{target organ}} = \{[Q_{tpy,TAC1} \times (\chi/Q) \times MP_{TAC1} \times MWAF]/\text{Chronic REL}_{TAC1}\}_{\text{target organ}} + \{[Q_{tpy,TAC2} \times (\chi/Q) \times MP_{TAC2} \times MWAF]/\text{Chronic REL}_{TAC2}\}_{\text{target organ}} + \ldots.$$

$$\text{Total HIC8}_{\text{target organ}} = \{[Q_{tpy,TAC1} \times (\chi/Q) \times WAF \times MWAF]/\text{8-Hour REL}_{TAC1}\}_{\text{target organ}} + \{[Q_{tpy,TAC1} \times (\chi/Q) \times WAF \times MWAF]/\text{8-Hour REL}_{TAC2}\}_{\text{target organ}} + \ldots..$$

$$\text{Total HIA}_{\text{target organ}} = \{[Q_{lbph,TAC1} \times (\chi/Q)_{hr} \times MWAF]/\text{Acute REL}_{TAC1}\}_{\text{target organ}} + \{[Q_{lbph,TAC2} \times (\chi/Q)_{hr} \times MWAF]/\text{Acute REL}_{TAC2}\}_{\text{target organ}} + \ldots..$$

Note that the HIC is based upon an annual average emission per year whereas the HIA is based upon a maximum 1-hour emission level and the HIA does not use the MP adjustment factor. In addition, the 8-hour RELs were developed only for repeated, chronic daily 8-hour exposures (e.g. a typical worker or resident exposed to a facility that operates equal to or more than eight hours per day and five days per week). The HIC8 is based upon the daily average 8-hour exposure only for those chemicals with 8-hour RELs. There are currently only a limited number of substances with an 8-hour inhalation REL.

[8] Available on CARB's website at https://www.arb.ca.gov/toxics/healthval/totables.pdf.

## PROCEDURE FOR ALTERNATE HI LEVEL EXEMPTION

Rule 1401(g)(3) provides an exemption from the HI limit of one in cases in which a higher exposure level is deemed to be safe. This exemption has never been used. Under this exemption, the HIC and/or HIA limit of one does not apply if the applicant substantiates to the satisfaction of South Coast AQMD staff that at all receptor locations and for every target organ system, the total HIC and HIA levels resulting from emissions from the equipment will not exceed alternate HI levels determined by OEHHA to be protective against adverse health effects. This applies only to TACs listed in Rule 1401 at the time the application was deemed complete.

Applicants should indicate in their permit application that they wish to apply for an exemption under the alternative HI provisions of Rule 1401. The permit application should include both a risk assessment estimating the HIA and HIC levels and relevant information supporting the exemption. Depending on the health risks in question, additional information such as characterization of the surrounding population, the location of sensitive receptors, or other data may be required.

South Coast AQMD staff will consult with OEHHA staff regarding the request for the alternative HI level. If OEHHA staff finds that the levels of exposure to the public will not exceed levels that are protective against adverse health effects, the application will be eligible for the exemption.

In some cases, OEHHA staff may establish a general policy recommending different acceptable exposure levels for different exposed populations. For example, if exposure to a certain compound is particularly harmful to children but less of a concern for adults, OEHHA staff may determine as a general policy that higher exposure levels are acceptable in locations where children would not be exposed. OEHHA policy in these cases would be a basis for eligibility for the alternate HI exemption.

# Tier 3 HRA: Screening Dispersion Modeling

A Tier 3 HRA uses a screening dispersion model to estimate cancer risk and requires more expertise than Tier 1 and 2 HRAs. The Tier 3 HRA should only be used for equipment with a single emission or release point. If there are multiple emission or release points, a Tier 4 HRA must be used. In addition, a Tier 3 HRA would only be beneficial for applications involving source parameters that differ substantially from those specific sources modeled for the Tier 2 HRA.

To perform a Tier 3 HRA, the following is needed:

- Air dispersion modeling expertise;
- The most recently approved version of U.S. EPA's screening dispersion model AERSCREEN, which can be downloaded from www.epa.gov/scram; and
- Additional equipment information such as stack gas temperature, stack gas exit velocity or flow rate, stack inside diameter, and surface characteristics (albedo, Bowen ratio, and surface roughness) of the appropriate meteorological station (see Appendix III).

AERSCREEN estimates peak 1-hour concentrations that can be used directly for HIA calculations. For the MICR, HIC, and HIC8 calculations, use the appropriate scaling factor to calculate the appropriate concentration to use. Note that when modeling an area source in AERSCREEN, only the 1-hour concentration is estimated. The U.S. EPA's user's guide states the following for area sources: "Do not use the multiplying factors to correct for averaging times greater than 1 hour. Concentrations close to an area source will not vary as much as those for point sources in response to varying wind directions, and the meteorological conditions which are likely to give maximum 1-hour concentrations can persist for several hours. Therefore, it is recommended that the maximum 1-hour concentration be conservatively assumed to apply for averaging periods out to 24 hours."

In a Tier 3 HRA, the Tier 2 HRA equations for MICR, HIC, HIC8, and HIA continue to be used except that a screening dispersion model is used to estimate each pollutant concentration. Additionally, given the uncertainty in estimating concentrations close to the source from screening dispersion models, distances closer than 25 meters should not be used, consistent with the approach used for Tier 2 HRAs. The Tier 3 HRA equations used are as follows:

$$\mathbf{MICR_R = CP \times AveConc \times CEF_R \times MP_R \times 10^{-6} \times MWAF}$$

$$\mathbf{MICR_W = CP \times AveConc \times CEF_W \times MP_W \times WAF \times 10^{-6} \times MWAF}$$

$$\mathbf{Total\ HIC_{target\ organ} = \Sigma\ \{[AveConc_{TAC} \times MP \times MWAF]/Chronic\ REL_{TAC}\}_{target\ organ}}$$

$$\mathbf{Total\ HIC8_{target\ organ} = \Sigma\ \{[Ave8Conc_{TAC} \times WAF \times MWAF]/8\text{-}Hour\ REL_{TAC}\}_{target\ organ}}$$

$$\mathbf{Total\ HIA_{target\ organ} = \Sigma\ \{[PeakConc_{TAC} \times MWAF]/Acute\ REL_{TAC}\}_{target\ organ}}$$

PeakConc is the peak 1-hour pollutant concentration, Ave8Conc is the 8-hour concentration, and AveConc is the annual average concentration estimated by a screening dispersion model.

# Tier 4: Detailed Risk Assessment

A Tier 4 HRA is a detailed risk assessment using the Hotspots Analysis and Reporting Program Version 2 (HARP 2) software developed by CARB which replaces the prior version of HARP and incorporates the information contained in the 2015 OEHHA Guidelines. The HARP 2 software and documentation can be obtained at http://www.arb.ca.gov/toxics/harp/harp.htm. The U.S. EPA's air quality dispersion model AERMOD is used by HARP 2 to estimate the concentration of pollutants. AERMOD documentation is available at: https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod. Meteorological data for use in HARP 2 and AERMOD can be downloaded from https://www.aqmd.gov/home/air-quality/meteorological-data/data-for-aermod.

The Tier 4 HRA is an option if neither a Tier 2 HRA nor Tier 3 HRA can demonstrate compliance, or if the applicant wishes to obtain a more refined estimate of health risks. Since a Tier 4 HRA involves detailed dispersion modeling using actual meteorological data from the station that is most representative of the facility's meteorological conditions, it will often result in a less conservative estimate of the risk than either Tier 2 or 3 HRAs. Detailed dispersion modeling will be most useful for analyses that have source parameters that differ substantially from those specific sources modeled for Tier 2 HRA, and/or analyses whose closest receptors do not lie immediately downwind of the emission sources.

A Tier 4 HRA should be performed by individuals with experience and training in air quality dispersion modeling and risk assessment. A modeling protocol is recommended for Tier 4 HRAs which deviate from South Coast AQMD's recommendations. AERMOD should be run using the averaging times PERIOD and 1-hour. Written guidance on preparing a detailed risk assessment is contained in the 2015 OEHHA Guidelines which may be obtained at: http://www.oehha.ca.gov/air/hot_spots/hotspots2015.html.

South Coast AQMD's AB 2588 program has supplemental risk assessment guidance (http://www.aqmd.gov/home/regulations/compliance/toxic-hot-spots-ab-2588/health-risk-assessment) which must be followed by all applicants submitting Tier 4 HRAs for that program. HARP 2 settings for both Tier 4 HRAs and AB 2588 HRAs should follow the options described in Appendix II. Lastly, South Coast AQMD guidance on using AERMOD can be found at: https://www.aqmd.gov/home/air-quality/meteorological-data/modeling-guidance.

## BEST AVAILABLE CONTROL TECHNOLOGY FOR TOXICS (T-BACT)

T-BACT is not required if the MICR is less than or equal to one in one million. If the MICR is greater than one in a million, T-BACT is required and must reduce cancer risk to less than or equal to ten in one million.

South Coast AQMD staff is continually examining and updating control technologies that comply with the definition presented in Rule 1401(c)(2). In many situations, T-BACT is equivalent to BACT. The applicant is encouraged to contact South Coast AQMD Engineering and Permitting staff (https://www.aqmd.gov/nav/contact/permitting-staff) for current T-BACT information.

# APPENDIX I

# DERIVATION OF MULTI-PATHWAY ADJUSTMENT FACTORS

## Introduction

Toxic air contaminants (TACs) enter the body through a number of routes: inhalation; absorption through the skin; and ingestion from contaminated food, water, milk and soil. To account for uptake of toxics through routes of exposure other than inhalation, health risk assessments often include a multi-pathway exposure analysis.

To simplify the screening health risk assessment, multi-pathway (MP) adjustment factors were developed. The inhalation risk is multiplied by the MP adjustment factors to account for the additional health risk due to other pathways of exposure.

## Development of MP Adjustment Factors

The MP adjustment factors were developed using the Risk Assessment Standalone Tool (RAST), a computer software package that calculates risks based on ground level concentrations (GLC). Assumptions and parameters used to develop the MP adjustment factors are listed below:

Risk assessment options:

- Deposition velocity – 0.02 m/sec
- OEHHA default exposures are assumed for mother's milk, homegrown produce, and soil exposure
- A 'warm' climate, typical for Southern California is assumed for the dermal exposure pathway
- For non-cancer chronic risk estimates, the "OEHHA Derived Method" risk analysis method is used. In this approach, the inhalation pathway is always considered a driving pathway, the next two dominant (driving) exposure pathways use the high-end point-estimates of exposure, while the remaining exposure pathways use mean point estimates.
- For residential cancer risk estimates, the "RMP (Derived) Method" risk analysis method is used. In this method, if inhalation is one of the top two dominant pathways, the method uses the breathing rate at 95$^{th}$ percentile of exposure for $\leq$ 2 years of age, and the breathing rate at the 80$^{th}$ percentile exposure for > 2 years of age. If inhalation is not the top two dominant pathways, it uses mean. For worker cancer risk, the "OEHHA Derived Method" risk analysis method is used.
- Pathways considered for residential exposure include inhalation, soil ingestion, dermal absorption, homegrown produce, and mother's milk.
- Pathways considered for worker exposure include inhalation, soil ingestion, and dermal absorption.
- The cancer risk estimates, including the Derived equations (both OEHHA and Adjusted), are based on 30-year exposures.
- The chronic MP adjustment factors (resident and worker) for the group listing of polychlorinated biphenyls (CAS number 57465-28-8) has been assigned those of its individual subspecies (243.908 and 10.82, respectively). (The group listing of PCBs does not include the Toxicity Equivalency Factors as developed by the World Health Organization 1997 and as adopted by the 2015 OEHHA Guidelines). PCB 126 (',3',',4',5-Pentachlorobiphenyl, CAS number 57465-28-8) was used in the calculation of the screening approach since it has the most stringent REL. In a case that a facility provides speciated PCB data, or other justification is available, different MP adjustment factors can be used subject to South Coast AQMD approval.

To calculate the MP adjustment factor for each cancer and non-cancer (chronic) for residential and/or worker exposures, perform two separate RAST runs – one for inhalation only and another using all recommended RAST options described above.

- For cancer risk:
  a) sum the risks from all pathways in each scenario (this is provided as "RISK_SUM")
  b) calculate the ratio by dividing sum of risks from the all pathways by sum of risks from the inhalation-only pathway for each toxic air contaminant, for each scenario.

- For non-cancer chronic health risk:
  a) find the maximum of all pathways ("CV", "CNS", "IMMUN", "KIDNEY", "GILV", "REPRO.DEVEL", "RESP", "SKIN", "EYE", "BONE.TEETH", "ENDO", "BLOOD", "ODOR", "GENERAL") in each scenario
  b) calculate the ratio by dividing the max risks from the all pathways by the max risks from the inhalation-only pathway.

# APPENDIX II

# PROCEDURES FOR ADDRESSING NON-DETECTED COMPOUNDS AND BLANKS IN HEALTH RISK ASSESSMENTS

## Introduction

This appendix describes guidelines for estimating emissions of non-detected toxic air contaminants (TACs) and using blanks in emissions estimations for purposes of preparing health risk assessments for Rules 1401, 1402, 212, and the Air Toxics "Hot Spots" Program (AB2588 Program). The procedures are the same for preparing health risk assessments for Rules 1401, 1402, 212, and the AB2588 Program, however the list of TACs are different. The procedures use cancer potency factors (CP) and reference exposure levels (RELs) approved by the Scientific Review Panel and prepared by the state Office of Environmental Health Hazard Assessment (OEHHA).

## Overview

An initial screening is used to determine whether a TAC is likely to be present and therefore should be tested for. If the screening guidelines are met, no further testing or analysis is required. If the screening guidelines are not met, the facility must quantify and report the emissions of the TAC through testing or other methods as approved by South Coast AQMD staff. The reported emission levels are calculated based on the number of test runs or analyses that are below the limit of detection (LOD).

## Screening Guidelines

For a TAC to be excluded from testing or analysis and hence quantification for health risk assessments, Condition A, B, or C must be met.

Proof for exclusion of any TAC based on literature studies on physical nature or chemistry of the compounds to substantiate the findings and any prior analysis or testing shall be submitted for South Coast AQMD approval. Any prior testing must have been conducted according to South Coast AQMD approved test methods or other recognized standards, as approved by South Coast AQMD staff.

If South Coast AQMD staff gets new information that suggests the presence of additional TACs, South Coast AQMD staff may require that the facility test for the presence of the additional TACs, even if a list of TACs to be tested had been previously agreed upon.

### Condition A: No likelihood of the presence of a TAC

An applicant may choose to demonstrate that there is no likelihood of a TAC being present in the raw materials, process streams, or materials introduced into the equipment or process. The methodology or documentation to show proof of the non-existence of the TAC must be deemed complete with the source test protocol or test method analysis protocol for South Coast AQMD staff approval. If the evidence to substantiate the absence of a TAC is insufficient, or South Coast AQMD staff has reason to believe that the TAC may be present, the TAC must be tested for and quantified (see Cases 1, 2, and 3 below).

For example, an applicant can demonstrate the absence of cadmium in emissions from the melting of lead ingots in a pot furnace by presenting the following documentation:

- Certified analysis of the lead ingots showing that cadmium is not a constituent of the ingot.
- Description of the process substantiating that no other material is added to the furnace that will contribute to cadmium emissions. An analysis of the fuel used in the process must be provided to demonstrate that the materials do not contain cadmium.

- Documentation substantiating that melting lead ingots without cadmium present in the ingot in a pot furnace will not result in the emissions of cadmium when the firebricks or pot liner are heated during the melting operations.

In addition, the applicant may submit results from tests performed within the last two years or a longer period if it can be demonstrated that no significant changes have occurred to the South Coast AQMD-approved test method, process equipment, or process materials that indicate cadmium was reported as below LOD.

**Condition B: Absence of a TAC or its precursors in the process**

If there is any evidence that precursors, which could lead to formation of a TAC during a process or reaction, may be present, then a facility may have to test for the TAC. To be excluded from testing and quantification requirements, the facility must provide documentation to demonstrate, based on test results, that none of the essential precursors are present in the material or process. This is similar to the previous criteria and differs only in that precursor compounds that could contribute to the formation of the subject TAC must also be identified as not being present.

An example is emission of dioxins from a waste incinerator. In this case, test data may be available to show that there are no dioxins present in the waste stream being incinerated. However, the presence of chlorine and hydrocarbons in the combustion process could result in the formation of products of incomplete combustion (PICs) such as dioxins or other toxic compounds. Testing for these compounds would be required unless the facility operator demonstrates that none of the essential precursors are present in the waste stream or the process itself.

**Condition C: Special TAC lists**

Most industrial sources have potential TAC emissions that are relatively well defined and which contain limited compounds, however proving the absence of TACs from emissions from sources with variable incoming streams, such as wastewater treatment facilities, may be more difficult. In such instances where there are numerous sources and source test data available, South Coast AQMD staff, with the assistance and cooperation of industry, may develop and approve industry-specific TAC lists.

Special TAC lists shall be developed outside these Risk Assessment Procedures and once approved by South Coast AQMD staff, will be made available to the public. Specific TACs may be added or deleted from the approved list on a case-by-case basis.

Once a special TAC list is established, facilities will be required to quantify the listed compounds through testing or other methods approved by South Coast AQMD staff for inclusion in the health risk assessment. The facility will not have to test for compounds not included in the special TAC list, and the inclusion of non-listed TACs in the health risk assessment is not required. However, if after the industry-specific list is developed and approved, the applicant or South Coast AQMD staff later discovers information that additional TACs may be present, South Coast AQMD staff may revise the industry-specific list and may require the applicant to quantify TAC emissions that were previously excluded from quantification.

## Quantification of Emissions Based on Source Test Results

The cases listed below illustrate the process for quantification of emissions based on the source test results.

### Treatment of Test Runs Below LOD

If some test runs are below LOD, quantification of the TAC depends on the percent of the test runs and analyses that are below LOD. Three possible scenarios are discussed below. In all of these cases, all of the following three conditions must be met:

1. All tests should be performed using South Coast AQMD-approved test methods, triplicate sample runs, and South Coast AQMD-approved detection limits. When non-detected values are reported, the actual analytical limit of detection for all runs and the number of sample runs shall be reported; and
2. The data from the analyses or tests were obtained within a period of two years prior to the time the data is to be used by South Coast AQMD staff, unless the applicant demonstrates to South Coast AQMD staff's satisfaction that earlier test data remain valid due to lack of significant changes in test methods, process equipment, or process materials; and
3. For cyclic operations or variations in feedstock, the tests or analyses conducted should be representative of the variations in loads, feed rates and seasons, if applicable. In such cases, an adequate number of test runs should be conducted for all cyclic or seasonal operations.

### Case #1: TAC is not detected in any test runs or analyses

In situations in which all test runs and analyses consistently indicate levels below the LOD, the compound can be identified as "not detected" and its inclusion in the health risk assessment will not be required, provided all three conditions listed above are met.

### Case #2: TAC is detected in less than 10% of the test runs or analyses

In situations in which a compound has been detected and the percentage of samples in which it is detected is less than ten percent, and provided that all three conditions listed above are met, the following procedure shall be used to average the results:

1. For those runs or analyses that were below LOD, assign zero.
2. Average the measured values obtained for the runs that were above LOD with zero values for the runs below LOD and report the final average result for use in the health risk assessment.

### Case #3: TAC is detected in 10% or more of the test runs or analyses

In cases in which ten or more percent of the test runs and analyses show measured values of a TAC above the LOD, and provided that all three conditions listed above are met, the following procedure shall be used to average the results:

1. For those runs or analysis that were below LOD, assign one half (1/2) of the corresponding LOD for each run.
2. Average the measured values obtained for the runs that were above LOD with 1/2 LOD values for the runs below LOD and report the final average result for use in the health risk assessment.

In cases in which there are fewer than ten samples (for example, two triplicate samples have been taken) and a TAC has been detected in one or more samples, the following procedures shall be used.

- If the TAC is detected in one sample, use Case #2.
- If the TAC is detected in two or more samples, use Case #3.

**Use of Reagent Blanks**

Reagent blank values may be subtracted from sample values under the conditions specified below. In order to use these procedures, prior to the test or analyses, it will be necessary to obtain a determination as to the maximum allowable value for the blank from South Coast AQMD staff.

If the level of the TAC in the reagent blank is less than or equal to the maximum allowable blank, the reagent blank may be subtracted. The data must be reported with and without the correction. If the level of the TAC in the reagent blank is greater than the maximum allowable blank and the concentration of the sample is greater than three times the reagent blank value, then the maximum allowable reagent blank value can be subtracted. The data must be reported with and without correction.

**Duplicate Samples**

Some source test methods may require duplicate samples to ensure consistency of the results. These duplicate samples may either be averaged for the final result of the source test run or used to calculate the worst-case result from one of the source test duplicates. For purposes of implementing the procedures in “Treatment of Source Test Runs Below LOD,” duplicate samples shall be utilized as a single source test run.

# APPENDIX III

# AIR QUALITY DISPERSION MODELING METHODOLOGY AND METEOROLOGICAL STATIONS/DATA

## Introduction

This appendix discusses the general modeling methodologies used in the development of the Tier 2 HRA in the HRA Tool. Information on the meteorological data used in the analyses and how the data was processed are also included in the discussion below. The meteorological data is available on the HRA Tool for use in Tier 4 health risk assessments.

## Air Quality Dispersion Modeling Methodology

Air quality modeling was performed using the air quality dispersion model AERMOD. As of December 9, 2006, U.S. EPA promulgated AERMOD as a replacement for ISCST3 as the recommended dispersion model. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

Air quality dispersion modeling performed for the development of the Tier 2 HRA in the HRA Tool used U.S. EPA's most recent approved version of AERMOD, which is version 22112. AERMOD was executed using the urban option, which is South Coast AQMD's recommendation for modeling urban areas in its jurisdiction. The U.S. EPA regulatory non-default option of flat terrain was implemented and South Coast AQMD's AERMOD-ready meteorological data was used. The County populations used are based on the 2023 estimates from the U.S. Census Bureau. The Los Angeles County population was 9,663,345; Orange County population was 3,135,755; Riverside County population was 2,492,442; and San Bernardino County population was 2,195,611.

For all modeling performed, a polar receptor grid was utilized with ten degree azimuth increments at the following downwind distances from the source: 25, 50, 75, 100, 200, 300, 500, and 1,000 meters. The peak model-predicted impacts at each downwind distance over the 36 azimuth angles are used for the Tier 2 HRA.

For all modeling that included building downwash effects as part of the analysis, the U.S. EPA's Building Profile Input Program for PRIME (BPIP-PRIME) version 04274 was used. BPIP-PRIME calculates downwash values that are used as input for models like AERMOD. The AERMOD modeling system (including all associated processors) is available on the U.S. EPA's website[1].

For more information regarding the modeling parameters and assumptions used to develop the screening tables for each specific category, please refer to the applicable appendix.

## Meteorological Stations

Please see https://www.aqmd.gov/home/air-quality/meteorological-data/data-for-aermod for more details.

---

[1] U.S. EPA's Support Center for Regulatory Atmospheric Modeling (SCRAM), AERMOD Modeling System. Available at: https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod

# APPENDIX IV

# TIER 2 HRA MODELING ASSUMPTIONS FOR NON-COMBUSTION SOURCES

## Introduction

The purpose of this appendix is to document the modeling assumptions used to estimate health risks from non-combustion sources using South Coast AQMD's Risk Assessment Procedures.

## Emission Inventory Methods

In order to determine the appropriate emission rates to use, please refer to the Emissions Calculator spreadsheet that is linked in the HRA Tool or contact the appropriate South Coast AQMD Engineering and Permitting staff (https://www.aqmd.gov/nav/contact/permitting-staff) for more information.

## Modeling Parameters

For the general dispersion modeling methodology and meteorological stations used, please refer to Appendix III.

The non-combustion sources were modeled as either a point source or volume source. The point source was modeled as a stack using a constant ambient temperature at the release point (0 K in AERMOD), a 0.3 meter stack diameter and 10 m/s exit velocity with varying release heights. Building downwash effects were analyzed for point sources with a 20 meter by 30 meter building, 4 meters high. Table IV-1 shows the parameters used to model the point sources while Table IV-2 shows the parameters used for the volume sources. The source IDs are used to differentiate between the different parameters for each source configuration.

**Table IV-1: Model Parameters for Point Sources**

| Source ID | Stack Height | | Stack Diameter | | Stack Temperature | | Stack Velocity | | Flowrate |
|---|---|---|---|---|---|---|---|---|---|
| | (ft) | (m) | (in) | (m) | ($^0$F) | (K) | (ft/s) | (m/s) | (ft$^3$/min) |
| P1 | 14 | 4.27 | 12 | 0.30 | Ambient | 0* | 32.81 | 10 | 1,546.1 |
| P2 | 25 | 7.62 | 12 | 0.30 | Ambient | 0* | 32.81 | 10 | 1,546.1 |
| P3 | 50 | 15.24 | 12 | 0.30 | Ambient | 0* | 32.81 | 10 | 1,546.1 |

Note: * The temperature used in AERMOD was set to 0 K, which indicates that the ambient temperature was used in the model run.

**Table VII-2: Model Parameters for Volume Sources**

| Source ID | Release Height | | Lateral Dimension | | Vertical Dimension | | $\sigma_y$ | $\sigma_z$ |
|---|---|---|---|---|---|---|---|---|
| | (ft) | (m) | (ft) | (m) | (ft) | (m) | (m) | (m) |
| V1 | 7.50 | 2.29 | 38.73 | 11.80 | 15.00 | 4.57 | 2.75 | 2.13 |
| V2 | 7.50 | 2.29 | 70.71 | 21.55 | 15.00 | 4.57 | 5.01 | 2.13 |
| V3 | 15.00 | 4.57 | 70.71 | 21.55 | 30.00 | 9.14 | 5.01 | 4.25 |
| V4 | 7.50 | 2.29 | 122.47 | 37.33 | 15.00 | 4.57 | 8.68 | 2.13 |
| V5 | 15.00 | 4.57 | 122.47 | 37.33 | 30.00 | 9.14 | 8.68 | 4.25 |
| V6 | 15.00 | 4.57 | 212.13 | 64.66 | 30.00 | 9.14 | 15.04 | 4.25 |

Appendix X contains sample AERMOD input file(s).

# APPENDIX V

# TIER 2 HRA MODELING ASSUMPTIONS FOR COMBUSTION SOURCES (NATURAL GAS BOILERS, NATURAL GAS INTERNAL COMBUSTION ENGINES, DIESEL INTERNAL COMBUSTION ENGINES)

## Introduction

The purpose of this appendix is to document the modeling assumptions used to estimate health risks from certain common types of combustion equipment, such as natural gas-fueled boilers, natural gas-fueled internal combustion engines (ICEs), and diesel-fueled ICEs, using South Coast AQMD's Risk Assessment Procedures.

## Emission Inventory Methods

In order to determine the appropriate/default emission rates to use for fuel combustion sources, please refer to the Emissions Calculator spreadsheet that is linked in the HRA Tool or "Supplemental Instructions, Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory, Annual Emissions Reporting Program" (http://www.aqmd.gov/docs/default-source/planning/annual-emission-reporting/supplemental-instructions-for-ab2588-facilities.pdf) or contact the appropriate South Coast AQMD Engineering and Permitting staff (https://www.aqmd.gov/nav/contact/permitting-staff) for more information.

## Modeling Parameters

For the general dispersion modeling methodology and meteorological stations used, please refer to Appendix III.

Combustion source stacks were modeled as a point source with the stack parameters presented in Table V-1. These parameters were based on the San Joaquin Valley Unified Air Pollution Control District's modeling parameters for combustion sources[2]. Building downwash effects were analyzed with a 20 meter by 30 meter building, 4 meters high.

[2] San Joaquin Valley Unified Air Pollution Control District, Final Draft Staff Report with Appendices for Update to District's Risk Management Policy to Address OEHHA's Revised Risk Assessment Guidance Document, found at https://www.valleyair.org/busind/pto/staff-report-5-28-15.pdf, accessed on June 15, 2017

**Table V-1: Model Parameters for Combustion Sources**

| Source ID | Release Height | | Stack Diameter | | Stack Temperature | | Stack Velocity | | Flowrate |
|---|---|---|---|---|---|---|---|---|---|
| | (ft) | (m) | (in) | (m) | ($^0$F) | (K) | (ft/s) | (m/s) | (ft$^3$/min) |
| **B1** | 29.53 | 9 | 1.46 | 0.4 | 332.3 | 440 | 16.40 | 5 | 11.5 |
| **B2** | 29.53 | 9 | 1.83 | 0.5 | 386.3 | 470 | 22.97 | 7 | 25.1 |
| **B3** | 29.53 | 9 | 2.01 | 0.55 | 386.3 | 470 | 29.53 | 9 | 39.1 |
| **B4** | 32.81 | 10 | 2.45 | 0.67 | 386.3 | 470 | 32.81 | 10 | 64.5 |
| **B5** | 32.81 | 10 | 2.63 | 0.72 | 431.3 | 495 | 39.37 | 12 | 89.4 |
| **B6** | 45.93 | 14 | 4.02 | 1.1 | 332.3 | 440 | 32.81 | 10 | 173.8 |
| **B7** | 52.49 | 16 | 5.49 | 1.5 | 314.3 | 430 | 39.37 | 12 | 387.8 |
| **N1** | 13.12 | 4 | 0.26 | 0.07 | 1070.3 | 850 | 131.23 | 40 | 2.8 |
| **N2** | 13.12 | 4 | 0.29 | 0.08 | 1070.3 | 850 | 213.25 | 65 | 6.0 |
| **N3** | 13.12 | 4 | 0.51 | 0.14 | 1142.3 | 890 | 180.45 | 55 | 15.5 |
| **N4** | 16.40 | 5 | 0.69 | 0.19 | 1016.3 | 820 | 196.85 | 60 | 31.1 |
| **N5** | 22.97 | 7 | 1.28 | 0.35 | 890.3 | 750 | 213.25 | 65 | 114.4 |
| **D1** | 9.84 | 3 | 0.33 | 0.09 | 908.3 | 760 | 213.25 | 65 | 7.6 |
| **D2** | 9.84 | 3 | 0.44 | 0.12 | 908.3 | 760 | 180.45 | 55 | 11.4 |
| **D3** | 9.84 | 3 | 0.48 | 0.13 | 908.3 | 760 | 262.47 | 80 | 19.4 |
| **D4** | 9.84 | 3 | 0.55 | 0.15 | 926.3 | 770 | 295.28 | 90 | 29.1 |
| **D5** | 13.12 | 4 | 0.62 | 0.17 | 980.3 | 800 | 524.93 | 160 | 66.4 |

Appendix X contains sample AERMOD input file(s).

# APPENDIX VI

# TIER 2 HRA MODELING ASSUMPTIONS FOR CREMATORIES

## Introduction

The purpose of this appendix is to document the modeling assumptions used to estimate health risks from crematories using South Coast AQMD's Risk Assessment Procedures.

## Emission Inventory Methods

In order to determine the appropriate emission rates to use, please refer to the Emissions Calculator spreadsheet that is linked in the HRA Tool or contact the appropriate South Coast AQMD Engineering and Permitting staff (https://www.aqmd.gov/nav/contact/permitting-staff) for more information.

## Modeling Parameters

For the general dispersion modeling methodology and meteorological stations used, please refer to Appendix III.

Based on information from South Coast AQMD Engineering and Permitting staff, the parameters for a standard crematory is a 13 foot building with a single stack located 6 feet above the roof of the building. The stack was modeled as a point source with the following stack parameters – 19 feet stack height, 19.03 ft/s exit velocity, 1,300ºF exit temperature. Due to the sensitivity to building downwash effects, there are three different square building sizes analyzed: 5,000, 10,000, and 15,000 $ft^2$.

**Table IX-1: Model Parameters for Crematories**

| Source ID* | Release Height | | Stack Diameter | | Stack Temperature | | Stack Velocity | | Flowrate |
|---|---|---|---|---|---|---|---|---|---|
| | (ft) | (m) | (in) | (m) | ($^0$F) | (K) | (ft/s) | (m/s) | ($ft^3$/min) |
| P1, P2, P3 | 19 | 5.79 | 20 | 0.508 | 1,300 | 977.59 | 19 | 5.8 | 2,490.9 |

*Same point source model parameters with three separate building sizes to account for differing building downwash effects.

Appendix X contains sample AERMOD input file(s).

# APPENDIX VII

# TIER 2 HRA MODELING ASSUMPTIONS FOR GASOLINE DISPENSING FACILITIES AND MOBILE FUELERS

## Introduction and Background

The purpose of this appendix is to document the emission factors and modeling assumptions used to estimate health risks from gasoline dispensing facilities (GDFs) and mobile fuelers using South Coast AQMD's Risk Assessment Procedures. Where applicable, assumptions used here are consistent with the California Air Resources Board (CARB) and California Air Pollution Control Officers Association (CAPCOA) Gasoline Service Station Industrywide Risk Assessment Technical Guidance[3] (2022 CARB/CAPCOA Guidance).

The primary purpose of GDFs and mobile fuelers is to store and dispense fuel into motor vehicles. The three main types of fuel commonly stored and dispensed are gasoline, E-85, and diesel. Gasoline is a volatile organic liquid with a Reid Vapor Pressure (RVP) up to 7 pounds per square inch (psi) during the warmer summer months and from 7 to 15 psi during colder winter months. The high RVP of gasoline facilitates rapid evaporation and emission of Reactive Organic Gases (ROGs), as well as TACs, upon exposure to the atmosphere. Gasoline typically comes in three different grades: 87, 89, and 91.

E-85, composed of a blend of ethanol and gasoline, serves as an alternative fuel for motor vehicles. Its actual ethanol content may vary by month and location, with a general composition of 79 vol. % ethanol (minimum), 15-21 vol. % hydrocarbons and aliphatic ethers (gasoline), and 2% other alcohols (maximum)[4]. E-85 is a volatile organic liquid with an RVP ranging from 6.5 to 10.2 psi depending on geographic location and time of year. E-85 is utilized in flexible fuel vehicles (FFVs), equipped with On-Board Refueling Vapor Recovery (ORVR) activated carbon canisters, to capture and retain displaced vapors during vehicle fueling.

Diesel is a lower volatility fuel that may be used in diesel motor vehicles. South Coast AQMD Rule 219 – Equipment Not Requiring A Written Permit Pursuant to Regulation II exempts diesel storage and dispensing equipment from requiring a written permit, unless the liquid fuel storage exceeds 40,000 gallons. This type of diesel fuel configuration requiring permitting is not common at GDFs or mobile fuelers.

Although GDFs primarily rely on underground storage tanks (USTs) for storing fuels delivered by tanker trucks, there are other gasoline storage and dispensing equipment options such as aboveground storage tanks (ASTs) and mobile fuelers. An aboveground storage tank (AST) is a stationary tank commonly used at non-retail facilities to fuel fleet vehicles, maintenance vehicles, and smaller equipment. A mobile fueler is a self-propelled vehicle equipped with one or more cargo tanks that is utilized to dispense fuel at a specific location, or at various locations throughout South Coast AQMD's jurisdiction. Mobile fuelers, unlike GDFs, can provide fuel directly at the location of demand, typically for fleet vehicles.

The fuel storage and dispensing operations described above are subject to CARB and South Coast AQMD requirements. The requirements differ depending on the specific operation (USTs, ASTs,

---

[3] CARB and CAPCOA Gasoline Service Station Industrywide Risk Assessment Technical Guidance, dated February 18, 2022, available online at: https://ww2.arb.ca.gov/sites/default/files/2022-03/Draft%202022%20Gas%20Station%20IWG%20-%20Technical%20Guidance_ADA%20Compliant.pdf.

[4] Cal. Code Regs. Tit. 13, § 2292.4 - Specifications for E-85 Fuel Ethanol (https://ww2.arb.ca.gov/sites/default/files/2020-05/alternative_fuels_specifications.pdf)

mobile fuelers) and fuel being dispensed (gasoline, E-85). The primary requirements include installation and use of Phase I vapor recovery and Phase II vapor recovery equipment, as applicable to the operation. Phase I vapor recovery systems control gasoline vapors displaced from storage tanks when cargo tank trucks make gasoline deliveries. Phase II vapor recovery systems control the vapors displaced from the vehicle fuel tanks during refueling.

This appendix focuses on the various operations at GDFs and mobile fuelers that require a South Coast AQMD permit, such as storage and dispensing of gasoline and E-85 at GDFs from underground storage tanks, storage and dispensing of gasoline at GDFs from aboveground storage tanks, and storage and dispensing of gasoline from mobile fuelers. Note that currently, E-85 transfer and dispensing systems are only certified to store E-85 in USTs. No vapor recovery systems have been CARB certified for ASTs serving E-85 dispensing facilities.

**General Emission Sources for Transfer and Dispensing of Fuels**

Rule 461 – Gasoline Transfer and Dispensing is designed to regulate gasoline and E-85 vapor emissions from gasoline transfer and dispensing processes which contain volatile organic compounds and TACs such as benzene, ethylbenzene, toluene, xylenes, and naphthalene. Rule 461.1 – Gasoline transfer and Dispensing for Mobile Fueling Operations Emissions is designed to do the same from mobile fueling. The emissions from gasoline and E-85 transfer and dispensing mainly occur during the five processes of loading, breathing, refueling, spillage, and hose permeation as described below:

> Loading – Emissions occur when a fuel tanker truck unloads gasoline to the storage tanks. The storage tank vapors, displaced during loading, are emitted through its vent pipe. A pressure/vacuum (P/V) valve installed on the tank vent pipe reduces these emissions.
>
> Breathing – Emissions occur through the storage tank vent pipe as a result of temperature and pressure changes in the tank vapor space.
>
> Refueling – Emissions occur during motor vehicle refueling when gasoline vapors escape either through the vehicle/nozzle interface or the ORVR system.
>
> Spillage – Emissions occur from evaporating gasoline that spills during vehicle refueling.
>
> Hose Permeation – Emissions occur when liquid gasoline or gasoline vapors diffuse through the dispensing hose outer surface to the atmosphere.

Emissions and health risk from these facilities can be calculated from the available emission factor information, which is described in greater detail below. Based on a sensitivity analysis performed by South Coast AQMD staff in previous versions of these Risk Assessment Procedures, it was determined that cancer risk is the driver of health risks from GDFs. Likewise, in the 2022 CARB/CAPCOA Guidance, an analysis of the non-cancer hazard indices found that the cancer risks would be the driver for health risks with the non-cancer health risks being orders of magnitude lower. Therefore, consistent with South Coast AQMD's current practice, only cancer risk effects are evaluated for GDFs and mobile fuelers.

## GDFs Utilizing Underground Storage Tanks for Gasoline and E-85

This section describes the emission factors and modeling assumptions used for GDFs with USTs for gasoline and/or E-85.

***Emission Factors***

All retail gasoline storage and dispensing systems (gasoline stations) within South Coast AQMD's jurisdiction are required to have Phase I and II vapor recovery systems to control gasoline emissions. Phase I vapor recovery systems control gasoline vapors displaced from storage tanks when cargo tank trucks make gasoline deliveries. Phase II vapor recovery systems control the vapors displaced from the vehicle fuel tanks during refueling. In addition, all gasoline is stored underground with valves installed on the tank vent pipes to further control gasoline emissions. Of the TACs emitted from gasoline stations, only benzene, ethylbenzene, and naphthalene have cancer toxicity values and will be evaluated further.

The emission factors for each of the five processes are summarized in Table VII-1. The emission factors are taken from CARB's Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities[5] (2013 CARB Emission Factors) except for Phase II ORVR. South Coast AQMD staff has been in communication with CARB staff regarding the refueling emissions factor. Both agencies agree that additional time is needed to better understand emission reductions from Phase II EVR for ORVR vehicles. South Coast AQMD staff will continue to use South Coast AQMD's current emission factor of 0.32 lbs per 1,000 gallons for refueling until consensus with CARB staff as to an appropriate emission factor is reached. Staff will use the CARB 2013 Emission Factors for all other categories (loading, breathing, spillage, and hose permeation). It is important to note that Phase II emissions are split into refueling and breathing for dispersion modeling purposes.

[5] CARB's Revised Emission Factors for Gasoline Marketing Operations at California Gasoline Dispensing Facilities, dated December 23, 2013, available online at https://ww2.arb.ca.gov/sites/default/files/classic/vapor/gdf-emisfactor/gdfumbrella.pdf.

| Table VII-1. Gasoline Emission Factors (EF) for GDFs with USTs (a)(b) | | Loading | Breathing | Refueling | Hose Permeation | Spillage |
|---|---|---|---|---|---|---|
| Uncontrolled Gasoline EF (lbs/1,000 gal) (c) | | 7.7 | 0.76 | 8.4 | 0.009 | 0.61 |
| Controlled Gasoline EF (lbs/1,000 gal) (c) | | 0.15 | 0.024 | 0.32 | 0.009 | 0.24 |
| Benzene | Weight Percent | 0.457% | 0.457% | 0.457% | 0.457% | 0.707% |
| | EF (lbs/1,000 gal) | 6.86E-04 | 1.10E-04 | 1.46E-03 | 4.11E-05 | 1.70E-03 |
| Ethylbenzene | Weight Percent | 0.107% | 0.107% | 0.107% | 0.107% | 1.29% |
| | EF (lbs/1,000 gal) | 1.61E-04 | 2.57E-05 | 3.42E-04 | 9.63E-06 | 3.10E-03 |
| Naphthalene | Weight Percent | 0.000445% | 0.000445% | 0.000445% | 0.000445% | 0.174% |
| | EF (lbs/1,000 gal) | 6.68E-07 | 1.07E-07 | 1.42E-06 | 4.01E-08 | 4.18E-04 |

Notes:
(a) The weight percentages of the TACs evaluated for cancer risk are based on weighted summer (59.2%, approx. 216 days) and winter (40.8%, approx. 149 days) gasoline speciation.
(b) Gasoline speciation profiles taken from the 2022 CARB/CAPCOA Guidance.
(c) Uncontrolled and controlled ROG emissions, excluding the controlled Refueling factor, based on the 2013 CARB Emission Factors.

E-85 UST systems operate similarly to gasoline UST systems, with slight differences in fuel volatility, vapor control equipment requirements, and emission factors. All retail E-85 storage and dispensing systems within South Coast AQMD's jurisdiction are required to have a Phase I vapor recovery system. A Phase II vapor recovery system is not required as there is currently no CARB certified Phase II system. In the absence of a Phase II system, refueling emissions are controlled through ORVR canisters equipped on motor vehicles.

The RVPs of E-85 and gasoline fall within similar ranges. The volatility of each fuel is similar, therefore the emission factors for gasoline UST systems are considered an appropriate basis for estimating emissions from E-85 UST systems, in the absence of more appropriate E-85 specific emission data. The uncontrolled emission factors for E-85 are identical to gasoline emission factors. The controlled emission factors are obtained from the 2022 CARB/CAPCOA Guidance, Table 9, Scenario 3, for a gasoline UST system equipped with Phase I EVR (no Phase II), fueling to ORVR vehicles. This scenario describes the setup of an E-85 UST system with Phase I EVR, associated P/V valve, and fueling ORVR vehicles. The controlled loading factor and hose permeation factors are consistent with the gasoline UST system. The loading factor is identical to gasoline USTs as both systems have the same Phase I control equipment requirements. The hose permeation factor is considered identical to the gasoline factor derived by CARB for gasoline hoses, in the absence of more appropriate permeation data specific to E-85 hoses. The differences in the controlled breathing factor, controlled refueling factor, controlled spillage factor, and TAC emissions are described below.

The breathing factor for E-85 UST systems includes a control efficiency of 0% as compared with control efficiency of 96.8% for gasoline UST systems. Gasoline storage tanks and associated vent pipes are equipped with P/V vent valves and Phase II vapor processers that control pressure-driven losses before exiting the vent pipe, whereas the breathing losses from E-85 storage tanks are not controlled by a vapor processer. While E-85 storage tanks and associated vent pipes are equipped with a P/V vent valve, any control imparted by the P/V valve has already been considered in the listed uncontrolled emission factor obtained from the 2022 CARB/CAPCOA Guidance, as Phase I EVR systems require a P/V valve.

The refueling factor for E-85 assumes a control efficiency of 95% from the fueling of vehicles equipped with ORVR canisters. This control efficiency is consistent with ORVR control efficiency findings for gasoline per the 2013 CARB Emission Factors. This 95% control is lower than the 96.2% control for gasoline, as gasoline refueling includes the combination of Phase II vapor recovery and ORVR canisters (please refer to discussion above as to the differences in South Coast AQMD's controlled emission factor compared to the 2013 CARB Emission Factors).

The spillage factor for E-85 includes a control efficiency of 0% as compared with control efficiency of 61% for gasoline. Spillage emissions are dependent on the type of nozzle used to dispense fuel into motor vehicles. Conventional, non-Phase II nozzles are used for dispensing E-85, whereas Phase II Enhanced Vapor Recovery (EVR) nozzles are used to dispense gasoline. The E-85 emission factor is consistent with the 2013 CARB Emission Factors for spillage for gasoline systems without Phase II nozzles.

TAC emissions differ between E-85 and gasoline as a result of the fuel compositions. E-85 is composed of at least 79% ethanol, blended with up to 21% gasoline, and less than 2% other alcohols. As ethanol is not considered a TAC, the primary source of TACs is the gasoline portion of E-85 which contains TACs including benzene, ethyl benzene, and naphthalene. TAC weight percentages for E-85 were determined through multiplication of the TAC weight percentages specified for the gasoline UST system by the maximum gasoline quantity of 21%. The calculated weight percentages were then multiplied with ROG emission factors for E-85, resulting in TAC mass emission factors listed in Table VII-2.

| Table VII-2. E-85 Emission Factors (EF) for GDFs with USTs [(a)] | | Loading | Breathing | Refueling | Hose Permeation | Spillage |
|---|---|---|---|---|---|---|
| Uncontrolled E-85 EF (lbs/1,000 gal) [(b)] | | 7.7 | 0.76 | 8.4 | 0.009 | 0.61 |
| Controlled E-85 EF (lbs/1,000 gal) [(c)] | | 0.15 | 0.76 | 0.42 | 0.009 | 0.61 |
| Benzene | Weight Percent | 0.096% | 0.096% | 0.096% | 0.096% | 0.15% |
| | EF (lbs/1,000 gal) | 1.44E-04 | 7.30E-04 | 4.03E-04 | 8.64E-06 | 9.15E-04 |
| Ethylbenzene | Weight Percent | 0.022% | 0.022% | 0.022% | 0.022% | 0.27% |
| | EF (lbs/1,000 gal) | 3.30E-05 | 1.67E-04 | 9.24E-05 | 1.98E-06 | 1.65E-03 |
| Naphthalene | Weight Percent | 0.00093% | 0.00093% | 0.00093% | 0.00093% | 0.037% |
| | EF (lbs/1,000 gal) | 1.40E-07 | 7.07E-07 | 3.91E-07 | 8.37E-09 | 2.26E-04 |

Notes:

(a) The weight percentages of the TACs evaluated for cancer risk are based on weighted summer (59.2%, approx. 216 days) and winter (40.8%, approx. 149 days) gasoline speciation, adjusted to account for 21% gasoline (maximum) in E-85 fuel. Gasoline speciation profiles taken from the 2022 CARB/CAPCOA Guidance.

(b) Uncontrolled ROG emissions based on the 2013 CARB Emission Factors.

(c) Controlled ROG emissions based on 2022 CARB/CAPCOA Guidance, Table 9, Scenario 3.

***Modeling Parameters***

For the general dispersion modeling methodology and meteorological stations used in the development of the screening tables, please see Appendix III.

Emissions from gasoline and E-85 service stations are non-buoyant and ground-based (or nearly ground-based). In addition, the peak impacts from this type of facility occur in close proximity to the source. Under these circumstances the local terrain is relatively unimportant; therefore flat terrain is assumed in the dispersion modeling.

CARB and CAPCOA have worked together to develop industry-wide risk assessment guidelines for gasoline service stations, which was most recently updated in 2022. The goal of these guidelines was to provide a cost-effective and uniform methodology that California's 35 air districts may use for preparing gas station emission inventories and health risk assessments for the AB 2588 program. However, CAPCOA recognized that many of the districts in the state have developed modeling methods and procedures unique to their situations. To address these differences among districts, CAPCOA allows for a district to deviate from the published guidelines to address district-specific situations. The modeling parameters used here are consistent with the 2022 CARB/CAPCOA Guidance and any notable differences are described.

Loading and breathing emissions exit the underground storage tank vent pipe and are thus treated as a point source. The height and diameter of the vent are assumed to be 3.66 meters (12 feet) and 0.05 meters (2 inches), respectively.

Refueling, spillage, and hose permeation emissions are modeled as volume sources with horizontal dimensions of 13 meters by 13 meters to correspond to the dimensions of the pump islands and a vertical dimension of 5 meters to correspond to the height of the canopy. For refueling and hose permeation, the release height is assumed to be 1 meter to approximate the height of a vehicle fuel tank inlet, whereas spillage emissions are assumed to be released at ground level since nearly all the gasoline from spillage reaches the ground. These dimensions match the 2022 CARB/CAPCOA Guidance recommendations except for the vertical dimension of the volume source. South Coast AQMD has been requiring gas station health risk assessments for permitting since early 1990s using a vertical dimension of the volume source corresponding to the pump island canopy top. Assuming a 5-meter vertical dimension continues this modeling practice, instead of using the 2022 CARB/CAPCOA Guidance assumption of 4 meters.

According to the 2022 CARB/CAPCOA Guidance, the effects of building downwash on the calculated cancer risk were determined by using multiple different scenarios with a 10 meter long by 5 meter wide, by 4 meter high building. The building downwash algorithms only affect point sources and do not affect volume or area sources. Results of the modeling indicated that the placement of the buildings and their subsequent potential to create downwash has a notable effect on the resultant health risks from the vent pipes. Thus, CAPCOA concluded that it is necessary to include building downwash when determining the dispersion from the vent pipes.

The vent pipe, volume sources, and building are assumed to be located at the center of the service station property. Ideally, the locations of the vent pipes, pump islands, and buildings would be determined on a site-by-site basis. Unfortunately, that level of detail is not feasible for the development of screening tables due to the large number of facilities.

It is assumed that the gas station described above operates continuously throughout the year. Further, it is assumed that 85 percent of the daily emissions occur equally each hour from 6:00 a.m. to 8:00 p.m. and the remaining 15 percent of the daily emissions occur equally each hour from 8:00 p.m. to 6:00 a.m.

The peak model-predicted impacts at each downwind distance over the 36 azimuth angles are used to develop the Tier 2 HRA for gasoline service stations in the HRA Tool.

## GDFs Utilizing Aboveground Storage Tanks for Gasoline

This section describes the emission factors and modeling assumptions used for GDFs with ASTs for gasoline. As mentioned previously, E-85 transfer and dispensing systems are certified to store E-85 only in USTs. No vapor recovery systems have been CARB-certified for ASTs serving E-85 dispensing facilities.

### *Emission Factors*

Gasoline AST systems operate similarly to gasoline UST systems, with slight differences in vapor control equipment requirements and emission factors. Gasoline AST systems operating within South Coast AQMD's jurisdiction are required to have standing loss control, Phase I vapor recovery, and Phase II vapor recovery unless meeting Phase II exemption requirements. Standing loss control is required for ASTs since they are exposed to diurnal effects and environmental factors (*i.e.*, ambient temperature, sunlight), and is intended to reduce standing loss (breathing) emissions. Gasoline AST systems may or may not include a Phase II vapor recovery system, depending on the specifics of the AST equipment and motor vehicles being fueled. In general, Phase II vapor recovery is required, although an AST system equipped with a certified low-permeation hose and enhanced conventional nozzle, dispensing only to motor vehicles equipped with ORVR canisters, is exempted from Phase II requirements.[6]

The 2022 CARB/CAPCOA Guidance explains that gasoline AST system emission factors have not been updated from the original 1997 CAPCOA Guidelines[7]. Therefore, the emission factors utilized here are primarily based on the 1997 CAPCOA Guidelines, with various appropriate updates included based on relevant data obtained since 1997 for gasoline UST systems. The Loading and Breathing factors are consistent with the 1997 CAPCOA Guidelines related to uncontrolled systems and systems equipped with Phase I vapor recovery, Phase II vapor recovery, and vent valves. Loading emissions are controlled to an efficiency of 95%, while Breathing emissions are controlled to an efficiency of approximately 97.5%.

The uncontrolled Refueling factor is consistent with the 1997 CAPCOA Guidelines while the controlled Refueling factor diverts from the 1997 CAPCOA Guidelines and assumes 95% control, consistent with AST Phase II vapor recovery equipment certification requirements[8], and consistent with ORVR control efficiency findings in the 2013 CARB Emission Factors.

The uncontrolled and controlled spillage factors are consistent with the 1997 CAPCOA Guidelines. AST installations have a variety of different nozzle requirements depending on the age of the equipment (new or existing), and Phase II compliance option (pre-EVR Phase II, Phase II EVR, or Phase II exempt). New AST installations are required to be installed with Phase II enhanced vapor recovery (EVR) or are exempt from Phase II and must utilize enhanced conventional nozzles while fueling only to ORVR equipped motor vehicles. Existing AST installations have the ability to operate with a Phase II pre-EVR system. To best represent the wide range of possible nozzles and spillage emissions, the 1997 CAPCOA Guidelines controlled emission factor for pre-EVR systems, achieving 31% control, is considered the most appropriate and applicable to gasoline AST systems.

Hose permeation emission factors were not specified in the 1997 CAPCOA Guidelines for AST systems. However, hose permeation emissions are expected and are estimated similar to gasoline UST systems. The 2013 CARB Emission Factors include hose permeation emission factors for gasoline UST systems, and the proposed factors are identical for Phase II EVR, Phase II Pre-EVR, and non-Phase II systems. Various certified gasoline UST and AST systems include common hose

[6] Per CARB Executive Order NVR-1 (https://ww2.arb.ca.gov/sites/default/files/classic/vapor/eos/eo-nvr1/eo_nvr1f.pdf). See CARB AST FAQs for additional reference (https://ww2.arb.ca.gov/resources/documents/frequently-asked-questions-vapor-recovery-requirements-gasoline-dispensing).

[7] CAPCOA Air Toxics "Hot Spots" Program, Gasoline Service Station Industrywide Risk Assessment Guidelines, dated November 1997, available online at: https://ww2.arb.ca.gov/sites/default/files/classic/ab2588/rrap-iwra/gasiwra.pdf.

[8] CP-206, Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities Using Aboveground Storage Tanks (https://ww2.arb.ca.gov/sites/default/files/2020-04/AST%20CP206%20Amended%20072519.pdf)

equipment requirements, therefore the hose permeation factor for UST systems is applied to AST systems. The TAC emission factors for ASTs are shown in Table VII-3.

| Table VII-3. Gasoline Emission Factors (EF) for GDFs with ASTs [(a)] | | Loading | Breathing | Refueling | Hose Permeation | Spillage |
|---|---|---|---|---|---|---|
| Uncontrolled Gasoline EF (lbs/1,000 gal) [(b)] | | 8.4 | 2.1 | 8.4 | 0.009 | 0.61 |
| Controlled Gasoline EF (lbs/1,000 gal) | | 0.42 | 0.053 | 0.42 | 0.009 | 0.42 |
| Benzene | Weight Percent | 0.457% | 0.457% | 0.457% | 0.457% | 0.707% |
| | EF (lbs/1,000 gal) | 1.92E-03 | 2.42E-04 | 1.92E-03 | 4.11E-05 | 2.97E-03 |
| Ethylbenzene | Weight Percent | 0.107% | 0.107% | 0.107% | 0.107% | 1.29% |
| | EF (lbs/1,000 gal) | 4.49E-04 | 5.67E-05 | 4.49E-04 | 9.63E-06 | 5.42E-03 |
| Naphthalene | Weight Percent | 0.000445% | 0.000445% | 0.000445% | 0.000445% | 0.174% |
| | EF (lbs/1,000 gal) | 1.87E-06 | 2.36E-07 | 1.87E-06 | 4.01E-08 | 7.31E-04 |

Notes:

(a) The weight percentages of the TACs evaluated for cancer risk are based on weighted summer (59.2%, approx. 216 days) and winter (40.8%, approx. 149 days) gasoline speciation. Gasoline speciation profiles taken from the 2022 CARB/CAPCOA Guidance.

(b) Uncontrolled ROG emissions are based on the 1997 CAPCOA Guidelines (Loading, Breathing, Refueling) or applicable data from CARB 2013 Factors (Hose Permeation, Spillage).

***Modeling Parameters***

For the general dispersion modeling methodology and meteorological stations used in the development of the screening tables, please see Appendix III. Consistent with the 2022 CARB/CAPCOA Guidance, the modeling parameters used for ASTs has not changed from the previous guidance document; therefore, South Coast AQMD continues to use the same input file which relies on the previous modeling methodology. The main difference between modeling USTs vs ASTs is that for ASTs, the exit temperature for loading and breathing are set to 291K.

## <u>Mobile Fuelers</u>

This section describes the emission factors and modeling assumptions used for mobile fuelers dispensing gasoline. Currently, there have not been any mobile fuelers with CARB Executive Orders allowing for dispensing E-85.

Rule 461.1 - Gasoline Transfer and Dispensing for Mobile Fueling Operations was adopted on January 7, 2022 to: 1) ensure CARB certified vapor control systems are installed on mobile fuelers; 2) allow permitting and operation of CARB certified mobile fuelers which did not meet the Phase II vapor recovery requirements in Rule 461; 3) limit health risk impacts to children by further restricting operations near schools during school hours; 4) establish additional requirements for retail and non-retail mobile fuelers; and 5) provide a framework to allow for permitting of various location mobile fuelers and site specific mobile fueling operations.

During rule development for Rule 461.1, a survey of mobile fuelers known to be operating resulted in the identification of three mobile fueler categories, which are shown in Figure 1. Model 1 mobile fuelers have both Phase I and Phase II vapor recovery systems and have been permitted by South Coast AQMD, as they meet the requirements in Rule 461. Model 2 mobile fuelers were recently certified by CARB, but were unable to be permitted by South Coast AQMD pursuant to Rule 461 as this model does not have an on-board Phase II vapor recovery system but instead relies on the ORVR system on-board the vehicle being fueled in order to meet the control efficiency requirement of 95%. Model 3 mobile fuelers did not have any vapor controls and were unregulated due to a regulatory gap in South Coast AQMD rule applicability and requirements.

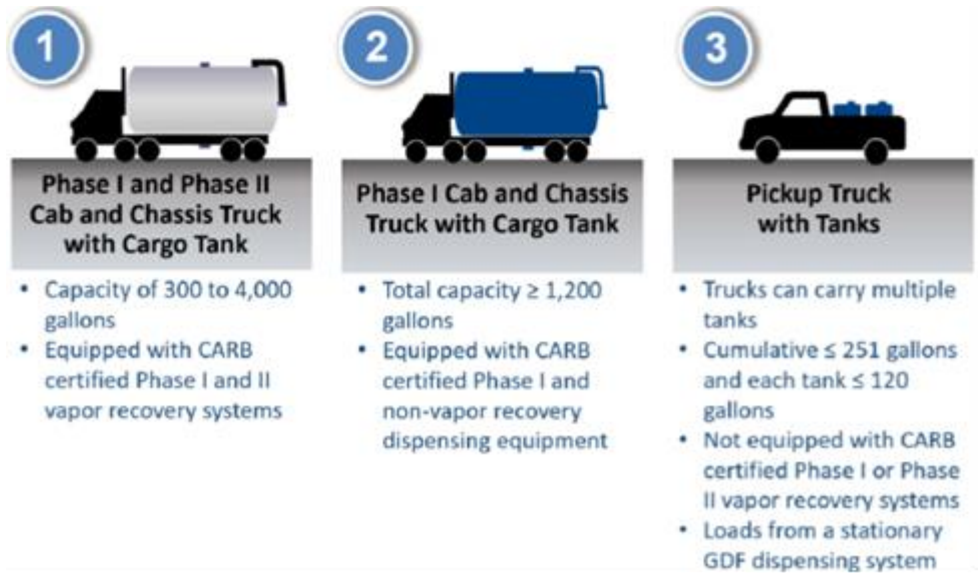


**Figure VII-1. Mobile Fueler Categories/Models**

Rule 461.1 temporarily allows for the operation of Model 2 mobile fuelers until a second CARB certified mobile fueler with both Phase I and Phase II vapor recovery systems (Model 1) becomes available. However, the Model 2 mobile fueler would be limited to dispensing gasoline only into motor vehicles equipped with onboard refueling vapor recovery (ORVR). Upon notification from South Coast AQMD that two Model 1 mobile fuelers are certified, the owner or operator of a Model 2 mobile fueler would have 60 months to cease operation of the Model 2 mobile fueler within South Coast AQMD's jurisdiction. At this time, only one certified Model 1 mobile fueler exists, and therefore Model 2 fuelers may continue to operate. CARB has not yet certified any Model 3 mobile fuelers; therefore, Model 3 mobile fuelers do not meet the requirements of Rule 461.1 and cannot be operated within South Coast AQMD's jurisdiction.

Mobile fuelers may be permitted with various locations permits and/or site-specific location permits. Mobile fuelers with various locations permits can operate throughout South Coast AQMD's jurisdiction and have throughput limits that are highly health conservative. Owners or operators can apply for a site-specific location permit with a higher throughput if it can be demonstrated that the operation does not result in health risks exceeding Rule 1401 and Rule 1401.1, if applicable, thresholds.

***Emission Factors***

Gasoline mobile fuelers operate similarly to gasoline UST and AST systems, with differences in emission sources, vapor control equipment requirements, and emission factors. The emission sources for mobile fuelers include breathing, refueling, spillage, and hose permeation. Loading emissions for mobile fuelers occur when the mobile fueler cargo tank is loaded with gasoline at the bulk terminal facility. This loading is associated with the bulk terminal operation, similar to gasoline tank trucks which transport and deliver fuel to USTs or ASTs at GDFs. The loading emissions are not associated with the mobile fueler operation and do not occur at the location where the mobile fueler would be dispensing gasoline. Therefore, for purposes of determining the ROG emissions and health risks from mobile fueling operations, loading emissions are not included.

Emission factors for mobile fuelers are conservatively estimated based on operation of the Model 2 mobile fueler specified above, not equipped with Phase II vapor recovery. Breathing emissions, considered as similar to transit losses for mobile equipment, were estimated from U.S. EPA AP-42 Chapter 5.2, Table 5.2-5 (June 2008) for transit losses from tank trucks loaded with gasoline. The emission factor assumes the high end of the "extreme" scenario listed, associated with maximum expected emissions. Refueling emissions are consistent with gasoline USTs and ASTs, assuming refueling is controlled to an efficiency of 95% due to ORVR, without Phase II vapor recovery.

Spillage emissions are based on CARB's Executive Order NVR-1-F in which the enhanced conventional (ECO) nozzle was certified to meet a spillage factor of 0.12 lbs/kgal. Hose Permeation emissions are based CARB's hose permeation standard of 10 $g/m^2$/day per CARB's 2013 Factors, and a mobile fueler hose length of 50 feet. The TAC emission factors for ASTs are shown in Table VII-4.

| **Table VII-4. Mobile Fueler Emission Factors (EF)** | **Breathing** | **Refueling** | **Spillage** | **Hose Permeation** |
|---|---|---|---|---|
| **Mobile Fueler EF** | 0.08 lbs/kgal [b] | 0.42 lb/kgal | 0.12 lb/kgal [c] | 0.0268 lb/day [d] |
| **Benzene Weight Percent** [a] | 0.46% | 0.46% | 0.71% | 0.46% |
| **Ethylbenzene Weight Percent** [a] | 0.107% | 0.107% | 1.29% | 0.107% |
| **Naphthalene Weight Percent** [a] | 0.000445% | 0.000445% | 0.174% | 0.000445% |

Notes:

(a) The weight percentages of the TACs evaluated for cancer risk are based on weighted summer (59.2%, approx. 216 days) and winter (40.8%, approx. 149 days) gasoline speciation. Gasoline speciation profiles taken from the 2022 CARB/CAPCOA Guidance.

(b) Breathing emissions were taken from U.S. EPA's AP-42 Chapter 5.2, Table 5.2-5 for transit losses from tank trucks loaded with product (higher end of extreme scenario).

(c) The spillage emission rate is based on CARB's Executive Order NVR-1-E for the ECO nozzle

(d) The hose permeation factor was adjusted based on the hose length of the MFOD (50 feet) and the hose permeation rate of 10.0 g/m2/day based on CARB's Executive Order NVR-1-C

***Modeling Parameters***

For the general dispersion modeling methodology and meteorological stations used in the development of the screening tables, please see Appendix III.

For stationary gas stations, the volume source is used for most of the emission sources because those emissions occur under the canopy of the gas station, at the location of the fuel islands. Due to the turbulence created by vehicles passing under the canopy, there is plume rise which allows the emissions to disperse more so than an area source with no plume rise. When mobile fuelers are dispensing into ORVR equipped motor vehicles, the mobile fuelers are stationary and unlike the gas stations, there is no turbulence or movement of air around the mobile fueler. Therefore, refueling, hose permeation, and spillage emissions were modeled as a volume source with different release heights. Similar to the stationary gas station, staff modeled the breathing losses as a point source using the dimensions of the mobile fueler unit. The exit velocity was calculated using Appendix D of the 1997 CAPCOA Guidelines. The model parameters are summarized in Table VII-5 below.

| **Table VII-5. Mobile Fueler Modeling Parameters** | **Breathing** | **Refueling and Hose Permeation** | **Spillage** |
|---|---|---|---|
| **Source Type** | Point | Volume | Volume |
| **Stack Height (meters)** | 2.306 | - | - |
| **Stack Diameter (meters)** | 0.254 | - | - |
| **Exit Velocity (meters/second)** | 0.000014 | - | - |
| **Temperature** | Ambient | - | - |
| **Length of Side (meters)** | - | 1.664 | 1.664 |
| **Release Height (meters)** | - | 1 | 0 |
| **Initial Lateral Dimension (σy) (meters)** | - | 0.387 | 0.387 |
| **Initial Vertical Dimension (σz) (meters)** | - | 1.073 | 1.073 |

Appendix X contains sample AERMOD input file(s).

# APPENDIX VIII

# TIER 2 HRA MODELING ASSUMPTIONS FOR SPRAY BOOTHS

## Introduction

The purpose of this appendix is to document the modeling assumptions used to estimate health risks from spray booths using South Coast AQMD's Risk Assessment Procedures.

## Emission Inventory Methods

In order to determine the appropriate emission rates to use, please refer to the Emissions Calculator spreadsheet that is linked in the HRA Tool or contact the appropriate South Coast AQMD Engineering and Permitting staff (https://www.aqmd.gov/nav/contact/permitting-staff) for more information.

## Modeling Parameters

For the general dispersion modeling methodology and meteorological stations used, please refer to Appendix III.

Based on information from South Coast AQMD Engineering and Permitting staff, the parameters were developed for two typical spray booth configurations, each with a single stack vent located 6 feet above the roof of a building. Each spray booth was modeled as a point source using the parameters shown in Table VIII-1. Building downwash effects were analyzed, with a building size of 20 meters by 70 meters and a building height of 6 feet below each stack height. Based on staff's experience, most spray booths are operated for a limited number of hours each day. Therefore, an hour of day adjustment was added to account for a typical 8 hours/day of operations from 9am to 5pm.

**Table VIII-1: Model Parameters for Spray Booths**

| Source ID | Stack Height | | Stack Diameter | | Stack Temperature | | Stack Velocity | | Flowrate |
|---|---|---|---|---|---|---|---|---|---|
| | (ft) | (m) | (ft) | (m) | ($^0$F) | (K) | (ft/s) | (m/s) | (ft$^3$/min) |
| P1 | 16 | 4.88 | 2.83 | 0.864 | Ambient | 0* | 26.43 | 8.05 | 10,000 |
| P2 | 24 | 7.32 | 2.83 | 0.864 | Ambient | 0* | 26.43 | 8.05 | 10,000 |

Note: * The temperature used in AERMOD was set to 0 K, which indicates that the ambient temperature was used in the model run.

Appendix X contains sample AERMOD input file(s).

# APPENDIX IX

# ADJUSTING TIER 2 HRA CANCER RISKS FOR SHORT-TERM PROJECTS

**Introduction**

For short-term projects (such as portable equipment, air pollution control equipment used for soil remediation projects, etc.), cancer risk is calculated using the equations described in the Tier 2 HRA section. However, the CEF and MP adjustment factor would need to be determined based on the duration of the project. The non-cancer health risks are not affected by the project's duration. Since these short-term calculations are only meant for projects with limits on the operating duration, these short-term cancer risk assessments can be thought of as being the equivalent to a 30-year cancer risk estimate and the appropriate thresholds would still apply (i.e. for a 5-year project, the maximum emissions during the 5-year period would be assessed on the more sensitive population, from the third trimester to age 5, after which the project's emissions would drop to 0 for the remaining 25 years to calculate the 30-year equivalent cancer risk estimate).

**Please note that South Coast AQMD Engineering and Permitting staff** (https://www.aqmd.gov/nav/contact/permitting-staff) **should be consulted prior to the use of the short-term factors to determine if the short-term factors are appropriate for the permit application.** Permit conditions limiting the duration of the use of equipment consistent with the analysis will be imposed and information regarding the project duration will need to be well documented for the short-term projects. The HRA Tool can be used to calculate the health risks from short-term projects by selecting the appropriate project duration.

# APPENDIX X

## AERMOD INPUT FILES USED TO DEVELOP TIER 2 SCREENING TABLES

A ZIP file containing all AERMOD input files described in previous appendices is available at https://www.aqmd.gov/docs/default-source/permitting/aermod_input_files_for_tier2_screening_tables.zip

| Equipment Type | Characteristics | Source ID | AERMOD Input File name within downloadable ZIP file |
|---|---|---|---|
| Spray Booths | 16 ≤ Stack Height < 24 ft | S1 | aermod_master_spray_booths.inp |
| Spray Booths | 24 ≤ Stack Height < 50 ft | S2 | |
| Crematories | 5,000 < Building Area ≤ 10,000 ft2 | C1 | aermod_master_crematories.snp |
| Crematories | 10,000 < Building Area ≤ 15,000 ft2 | C2 | |
| Crematories | Building Area > 15,000 ft2 | C3 | |
| Gaseous Fuel Fired (Natural Gas) Boilers | 2 < Rating ≤ 5 MMBTU/ hr | B1 | aermod_master_combustion_diesel_NG_boilers.inp |
| Gaseous Fuel Fired (Natural Gas) Boilers | 5 < Rating ≤ 10 MMBTU/ hr | B2 | |
| Gaseous Fuel Fired (Natural Gas) Boilers | 10 < Rating ≤ 20 MMBTU/ hr | B3 | |
| Gaseous Fuel Fired (Natural Gas) Boilers | 20 < Rating ≤ 30 MMBTU/ hr | B4 | |
| Gaseous Fuel Fired (Natural Gas) Boilers | 30 < Rating ≤ 50 MMBTU/ hr | B5 | |
| Gaseous Fuel Fired (Natural Gas) Boilers | 50 < Rating ≤ 150 MMBTU/ hr | B6 | |
| Gaseous Fuel Fired (Natural Gas) Boilers | 150 < Rating ≤ 200 MMBTU/ hr | B7 | |
| Natural Gas Reciprocating Internal Combustion Engines | 50 < Rating ≤ 75 BHP | N1 | |
| Natural Gas Reciprocating Internal Combustion Engines | 75 < Rating ≤ 150 BHP | N2 | |
| Natural Gas Reciprocating Internal Combustion Engines | 150 < Rating ≤ 250 BHP | N3 | |
| Natural Gas Reciprocating Internal Combustion Engines | 250 < Rating ≤ 1000 BHP | N4 | |
| Natural Gas Reciprocating Internal Combustion Engines | Rating > 1000 BHP | N5 | |
| Diesel Reciprocating Internal Combustion Engines | 50 < Rating ≤ 175 BHP | D1 | |
| Diesel Reciprocating Internal Combustion Engines | 175 < Rating ≤ 300 BHP | D2 | |
| Diesel Reciprocating Internal Combustion Engines | 300 < Rating ≤ 400 BHP | D3 | |
| Diesel Reciprocating Internal Combustion Engines | 400 < Rating ≤ 600 BHP | D4 | |
| Diesel Reciprocating Internal Combustion Engines | 600 < Rating ≤ 1150 BHP | D5 | |
| General Non-Combustion Volume Source Equipment | Building Area ≤ 3,000 ft2 & height ≤ 20 ft | V1 | aermod_master_noncombustion_V1.inp |

| | | | |
|---|---|---|---|
| General Non-Combustion Volume Source Equipment | 3,000 < Building Area ≤ 10,000 ft2 & height ≤ 20 ft | V2 | aermod_master_noncombustion_V2-V3.inp |
| General Non-Combustion Volume Source Equipment | 10,000 < Building Area ≤ 30,000 ft2 & height ≤ 20 ft | V3 | |
| General Non-Combustion Volume Source Equipment | Building Area ≤ 3,000 ft2 & height > 20 ft | V4 | aermod_master_noncombustion_V4-V5.inp |
| General Non-Combustion Volume Source Equipment | 3,000 < Building Area ≤ 10,000 ft2 & height > 20 ft | V5 | |
| General Non-Combustion Volume Source Equipment | 10,000 < Building Area ≤ 30,000 ft2 & height > 20 ft | V6 | aermod_master_noncombustion_V6.inp |
| General Non-Combustion Point Source Equipment | 14 ≤ Stack Height < 25 ft | P1 | aermod_master_noncombustion_point.inp |
| General Non-Combustion Point Source Equipment | 25 ≤ Stack Height < 50 ft | P2 | |
| General Non-Combustion Point Source Equipment | Stack Height ≥ 50 ft | P3 | |
| Gasoline Underground Storage Tanks | | U | aermod_master_underground_tanks.inp |
| Gasoline Aboveground Storage Tanks | | A | aermod_master_aboveground_tanks.inp |
| Mobile Fuelers | | A | aermod_master_mobile_fuelers.inp |
| Ethanol 85 Underground Storage Tanks | | U | aermod_master_E85.inp |