



BAY AREA AIR QUALITY
MANAGEMENT DISTRICT

California Environmental Quality Act
Air Quality Guidelines
Appendix A: Thresholds
of Significance
Justification

These guidelines are nonbinding recommendations, intended to assist lead agencies with navigating the CEQA process. They may be updated as needed in the future, and any updates will likewise be nonbinding and advisory.

TABLE OF CONTENTS

Section	Page
Table of Contents	A-i
List of Abbreviations	A-iii
1 Introduction.....	A-1
1.1 BAAQMD/CEQA Regulatory Authority	A-2
1.2 Justification for Updating CEQA Thresholds.....	A-3
2 Greenhouse Gas Thresholds.....	A-7
2.1 Thresholds of Significance	A-7
2.2 Justification and Substantial Evidence Supporting Thresholds.....	A-7
2.2.1 Scientific and Regulatory Justification	A-8
2.2.2 Project-Level GHG Thresholds	A-10
2.2.3 Plan-Level GHG Thresholds.....	A-21
2.2.4 Greenhouse Gas Reduction Strategies.....	A-23
2.2.5 Stationary Source GHG Threshold	A-25
2.2.6 Summary of Justification for GHG Thresholds.....	A-26
3 Community Risk and Hazard Thresholds	A-28
3.1 Thresholds of Significance	A-30
3.2 Justification and Substantial Evidence Supporting Thresholds.....	A-32
3.2.1 Scientific and Regulatory Justification	A-32
3.2.2 Construction, Land Use and Stationary Source Risk and Hazard Thresholds.....	A-38
3.2.3 Cumulative Risk and Hazard Thresholds	A-41
3.2.4 Plan-Level Risk and Hazard Thresholds	A-43
3.2.5 Community Risk Reduction Plans.....	A-43
4 Criteria Pollutant Thresholds	A-44
4.1 Thresholds of Significance	A-44
4.2 Justification and Substantial Evidence Supporting Thresholds.....	A-45
4.2.1 Project Construction Criteria Pollutant Thresholds	A-45
4.2.2 Project Operation Criteria Pollutant Thresholds.....	A-45
4.2.3 Local Carbon Monoxide Thresholds.....	A-46
4.2.4 Plan-Level Criteria Pollutant Thresholds	A-47
4.2.5 Criteria Pollutant Thresholds for Regional Plans.....	A-47

5	Odor Thresholds.....	A-48
5.1	Thresholds of Significance	A-48
5.2	Justification and Substantial Evidence Supporting Thresholds.....	A-48
6	References	A-50
7	Glossary	A-59

List of Tables

Table A-1	Air Quality CEQA Thresholds of Significance.....	A-4
Table A-2	California 1990, 2002-2004, and 2020 Land Use Sector GHG.....	A-14
Table A-3	2020 Land Use Sector GHG Emission Reductions from State Regulations & AB 32 Measures.....	A-15
Table A-4	SFBAAB 1990, 2007, and 2020 Land Use Sector GHG Emissions Inventories and Projection....	A-16
Table A-5	Operational GHG Threshold Sensitivity Analysis	A-19
Table A-6	California 2020 GHG Emissions, Population Projections and GHG Efficiency Thresholds - Land Use Inventory Sectors.....	A-20
Table A-7	California 2020 GHG Emissions, Population Projections and GHG Efficiency Thresholds - All Inventory Sectors.....	A-22
Table A-8	Statistical Summary of Estimated Population-Weighted Ambient Cancer Risk in 2005	A-29
Table A-9	Screening Distances for Potential Odor Sources.....	A-49

LIST OF ABBREVIATIONS

ABAG	Association of Bay Area Governments
Air District	Bay Area Air Quality Management District
APS	Alternative Planning Strategy
ARB	Air Resources Board
ATHS	Air Toxics Hot Spots
BAAQMD	Bay Area Air Quality Management District
BCDC	Bay Conservation and Development Commission
Board	Air District Board of Directors
CAAQS	California Ambient Air Quality Standard
CARB	California Air Resources Board
CARE	Community Air Risk Evaluation program
CEQA	California Environmental Quality Act
CH ₄	methane
CIWMB	California Integrated Waste Management Board
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide-equivalent
CRRP	Community Risk Reduction Plan
EIR	Environmental Impact Report
ERPG	Emergency Response Planning Guidelines
FPL	federal poverty level
HAPs	hazardous air pollutants
HI	Hazard Index
LCFS	Low Carbon Fuel Standard

LVMl	left ventricular mass index
MACT	maximum achievable control technology
MEI	Maximally Exposed Individual
MMT/yr	metric tons per year
MPO	metropolitan planning organization
MRI	magnetic resonance imaging
MTC	the Metropolitan Transportation Commission
MTP	Metropolitan Transportation Plan
N ₂ O	nitrous oxide
NAAQS	The National Ambient Air Quality Standard
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NHTSA	National Highway Safety Administration
NSR	new source review
OEHHA	Office of Environmental Health Hazard Assessment
OIMP	Odor Impact Minimization Plans
OPR	the Governor's Office of Planning and Research
PM _{2.5}	Less than 2.5 microns in diameter
Ppm	parts per million
PSD	Prevention of Significant Deterioration
REL	reference exposure level
RMPP	Risk Management Prevention Program
RTP	Regional Transportation Plan
RTPA	Regional Transportation Planning Agencies
Rules	The Renewable Portfolio Standard

SB	Senate Bill
Scoping Plan	Climate Change Scoping Plan
SCS	Sustainable Communities Strategy
SFBAAB	San Francisco Bay Area Air Basin
SIL	Significant Impact Level
SP	service population
TAC	toxic air contaminant
UNFCCC	the United Nations Framework Convention on Climate Change
URBEMIS	Urban Emissions Model

This page intentionally left blank.



1 INTRODUCTION

Bay Area Air Quality Management District (BAAQMD or Air District) staff analyzed various options for California Environmental Quality Act (CEQA) air quality thresholds of significance for use within BAAQMD's jurisdiction. The analysis and evaluation undertaken by Air District staff is documented in the *Revised Draft Options and Justification Report – California Environmental Quality Act Thresholds of Significance* (Draft Options Report) (BAAQMD October 2009).

Air District staff hosted public workshops in February, April, September and October 2009, and April 2010 at several locations around the Bay Area. Air District staff also hosted additional workshops in each of the nine Bay Area counties specifically designed for, and to solicit input from, local agency staff. In addition, Air District staff met with regional stakeholder groups to discuss and receive input on the threshold options being evaluated. Throughout the course of the public workshops and stakeholder meetings Air District staff received many comments on the various options under consideration. Based on comments received and additional staff analysis, the threshold options and staff-recommended thresholds were further refined. The culmination of this nearly year and a half-long effort was presented in the Proposed Thresholds of Significance Report published on November 2, 2009 as the Air District staff's proposed air quality thresholds of significance.

The Air District Board of Directors (Board) held public hearings on November 18 and December 2, 2009 and January 6, 2010, to receive comments on staff's Proposed Thresholds of Significance (November 2, 2009; revised December 7, 2009). After public testimony and Board deliberations, the Board requested staff to present additional options for risk and hazard thresholds for Board consideration. This Report includes risks and hazards threshold options, as requested by the Board, in addition to staff's previously recommended thresholds of significance. The thresholds presented herein, adopted by the Air District Board of Directors, are intended to

replace all of the Air District's currently recommended thresholds. The air quality thresholds of significance, and Board-requested risk and hazard threshold options, are provided in Table A-1 at the end of this introduction.

1.1 BAAQMD/CEQA REGULATORY AUTHORITY

The BAAQMD has direct and indirect regulatory authority over sources of air pollution in the San Francisco Bay Area Air Basin (SFBAAB). CEQA requires that public agencies consider the potential adverse environmental impacts of any project that a public agency proposes to carry out, fund or approve. CEQA requires that a lead agency prepare an Environmental Impact Report (EIR) whenever it can be fairly argued (the "fair argument" standard), based on substantial evidence,¹ that a project may have a significant effect² on the environment, even if there is substantial evidence to the contrary (CEQA Guidelines §15064). CEQA requires that the lead agency review not only a project's direct effects on the environment, but also the cumulative impacts of a project and other projects causing related impacts. When the incremental effect of a project is cumulatively considerable, the lead agency must discuss the cumulative impacts in an EIR. (CEQA Guidelines §15064).

The "fair argument" standard refers to whether a fair argument can be made that a project may have a significant effect on the environment (*No Oil, Inc. v. City of Los Angeles* (1974) 13 Cal.3d 68, 84). The fair argument standard is generally considered a low threshold requirement for preparation of an EIR. The legal standards reflect a preference for requiring preparation of an EIR and for "resolving doubts in favor of environmental review." *Meija v. City of Los Angeles* (2005) 130 Cal. App. 4th 322, 332. "The determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data." (CEQA Guidelines §15064(b)).

In determining whether a project may have a significant effect on the environment, CEQA Guidelines Section 15064.7 provides that lead agencies may adopt and/or apply "thresholds of significance." A threshold of significance is "an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant" (CEQA Guidelines §15064.7).

While thresholds of significance give rise to a presumption of insignificance, thresholds are not conclusive, and do not excuse a public agency of the duty to consider evidence that a significant effect may occur under the fair argument standard. *Meija*, 130 Cal. App. 4th at 342. "A public agency cannot apply a threshold of significance or regulatory standard 'in a way that forecloses the consideration of any other substantial evidence showing there may be a significant effect.'" *Id.* This means that if a public agency is presented with factual information or other substantial evidence establishing a fair argument that a project may have a significant effect on the environment, the agency must prepare an EIR to study those impacts even if the project's impacts fall below the applicable threshold of significance.

¹"Substantial evidence" includes facts, reasonable assumptions predicated upon facts, or expert opinions supported by facts, but does not include argument, speculation, unsubstantiated opinion or narrative, evidence that is clearly inaccurate or erroneous, or evidence of social or economic impacts that do not contribute to, or are not caused by, physical impacts on the environment. Cal. Pub. Res. C. §21080(c); *see also* CEQA Guidelines §15384.

² A "significant effect" on the environment is defined as a "substantial, or potentially substantial, adverse change in the environment." Cal. Pub. Res. C. §21068; *see also* CEQA Guidelines §15382.

Thresholds of significance must be supported by substantial evidence. This Report provides the substantial evidence in support of the thresholds of significance developed by the BAAQMD. If adopted by the BAAQMD Board of Directors, the Air District will recommend that lead agencies within the nine counties of the BAAQMD's jurisdiction use the thresholds of significance in this Report when considering the air quality impacts of projects under their consideration.

1.2 JUSTIFICATION FOR UPDATING CEQA THRESHOLDS

Any analysis of environmental impacts under CEQA includes an assessment of the nature and extent of each impact expected to result from the project to determine whether the impact will be treated as significant or less than significant. CEQA gives lead agencies discretion whether to classify a particular environmental impact as significant. Ultimately, formulation of a standard of significance requires the lead agency to make a policy judgment about where the line should be drawn distinguishing adverse impacts it considers significant from those that are not deemed significant. This judgment must, however, be based on scientific information and other factual data to the extent possible (CEQA Guidelines §15064(b)).

In the sense that advances in science provide new or refined factual data, combined with advances in technology and the gradual improvement or degradation of an environmental resource, the point where an environmental effect is considered significant is fluid over time. Other factors influencing this fluidity include new or revised regulations and standards, and emerging, new areas of concern.

In the ten years since BAAQMD last reviewed its recommended CEQA thresholds of significance for air quality, there have been tremendous changes that affect the quality and management of the air resources in the Bay Area. Traditional criteria air pollutant ambient air quality standards, at both the state and federal levels, have become increasingly more stringent. A new criteria air pollutant standard for fine particulate matter less than 2.5 microns in diameter (PM_{2.5}) has been added to federal and state ambient air quality standards. We have found, through technical advances in impact assessment, that toxic air contaminants are not only worse than previously thought from a health perspective, but that certain communities experience high levels of toxic air contaminants, giving rise to new regulations and programs to reduce the significantly elevated levels of ambient toxic air contaminant concentrations in the Bay Area.

In response to the elevated levels of toxic air contaminants in some Bay Area communities, the Air District created the Community Air Risk Evaluation (CARE) Program. Phase 1 of the BAAQMD's CARE program compiled and analyzed a regional emissions inventory of toxic air contaminants (TACs), including emissions from stationary sources, area sources, and on-road and off-road mobile sources. Phase 2 of the CARE Program conducted regional computer modeling of selected TAC species, species which collectively posed the greatest risk to Bay Area residents. In both Phases 1 and 2, demographic data were combined with estimates of TAC emissions or concentrations to identify communities that are disproportionately impacted from high concentrations of TACs. Bay Area Public Health Officers, in discussions with Air District staff and in comments to the Air District's Advisory Council (February 11, 2009, Advisory Council Meeting on Air Quality and Public Health), have recommended that PM_{2.5}, in addition to TACs, be considered in assessments of community-scale impacts of air pollution.

Another significant issue that affects the quality of life for Bay Area residents is the growing concern with global climate change. In just the past few years, estimates of the global atmospheric temperature and greenhouse gas concentration limits needed to stabilize climate change have been adjusted downward and the impacts of greenhouse gas emissions considered more dire. Previous scientific assessments assumed that limiting global temperature rise to 2-3°C above pre-industrial levels would stabilize greenhouse gas concentrations in the range of 450-550 parts per million (ppm) of carbon dioxide-equivalent (CO₂e). Now the science indicates that a temperature rise of 2°C would not prevent dangerous interference with the climate system. Recent scientific assessments suggest that global temperature rise should be kept below 2°C by stabilizing greenhouse gas concentrations below 350 ppm CO₂e, a significant reduction from the current level of 385 ppm CO₂e.

For the reasons stated above, and to further the goals of other Air District programs such as encouraging transit-oriented and infill development, BAAQMD has undertaken an effort to review all of its currently recommended CEQA thresholds, revise them as appropriate, and develop new thresholds where appropriate. The overall goal of this effort is to develop CEQA significance criteria that ensure new development implements appropriate and feasible emission reduction measures to mitigate significant air quality impacts. The Air District's recommended CEQA significance thresholds have been vetted through a public review process and will be presented to the BAAQMD Board of Directors for adoption.

Table A-1 Air Quality CEQA Thresholds of Significance

Pollutant	Construction-Related	Operational-Related
Project-Level		
Criteria Air Pollutants and Precursors (Regional) ROG	Average Daily Emissions 54 (lb/day)	Average Daily Emissions 54 (lb/day) Maximum Annual Emissions 10 (tpy)
Criteria Air Pollutants and Precursors (Regional) NO _x	Average Daily Emissions 54 (lb/day)	Average Daily Emissions 54 (lb/day) Maximum Annual Emissions 10 (tpy)
Criteria Air Pollutants and Precursors (Regional) PM ₁₀	Average Daily Emissions 82 (lb/day) (exhaust only)	Average Daily Emissions 82 (lb/day) Maximum Annual Emissions 15 (tpy)
Criteria Air Pollutants and Precursors (Regional) PM _{2.5}	Average Daily Emissions 54 (lb/day) (exhaust only)	Average Daily Emissions 54 (lb/day) Maximum Annual Emissions 10 (tpy)
PM ₁₀ /PM _{2.5} (fugitive dust)	Best Management Practices	None
Local CO	None	9.0 ppm (8-hour average), 20.0 ppm (1-hour average)
<i>This row is superseded</i> GHGs Projects other than Stationary Sources	None	Compliance with Qualified Greenhouse Gas Reduction Strategy OR 1,100 MT of CO ₂ e/yr OR 4.6 MT CO ₂ e/SP/yr (residents + employees)

Pollutant	Construction-Related	Operational-Related
GHGs Stationary Sources	None	10,000 MT/yr
Risks and Hazards – New Source (All Areas) (Individual Project) <u>Staff Proposal</u>	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.3 µg/m ³ annual average <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Risks and Hazards – New Receptor (All Areas) (Individual Project) <u>Staff Proposal</u>	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.3 µg/m ³ annual average <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Risks and Hazards (Individual Project) <u>Tiered Thresholds Option</u> Risks and Hazards (Individual Project) <u>Tiered Thresholds Option</u> (Continued)	Same as Operational Thresholds*	<u>Impacted Communities: Siting a New Source</u> Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >5.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.2 µg/m ³ annual average <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
	Same as Operational Thresholds*	<u>Impacted Communities: Siting a New Receptor</u> <u>All Other Areas: Siting a New Source or Receptor</u> Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.3 µg/m ³ annual average <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Risks and Hazards – New Source (All Areas) (Cumulative Thresholds)	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Cancer: > 100 in a million (from all local sources) Non-cancer: > 10.0 Hazard Index (from all local sources) (Chronic) PM _{2.5} : > 0.8 µg/m ³ annual average (from all local sources) <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor

Pollutant	Construction-Related	Operational-Related
Risks and Hazards – New Receptor (All Areas) (Cumulative Thresholds)	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Cancer: > 100 in a million (from all local sources) Non-cancer: > 10.0 Hazard Index (from all local sources) (Chronic) PM _{2.5} : > 0.8 µg/m ³ annual average (from all local sources) <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Accidental Release of Acutely Hazardous Air Pollutants	None	Storage or use of acutely hazardous materials locating near receptors or receptors locating near stored or used acutely hazardous materials considered significant
Odors	None	Complaint History—Five confirmed complaints per year averaged over three years
Plan-Level		
Criteria Air Pollutants and Precursors	None	Consistency with Current Air Quality Plan control measures Projected VMT or vehicle trip increase is less than or equal to projected population increase
<i>This row is superseded</i> GHGs	None	Compliance with Qualified Greenhouse Gas Reduction Strategy (or similar criteria included in a General Plan) OR 6.6 MT CO ₂ e/ SP/yr (residents + employees)
Risks and Hazards	None	Overlay zones around existing and planned sources of TACs (including adopted Risk Reduction Plan areas) Overlay zones of at least 500 feet (or Air District-approved modeled distance) from all freeways and high volume roadways
Odors	None	Identify the location of existing and planned sources of odors
Accidental Release of Acutely Hazardous Air Pollutants	None	None
Regional Plans (Transportation and Air Quality Plans)		
<i>This row is superseded</i> GHGs, Criteria Air Pollutants and Precursors, and Toxic Air Contaminants	None	No net increase in emissions

Notes: CO = carbon monoxide; CO₂e = carbon dioxide equivalent; GHGs = greenhouse gases; lb/day = pounds per day; MT = metric tons; NO_x = oxides of nitrogen; PM_{2.5} = fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less; PM₁₀ = respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less; ppm = parts per million; ROG = reactive organic gases; SO₂ = sulfur dioxide; SP = service population; TACs = toxic air contaminants; TBP = toxic best practices; tons/day = tons per day; tpy = tons per year; yr = year.

* Note: The Air District recommends that for construction projects that are less than one year duration, Lead Agencies should annualize impacts over the scope of actual days that peak impacts are to occur, rather than the full year.

Superseded text starts here.

2 GREENHOUSE GAS THRESHOLDS

BAAQMD does not currently have an adopted threshold of significance for GHG emissions. BAAQMD currently recommends that lead agencies quantify GHG emissions resulting from new development and apply all feasible mitigation measures to lessen the potentially significant adverse impacts. One of the primary objectives in updating the current CEQA Guidelines is to identify a GHG significance threshold, analytical methodologies, and mitigation measures to ensure new land use development meets its fair share of the emission reductions needed to address the cumulative environmental impact from GHG emissions. GHG emissions contribute, on a cumulative basis, to the significant adverse environmental impacts of global climate change. As reviewed herein, climate change impacts include an increase in extreme heat days, higher ambient concentrations of air pollutants, sea level rise, impacts to water supply and water quality, public health impacts, impacts to ecosystems, impacts to agriculture, and other environmental impacts. No single land use project could generate enough GHG emissions to noticeably change the global average temperature. The combination of GHG emissions from past, present, and future projects contribute substantially to the phenomenon of global climate change and its associated environmental impacts.

2.1 THRESHOLDS OF SIGNIFICANCE

Project Type	Thresholds
Projects other than Stationary Sources	Compliance with Qualified Greenhouse Gas Reduction Strategy OR 1,100 MT of CO ₂ e/yr OR 4.6 MT CO ₂ e/SP/yr (residents + employees)
Stationary Sources	10,000 MT of CO ₂ e/yr
Plans	Compliance with Qualified Greenhouse Gas Reduction Strategy (or similar criteria included in a General Plan) OR 6.6 MT CO ₂ e/SP/yr (residents + employees)
Regional Plans (Transportation and Air Quality Plans)	No net increase in GHG emissions

2.2 JUSTIFICATION AND SUBSTANTIAL EVIDENCE SUPPORTING THRESHOLDS

BAAQMD's approach to developing a threshold of significance for GHG emissions is to identify the emissions level for which a project would not be expected to substantially conflict with existing California legislation adopted to reduce statewide GHG emissions. If a project would generate GHG emissions above the threshold level, it would be considered to contribute substantially to a cumulative impact, and would be considered significant. If mitigation can be applied to lessen the emissions such that the project meets its share of emission reductions needed to address the cumulative impact, the project would normally be considered less than significant.

As explained in the Air District's *Revised Draft Options and Justifications Report* (BAAQMD 2009), there are several types of thresholds that may be supported by substantial evidence and be consistent with existing California legislation and policy to reduce statewide GHG emissions. In determining which thresholds to recommend, Staff studied numerous options, relying on reasonable, environmentally conservative assumptions on growth in the land use sector, predicted emissions reductions from statewide regulatory measures and resulting emissions inventories, and the efficacies of GHG mitigation measures. The thresholds recommended herein were chosen based on the substantial evidence that such thresholds represent quantitative and/or qualitative levels of GHG emissions, compliance with which means that the environmental impact of the GHG emissions will normally not be cumulatively considerable under CEQA. Compliance with such thresholds will be part of the solution to the cumulative GHG emissions problem, rather than hinder the state's ability to meet its goals of reduced statewide GHG emissions. Staff notes that it does not believe there is only one threshold for GHG emissions that can be supported by substantial evidence.

GHG CEQA significance thresholds recommended herein are intended to serve as interim levels during the implementation of the AB 32 Scoping Plan and SB 375, which will occur over time. Until AB 32 has been fully implemented in terms of adopted regulations, incentives, and programs and until SB 375 required plans have been fully adopted, or the California Air Resources Board (ARB) adopts a recommended threshold, the BAAQMD recommends that local agencies in the Bay Area apply the GHG thresholds recommended herein.

If left unchecked, GHG emissions from new land use development in California will result in a cumulatively considerable amount of GHG emissions and a substantial conflict with the State's ability to meet the goals within AB 32. Thus, BAAQMD proposes to adopt interim GHG thresholds for CEQA analysis, which can be used by lead agencies within the Bay Area. This would help lead agencies navigate this dynamic regulatory and technological environment where the field of analysis has remained wide open and inconsistent. BAAQMD's framework for developing a GHG threshold for land development projects that is based on policy and substantial evidence follows.

2.2.1 Scientific and Regulatory Justification

CLIMATE SCIENCE OVERVIEW

Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, chlorofluorocarbons, and sulfur hexafluoride. Human-caused emissions of these GHGs in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of the earth's climate, known as global climate change or global warming. It is *extremely unlikely* that global climate change of the past 50 years can be explained without the contribution from human activities (IPCC 2007).

According to Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC), "Avoiding Dangerous Climate Change" means: "*stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.*" Dangerous climate change defined in the UNFCCC is based on several key indicators including the potential for severe degradation of coral reef systems, disintegration of the West Antarctic Ice Sheet, and shut down of the large-scale, salinity- and thermally-driven circulation of the oceans. (UNFCCC 2009). The

global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005 (IPCC 2007). “Avoiding dangerous climate change” is generally understood to be achieved by stabilizing global average temperatures between 2 and 2.4°C above pre-industrial levels. In order to limit temperature increases to this level, ambient global CO₂ concentrations must stabilize between 350 and 400 ppm (IPCC 2007).

EXECUTIVE ORDER S-3-05

Executive Order S-3-05, which was signed by Governor Schwarzenegger in 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra’s snowpack, further exacerbate California’s air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total GHG emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050.

ASSEMBLY BILL 32, THE CALIFORNIA GLOBAL WARMING SOLUTIONS ACT OF 2006

In September 2006, Governor Arnold Schwarzenegger signed Assembly Bill 32, the California Global Warming Solutions Act of 2006, which set the 2020 greenhouse gas emissions reduction goal into law. AB 32 finds and declares that “Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California.” AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020, and establishes regulatory, reporting, voluntary, and market mechanisms to achieve quantifiable reductions in GHG emissions to meet the statewide goal.

In December of 2008, ARB adopted its *Climate Change Scoping Plan (Scoping Plan)*, which is the State’s plan to achieve GHG reductions in California, as required by AB 32 (ARB 2008). The Scoping Plan contains strategies California will implement to achieve a reduction of 169 MMT CO₂e emissions, or approximately 28 percent from the state’s projected 2020 emission level of 596 MMT of CO₂e under a business-as-usual scenario (this is a reduction of 42 MMT of CO₂e, or almost 10 percent, from 2002-2004 average emissions), so that the state can return to 1990 emission levels, as required by AB 32.

While the Scoping Plan establishes the policy intent to control numerous GHG sources through regulatory, incentive, and market means, given the early phase of implementation and the level of control that local CEQA lead agencies have over numerous GHG sources, CEQA is an important and supporting tool in achieving GHG reductions overall in compliance with AB 32. In this spirit, BAAQMD is considering the adoption of thresholds of significance for GHG emissions for stationary source and land use development projects.

SENATE BILL 375

Senate Bill (SB) 375, signed in September 2008, aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation. SB 375 requires Metropolitan Planning Organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which will prescribe land use allocation in that MPO’s Regional Transportation Plan (RTP). ARB, in consultation with MPOs, will provide each affected region with reduction targets for GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets will be updated every eight years,

but can be updated every four years if advancements in emission technologies affect the reduction strategies to achieve the targets. ARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG reduction targets, transportation projects would not be eligible for State funding programmed after January 1, 2012. New provisions of CEQA incentivize qualified projects that are consistent with an approved SCS or APS, categorized as "transit priority projects."

The revised Air District CEQA Guidelines includes methodology consistent with the recently updated State CEQA Guidelines, which provides that certain residential and mixed use projects, and transit priority projects consistent with an applicable SCS or APS need not analyze GHG impacts from cars and light duty trucks (CEQA Guidelines §15183.5(c)).

2.2.2 Project-Level GHG Thresholds

Staff recommends setting GHG significance thresholds based on AB 32 GHG emission reduction goals while taking into consideration emission reduction strategies outlined in ARB's Scoping Plan. Staff proposes two quantitative thresholds for land use projects: a bright line threshold based on a "gap" analysis and an efficiency threshold based on emission levels required to be met in order to achieve AB 32 goals.

Staff also proposes one qualitative threshold for land use projects: if a project complies with a Qualified Greenhouse Gas Reduction Strategy (as defined in Section 2.2.4 below) that addresses the project it would be considered less than significant. As explained in detail in Section 2.2.4 below, compliance with a Qualified Greenhouse Gas Reduction Strategy (or similar adopted policies, ordinances and programs), would provide the evidentiary basis for making CEQA findings that development consistent with the plan would result in feasible, measurable, and verifiable GHG reductions consistent with broad state goals such that projects approved under qualified Greenhouse Gas Reduction Strategies or equivalent demonstrations would achieve their fair share of GHG emission reductions.

LAND USE PROJECTS "GAP-BASED" THRESHOLD

Staff took eight steps in developing this threshold approach, which are summarized here and detailed in the sections that follow. It should be noted that the "gap-based approach" used for threshold development is a conservative approach that focuses on a limited set of state mandates that appear to have the greatest potential to reduce land use development-related GHG emissions at the time of this writing. It is also important to note that over time, as the effectiveness of the State's implementation of AB 32 (and SB 375) progresses, BAAQMD will need to reconsider the extent of GHG reductions needed over and above those from the implementation thereof for the discretionary approval of land use development projects. Although there is an inherent amount of uncertainty in the estimated capture rates (i.e., frequency at which project-generated emissions would exceed a threshold and would be subject to mitigation under CEQA) and the aggregate emission reductions used in the gap analysis, they are based on BAAQMD's expertise, the best available data, and use conservative assumptions for the amount of emission reductions from legislation in derivation of the gap (e.g., only adopted legislation was relied upon). This approach is intended to attribute an appropriate share of GHG emission reductions necessary to reach AB 32 goals to new land use development projects in BAAQMD's jurisdiction that are evaluated pursuant to CEQA.

Step 1 Estimate from ARB's statewide GHG emissions inventory the growth in emissions between 1990 and 2020 attributable to "land use-driven" sectors of the emission inventory as defined by OPR's guidance document (*CEQA and Climate Change*). Land use-driven emission sectors include Transportation (On-Road Passenger Vehicles; On-Road Heavy Duty), Electric Power (Electricity; Cogeneration), Commercial and Residential (Residential Fuel Use; Commercial Fuel Use) and Recycling and Waste (Domestic Waste Water Treatment).

Result: 1990 GHG emissions were 295.53 MMT CO₂e/yr and projected 2020 business-as-usual GHG emissions would be 400.22 MMT CO₂e/yr; thus a 26.2 percent reduction from statewide land use-driven GHG emissions would be necessary to meet the AB 32 goal of returning to 1990 emission levels by 2020. (See Table A-2)

Step 2 Estimate the anticipated GHG emission reductions affecting the same land use-driven emissions inventory sectors associated with adopted statewide regulations identified in the AB 32 Scoping Plan.

Result: Estimated a 23.9 percent reduction can be expected in the land use-driven GHG emissions inventory from adopted Scoping Plan regulations, including AB 1493 (Pavley), LCFS, Heavy/Medium Duty Efficiency, Passenger Vehicle Efficiency, Energy-Efficiency Measures, Renewable Portfolio Standard, and Solar Roofs. (See Table A-3)

Step 3 Determine any short fall or "gap" between the 2020 statewide emission inventory estimates and the anticipated emission reductions from adopted Scoping Plan regulations. This "gap" represents additional GHG emission reductions needed statewide from the land use-driven emissions inventory sectors, which represents new land use development's share of the emission reductions needed to meet statewide GHG emission reduction goals.

Result: With the 23.9 percent reductions from AB 32 Scoping Measures, there is a "gap" of 2.3 percent in necessary additional GHG emissions reductions to meet AB 32 goals of a 26.2 percent reduction from statewide land use-driven GHG emissions to return to 1990 levels in 2020. (See Table A-2)

Step 4 Determine the percent reduction this "gap" represents in the "land use-driven" emissions inventory sectors from BAAQMD's 2020 GHG emissions inventory. Identify the mass of emission reductions needed in the SFBAAB from land use-driven emissions inventory sectors.

Result: Estimated that a 2.3 percent reduction in BAAQMD's projected 2020 emissions projections requires emissions reductions of 1.6 MMT CO₂e/yr from the land use-driven sectors. (See Table A-4)

Step 5 Assess BAAQMD's historical CEQA database (2001-2008) to determine the frequency distribution trend of project sizes and types that have been subject to CEQA over the past several years.

Result: Determined historical patterns of residential, commercial and industrial development by ranges of average sizes of each development type. Results were used in Step 6 below to distribute anticipated Bay Area growth among different future project types and sizes.

Step 6 Forecast new land use development for the Bay Area using DOF/EDD population and employment projections and distribute the anticipated growth into appropriate land use types and sizes needed to accommodate the anticipated growth (based on the trend analysis in Step 5 above). Translate

the land use development projections into land use categories consistent with those contained in the Urban Emissions Model (URBEMIS).

Result: Based on population and employment projections and the trend analysis from Step 5 above, forecasted approximately 4,000 new development projects, averaging about 400 projects per year through 2020 in the Bay Area.

- Step 7 Estimate the amount of GHG emissions from each land use development project type and size using URBEMIS and post-model manual calculation methods (for emissions not included in URBEMIS). Determine the amount of GHG emissions that can reasonably and feasibly be reduced through currently available mitigation measures (“mitigation effectiveness”) for future land use development projects subject to CEQA (based on land use development projections and frequency distribution from Step 6 above).

Result: Based on the information available and on sample URBEMIS calculations, found that mitigation effectiveness of between 25 and 30 percent is feasible.

- Step 8 Conduct a sensitivity analysis of the numeric GHG mass emissions threshold needed to achieve the desired emissions reduction (i.e., “gap”) determined in Step 4. This mass emission GHG threshold is that which would be needed to achieve the emission reductions necessary by 2020 to meet the Bay Area’s share of the statewide “gap” needed from the land use-driven emissions inventory sectors.

Result: The results of the sensitivity analysis conducted in Step 8 found that reductions between about 125,000 MT/yr (an aggregate of 1.3 MMT in 2020) and over 200,000 MT/yr (an aggregate of over 2.0 MMT in 2020) were achievable and feasible. A mass emissions threshold of 1,100 MT of CO₂e/yr would result in approximately 59 percent of all projects being above the significance threshold (e.g., this is approximately the operational GHG emissions that would be associated with a 60 residential unit subdivision) and must implement feasible mitigation measures to meet CEQA requirements. With an estimated 26 percent mitigation effectiveness, the 1,100 MT threshold would achieve 1.6 MMT CO₂e/yr in GHG emissions reductions.

DETAILED BASIS AND ANALYSIS

Derivation of Greenhouse Gas Reduction Goal

To meet the target emissions limit established in AB 32 (equivalent to levels in 1990), total GHG emissions would need to be reduced by approximately 28 percent from projected 2020 forecasts (ARB 2009a). The AB 32 Scoping Plan is ARB’s plan for meeting this mandate (ARB 2008). While the Scoping Plan does not specifically identify GHG emission reductions from the CEQA process for meeting AB 32 derived emission limits, the scoping plan acknowledges that “other strategies to mitigate climate change . . . should also be explored.” The Scoping Plan also acknowledges that “Some of the measures in the plan may deliver more emission reductions than we expect; others less . . . and new ideas and strategies will emerge.” In addition, climate change is considered a significant environmental issue and, therefore, warrants consideration under CEQA. SB 97 represents the State Legislature’s confirmation of this fact, and it directed the Governor’s Office of Planning and Research (OPR) to develop CEQA Guidelines for evaluation of GHG emissions impacts and recommend mitigation strategies. In response, OPR released the *Technical Advisory: CEQA and Climate*

Change (OPR 2008), and proposed revisions to the State CEQA guidelines (April 14, 2009) for consideration of GHG emissions. The California Natural Resources Agency adopted the proposed State CEQA Guidelines revisions on December 30, 2009 and the revisions were effective beginning March 18, 2010. It is known that new land use development must also do its fair share toward achieving AB 32 goals (or, at a minimum, should not hinder the State's progress toward the mandated emission reductions).

Foreseeable Scoping Plan Measures Emission Reductions and Remaining "Gap"

Step 1 of the Gap Analysis entailed estimating from ARB's statewide GHG inventory the growth in emissions between 1990 and 2020 attributable to land use driven sectors of the emissions inventory. As stated above, to meet the requirements set forth in AB 32 (i.e., achieve California's 1990-equivalent GHG emissions levels by 2020) California would need to achieve an approximate 28 percent reduction in emissions across all sectors of the GHG emissions inventory compared with 2020 projections. However, to meet the AB 32 reduction goals in the emissions sectors that are related to land use development (e.g., on-road passenger and heavy-duty motor vehicles, commercial and residential area sources [i.e., natural gas], electricity generation/consumption, wastewater treatment, and water distribution/consumption), staff determined that California would need to achieve an approximate 26 percent reduction in GHG emissions from these land use-driven sectors (ARB 2009a) by 2020 to return to 1990 land use emission levels.

Next, in Step 2 of the Gap Analysis, Staff determined the GHG emission reductions within the land use-driven sectors that are anticipated to occur from implementation of the Scoping Plan measures statewide, which are summarized in Table A-2 and described below. Since the GHG emission reductions anticipated with the Scoping Plan were not accounted for in ARB's or BAAQMD's 2020 GHG emissions inventory forecasts (i.e., business as usual), an adjustment was made to include (i.e., give credit for) GHG emission reductions associated with key Scoping Plans measures, such as the Renewable Portfolio Standard, improvements in energy efficiency through periodic updates to Title 24, AB 1493 (Pavley) (which recently received a federal waiver to allow it to be enacted in law), the Low Carbon Fuel Standard (LCFS), and other measures. With reductions from these State regulations (Scoping Plan measures) taken into consideration and accounting for an estimated 23.9 percent reduction in GHG emissions, in Step 3 of the Gap Analysis Staff determined that the Bay Area would still need to achieve an additional 2.3 percent reduction from projected 2020 GHG emissions to meet the 1990 GHG emissions goal from the land-use driven sectors. This necessary 2.3 percent reduction in projected GHG emissions from the land use sector is the "gap" the Bay Area needs to fill to do its share to meet the AB 32 goals. Refer to the following explanation and Tables 2 through 4 for data used in this analysis.

Because the transportation sector is the largest emissions sector of the state's GHG emissions inventory, it is aggressively targeted in early actions and other priority actions in the Scoping Plan including measures concerning gas mileage (Pavley), fuel carbon intensity (LCFS) and vehicle efficiency measures.

Table A-2 California 1990, 2002-2004, and 2020 Land Use Sector GHG¹ (MMT CO₂e/yr)

Sector	1990 Emissions	2002-2004 Average	2020 BAU Emissions Projections	% of 2020 Total
Transportation	137.98	168.66	209.06	52%
On-Road Passenger Vehicles	108.95	133.95	160.78	40%
On-Road Heavy Duty	29.03	34.69	48.28	12%
Electric Power	110.63	110.04	140.24	35%
Electricity	95.39	88.97	107.40	27%
Cogeneration ²	15.24	21.07	32.84	8%
Commercial and Residential	44.09	40.96	46.79	12%
Residential Fuel Use	29.66	28.52	32.10	8%
Commercial Fuel Use	14.43	12.45	14.63	4%
Recycling and Waste¹	2.83	3.39	4.19	1%
Domestic Wastewater Treatment	2.83	3.39	4.19	1%
TOTAL GROSS EMISSIONS	295.53	323.05	400.22	
% Reduction Goal from Statewide land use driven sectors (from 2020 levels to reach 1990 levels in these emission inventory sectors)				26.2%
% Reduction from AB32 Scoping Plan measures applied to land use sectors (see Table A-3)				-23.9%
% Reduction needed statewide beyond Scoping Plan measures (Gap)				2.3%

Notes: MMT CO₂e /yr = million metric tons of carbon dioxide equivalent emissions per year.

¹ Landfills not included. See text.

² Cogeneration included due to many different applications for electricity, in some cases provides substantial power for grid use, and because electricity use served by cogeneration is often amenable to efficiency requirements of local land use authorities.

Sources: Data compiled by EDAW and ICF Jones & Stokes from ARB data.

Pavley Regulations. The AB 32 Scoping Plan assigns an approximate 20 percent reduction in emissions from passenger vehicles associated with the implementation of AB 1493. The AB 32 Scoping Plan also notes that "AB 32 specifically states that if the Pavley regulations do not remain in effect, ARB shall implement alternative regulations to control mobile sources to achieve equivalent or greater reductions of greenhouse gas emissions (HSC §38590)." Thus, it is reasonable to assume full implementation of AB 1493 standards, or equivalent programs that would be implemented by ARB. Furthermore, on April 1, 2010, U.S. EPA and the Department of Transportation's National Highway Safety Administration (NHTSA) announced a joint final rule establishing a national program that will dramatically reduce greenhouse gas emissions and improve fuel economy for new cars and trucks sold in the United States after 2011. Under this national program, automobile manufacturers will be able to build a single light-duty national fleet that satisfies all requirements under both the national program and the standards of California and other states. Nonetheless, BAAQMD may need to revisit this methodology as the federal standards come on line to ensure that vehicle standards are as aggressive as contemplated in development of this threshold.

Table A-3 2020 Land Use Sector GHG Emission Reductions from State Regulations and AB 32 Measures

Affected Emissions Source	California Legislation	% Reduction from 2020 GHG inventory	End Use Sector (% of Bay Area LU Inventory)	Scaled % Emissions Reduction (credit)
Mobile	AB 1493 (Pavley)	19.7%	On road passenger/light truck transportation (45%)	8.9%
	LCFS	7.2%	On road passenger/light truck transportation (45%)	3.2%
	LCFS	7.2%	On road Heavy/Medium Duty Transportation (5%)	0.4%
	Heavy/Medium Duty Efficiency	2.9%	On road Heavy/Medium Duty Transportation (5%)	0.2%
	Passenger Vehicle Efficiency	2.8%	On road passenger/light truck transportation (45%)	1.3%
Area	Energy-Efficiency Measures	9.5%	Natural gas (Residential, 10%)	1.0%
			Natural gas (Non-residential, 13%)	1.2%
Indirect	Renewable Portfolio Standard	21.0%	Electricity (excluding cogen) (17%)	3.5%
	Energy-Efficiency Measures	15.7%	Electricity (26%)	4.0%
	Solar Roofs	1.5%	Electricity (excluding cogen) (17%)	0.2%
Total credits given to land use-driven emission inventory sectors from Scoping Plan measures				23.9%

Notes: AB = Assembly Bill; LCFS = Low Carbon Fuel Standard; SB = Senate Bill; RPS = Renewable Portfolio Standard

Please refer to Appendix D for detailed calculations. Sources: Data compiled by ICF Jones & Stokes.

LCFS. According to the adopted LCFS rule (ARB 2009b), the LCFS is expected to result in approximately 10 percent reduction in the carbon intensity of transportation fuels. However, a portion of the emission reductions required from the LCFS would be achieved over the life cycle of transportation fuel production rather than from mobile-source emission factors. Based on ARB's estimate of nearly 16 MMT reductions in on-road emissions from implementation of the LCFS and comparison to the statewide on-road emissions sector, the LCFS is assumed to result in a 7.2 percent reduction compared to 2020 BAU conditions (ARB 2009b).

Table A-4 SFBAAB 1990, 2007, and 2020 Land Use Sector GHG Emissions Inventories and Projections (MMT CO₂e/yr)

Sector	1990 Emissions	2007 Emissions	2020 Emissions Projections	% of 2020 Total ²
Transportation	26.1	30.8	35.7	50%
On-Road Passenger Vehicles	23.0	27.5	32.0	
On-Road Heavy Duty	3.1	3.3	3.7	
Electric Power	25.1	15.2	18.2	26%
Electricity	16.5	9.9	11.8	
Cogeneration	8.6	5.3	6.4	
Commercial and Residential	8.9	15.0	16.8	24%
Residential Fuel Use	5.8	7.0	7.5	
Commercial Fuel Use	3.1	8.0	9.3	
Recycling and Waste¹	0.2	0.4	0.4	1%
Domestic Waste Water Treatment	0.2	0.4	0.4	
TOTAL GROSS EMISSIONS	60.3	61.4	71.1	
SFBAAB's "Fair Share" % Reduction (from 2020 levels to reach 1990 levels) with AB-32 Reductions (from Table A-3)			2.3%	
SFBAAB's Equivalent Mass Emissions Land Use Reduction Target at 2020 (MMT CO ₂ e/yr)			1.6	

Notes: MMT CO₂e /yr = million metric tons of carbon dioxide equivalent emissions per year; SFBAAB = San Francisco Bay Area Air Basin.

¹ Landfills not included.

² Percentages do not sum exactly to 100% in table due to rounding.

Please refer to Appendix D for detailed calculations.

Sources: Data compiled by EDAW 2009, ICF Jones & Stokes 2009, BAAQMD 2008.

Renewable Portfolio Standard, Energy Efficiency and Solar Roofs. Energy efficiency and renewable energy measures from the Scoping Plan were also included in the gap analysis. The Renewable Portfolio Standard (rules) will require the renewable energy portion of the retail electricity portfolio to be 33 percent in 2020. For PG&E, the dominant electricity provider in the Basin, approximately 12 percent of their current portfolio qualifies under the RPS rules and thus the gain by 2020 would be approximately 21 percent. The Scoping Plan also estimates that energy efficiency gains with periodic improvement in building and appliance energy standards and incentives will reach 10 to 15 percent for natural gas and electricity respectively. The final state measure included in this gap analysis is the solar roof initiative, which is estimated to result in reduction of the overall electricity inventory of 1.5 percent.

Landfill emissions are excluded from this analysis. While land use development does generate waste related to both construction and operations, the California Integrated Waste Management Board (CIWMB) has mandatory diversion requirements that will, in all probability, increase over time to promote waste reductions, reuse, and recycle. The Bay Area has relatively high levels of waste diversion and extensive recycling efforts. Further, ARB has established and proposes to increase methane capture requirements for

all major landfills. Thus, at this time, landfill emissions associated with land use development waste generation is not included in the land use sector inventory used to develop this threshold approach.

Industrial stationary sources thresholds were developed separately from the land use threshold development using a market capture approach as described below. However, mobile source and area source emissions, as well as indirect electricity emissions that derive from industrial use are included in the land use inventory above as these particular activities fall within the influence of local land use authorities in terms of the effect on trip generation and energy efficiency.

AB 32 mandates reduction to 1990-equivalent GHG levels by 2020, with foreseeable emission reductions from State regulations and key Scoping Plan measures taken into account, were applied to the land use-driven emission sectors within the SFBAAB (i.e., those that are included in the quantification of emissions from a land use project pursuant to a CEQA analysis [on-road passenger vehicles, commercial and residential natural gas, commercial and residential electricity consumption, and domestic waste water treatment], as directed by OPR in the Technical Advisory: *Climate Change and CEQA* [OPR 2008]). This translates to a 2.3 percent gap in necessary GHG emission reductions by 2020 from these sectors.

LAND USE PROJECTS BRIGHT LINE THRESHOLD

In Steps 4 and 5 of the gap analysis, Staff determined that applying a 2.3 percent reduction to these land use emissions sectors in the SFBAAB's GHG emissions inventory would result in an equivalent fair share of 1.6 million metric tons per year (MMT/yr) reductions in GHG emissions from new land use development. As additional regulations and legislation aimed at reducing GHG emissions from land use-related sectors become available in the future, the 1.6 MMT GHG emissions reduction goal may be revisited and recalculated by BAAQMD.

In order to derive the 1.6 MMT "gap," a projected development inventory for the next ten years in the SFBAAB was calculated (see Table A-4 and *Revised Draft Options and Justifications Report* (BAAQMD 2009)). CO₂e emissions were modeled for projected development in the SFBAAB and compiled to estimate the associated GHG emissions inventory. The GHG (i.e., CO₂e) CEQA threshold level was adjusted for projected land use development that would occur within BAAQMD's jurisdiction over the period from 2010 through 2020.

Projects with emissions greater than the threshold would be required to mitigate to the threshold level or reduce project emissions by a percentage (mitigation effectiveness) deemed feasible by the Lead Agency under CEQA compared to a base year condition. The base year condition is defined by an equivalent size and character of project with annual emissions using the defaults in URBEMIS and the California Climate Action Registry's General Reporting Protocol for 2008. By this method, land use project mitigation subject to CEQA would help close the "gap" remaining after application of the key regulations and measures noted above supporting overall AB 32 goals.

This threshold takes into account Steps 1-8 of the gap analysis described above to arrive at a numerical mass emissions threshold. Various mass emissions significance threshold levels (i.e., bright lines) could be chosen based on the mitigation effectiveness and performance anticipated to be achieved per project to meet the aggregate emission reductions of 1.6 MMT needed in the SFBAAB by 2020 (see Table A-5 and *Revised Draft Options and Justifications Report* (BAAQMD 2009)). Staff recommends a 1,100 MT CO₂e per

year threshold. Choosing a 1,100 MT mass emissions significance threshold level (equivalent to approximately 60 single-family units), would result in about 59 percent of all projects being above the significance threshold and having to implement feasible mitigation measures to meet their CEQA obligations. These projects account for approximately 92 percent of all GHG emissions anticipated to occur between now and 2020 from new land use development in the SFBAAB.

Project applicants and lead agencies could use readily available computer models to estimate a project's GHG emissions, based on project specific attributes, to determine if they are above or below the bright line numeric threshold. With this threshold, projects that are above the threshold level, after consideration of emission-reducing characteristics of the project as proposed, would have to reduce their emissions to below the threshold to be considered less than significant.

Table A-5 Operational GHG Threshold Sensitivity Analysis

Option	Mitigation Effectiveness Assumptions Performance Standards Applied to All Projects with Emissions < Threshold Level	Mitigation Effectiveness Assumptions Applied to Emissions > Threshold Level	Mass Emission Threshold Level (MT CO ₂ e/yr)	% of Projects Captured (>threshold)	% of Emissions Captured (> threshold)	Emissions Reduction per year (MT/yr)	Aggregate Emissions Reduction (MMT) at 2020	Threshold Project Size Equivalent (single family dwelling units)
1A	N/A	30%	975	60%	93%	201,664	2.0	53
1A	N/A	25%	110	96%	100%	200,108	2.0	66
1A	N/A	30%	1,225	21%	67%	159,276	1.6	67
1A	N/A	26%	1,100	59%	92%	159,877	1.6	60
1A	N/A	30%	2,000	14%	61%	143,418	1.4	109
1A	N/A	25%	1,200	58%	92%	136,907	1.4	66
1A	N/A	30%	3,000	10%	56%	127,427	1.3	164
1A	N/A	25%	1,500	20%	67%	127,303	1.3	82
1B	26%	N/A	N/A	100%	100%	208,594	2.1	N/A1
1C	5%	30%	1,900	15%	62%	160,073	1.6	104
1C	10%	25%	1,250	21%	67%	159,555	1.6	68
1C	5%	30%	3,000	10%	56%	145,261	1.5	164
1C	10%	25%	2,000	4%	61%	151,410	1.5	109
1C	10%	30%	10,000	2%	33%	125,271	1.3	547

MMT = million metric tons per year; MT CO₂e/yr = metric tons of carbon dioxide equivalent emissions per year; MT/yr = metric tons per year; N/A = not applicable.

¹ Any project subject to CEQA would trigger this threshold.

Please refer to Appendix D for detailed calculations.

Source: Data modeled by ICF Jones & Stokes.

ESTABLISHING A “BRIGHT LINE” TO DETERMINE THE SIGNIFICANCE OF A PROJECT’S GHG EMISSIONS IMPACT PROVIDES A LEVEL OF CERTAINTY TO LEAD AGENCIES IN DETERMINING IF A PROJECT NEEDS TO REDUCE ITS GHG EMISSIONS THROUGH MITIGATION MEASURES AND WHEN AN EIR IS REQUIRED.

Land Use Projects Efficiency-Based Threshold

GHG efficiency metrics can also be utilized as thresholds to assess the GHG efficiency of a project on a per capita basis (residential only projects) or on a “service population” basis (the sum of the number of jobs and the number of residents provided by a project) such that the project will allow for consistency with the goals of AB 32 (i.e., 1990 GHG emissions levels by 2020). GHG efficiency thresholds can be determined by dividing the GHG emissions inventory goal (allowable emissions), by the estimated 2020 population and employment. This method allows highly efficient projects with higher mass emissions to meet the overall reduction goals of AB 32. Staff believes it is more appropriate to base the land use efficiency threshold on the service population metric for the land use-driven emission inventory. This approach is appropriate because the threshold can be applied evenly to all project types (residential or commercial/retail only and mixed use) and uses only the land use emissions inventory that is comprised of all land use projects. Staff will provide the methodology to calculate a project’s GHG emissions in the revised CEQA Guidelines, such as allowing infill projects up to a 50 percent or more reduction in daily vehicle trips if the reduction can be supported by close proximity to transit and support services, or a traffic study prepared for the project.

Table A-6 California 2020 GHG Emissions, Population Projections and GHG Efficiency Thresholds - Land Use Inventory Sectors

Land Use Sectors Greenhouse Gas Emissions Target	295,530,000
Population	44,135,923
Employment	20,194,661
California Service Population (Population + Employment)	64,330,584
AB 32 Goal GHG emissions (metric tons CO ₂ e)/SP ¹	4.6

Notes: AB = Assembly Bill; CO₂e = carbon dioxide equivalent; GHG = greenhouse gas; SP = service population.

¹ Greenhouse gas efficiency levels were calculated using only the “land use-related” sectors of ARB’s emissions inventory.

Please refer to Appendix D for detailed calculations.

Sources: Data compiled by EDAW 2009, ARB 2009a, DOF 2009, EDD 2009, ICF Jones & Stokes 2009.

Staff proposes a project-level efficiency threshold of 4.6 MT CO₂e/SP, the derivation of which is shown Table A-6. This efficiency-based threshold reflects very GHG-efficient projects. As stated previously and below, staff anticipates that significance thresholds (rebuttable presumptions of significance at the project level) will function on an interim basis only until adequate programmatic approaches are in place at the city, county, and regional level that will allow the CEQA streamlining of individual projects. (See State CEQA Guidelines §15183.5 [“Tiering and Streamlining the Analysis of Greenhouse Gas Emissions”]).

2.2.3 Plan-Level GHG Thresholds

Staff proposes using a two-step process for determining the significance of proposed plans and plan amendments for GHG. As a first step in assessing plan-level impacts, Staff is proposing that agencies that have adopted a qualified Greenhouse Gas Reduction Strategy (or have incorporated similar criteria in their general plan) and the general plan is consistent with the Greenhouse Gas Reduction Strategy, the general plan would be considered less than significant. In addition, as discussed above for project-level GHG impacts, Staff is proposing an efficiency threshold to assess plan-level impacts. Staff believes a programmatic approach to limiting GHG emissions is appropriate at the plan-level. Thus, as projects consistent with the Greenhouse Gas Reduction Strategy are proposed, they may be able to tier off the plan and its environmental analysis.

GHG EFFICIENCY METRICS FOR PLANS

For local land use plans, a GHG-efficiency metric (e.g., GHG emissions per unit) would enable comparison of a proposed general plan to its alternatives and to determine if the proposed general plan meets AB 32 emission reduction goals.

AB 32 identifies local governments as essential partners in achieving California's goal to reduce GHG emissions. Local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth and the changing needs of their jurisdiction. ARB has developed the Local Government Operations Protocol and is developing a protocol to estimate community-wide GHG emissions. ARB encourages local governments to use these protocols to track progress in reducing GHG emissions. ARB encourages local governments to institutionalize the community's strategy for reducing its carbon footprint in its general plan. SB 375 creates a process for regional integration of land development patterns and transportation infrastructure planning with the primary goal of reducing GHG emissions from the largest sector of the GHG emission inventory, light duty vehicles.

If the statewide AB 32 GHG emissions reduction context is established, GHG efficiency can be viewed independently from the jurisdiction in which the plan is located. Expressing projected 2020 mass of emissions from land use-related emissions sectors by comparison to a demographic unit (e.g., population and employment) provides evaluation of the GHG efficiency of a project in terms of what emissions are allowable while meeting AB 32 targets.

Two approaches were considered for efficiency metrics. The "service population" (SP) approach would consider efficiency in terms of the GHG emissions compared to the sum of the number of jobs and the number of residents at a point in time. The per capita option would consider efficiency in terms of GHG emissions per resident only. Staff recommends that the efficiency threshold for plans be based on all emission inventory sectors because, unlike land use projects, general plans comprise more than just land use related emissions (e.g. industrial). Further, Staff recommends that the plan threshold be based on the service population metric as general plans include a mix of residents and employees. The Service Population metric would allow decision makers to compare GHG efficiency of general plan alternatives that vary residential and non-residential development totals, encouraging GHG efficiency through improving jobs/housing balance. This approach would not give preference to communities that accommodate more residential (population-driven) land uses than non-residential (employment driven) land uses which could occur with the per capita approach.

A SP-based GHG efficiency metric (see Table A-7) was derived from the emission rates at the State level that would accommodate projected population and employment growth under trend forecast conditions, and the emission rates needed to accommodate growth while allowing for consistency with the goals of AB 32 (i.e., 1990 GHG emissions levels by 2020).

Table A-7 California 2020 GHG Emissions, Population Projections and GHG Efficiency Thresholds - All Inventory Sectors

All Inventory Sectors Greenhouse Gas Emissions Target	426,500,000
Population	44,135,923
Employment	20,194,661
California Service Population (Population + Employment)	64,330,584
AB 32 Goal GHG emissions (metric tons CO ₂ e)/SP ¹	6.6

Notes: AB = Assembly Bill; CO₂e = carbon dioxide equivalent; GHG = greenhouse gas; SP = service population.

¹ Greenhouse gas efficiency levels were calculated using only the “land use-related” sectors of ARB’s emissions inventory.

Please refer to Appendix D for detailed calculations.

Sources: Data compiled by EDAW 2009, ARB 2009a, DOF 2009, EDD 2009, ICF Jones & Stokes 2009.

If a general plan demonstrates, through dividing the emissions inventory projections (MT CO₂e) by the amount of growth that would be accommodated in 2020, that it could meet the GHG efficiency metrics in this section (6.6 MT CO₂e/SP from all emission sectors, as noted in Table A-7), then the amount of GHG emissions associated with the general plan would be considered less than significant, regardless of its size (and magnitude of GHG emissions). In other words, the general plan would accommodate growth in a manner that would not hinder the State’s ability to achieve AB 32 goals, and thus, would be less than significant for GHG emissions and their contribution to climate change. The efficiency metric would not penalize well-planned communities that propose a large amount of development. Instead, the SP-based GHG efficiency metric acts to encourage the types of development that BAAQMD and OPR support (i.e., infill and transit-oriented development) because it tends to reduce GHG and other air pollutant emissions overall, rather than discourage large developments for being accompanied by a large mass of GHG emissions. Plans that are more GHG efficient would have no or limited mitigation requirements to help them complete the CEQA process more readily than plans that promote GHG inefficiencies, which will require detailed design of mitigation during the CEQA process and could subject a plan to potential challenge as to whether all feasible mitigation was identified and adopted. This type of threshold can shed light on a well-planned general plan that accommodates a large amount of growth in a GHG-efficient way.

When analyzing long-range plans, such as general plans, it is important to note that the planning horizon will often surpass the 2020 timeframe for implementation of AB 32. Executive Order S-3-05 establishes a more aggressive emissions reduction goal for the year 2050 of 80 percent below 1990 emissions levels. The year 2020 should be viewed as a milestone year, and the general plan should not preclude the community from a trajectory toward the 2050 goal. However, the 2020 timeframe is examined in this threshold evaluation because doing so for the 2050 timeframe (with respect to population, employment, and GHG emissions projections) would be too speculative. Advances in technology and policy decisions at the state level will be needed to meet the aggressive 2050 goals. It is beyond the scope of the analysis tools available at this time to examine reasonable emissions reductions that can be achieved through CEQA

analysis in the year 2050. As the 2020 timeframe draws nearer, BAAQMD will need to reevaluate the threshold to better represent progress toward 2050 goals.

2.2.4 Greenhouse Gas Reduction Strategies

Finally, many local agencies have already undergone or plan to undergo efforts to create general or other plans that are consistent with AB 32 goals. The Air District encourages such planning efforts and recognizes that careful upfront planning by local agencies is invaluable to achieving the state's GHG reduction goals. If a project is consistent with an adopted Qualified Greenhouse Gas Reduction Strategy that addresses the project's GHG emissions, it can be presumed that the project will not have significant GHG emission impacts. This approach is consistent with CEQA Guidelines Sections 15064(h)(3) and 15183.5(b), which provides that a "lead agency may determine that a project's incremental contribution to a cumulative effect is not cumulatively considerable if the project will comply with the requirements in a previously approved plan or mitigation program which provides specific requirements that will avoid or substantially lessen the cumulative problem."

A qualified Greenhouse Gas Reduction Strategy (or similar adopted policies, ordinances and programs) is one that is consistent with all of the AB 32 Scoping Plan measures and goals. The Greenhouse Gas Reduction Strategy should identify a land use design, transportation network, goals, policies and implementation measures that would achieve AB 32 goals. Strategies with horizon years beyond 2020 should consider continuing the downward reduction path set by AB 32 and move toward climate stabilization goals established in Executive Order S-3-05.

QUALIFIED GREENHOUSE GAS REDUCTION STRATEGY

A qualified Greenhouse Gas Reduction Strategy adopted by a local jurisdiction should include the following elements as described in the State CEQA Guidelines Section 15183.5. The Air District's revised CEQA Guidelines provides the methodology to determine if a Greenhouse Gas Reduction Strategy meets these requirements.

- ▶ Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;
- ▶ Establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable;
- ▶ Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area;
- ▶ Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;
- ▶ Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels;
- ▶ Be adopted in a public process following environmental review.

LOCAL CLIMATE ACTION POLICIES, ORDINANCES AND PROGRAMS

Air District staff recognizes that many communities in the Bay Area have been proactive in planning for climate change but have not yet developed a stand-alone Greenhouse Gas Reduction Strategy that meets the above criteria. Many cities and counties have adopted climate action policies, ordinances and program that may in fact achieve the goals of AB 32 and a qualified Greenhouse Gas Reduction Strategy. Staff recommends that if a local jurisdiction can demonstrate that its collective set of climate action policies, ordinances and other programs is consistent with AB 32 and State CEQA Guidelines Section 15183.5, includes requirements or feasible measures to reduce GHG emissions and achieves one of the following GHG emission reduction goals,³ the AB 32 consistency demonstration should be considered equivalent to a qualified Greenhouse Gas Reduction Strategy:

- ▶ 1990 GHG emission levels,
- ▶ 15 percent below 2008 emission levels, or
- ▶ Meet the plan efficiency threshold of 6.6 MT CO₂e/service population/year.

Qualified Greenhouse Gas Reduction Strategies that are tied to the AB 32 reduction goals would promote reductions on a plan level without impeding the implementation of GHG-efficient development, and would recognize the initiative of many Bay Area communities who have already developed or are in the process of developing a GHG reduction plan. The details required above for a qualified Greenhouse Gas Reduction Strategy (or similar adopted policies, ordinances and programs) would provide the evidentiary basis for making CEQA findings that development consistent with the plan would result in feasible, measurable, and verifiable GHG reductions consistent with broad state goals such that projects approved under qualified Greenhouse Gas Reduction Strategies or equivalent demonstrations would achieve their fair share of GHG emission reductions.

GHG THRESHOLDS FOR REGIONAL PLANS

Regional plans include the Regional Transportation Plan prepared by the Metropolitan Transportation Commission (MTC) and air quality plans prepared by the Air District.

The Regional Transportation Plan (RTP), also called a Metropolitan Transportation Plan (MTP) or Long-Range Transportation Plan is the mechanism used in California by both Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Agencies (RTPAs) to conduct long-range (minimum of 20 years) planning in their regions. MTC functions as both the regional transportation planning agency, a state designation, and, for federal purposes, as the region's metropolitan planning organization (MPO). As such, it is responsible for regularly updating the Regional Transportation Plan, a comprehensive blueprint for the development of the Bay Area's transportation system that includes mass transit, highway, airport, seaport, railroad, bicycle and pedestrian facilities. The performance of this system affects such public policy concerns as air quality, environmental resource consumption, social equity, "smart growth," economic development, safety, and security. Transportation planning recognizes the critical links between transportation and other societal goals. The planning process requires developing

³ Lead agencies using consistency with their jurisdiction's climate action policies, ordinances and programs as a measure of significance under CEQA Guidelines section 15064(h)(3) and 15183.5(b) should ensure that the policies, ordinances and programs satisfy all of the requirements of that subsection before relying on them in a CEQA analysis.

strategies for operating, managing, maintaining, and financing the area's transportation system in such a way as to advance the area's long-term goals.

The Air District periodically prepares and updates plans to achieve the goal of healthy air. Typically, a plan will analyze emissions inventories (estimates of current and future emissions from industry, motor vehicles, and other sources) and combine that information with air monitoring data (used to assess progress in improving air quality) and computer modeling simulations to test future strategies to reduce emissions in order to achieve air quality standards. Air quality plans usually include measures to reduce air pollutant emissions from industrial facilities, commercial processes, motor vehicles, and other sources. Bay Area air quality plans are prepared with the cooperation of MTC, the Association of Bay Area Governments (ABAG) and the Bay Conservation and Development Commission (BCDC).

The threshold of significance for regional plans is no net increase in emissions including greenhouse gas emissions. This threshold serves to answer the State CEQA Guidelines Appendix G sample question: "Would the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?"

Superseded text ends here

2.2.5 Stationary Source GHG Threshold

Staff's recommended threshold for stationary source GHG emissions is based on estimating the GHG emissions from combustion sources for all permit applications submitted to the Air District in 2005, 2006 and 2007. The analysis is based only on CO₂ emissions from stationary sources, as that would cover the vast majority of the GHG emissions due to stationary combustion sources in the SFBAAB. The estimated CO₂ emissions were calculated for the maximum permitted amount, i.e. emissions that would be emitted if the sources applying for a permit application operate at maximum permitted load and for the total permitted hours. All fuel types are included in the estimates. For boilers burning natural gas, diesel fuel is excluded since it is backup fuel and is used only if natural gas is not available. Emission values are estimated before any offsets (i.e., Emission Reduction Credits) are applied. GHG emissions from mobile sources, electricity use and water delivery associated with the operation of the permitted sources are not included in the estimates.

It is projected that a threshold level of 10,000 metric tons of CO₂e per year would capture approximately 95 percent of all GHG emissions from new permit applications from stationary sources in the SFBAAB. That threshold level was calculated as an average of the combined CO₂ emissions from all stationary source permit applications submitted to the Air District during the three year analysis period.

Staff recommends this 10,000 MT of CO₂/yr as it would address a broad range of combustion sources and thus provide for a greater amount of GHG reductions to be captured and mitigated through the CEQA process. As documented in the Scoping Plan, in order to achieve statewide reduction targets, emissions reductions need to be obtained through a broad range of sources throughout the California economy and this threshold would achieve this purpose. While this threshold would capture 95 percent of the GHG emissions from new permit applications, the threshold would do so by capturing only the large, significant projects. Permit applications with emissions above the 10,000 MT of CO₂/yr threshold account for less than

10 percent of stationary source permit applications which represent 95 percent of GHG emissions from new permits analyzed during the three year analysis period.

This threshold would be considered an interim threshold and Air District staff will reevaluate the threshold as AB 32 Scoping Plan measures such as cap and trade are more fully developed and implemented at the state level.

Superseded text begins here.

2.2.6 Summary of Justification for GHG Thresholds

The bright-line numeric threshold of 1,100 MT CO₂e/yr is a numeric emissions level below which a project's contribution to global climate change would be less than "cumulatively considerable." This emissions rate is equivalent to a project size of approximately 60 single-family dwelling units, and approximately 59 percent of all future projects and 92 percent of all emissions from future projects would exceed this level. For projects that are above this bright-line cutoff level, emissions from these projects would still be less than cumulatively significant if the project as a whole would result in an efficiency of 4.6 MT CO₂e per service population or better for mixed-use projects. Projects with emissions above 1,100 MT CO₂e/yr would therefore still be less than significant if they achieved project efficiencies below these levels. If projects as proposed exceed these levels, they would be required to implement mitigation measures to bring them back below the 1,100 MT CO₂e/yr bright-line cutoff or within the 4.6 MT CO₂e Service Population efficiency threshold. If mitigation did not bring a project back within the threshold requirements, the project would be cumulatively significant and could be approved only with a Statement of Overriding Considerations and a showing that all feasible mitigation measures have been implemented. Projects' GHG emissions would also be less than significant if they comply with a Qualified Greenhouse Gas Reduction Strategy.

As explained in the preceding analyses of these thresholds, the greenhouse gas emissions from land use projects expected between now and 2020 built in compliance with these thresholds would be approximately 26 percent below BAU 2020 conditions and thus would be consistent with achieving an AB 32 equivalent reduction. The 26 percent reduction from BAU 2020 from new projects built in conformance with these thresholds would achieve an aggregate reduction of approximately 1.6 MMT CO₂e/yr, which is the level of emission reductions from new Bay Area land use sources needed to meet the AB 32 goals, per ARB's Scoping Plan as discussed above.

Projects with greenhouse gas emissions in conformance with these thresholds would therefore not be considered significant for purposes of CEQA. Although the emissions from such projects would add an incremental amount to the overall greenhouse gas emissions that cause global climate change impacts, emissions from projects consistent with these thresholds would not be a "cumulatively considerable" contribution under CEQA. Such projects would not be "cumulatively considerable" because they would be helping to solve the cumulative problem as a part of the AB 32 process.

California's response to the problem of global climate change is to reduce greenhouse gas emissions to 1990 levels by 2020 under AB 32 as a near-term measure and ultimately to 80 percent below 1990 levels by 2050 as the long-term solution to stabilizing greenhouse gas concentrations in the atmosphere at a level that will not cause unacceptable climate change impacts. To implement this solution, the Air Resources

Board has adopted a Scoping Plan and budgeted emissions reductions that will be needed from all sectors of society in order to reach the interim 2020 target.

The land-use sector in the Bay Area needs to achieve aggregate emission reductions of approximately 1.6 MMT CO₂e/yr from new projects between now and 2020 to achieve this goal, as noted above, and each individual new project will need to achieve its own respective portion of this amount in order for the Bay Area land use sector as a whole to achieve its allocated emissions target. Building all of the new projects expected in the Bay Area between now and 2020 in accordance with the thresholds that Air District staff are proposing will achieve the overall appropriate share for the land use sector, and building each individual project in accordance with the thresholds will achieve that individual project's respective portion of the emission reductions needed to implement the AB 32 solution. For these reasons, projects built in conformance with the thresholds will be part of the solution to the cumulative problem, and not part of the continuing problem. They will allow the Bay Area's land use sector to achieve the emission reductions necessary from that sector for California to implement its solution to the cumulative problem of global climate change. As such, even though such projects will add an incremental amount of greenhouse gas emissions, their incremental contribution will be less than "cumulatively considerable" because they are helping to achieve the cumulative solution, not hindering it. Such projects will therefore not be "significant" for purposes of CEQA (see CEQA Guidelines §15064(h)(1)).

The conclusion that land use projects that comply with these thresholds is also supported by CEQA Guidelines Section 15030(a)(3), which provides that a project's contribution to a cumulative problem can be less than cumulatively considerable "if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact." In the case of greenhouse gas emissions associated with land use projects, achieving the amount of emission reductions below BAU that will be required to achieve the AB 32 goals is the project's "fair share" of the overall emission reductions needed under ARB's scoping plan to reach the overall statewide AB 32 emissions levels for 2020. If a project is designed to implement greenhouse gas mitigation measures that achieve a level of reductions consistent with what is required from all new land use projects to achieve the land use sector "budget" – i.e., keeping overall project emissions below 1,100 MT CO₂e/yr or ensuring that project efficiency is better than 4.6 MT CO₂e/service population – then it will be implementing its share of the mitigation measures necessary to alleviate the cumulative impact, as shown in the analyses set forth above.

It is also worth noting that this "fair share" approach is flexible and will allow a project's significance to be determined by how well it is designed from a greenhouse gas efficiency standpoint, and not just by the project's size. For example, a large high-density infill project located in an urban core nearby to public transit and other alternative transportation options, and built using state-of-the-art energy efficiency methods and improvements such as solar panels, as well as all other feasible mitigation measures, would not become significant for greenhouse gas purposes (and thus require a Statement of Overriding Considerations in order to be approved) simply because it happened to be a large project. Projects such as this hypothetical development with low greenhouse gas emissions per service population are what California will need in the future in order to do its part in achieving a solution to the problem of global climate change. The determination of significance under CEQA should therefore take these factors into account, and the significance thresholds would achieve this important policy goal. In all, land use sector

projects that comply with the GHG thresholds would not be “cumulatively considerable” because they would be helping to solve the cumulative problem as a part of the AB 32 process.

Likewise, new Air District permit applications for stationary sources that comply with the quantitative threshold of 10,000 MT CO₂e/yr would not be “cumulatively considerable” because they also would not hinder the state’s ability to solve the cumulative greenhouse gas emissions problem pursuant to AB 32. Unlike the land use sector, the AB 32 Scoping Plan measures, including the cap-and-trade program, provide for necessary emissions reductions from the stationary source sector to achieve AB 32 2020 goals.

While stationary source projects will need to comply with the cap-and-trade program once it is enacted and reduce their emissions accordingly, the program will be phased in over time starting in 2012 and at first will only apply to the very largest sources of GHG emissions. In the mean time, certain stationary source projects, particularly those with large GHG emissions, still will have a cumulatively considerable impact on climate change. The 10,000 MT CO₂e/yr threshold will capture 95 percent of the stationary source sector GHG emissions in the Bay Area. The five percent of emissions that are from stationary source projects below the 10,000 MT CO₂e/yr threshold account for a small portion of the Bay Area’s total GHG emissions from stationary sources and these emissions come from very small projects. Such small stationary source projects will not significantly add to the global problem of climate change, and they will not hinder the Bay Area’s ability to reach the AB 32 goal in any significant way, even when considered cumulatively. In Air District’s staff’s judgment, the potential environmental benefits from requiring EIRs and mitigation for these projects would be insignificant. In all, based on staff’s expertise, stationary source projects with emissions below 10,000 MT CO₂e/yr will not provide a cumulatively considerable contribution to the cumulative impact of climate change.

Superseded text ends here.

3 COMMUNITY RISK AND HAZARD THRESHOLDS

To address community risk from air toxics, the Air District initiated the Community Air Risk Evaluation (CARE) program in 2004 to identify locations with high levels of risk from ambient toxic air contaminants (TAC) co-located with sensitive populations and use the information to help focus mitigation measures. Through the CARE program, the Air District developed an inventory of TAC emissions for 2005 and compiled demographic and health indicator data. According to the findings of the CARE Program, diesel PM—mostly from on and off-road mobile sources—accounts for over 80 percent of the inhalation cancer risk from TACs in the Bay Area (BAAQMD 2006).

The Air District applied a regional air quality model using the 2005 emission inventory data to estimate excess cancer risk from ambient concentrations of important TAC species, including diesel PM, 1,3-butadiene, benzene, formaldehyde and acetaldehyde. The highest cancer risk levels from ambient TAC in the Bay Area tend to occur in the core urban areas, along major roadways and adjacent to freeways and port activity. Cancer risks in areas along these major freeways are estimated to range from 200 to over 500 excess cases in a million for a lifetime of exposure. Priority communities within the Bay Area – defined as having higher emitting sources, highest air concentrations, and nearby low income and sensitive

populations – include the urban core areas of Concord, eastern San Francisco, western Alameda County, Redwood City/East Palo Alto, Richmond/San Pablo, and San Jose.

Fifty percent of BAAQMD's population was estimated to have an ambient background inhalation cancer risk of less than 500 cases in one million, based on emission levels in 2005. Table A-8 presents a summary of percentages of the population exposed to varying levels of cancer risk from ambient TACs.

Approximately two percent of the SFBAAB population is exposed to background risk levels of less than 200 excess cases in one million. This is in contrast to the upper percentile ranges where eight percent of the SFBAAB population is exposed to background risk levels of greater than 1,000 excess cases per one million. To identify and reduce risks from TAC, this chapter presents thresholds of significance for both cancer risk and non-cancer health hazards.

Table A-8 Statistical Summary of Estimated Population-Weighted Ambient Cancer Risk in 2005

Percentage of Population (Percent below level of ambient risk)	Ambient Cancer Risk (inhalation cancer cases in one million)
92	1,000
90	900
83	800
77	700
63	600
50	500
32	400
13	300
2	200
<1	100

Source: Data compiled by EDAW 2009.

Many scientific studies have linked fine particulate matter and traffic-related air pollution to respiratory illness (Hiltermann et al. 1997, Schikowski et al 2005, Vineis et al. 2007) and premature mortality (Dockery 1993, Pope et al. 1995, Jerrett et al. 2005). Traffic-related air pollution is a complex mix of chemical compounds (Schauer et al. 2006), often spatially correlated with other stressors, such as noise and poverty (Wheeler and Ben-Shlomo 2005). While such correlations can be difficult to disentangle, strong evidence for adverse health effects of fine particulate matter (PM_{2.5}) has been developed for regulatory applications in a study by the U.S. EPA. This study found that a 10 percent increase in PM_{2.5} concentrations increased the non-injury death rate by 10 percent (U.S. EPA 2006).

Public Health Officers for four counties in the San Francisco Bay Area in 2009 provided testimony to the Air District's Advisory Council (February 11, 2009, Advisory Council Meeting on Air Quality and Public Health). Among the recommendations made, was that PM_{2.5}, in addition to TACs, be considered in assessments of community-scale impacts of air pollution. In consideration of the scientific studies and recommendations by the Bay Area Health Directors, it is apparent that, in addition to the significance thresholds for local-scale TAC, thresholds of significance are required for near-source, local-scale concentrations of PM_{2.5}.

3.1 THRESHOLDS OF SIGNIFICANCE

The thresholds of significance and Board-requested options are presented in this section:

- ▶ The **Staff Proposal** includes thresholds for cancer risk, non-cancer health hazards, and fine particulate matter.
- ▶ **Tiered Thresholds Option** includes tiered thresholds for new sources in impacted communities. Thresholds for receptors and cumulative impacts are the same as the Staff Proposal.

Proposal/Option	Construction-Related	Operational-Related
Project-Level – Individual Project		
Risks and Hazards – New Source (All Areas) (Individual Project) <u>Staff Proposal</u>	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.3 µg/m ³ annual average <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Risks and Hazards – New Receptor (All Areas) (Individual Project) <u>Staff Proposal</u>	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.3 µg/m ³ annual average <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Risks and Hazards (Individual Project) <u>Tiered Thresholds Option</u>	Same as Operational Thresholds*	<u>Impacted Communities: Siting a New Source</u> Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >5.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.2 µg/m ³ annual average <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
	Same as Operational Thresholds*	<u>Impacted Communities: Siting a New Receptor</u> <u>All Other Areas: Siting a New Source or Receptor</u> Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million

Proposal/Option	Construction-Related	Operational-Related
		Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.3 µg/m ³ annual average <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Accidental Release of Acutely Hazardous Air Pollutants	None	Storage or use of acutely hazardous materials locating near receptors or receptors locating near stored or used acutely hazardous materials considered significant
Project-Level – Cumulative		
Risks and Hazards – New Source (All Areas) (Cumulative Thresholds)	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Cancer: > 100 in a million (from all local sources) Non-cancer: > 10.0 Hazard Index (from all local sources) (Chronic) PM _{2.5} : > 0.8 µg/m ³ annual average (from all local sources) <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Risks and Hazards – New Receptor (All Areas) (Cumulative Thresholds)	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Cancer: > 100 in a million (from all local sources) Non-cancer: > 10.0 Hazard Index (from all local sources) (Chronic) PM _{2.5} : > 0.8 µg/m ³ annual average (from all local sources) <u>Zone of Influence</u> : 1,000-foot radius from fence line of source or receptor
Plan-Level		
Risks and Hazards	None	Overlay zones around existing and planned sources of TACs (including adopted Risk Reduction Plan areas). Overlay zones of at least 500 feet (or Air District-approved modeled distance) from all freeways and high volume roadways.
Accidental Release of Acutely Hazardous Air Pollutants	None	None
Regional Plans (Transportation and Air Quality Plans)		
Risks and Hazards	None	No net increase in toxic air contaminants

* Note: The Air District recommends that for construction projects that are less than one year duration, Lead Agencies should annualize impacts over the scope of actual days that peak impacts are to occur, rather than the full year.

3.2 JUSTIFICATION AND SUBSTANTIAL EVIDENCE SUPPORTING THRESHOLDS

The goal of the thresholds is to ensure that no source creates, or receptor endures, a significant adverse impact from any individual project, and that the total of all nearby directly emitted risk and hazard emissions is also not significantly adverse. The thresholds for local risks and hazards from TAC and PM_{2.5} are intended to apply to all sources of emissions, including both permitted stationary sources and on- and off-road mobile sources, such as sources related to construction, busy roadways, or freight movement.

Thresholds for an individual new source are designed to ensure that the source does not contribute to a cumulatively significant impact. Cumulative thresholds for sources recognize that some areas are already near or at levels of significant impact. If within such an area there are receptors, or it can reasonably be foreseen that there will be receptors, then a cumulative significance threshold sets a level beyond which any additional risk is significant.

For new receptors – sensitive populations or the general public – thresholds of significance are designed to identify levels of contributed risk or hazards from existing local sources that pose a significant risk to the receptors. Single-source thresholds for receptors are provided to recognize that within the area defined there can be variations in risk levels that may be significant. Single-source thresholds assist in the identification of significant risks, hazards, or concentrations in a subarea, within the area defined by the selected radius. Cumulative thresholds for receptors are designed to account for the effects of all sources within the defined area.

Cumulative thresholds, for both sources and receptors, must consider the size of the source area, defined by a radius from the proposed project. To determine cumulative impacts from a prescribed zone of influence requires the use of modeling. The larger the radius, the greater the number of sources considered that may contribute to the modeled risk and, until the radius approaches a regional length scale, the greater the expected modeled risk increment. If the area of impact considered were grown to the scale of a city, the modeled risk increment would approach the risk level present in the ambient air.

3.2.1 Scientific and Regulatory Justification

REGULATORY FRAMEWORK FOR TACS

Prior to 1990, the Clean Air Act required EPA to list air toxics it deemed hazardous and to establish control standards which would restrict concentrations of hazardous air pollutants (HAP) to a level that would prevent any adverse effects “with an ample margin of safety.” By 1990, EPA had regulated only seven such pollutants and it was widely acknowledged by that time that the original Clean Air Act had failed to address toxic air emissions in any meaningful way. As a result, Congress changed the focus of regulation in 1990 from a risk-based approach to technology-based standards. Title III, Section 112(b) of the 1990 Clean Air Act Amendment established this new regulatory approach. Under this framework, prescribed pollution control technologies based upon maximum achievable control technology (MACT) were installed without the a priori estimation of the health or environmental risk associated with each individual source. The law listed 188 HAPs that would be subject to the MACT standards. EPA issued 53 standards for 89 different types of major industrial sources of air toxics and eight categories of smaller sources such as dry cleaners.

These requirements took effect between 1996 and 2002. Under the federal Title V Air Operating Permit Program, a facility with the potential to emit 10 tons of any toxic air pollutant, or 25 tons per year of any combination of toxic air pollutants, is defined as a major source HAPs. Title V permits include requirements for these facilities to limit toxic air pollutant emissions.

Several state and local agencies adopted programs to address gaps in EPA's program prior to the overhaul of the national program in 1990. California's program to reduce exposure to air toxics was established in 1983 by the Toxic Air Contaminant Identification and Control Act (AB 1807, Tanner 1983) and the Air Toxics "Hot Spots" Information and Assessment Act (AB 2588, Connelly 1987). Under AB 1807, ARB and the Office of Environmental Health Hazard Assessment (OEHHA) determines if a substance should be formally identified as a toxic air contaminant (TAC) in California. OEHHA also establishes associated risk factors and safe concentrations of exposure.

AB 1807 was amended in 1993 by AB 2728, which required ARB to identify the 189 federal hazardous air pollutants as TACs. AB 2588 (Connelly, 1987) supplements the AB 1807 program, by requiring a statewide air toxics inventory, notification of people exposed to a significant health risk, and facility plans to reduce these risks. In September 1992, the "Hot Spots" Act was amended by Senate Bill 1731 which required facilities that pose a significant health risk to the community to reduce their risk through a risk management plan.

Cancer Risk

Cancer risk from TACs is typically expressed in numbers of excess cancer cases per million persons exposed over a defined period of exposure, for example, over an assumed 70 year lifetime. The Air District is not aware of any agency that has established an acceptable level of cancer risk for TACs. However, a range of what constitutes a significant increment of cancer risk from any compound has been established by the U.S. EPA. EPA's guidance for conducting air toxics analyses and making risk management decisions at the facility- and community-scale level considers a range of acceptable cancer risks from one in a million to one in ten thousand (100 in a million). The guidance considers an acceptable range of cancer risk increments to be from one in a million to one in ten thousand. In protecting public health with an ample margin of safety, EPA strives to provide maximum feasible protection against risks to health from HAPs by limiting additional risk to a level no higher than the one in ten thousand estimated risk that a person living near a source would be exposed to at the maximum pollutant concentrations for 70 years. This goal is described in the preamble to the benzene National Emissions Standards for Hazardous Air Pollutants (NESHAP) rulemaking (54 Federal Register 38044, September 14, 1989) and is incorporated by Congress for EPA's residual risk program under Clean Air Act section 112(f).

Regulation 2, Rule 5 of the Air District specifies permit requirements for new and modified stationary sources of TAC. The Project Risk Requirement (2-5-302.1) states that the Air Pollution Control Officer shall deny an Authority to Construct or Permit to Operate for any new or modified source of TACs if the project cancer risk exceeds 10.0 in one million.

Hazard Index for Non-cancer Health Effects

Non-cancer health hazards for chronic and acute diseases are expressed in terms of a hazard index (HI), a ratio of TAC concentration to a reference exposure level (REL), below which no adverse health effects are expected, even for sensitive individuals. As such, OEHHA has defined acceptable concentration levels, and

also significant concentration increments, for compounds that pose non-cancer health hazards. If the HI for a compound is less than one, non-cancer chronic and acute health impacts have been determined to be less than significant.

State and Federal Ambient Air Quality Standards for PM_{2.5}

The Children's Environmental Health Protection Act (Senate Bill 25), passed by the California state legislature in 1999, requires ARB, in consultation with OEHHA, to "review all existing health-based ambient air quality standards to determine whether, based on public health, scientific literature and exposure pattern data, these standards adequately protect the public, including infants and children, with an adequate margin of safety." As a result of the review requirement, in 2002 ARB adopted an annual average California Ambient Air Quality Standard (CAAQS) for PM_{2.5} of 12 ug/m³ that is not to be exceeded (California Code of Regulations, Title 17 § 70200, Table of Standards). The National Ambient Air Quality Standard (NAAQS) established an annual standard for PM_{2.5} (15 ug/m³) that is less stringent than the CAAQS, but also set a 24-hour average standard (35 ug/m³), which is not included in the CAAQS (Code of Federal Regulations, Title 40, Part 50.7).

Significant Impact Levels for PM_{2.5}

EPA recently proposed and documented alternative options for PM_{2.5} Significant Impact Levels (SILs) (Federal Register 40 CFR Parts 51 and 52, September 21, 2007). The EPA is proposing to facilitate implementation of a PM_{2.5} Prevention of Significant Deterioration (PSD) program in areas attaining the PM_{2.5} NAAQS by developing PM_{2.5} increments, or SILs. These "increments" are maximum increases in ambient PM_{2.5} concentrations (PM_{2.5} increments) allowed in an area above the baseline concentration.

The SIL is a threshold that would be applied to individual facilities that apply for a permit to emit a regulated pollutant in an area that meets the NAAQS. The State and EPA must determine if emissions from that facility will cause the air quality to worsen. If an individual facility projects an increase in emissions that result in ambient impacts greater than the established SIL, the permit applicant would be required to perform additional analyses to determine if those impacts will be more than the amount of the PSD increment. This analysis would combine the impact of the proposed facility when added to all other sources in the area.

The EPA is proposing such values for PM_{2.5} that will be used as screening tools by a major source subject to PSD to determine the subsequent level of analysis and data gathering required for a PSD permit application for emissions of PM_{2.5}. The SIL is one element of the EPA program to prevent deterioration in regional air quality and is utilized in the new source review (NSR) process. New source review is required under Section 165 of the Clean Air Act, whereby a permit applicant must demonstrate that emissions from the proposed construction and operation of a facility "will not cause, or contribute to, air pollution in excess of any maximum allowable increase or maximum allowable concentration for any pollutant." The purpose of the SIL is to provide a screening level that triggers further analysis in the permit application process.

For the purpose of NSR, SILs are set for three types of areas: Class I areas where especially clean air is most desirable, including national parks and wilderness areas; Class II areas where there is not expected to be substantial industrial growth; and Class III areas where the highest relative level of industrial development is expected. In Class II and Class III areas, a PM_{2.5} concentration of 0.3, 0.8, and 1 µg/m³ has been proposed as a SIL. To arrive at the SIL PM_{2.5} option of 0.8 µg/m³, EPA scaled an established PM₁₀ SILs of 1.0 µg/m³ by

the ratio of emissions of $PM_{2.5}$ to PM_{10} using the EPA's 1999 National Emissions Inventory. To arrive at the SIL option of $0.3 \mu\text{g}/\text{m}^3$, EPA scaled the PM_{10} SIL of $1.0 \mu\text{g}/\text{m}^3$ by the ratio of the current Federal ambient air quality standards for $PM_{2.5}$ and PM_{10} (15/50). These options represent what EPA currently considers as a range of appropriate SIL values.

EPA interprets the SIL to be the level of $PM_{2.5}$ increment that represents a "significant contribution" to regional non-attainment. While SIL options were not designed to be thresholds for assessing community risk and hazards, they are being considered to protect public health at a regional level by helping an area maintain the NAAQS. Furthermore, since it is the goal of the Air District to achieve and maintain the NAAQS and CAAQS at both regional and local scales, the SILs may be reasonably be considered as thresholds of significance under CEQA for local-scale increments of $PM_{2.5}$.

Roadway Proximity Health Studies

Several medical research studies have linked near-road pollution exposure to a variety of adverse health outcomes impacting children and adults. Kleinman et al. (2007) studied the potential of roadway particles to aggravate allergic and immune responses in mice. Using mice that were not inherently susceptible, the researchers placed these mice at various distances downwind of State Road 60 and Interstate 5 freeways in Los Angeles to test the effect these roadway particles have on their immune system. They found that within five meters of the roadway, there was a significant allergic response and elevated production of specific antibodies. At 150 meters (492 feet) and 500 meters (1,640 feet) downwind of the roadway, these effects were not statistically significant.

Another significant study (Van Hee et al. 2009) conducted a survey involving 3,827 participants that aimed to determine the effect of residential traffic exposure on two preclinical indicators of heart failure; left ventricular mass index (LVMI), measured by the cardiac magnetic resonance imaging (MRI), and ejection fraction. The studies classified participants based on the distance between their residence and the nearest interstate highway, state or local highway, or major arterial road. Four distance groups were defined: less than 50 meters (165 feet), 50-100 meters, 101-150 meters, and greater than 150 meters. After adjusting for demographics, behavioral, and clinical covariates, the study found that living within 50 meters of a major roadway was associated with a $1.4 \text{ g}/\text{m}^2$ higher LVMI than living more than 150 meters from one. This suggests an association between traffic-related air pollution and increased prevalence of a preclinical predictor of heart failure among people living near roadways.

To quantify the roadway concentrations of $PM_{2.5}$ that contributed to the health impacts reported by Kleinman et al (2007), the Air District modeled the emissions and associated particulate matter concentrations for the roadways studied. To perform the modeling, emissions were estimated for Los Angeles using the EMFAC model and annual average vehicle traffic data taken from Caltrans was used in the roadway model (CAL3QHCR) to estimate the downwind $PM_{2.5}$ concentrations at 50 meters and 150 meters. Additionally, emissions were assumed to occur from 10:00 a.m. to 2:00 p.m. corresponding to the time in which the mice were exposed during the study. The results of the modeling indicate that at 150 meters, where no significant health effects were found, the downwind concentration of $PM_{2.5}$ was $0.78 \mu\text{g}/\text{m}^3$, consistent with the proposed EPA SIL option of $0.8 \mu\text{g}/\text{m}^3$.

Concentration-Response Function for PM_{2.5}

The U.S. EPA reevaluated the relative risk of premature death associated with PM_{2.5} exposure and developed a new relative risk factor (U.S. EPA 2006). This expert elicitation was prepared in support of the characterization of uncertainty in EPA's benefits analyses associated with reductions in exposure to particulate matter pollution. As recommended by the National Academy of Sciences, EPA used expert judgment to better describe the uncertainties inherent in their benefits analysis. Twelve experts participated in the study and provided not just a point estimate of the health effects of PM_{2.5}, but a probability distribution representing the range where they expected the true effect would be. Among the experts who directly incorporated their views on the likelihood of a causal relationship into their distributions, the central (median) estimates of the percent change in all-cause mortality in the adult U.S. population that would result from a permanent 1 µg/m³ drop in annual average PM_{2.5} concentrations ranged from 0.7 to 1.6 percent. The median of their estimates was 1.0 (% increase per 1 µg/m³ increase in PM_{2.5}), with a 90% confidence interval of 0.3 to 2.0 (medians of their 5th and 95th percentiles, respectively) (BAAQMD 2010). Subsequent to the EPA elicitation, Schwartz et al. (2008) examined the linearity of the concentration-response function of PM_{2.5}-mortality and showed that the response function was linear, with health effects clearly continuing below the current U.S. standard of 15 µg/m³, and that the effects of changes in exposure on mortality were seen within two years.

San Francisco Ordinance on Roadway Proximity Health Effects

In 2008, the City and County of San Francisco adopted an ordinance (San Francisco Health Code, Article 38 - Air Quality Assessment and Ventilation Requirement for Urban Infill Residential Development, Ord. 281-08, File No. 080934, December 5, 2008) requiring that public agencies in San Francisco take regulatory action to prevent future air quality health impacts from new sensitive uses proposed near busy roadways (SFDPH 2008). The regulation requires that developers screen sensitive use projects for proximity to traffic and calculate the concentration of PM_{2.5} from traffic sources where traffic volumes suggest a potential hazard. If modeled levels of traffic-attributable PM_{2.5} at a project site exceed an action level (currently set at 0.2 µg/m³) developers would be required to incorporate ventilation systems to remove 80 percent of PM_{2.5} from outdoor air. The regulation does not place any requirements on proposed sensitive uses if modeled air pollutant levels fall below the action threshold. This ordinance only considers impacts from on-road motor vehicles, not impacts related to construction equipment or stationary sources.

A report with supporting documentation for the ordinance (SFPHD 2008) provided a threshold to trigger action or mitigation of 0.2 µg/m³ of PM_{2.5} annual average exposure from roadway vehicles within a 150 meter (492 feet) maximum radius of a sensitive receptor. The report applied the concentration-response function from Jerrett et al. (2005) that attributed 14 percent increase in mortality to a 10 µg/m³ increase in PM_{2.5} to estimate an increase in non-injury mortality in San Francisco of about 21 excess deaths per million population per year from a 0.2 µg/m³ increment of annual average PM_{2.5}.

Distance for Significant Impact

The distance used for the radius around the project boundary should reflect the zone or area over which sources may have a significant influence. For cumulative thresholds, for both sources and receptors, this distance also determines the size of the source area, defined. To determine cumulative impacts from a

prescribed zone of influence requires the use of modeling. The larger the radius, the greater the number of sources considered that may contribute to the risk and the greater the expected modeled risk increment. If the area of impact considered were grown to approach the scale of a city, the modeled risk increment would approach the risk level present in the ambient air.

A summary of research findings in ARB's Land Use Compatibility Handbook (ARB 2005) indicates that traffic-related pollutants were higher than regional levels within approximately 1,000 feet downwind and that differences in health-related effects (such as asthma, bronchitis, reduced lung function, and increased medical visits) could be attributed in part to the proximity to heavy vehicle and truck traffic within 300 to 1,000 feet of receptors. In the same summary report, ARB recommended avoiding siting sensitive land uses within 1,000 feet of a distribution center and major rail yard, which supports the use of a 1,000 feet evaluation distance in case such sources may be relevant to a particular project setting. A 1,000 foot zone of influence is also supported by Health & Safety Code §42301.6 (Notice for Possible Source Near School).

Some studies have shown that the concentrations of particulate matter tend to be reduced substantially or can even be indistinguishable from upwind background concentrations at a distance 1,000 feet downwind from sources such as freeways or large distribution centers. Zhu et al. (2002) conducted a systematic ultrafine particle study near Interstate 710, one of the busiest freeways in the Los Angeles Basin. Particle number concentration and size distribution were measured as a function of distances upwind and downwind of the I-710 freeway. Approximately 25 percent of the 12,180 vehicles per hour are heavy duty diesel trucks based on video counts conducted as part of the research. Measurements were taken at 13 feet, 23 feet, 55 feet, 252 feet, 449 feet, and 941 feet downwind and 613 feet upwind from the edge of the freeway. The particle number and supporting measurements of carbon monoxide and black carbon decreased exponentially and all constituents simultaneously tracked with each other as one moves away from the freeway. Ultrafine particle size distribution changed markedly and its number concentrations dropped dramatically with increasing distance. The study found that ultrafine particle concentrations measured 941 feet downwind of I-710 were indistinguishable from the upwind background concentration.

Impacted Communities

Starting in 2006, the Air District's CARE program developed gridded TAC emissions inventories and compiled demographic information that were used to identify communities that were particularly impacted by toxic air pollution for the purposes of distributing grant and incentive funding. In 2009, the Air District completed regional modeling of TAC on a one kilometer by one kilometer grid system. This modeling was used to estimate cancer risk and TAC population exposures for the entire Air District. The information derived from the modeling was then used to update and refine the identification of impacted communities. One kilometer modeling yielded estimates of annual concentrations of five key compounds – diesel particulate matter, benzene, 1,3-butadiene, formaldehyde, and acetaldehyde – for year 2005. These concentrations were multiplied by their respective unit cancer risk factors, as established by OEHH, to estimate the expected excess cancer risk per million people from these compounds.

Sensitive populations from the 2000 U.S. Census database were identified as youth (under 18) and seniors (over 64) and mapped to the same one kilometer grid used for the toxics modeling. Excess cancers from TAC exposure were determined by multiplying these sensitive populations by the model-estimated excess risk to establish a data set representing sensitive populations with high TAC exposures. TAC emissions (year 2005)

were mapped to the one kilometer grid and also scaled by their unit cancer risk factor to provide a data set representing source regions for TAC emissions. Block-group level household income data from the U.S. Census database were used to identify block groups with family incomes where more than 40 percent of the population was below 185 percent of the federal poverty level (FPL). Poverty-level polygons that intersect high (top 50 percent) exposure cells and are within one grid cell of a high emissions cell (top 25 percent) were used to identify impacted areas. Boundaries were constructed along major roads or highways that encompass nearby high emission cells and low income areas. This method identified the following six areas as priority communities: (1) portions of the City of Concord; (2) Western Contra Costa County (including portions of the Cities of Richmond and San Pablo); (3) Western Alameda County along the Interstate-880 corridor (including portions of the Cities of Berkeley, Oakland, San Leandro, San Lorenzo, Hayward); (4) Portions of the City of San Jose. (5) Eastern San Mateo County (including portions of the Cities of Redwood City and East Palo Alto); and (6) Eastern portions of the City of San Francisco.

3.2.2 Construction, Land Use and Stationary Source Risk and Hazard Thresholds

The options for local risk and hazards thresholds of significance are based on U.S. EPA guidance for conducting air toxics analyses and making risk management decisions at the facility and community-scale level. The thresholds consider reviews of recent health effects studies that link increased concentrations of fine particulate matter to increased mortality. The thresholds would apply to both siting new sources and siting new receptors.

For new sources of TACs, thresholds of significance for a single source are designed to ensure that emissions do not raise the risk of cancer or non-cancer health impacts to cumulatively significant levels. For new sources of PM_{2.5}, thresholds are designed to ensure that PM_{2.5} concentrations are maintained below state and federal standards in all areas where sensitive receptors or members of the general public live or may foreseeably live, even if at the local- or community-scale where sources of TACs and PM may be nearby.

PROJECT RADIUS FOR ASSESSING IMPACTS

For a project proposing a new source or receptor it is recommended to assess impacts within 1,000 feet, taking into account both its individual and nearby cumulative sources (i.e. proposed project plus existing and foreseeable future projects). Cumulative sources are the combined total risk values of each individual source within the 1,000-foot evaluation zone. A lead agency should enlarge the 1,000-foot radius on a case-by-case basis if an unusually large source or sources of risk or hazard emissions that may affect a proposed project is beyond the recommended radius.

The 1,000 foot radius is consistent with findings in ARB's Land Use Compatibility Handbook (ARB 2005), the Health & Safety Code §42301.6 (Notice for Possible Source Near School), and studies such as that of Zhu et al (2002) which found that concentrations of particulate matter tend to be reduced substantially at a distance 1,000 feet downwind from sources such as freeways or large distribution centers.

Qualified Community Risk Reduction Plan

Within the framework of these thresholds, proposed projects would be considered to be less than significant if they are consistent with a qualified Community Risk Reduction Plan (CRRP) adopted by the local jurisdiction with enforceable measures to reduce the community risk.

Project proposed in areas where a CRRP has been adopted that are not consistent with the CRRP would be considered to have a significant impact.

Projects proposed in areas where a CRRP has not been adopted and that have the potential to expose sensitive receptors or the general public to emissions-related risk in excess of the thresholds below from any source would be considered to have a significant air quality impact.

The conclusion that land use projects that comply with qualified Community Risk Reduction Plans are less than significant is supported by CEQA Guidelines Sections 15030(a)(3) and 15064(h)(3), which provides that a project's contribution to a cumulative problem can be less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact.

Increased Cancer Risk to Maximally Exposed Individual (MEI)

Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of carcinogenic TACs from any source result in an increased cancer risk greater than 10.0 in one million, assuming a 70 year lifetime exposure. Under Board Option 1, within Impacted Communities as defined through the CARE program, the significance level for cancer would be reduced to 5.0 in one million for new sources.

The 10.0 in one million cancer risk threshold for a single source is supported by EPA's guidance for conducting air toxics analyses and making risk management decisions at the facility and community-scale level. It is also the level set by the Project Risk Requirement in the Air District's Regulation 2, Rule 5 new and modified stationary sources of TAC, which states that the Air Pollution Control Officer shall deny an Authority to Construct or Permit to Operate for any new or modified source of TACs if the project risk exceeds a cancer risk of 10.0 in one million.

This threshold for an individual new source is designed to ensure that the source does not contribute a cumulatively significant impact. The justification for the Tiered Thresholds Option threshold of 5.0 in one million for new sources in an impacted community is that in these areas the cancer risk burden is higher than in other parts of the Bay Area; the threshold at which an individual source becomes significant is lower for an area that is already at or near unhealthy levels. However, even without a tiered approach, the recommended thresholds already address the burden of impacted communities via the cumulative thresholds: specifically, if an area has many existing TAC sources near receptors, then the cumulative threshold will be reached sooner than it would in another area with fewer TAC sources.

The single-source threshold for receptors is provided to address the possibility that within the area defined by the 1,000 foot radius there can be variations in risk levels that may be significant, below the corresponding cumulative threshold. Single-source thresholds assist in the identification of significant risks, hazards, or concentrations in a subarea, within the 1,000 foot radius.

Increased Non-Cancer Risk to MEI

Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of non-carcinogenic TACs result in an increased chronic or acute Hazard Index (HI) from any source greater than 1.0. This threshold is unchanged under Tiered Thresholds Option.

A HI less than 1.0 represents a TAC concentration, as determined by OEHHA that is at a health protective level. While some TACs pose non-carcinogenic, chronic and acute health hazards, if the TAC concentrations result in a HI less than one, those concentrations have been determined to be less than significant.

Increased Ambient Concentration of PM_{2.5}

Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of PM_{2.5} from any source would result in an average annual increase greater than 0.3 µg/m³. Under Tiered Thresholds Option, within Impacted Communities as defined through the CARE program, the significance level for a PM_{2.5} increment is 0.2 µg/m³.

If one applies the concentration-response of the median of the EPA consensus review (EPA 2005, BAAQMD 2010) and attributes a 1 percent increase in mortality to a 1 µg/m³ increase in PM_{2.5}, one finds an increase in non-injury mortality in the Bay Area of about 20 excess deaths per million per year from a 0.3 µg/m³ increment of PM_{2.5}. This is consistent with the impacts reported and considered significant by SFDPH (2008) using an earlier study (Jerrett et al. 2005) to estimate the increase in mortality from a 0.2 µg/m³ PM_{2.5} increment.

The SFDPH recommended a lower threshold of significance for multiple sources but only considered roadway emissions within a 492 foot radius. This recommendation applies to a single source but considers all types of emissions within 1,000 feet. On balance, the Air District estimates that the SFDPH threshold and this one, in combination with the cumulative threshold for PM_{2.5}, will afford similar levels of health protection.

The PM_{2.5} threshold represents the lower range of an EPA proposed Significant Impact Level (SIL). EPA interprets the SIL to be the level of ambient impact that is considered to represent a "significant contribution" to regional non-attainment. While this threshold was not designed to be a threshold for assessing community risk and hazards, it was designed to protect public health at a regional level by helping an area maintain the NAAQS. Since achieving and maintaining state and federal AAQS is a reasonable goal at the local scale, the SIL provides a useful reference for comparison.

This threshold for an individual new source is designed to ensure that the source does not contribute a cumulatively significant impact. The justification for the Tiered Thresholds Option threshold of 0.2 µg/m³ for new sources in an impacted community is that these areas have higher levels of diesel particulate matter than do other parts of the Bay Area; the threshold at which an individual source becomes significant is lower for an area that is already at or near unhealthy levels. However, even without a tiered approach, the recommended thresholds already address the burden of impacted communities via the cumulative thresholds: specifically, if an area has many existing PM_{2.5} sources near receptors, then the cumulative threshold will be reached sooner than it would in another area with fewer PM_{2.5} sources.

The single-source threshold for receptors is provided to address the possibility that within the area defined by the 1,000 foot radius there can be variations in risk levels that may be significant, below the

corresponding cumulative threshold. Single-source thresholds assist in the identification of significant risks, hazards, or concentrations in a subarea, within the 1,000 foot radius.

ACCIDENTAL RELEASE OF ACUTELY HAZARDOUS AIR EMISSIONS

The BAAQMD currently recommends, at a minimum, that the lead agency, in consultation with the administering agency of the Risk Management Prevention Program (RMPP), find that any project resulting in receptors being within the Emergency Response Planning Guidelines (ERPG) exposure level 2 for a facility has a significant air quality impact. ERPG exposure level 2 is defined as "the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action."

Staff proposes continuing with the current threshold for the accidental release of hazardous air pollutants. Staff recommends that agencies consult with the California Emergency Management Agency for the most recent guidelines and regulations for the storage of hazardous materials. Staff proposes that projects using or storing acutely hazardous materials locating near existing receptors, and projects resulting in receptors locating near facilities using or storing acutely hazardous materials be considered significant.

The current Accidental Release/Hazardous Air Emissions threshold of significance could affect all projects, regardless of size, and require mitigation for Accidental Release/Hazardous Air Emissions impacts.

3.2.3 Cumulative Risk and Hazard Thresholds

QUALIFIED COMMUNITY RISK REDUCTION PLAN

Proposed projects would be considered to be less than significant if they are consistent with a qualified Community Risk Reduction Plan (CRRP) adopted by the local jurisdiction with enforceable measures to reduce the community risk.

Project proposed in areas where a CRRP has been adopted that are not consistent with the CRRP would be considered to have a significant impact.

Projects proposed in areas where a CRRP has not been adopted and that have the potential to expose sensitive receptors or the general public to emissions-related risk in excess of the following thresholds from the aggregate of cumulative sources would be considered to have a significant air quality impact.

The conclusion that land use projects that comply with qualified Community Risk Reduction Plans are less than significant is supported by CEQA Guidelines Sections 15030(a)(3) and 15064(h)(3), which provides that a project's contribution to a cumulative problem can be less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact.

Increased Cancer Risk to Maximally Exposed Individual (MEI)

Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of carcinogenic TACs from any source result in an increased cancer risk greater than 100.0 in one million.

The significance threshold of 100 in a million increased excess cancer risk would be applied to the cumulative emissions. The 100 in a million threshold is based on EPA guidance for conducting air toxics analyses and making risk management decisions at the facility and community-scale level. In protecting public health with an ample margin of safety, EPA strives to provide maximum feasible protection against risks to health from hazardous air pollutants (HAPs) by limiting risk to a level no higher than the one in ten thousand (100 in a million) estimated risk that a person living near a source would be exposed to at the maximum pollutant concentrations for 70 years (NESHAP 54 Federal Register 38044, September 14, 1989; CAA section 112(f)). One hundred in a million excess cancer cases is also consistent with the ambient cancer risk in the most pristine portions of the Bay Area based on the Air District's recent regional modeling analysis.

Increased Non-Cancer Risk to MEI

Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of non-carcinogenic TACs result in an increased chronic Hazard Index from any source greater than 10.0.

The Air District has developed an Air Toxics Hot Spots (ATHS) program that provides guidance for implementing the Air Toxics "Hot Spots" Information and Assessment Act (AB 2588, Connelly, 1987: chaptered in the California Health and Safety Code § 44300, et. al.). The ATHS provides that if the health risks resulting from the facility's emissions exceed significance levels established by the air district, the facility is required to conduct an airborne toxic risk reduction audit and develop a plan to implement measures that will reduce emissions from the facility to a level below the significance level. The Air District has established a non-cancer Hazard Index of ten (10.0) as ATHS mandatory risk reduction levels. The cumulative chronic non-cancer Hazard Index threshold is consistent with the Air District's ATHS program.

Increased Ambient Concentration of PM_{2.5}

Emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of PM_{2.5} from any source would result in an average annual increase greater than 0.8 µg/m³.

If one applies the concentration-response function from the U.S. EPA assessment (U.S. EPA 2006) and attributes a 10 percent increase in mortality to a 10 µg/m³ increase in PM_{2.5}, one finds an increase in non-injury mortality in the Bay Area of about 50 excess deaths per year from a 0.8 µg/m³ increment of PM_{2.5}. This is greater the impacts reported and considered significant by SFDPH (2008) using an earlier study (Jerrett et al. 2005) to estimate the increase in mortality from a 0.2 µg/m³ PM_{2.5} increment (SFDPH reported 21 excess deaths per year). However, SFDPH only considered roadway emissions within a 492 foot radius. This threshold applies to all types of emissions within 1,000 feet. In modeling applications for proposed projects, a larger radius results in a greater number of sources considered and higher modeled

concentrations. On balance, the Air District estimates that the SFDPH threshold and this one, in combination with the individual source threshold for PM_{2.5}, will afford similar levels of health protection.

The cumulative PM_{2.5} threshold represents the middle range of an EPA proposed Significant Impact Level (SIL). EPA interprets the SIL to be the level of ambient impact that is considered to represent a “significant contribution” to regional non-attainment. While this threshold was not designed to be a threshold for assessing community risk and hazards, it was designed to protect public health at a regional level by helping an area maintain the NAAQS. Since achieving and maintaining state and federal AAQS is a reasonable goal at the local scale, the SIL provides a useful reference for comparison. Furthermore, the 0.8 µg/m³ threshold is consistent with studies (Kleinman et al 2007) that examined the potential health impacts of roadway particles.

3.2.4 Plan-Level Risk and Hazard Thresholds

Staff proposes plan-level thresholds that will encourage a programmatic approach to addressing the overall adverse conditions resulting from risks and hazards that many Bay Area communities experience. By designating overlay zones in land use plans, local land use jurisdictions can take preemptive action before project-level review to reduce the potential for significant exposures to risk and hazard emissions. While this will require more up-front work at the general plan level, in the long-run this approach is a more feasible approach consistent with Air District and CARB guidance about siting sources and sensitive receptors that is more effective than project by project consideration of effects that often has more limited mitigation opportunities. This approach would also promote more robust cumulative consideration of effects of both existing and future development for the plan-level CEQA analysis as well as subsequent project-level analysis.

For local plans to have a less-than-significant impact with respect to potential risks and hazards, overlay zones would have to be established around existing and proposed land uses that would emit these air pollutants. Overlay zones to avoid risk impacts should be reflected in local plan policies, land use map(s), and implementing ordinances (e.g., zoning ordinance). The overlay zones around existing and future risk sources would be delineated using the quantitative approaches described above for project-level review and the resultant risk buffers would be included in the General Plan (or the EIR for the General Plan) to assist in site planning. BAAQMD will provide guidance as to the methods used to establish the TAC buffers and what standards to be applied for acceptable exposure level in the updated CEQA Guidelines document. Special overlay zones of at least 500 feet (or an appropriate distance determined by modeling and approved by the Air District) on each side of all freeways and high volume roadways would be included in this threshold.

The threshold of significance for plan impacts could affect all plan adoptions and amendments and require mitigation for a plan’s air quality impacts. Where sensitive receptors would be exposed above the acceptable exposure level, the plan impacts would be considered significant and mitigation would be required to be imposed either at the plan level (through policy) or at the project level (through project level requirements).

3.2.5 Community Risk Reduction Plans

The goal of a Community Risk Reduction Plan would be to bring TAC and PM_{2.5} concentrations for the entire community covered by the Plan down to acceptable levels as identified by the local jurisdiction and approved

by the Air District. This approach provides local agencies a proactive alternative to addressing communities with high levels of risk on a project-by-project approach. This approach is supported by CEQA Guidelines Section 15030(a)(3), which provides that a project's contribution to a cumulative problem can be less than cumulatively considerable "if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact." This approach is also further supported by CEQA Guidelines Section 15064(h)(3), which provides that a project's contribution to a cumulative effect is not considerable "if the project will comply with the requirements in a previously approved plan or mitigation program which provides specific requirements that will avoid or substantially lessen the cumulative problem."

QUALIFIED COMMUNITY RISK REDUCTION PLANS

A qualified Community Risk Reduction Plan adopted by a local jurisdiction should include, at a minimum, the following elements. The Air District's revised CEQA Guidelines provides the methodology to determine if a Community Risk Reduction Plan meets these requirements. Define a planning area;

Include base year and future year emissions inventories of TACs and PM_{2.5};

(A) Include Air District-approved risk modeling of current and future risks;

(B) Establish risk and exposure reduction goals and targets for the community in consultation with Air District staff;

(C) Identify feasible, quantifiable, and verifiable measures to reduce emissions and exposures;

(D) Include procedures for monitoring and updating the inventory, modeling and reduction measures in coordination with Air District staff;

(E) Be adopted in a public process following environmental review.

4 CRITERIA POLLUTANT THRESHOLDS

4.1 THRESHOLDS OF SIGNIFICANCE

Project Construction

Pollutant	Average Daily (pounds/day)
ROG (reactive organic gases)	54
NO _x (nitrogen oxides)	54
PM ₁₀ (exhaust) (particulate matter-10 microns)	82
PM _{2.5} (exhaust) (particulate matter-2.5 microns)	54
PM ₁₀ /PM _{2.5} (fugitive dust)	Best Management Practices
Local CO (carbon monoxide)	None

Project Operations

Pollutant	Average Daily (pounds/day)	Maximum Annual (tons/year)
ROG	54	10

NO _x	54	10
PM ₁₀	82	15
PM _{2.5}	54	10
Local CO	9.0 ppm (8-hour average), 20.0 ppm (1-hour average)	

Plans

1. Consistency with Current Air Quality Plan control measures
 2. Projected VMT or vehicle trip increase is less than or equal to projected population increase
-

Regional Plans (Transportation and Air Quality Plans)

No net increase in emissions of criteria air pollutants and precursors

4.2 JUSTIFICATION AND SUBSTANTIAL EVIDENCE SUPPORTING THRESHOLDS

4.2.1 Project Construction Criteria Pollutant Thresholds

Staff proposes criteria pollutant construction thresholds that add significance criteria for exhaust emissions to the existing fugitive dust criteria employed by the Air District. While our current Guidelines considered construction exhaust emissions controlled by the overall air quality plan, the implementation of new and more stringent state and federal standards over the past ten years now warrants additional control of this source of emissions.

The average daily criteria air pollutant and precursor emission levels shown above are recommended as the thresholds of significance for construction activity for exhaust emissions. These thresholds represent the levels above which a project's individual emissions would result in a considerable contribution (i.e., significant) to the SFBAAB's existing non-attainment air quality conditions and thus establish a nexus to regional air quality impacts that satisfies CEQA requirements for evidence-based determinations of significant impacts.

For fugitive dust emissions, staff recommends following the current best management practices approach which has been a pragmatic and effective approach to the control of fugitive dust emissions. Studies have demonstrated (Western Regional Air Partnership, U.S.EPA) that the application of best management practices at construction sites have significantly controlled fugitive dust emissions. Individual measures have been shown to reduce fugitive dust by anywhere from 30 percent to more than 90 percent. In the aggregate best management practices will substantially reduce fugitive dust emissions from construction sites. These studies support staff's recommendation that projects implementing construction best management practices will reduce fugitive dust emissions to a less than significant level.

4.2.2 Project Operation Criteria Pollutant Thresholds

The thresholds for project operations are the average daily and maximum annual criteria air pollutant and precursor levels shown above. These thresholds are based on the federal BAAQMD Offset Requirements to

ozone precursors for which the SFBAAB is designated as a non-attainment area which is an appropriate approach to prevent further deterioration of ambient air quality and thus has nexus and proportionality to prevention of a regionally cumulative significant impact (e.g. worsened status of non-attainment). Despite non-attainment area for state PM₁₀ and pending nonattainment for federal PM_{2.5}, the federal NSR Significant Emission Rate annual limits of 15 and 10 tons per year, respectively, are the thresholds as BAAQMD has not established an Offset Requirement limit for PM_{2.5} and the existing limit of 100 tons per year is much less stringent and would not be appropriate in light of our pending nonattainment designation for the federal 24-hour PM_{2.5} standard. These thresholds represent the emission levels above which a project's individual emissions would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions. The thresholds would be an evaluation of the incremental contribution of a project to a significant cumulative impact. These threshold levels are well-established in terms of existing regulations as promoting review of emissions sources to prevent cumulative deterioration of air quality. Using existing environmental standards in this way to establish CEQA thresholds of significance under Guidelines section 15067.4 is an appropriate and effective means of promoting consistency in significance determinations and integrating CEQA environmental review activities with other areas of environmental regulation. (See *Communities for a Better Environment v. California Resources Agency* (2002) 103 Cal. App. 4th 98, 111.⁴)

4.2.3 Local Carbon Monoxide Thresholds

The carbon monoxide thresholds are based solely on ambient concentration limits set by the California Clean Air Act for Carbon Monoxide and Appendix G of the State of California CEQA Guidelines.

Since the ambient air quality standards are health-based (i.e., protective of public health), there is substantial evidence (i.e., health studies that the standards are based on) in support of their use as CEQA significance thresholds. The use of the ambient standard would relate directly to the CEQA checklist question. By not using a proxy standard, there would be a definitive bright line about what is or is not a significant impact and that line would be set using a health-based level.

The CAAQS of 20.0 ppm and 9 ppm for 1-hour and 8-hour CO, respectively, would be used as the thresholds of significance for localized concentrations of CO. Carbon monoxide is a directly emitted pollutant with primarily localized adverse effects when concentrations exceed the health based standards established by the California Air Resources Board (ARB).

In addition, Appendix G of the State of California CEQA Guidelines includes the checklist question: Would the project violate any air quality standard or contribute substantially to an existing or projected air quality violation? Answering yes to this question would indicate that the project would result in a significant impact under CEQA. The use of the ambient standard would relate directly to this checklist question.

⁴ The Court of Appeal in the *Communities for a Better Environment* case held that existing regulatory standards could not be used as a definitive determination of whether a project would be significant under CEQA where there is substantial evidence to the contrary. Staff's thresholds would not do that. The thresholds are levels at which a project's emissions would normally be significant, but would not be binding on a lead agency if there is contrary evidence in the record.

4.2.4 Plan-Level Criteria Pollutant Thresholds

This threshold achieves the same goals as the Air District's current approach while alleviating the existing analytical difficulties and the inconsistency of comparing a plan update with AQP growth projections that may be up to several years old. Eliminating the analytical inconsistency provides better nexus and proportionality for evaluating air quality impacts for plans.

Over the years staff has received comments on the difficulties inherent in the current approach regarding the consistency tests for population and VMT growth. First, the population growth estimates used in the most recent AQP can be up to several years older than growth estimates used in a recent plan update, creating an inconsistency in this analysis. Staff recommends that this test of consistency be eliminated because the Air District and local jurisdictions all use regional population growth estimates that are disaggregated to local cities and counties. In addition, the impact to air quality is not necessarily growth but where that growth is located. The second test, rate of increase in vehicle use compared to growth rate, will determine if planned growth will impact air quality. Compact infill development inherently has less vehicle travel and more transit opportunities than suburban sprawl.

Second, the consistency test of comparing the rate of increase in VMT to the rate of increase in population has been problematic at times for practitioners because VMT is not always available with the project analysis. Staff recommends that either the rate of increase in VMT or vehicle trips be compared to the rate of increase in population. Staff also recommends that the growth estimates used in this analysis be for the years covered by the plan. Staff also recommends that the growth estimates be obtained from the Association of Bay Area Governments since the Air District uses ABAG growth estimates for air quality planning purposes.

4.2.5 Criteria Pollutant Thresholds for Regional Plans

Regional plans include the Regional Transportation Plan prepared by the Metropolitan Transportation Commission (MTC) and air quality plans prepared by the Air District.

The Regional Transportation Plan (RTP), also called a Metropolitan Transportation Plan (MTP) or Long-Range Transportation Plan is the mechanism used in California by both Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Agencies (RTPAs) to conduct long-range (minimum of 20 years) planning in their regions. MTC functions as both the regional transportation planning agency, a state designation, and, for federal purposes, as the region's metropolitan planning organization (MPO). As such, it is responsible for regularly updating the Regional Transportation Plan, a comprehensive blueprint for the development of comprehensive transportation system that includes mass transit, highway, airport, seaport, railroad, bicycle and pedestrian facilities. The performance of this system affects such public policy concerns as air quality, environmental resource consumption, social equity, "smart growth," economic development, safety, and security. Transportation planning recognizes the critical links between transportation and other societal goals. The planning process requires developing strategies for operating, managing, maintaining, and financing the area's transportation system in such a way as to advance the area's long-term goals.

The Air District periodically prepares and updates plans to achieve the goal of healthy air. Typically, a plan will analyze emissions inventories (estimates of current and future emissions from industry, motor vehicles, and

other sources) and combine that information with air monitoring data (used to assess progress in improving air quality) and computer modeling simulations to test future strategies to reduce emissions in order to achieve air quality standards. Air quality plans usually include measures to reduce air pollutant emissions from industrial facilities, commercial processes, motor vehicles, and other sources. Bay Area air quality plans are prepared with the cooperation of MTC and the Association of Bay Area Governments (ABAG).

The threshold of significance for regional plans is no net increase in emissions including criteria pollutant emissions. This threshold serves to answer the State CEQA Guidelines Appendix G sample question: "Would the project Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?"

5 ODOR THRESHOLDS

5.1 THRESHOLDS OF SIGNIFICANCE

Project Operations – Source or Receptor	Plans
Five confirmed complaints per year averaged over three years	Identify the location, and include policies to reduce the impacts, of existing or planned sources of odors

5.2 JUSTIFICATION AND SUBSTANTIAL EVIDENCE SUPPORTING THRESHOLDS

Staff proposes revising the current CEQA significance threshold for odors to be consistent with the Air District's regulation governing odor nuisances (Regulation 7—Odorous Substances). The current approach includes assessing the number of unconfirmed complaints which are not considered indicative of actual odor impacts. Basing the threshold on an average of five confirmed complaints per year over a three year period reflects the most stringent standards derived from the Air District rule and is therefore considered an appropriate approach to a CEQA evaluation of odor impacts.

Odors are generally considered a nuisance, but can result in a public health concern. Some land uses that are needed to provide services to the population of an area can result in offensive odors, such as filling portable propane tanks or recycling center operations. When a proposed project includes the siting of sensitive receptors in proximity to an existing odor source, or when siting a new source of potential odors, the following qualitative evaluation should be performed.

When determining whether potential for odor impacts exists, it is recommended that Lead Agencies consider the following factors and make a determination based on evidence in each qualitative analysis category:

Distance: Use the screening-level distances in Table A-9.

Wind Direction: Consider whether sensitive receptors are located upwind or downwind from the source for the most of the year. If odor occurrences associated with the source are seasonal in nature, consider whether sensitive receptors are located downwind during the season in which odor emissions occur.

Complaint History: Consider whether there is a history of complaints associated with the source. If there is no complaint history associated with a particular source (perhaps because sensitive receptors do not already exist in proximity to the source), consider complaint-history associated with other similar sources in BAAQMD's jurisdiction with potential to emit the same or similar types of odorous chemicals or compounds, or that accommodate similar types of processes.

Character of Source: Consider the character of the odor source, for example, the type of odor events according to duration of exposure or averaging time (e.g., continuous release, frequent release events, or infrequent events).

Exposure: Consider whether the project would result in the exposure of a substantial number of people to odorous emissions.

Table A-9 Screening Distances for Potential Odor Sources

Type of Operation Project Screening	Distance
Wastewater Treatment Plant	2 miles
Wastewater Pumping Facilities	1 mile
Sanitary Landfill	2 miles
Transfer Station	1 mile
Composting Facility	1 mile
Petroleum Refinery	2 miles
Asphalt Batch Plant	2 miles
Chemical Manufacturing	2 miles
Fiberglass Manufacturing	1 mile
Painting/Coating Operations	1 mile
Rendering Plant	2 miles
Food Processing Facility	1 mile
Confined Animal Facility/Feed Lot/Dairy	1 mile
Green Waste and Recycling Operations	1 mile
Coffee Roaster	1 mile

California Integrated Waste Management Board (CIWMB). Facilities that are regulated by the CIWMB (e.g. landfill, composting, etc.) are required to have Odor Impact Minimization Plans (OIMP) in place and have procedures that establish fence line odor detection thresholds. The Air District recognizes a Lead Agency's discretion under CEQA to use established odor detection thresholds as thresholds of significance for CEQA review for CIWMB regulated facilities with an adopted OIMP.

6 REFERENCES

ARB. See California Air Resources Board.

BAAQMD. See Bay Area Air Quality Management District.

Bay Area Air Quality Management District. 1999 (December). *BAAQMD CEQA Guidelines*. San Francisco, CA.

_____. 2006. CARE Phase 1 Findings and Policy Recommendations. Available:

<http://baaqmd.gov/CARE/documents/care_p1_findings_recommendations_v2.pdf>. Accessed March 2009.

_____. 2008. Source Inventory of Bay Area Greenhouse Gas Emissions. San Francisco, CA.

_____. 2009. *Revised Draft Options and Justifications Report – California Environmental Quality Act Thresholds of Significance*

(<http://www.baaqmd.gov/~media/Files/Planning%20and%20Research/CEQA/Revised%20Draft%20CEQA%20Thresholds%20%20Justification%20Report%20Oct%202009.ashx>)

_____. 2010. *Draft 2010 CAP Appendix A – Bay Area Air Pollution Burden: Past & Present* San Francisco, CA

California Air Resources Board. 2000. Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles. Stationary Source Division. Mobile Source Control Division. October.

_____. 2005. *Land Use Compatibility Handbook. A Community Health Perspective*. Sacramento, CA.

_____. *Climate Change Proposed Scoping Plan*. Sacramento, CA. Adopted in December 2008. Available:

<<http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm>>. Accessed March 2009.

_____. 2009a. Greenhouse Gas Inventory and Forecast. Available:

<http://www.arb.ca.gov/cc/inventory/data/tables/arb_ghg_inventory_forecast_2008_06_26.xls>. Accessed March 2009.

_____. 2009b (April 23). Rulemaking to Consider the Proposed Regulation to Implement the Low Carbon Fuel Standard. Available: <https://ww3.arb.ca.gov/regact/2009/lcfs09/lcfs09.htm>. Accessed April 10, 2023.

California Department of Finance. 2009. Residential Development Data: E5 – City and County Population Estimates. 2000-2050 - Race and Ethnic Populations Totals. Available:

<<http://www.labormarketinfo.edd.ca.gov/?pageid=145>>. Accessed February 2009.

California Economic Development Department. 2009. Commercial/Industrial Employment Data: Projections of Employment by Industry and Occupation. Available:

<<http://www.labormarketinfo.edd.ca.gov/?pageid=145>>. Accessed February 2009.

City and County of San Francisco Department of Public Health. 2008. Assessment and Mitigation of Air Pollutant Health Effects from Intra-urban Roadways: Guidance for Land Use Planning and

Environmental Review. Program on Health, Equity, & Sustainability. Occupational & Environmental Health Section. Prepared by Rajiv Bhatia and Thomas Rivard. May 6.

Dockery D. 1993. An association between air pollution and mortality in six U.S. cities. *N Engl J Med* 329:1753–1759.

DOF See California Department of Finance

EDD See California Economic Development Department

EPA. See U.S. Environmental Protection Agency.

Governor's Office of Planning and Research. 2008 (June 19). *Technical Advisory: CEQA and Climate Change: Addressing Climate Change Through California Environmental Quality Act (CEQA) Review*. Sacramento, CA. Available: <<http://opr.ca.gov/ceqa/pdfs/june08-ceqa.pdf>>. Accessed February 2009.

Hiltermann T, Bruijne Cd, Stolk J, Zwinderman A, Spijksma F, Roemer W, et al. 1997. Effects of photochemical air pollution and allergen exposure on upper respiratory tract inflammation in asthmatics. *Am J Respir Crit Care Med* 156(6):1765–1772.

Intergovernmental Panel on Climate Change. 2007 (February). *Climate Change 2007: Climate Change 2007: Synthesis Report Summary for Policymakers*. Geneva, Switzerland.

IPCC. See Intergovernmental Panel on Climate Change.

Jerrett M et al. 2005. Spatial Analysis of Air Pollution and Mortality in Los Angeles. *Epidemiology*. 16: 727–736

Kleinman, M.T., Sioutas, C., Froines, J.R., Fanning, E., Hamade, A., Mendez, L., Meacher, D., Oldham, M. Inhalation of Concentrated Ambient Particulate Matter Near a Heavily Trafficked Road Simulates Antigen-Induced Airway Responses in Mice; *Inhal. Toxicol.* 2007, 19 (Supp. 1), 117-126.

OPR. See Governor's Office of Planning and Research.

Pope C III, Thun M, Namboordiri M, Dockery D, Evans J, Speizer F. 1995. Particulate air pollution as a predictor of mortality in a prospective study of U.S. adults. *Am J Respir Crit Care Med* 151(3):669–6

Schauer JJ, Lough GC, Schafer MM, Christensen WF, Arndt MF, DeMinter JT, et al. 2006. Characterization of metals emitted from motor vehicles. *Res Rep Health Eff Inst* 133:1–7.

Schikowski T, Sugiri D, Ranft U, Gehring U, Heinrich J, Wichmann E, et al. 2005. Long-term air pollution exposure and living close to busy roads are associated with COPD in women. *Respir Res* 6(1):152.

Schwartz, J.; Coull, B.; Laden, F.; Ryan, L. The Effect of Dose and Timing of Dose on the Association between Airborne Particles and Survival. *Env Health Persp* (2008) 116, 1: 64-69.

SFDPH. See City and County of San Francisco Department of Public Health.

UNFCCC. See United Nations Framework Convention on Climate Change.

- United Nations Framework Convention on Climate Change. 2009. *Article 1 of the UNFCCC*. Available: http://unfccc.int/essential_background/convention/background/items/2536.php. Accessed April 8, 2009.
- U.S. Environmental Protection Agency. 2008. Federal Register: Implementation of the New Source Review (NSR) Program for Particulate Matter (PM_{2.5}) less than 2.5 Micrometers. Available: <http://www.epa.gov/fedrgstr/EPA-AIR/2008May/Day-1a10768.pdf>. Accessed February 2009.
- _____. 2009. Monitor Values Report Data. Available: <http://www.epa.gov/air/data/index.html>. Accessed April 8, 2009.
- _____. 2006. *Expanded Expert Judgment Assessment of the Concentration-Response Relationship between PM_{2.5} Exposure and Mortality*, prepared for OAQPS-EPA by Industrial Economics Inc., September 21, 2006. A summary of this study is provided in Roman, HA et al., *Environ. Sci. Tech.* 2008, 42, 2268-2274.
- _____. 1988. C. Cowherd, et al., *Control of Open Fugitive Dust Sources*, EPA-450/3-88-008, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1988.
- Van Hee, V.C., Adar, S.D., Szpiro, A.A., Barr, R.G., Bluemke, D.A., Diez Roux, A.V., Gill, E.A., Sheppard, L., Kaufman, J.D. Exposure to Traffic and Left Ventricular Mass and Function; *Am. J. Respir. Crit. Care Med.* 2009, 179 (9), 827-834.
- Vineis P, Hoek G, Krzyzanowski M, Vigna-Taglianti F, Veglia F, Airoidi L, et al. 2007. Lung cancers attributable to environmental tobacco smoke and air pollution in non-smokers in different European countries: a prospective study. *Environ Health* 6:7; doi:10.1186/1476-069X-6-7 [Online 15 February 2007]
- Zhu, Y. Hinds, W.C., Kim S, and Sioutas, C. 2002. Concentration and size distribution of ultrafine particles near a major highway. *Journal of Air and Waste Management Association*. 2002 Sep; 52 (9): 1032-42.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT**RESOLUTION No. 2010-06****A Resolution of the Board of Directors of the Bay Area Air Quality Management District Adopting Thresholds For Use In Determining the Significance of Projects' Environmental Effects Under the California Environmental Quality Act**

WHEREAS, pursuant to Title 14, Chapter 3, Article 5, Section 15064.7 of the California Code of Regulations ("Section 15064.7"), the California Resources Agency encourages public agencies to adopt "Thresholds of Significance" under the California Environmental Quality Act ("CEQA");

WHEREAS, pursuant to Section 15064.7, CEQA Thresholds of Significance are identifiable quantitative, qualitative or performance levels of a particular environmental effect, non-compliance with which means the effect will normally be determined to be "significant" under CEQA, and compliance with which means the effect normally will be determined to be less than significant under CEQA;

WHEREAS, the Board of Directors ("Board") of the Bay Area Air Quality Management District ("District") finds it necessary and appropriate to adopt CEQA Thresholds of Significance as set forth in Attachment A hereto for use by District staff and by other appropriate agencies in determining whether projects may have significant effects on the environment for purposes of CEQA environmental analyses;

WHEREAS, the CEQA Thresholds of Significance as set forth in Attachment A hereto do not alter the existing procedural and substantive requirements of CEQA under California law, but simply clarify the level at which, in the District's considered opinion, an environmental effect should normally be considered "significant" for purposes of existing CEQA law;

WHEREAS, the CEQA Thresholds of Significance set forth in Attachment A hereto were developed through an extensive public review process, which included public workshops, Board meetings and meetings with local government agency and non-government organization staff, including the cities of Berkeley, Colma, Daly City, Dublin, Fremont, Livermore, Oakland, Pleasanton, Richmond, San Leandro, San Mateo, San Francisco and Santa Rosa; the counties of Alameda, Contra Costa, Napa, Santa Clara, and Sonoma; and the CARE Task Force, the Alameda County Planning for Healthy Communities Network and the Governor's Office of Planning and Research Local Government Roundtable;

WHEREAS, District staff held ten public workshops throughout the Bay Area on February 26, 2009, April 27, 29 and 30, 2009, September 8, 9, and 10, 2009, October 2, 2009, and April 15 and 26, 2010; solicited Thresholds of Significance options for consideration; and published for public review and comment the Threshold Options Report on April 24, 2009, the CEQA Thresholds Options and Justification Report on October 8, 2009, and the Proposed Thresholds of Significance Report on November 2, 2009, December 7, 2009 and May 3, 2010;

WHEREAS, District staff held ten local agency staff workshops throughout the Bay Area on March 30 and April 12, 13, 14, 16, 19, 20, 21 and 27, 2010.

WHEREAS, District staff considered and responded in writing to all written comments on the Proposed Thresholds of Significance that were received prior to May 25, 2010;

WHEREAS, public meetings to consider and discuss the proposed Thresholds of Significance options and staff's recommendations were held before several committees of the Board, including the Board's Executive Committee on March 16, 2009, June 29, 2009, September 24, 2009, February 22, 2010, and May 24, 2010; the Board's Climate Protection Committee on September 10, 2009; and the Board's Stationary Source Committee on November 16, 2009;

WHEREAS, the Thresholds of Significance set forth in Attachment A hereto are supported by substantial evidence, as documented in the report entitled Proposed Thresholds of Significance, dated May 3, 2010, and other documentation compiled by District staff;

WHEREAS, the substantial evidence as documented in the May 3, 2010, Proposed Thresholds of Significance report and other documentation establishes that the Thresholds of Significance set forth in Attachment A hereto reflect the levels at which environmental effects should be considered "significant" for purposes of CEQA, such that exceedance of the thresholds will normally establish that the effect is "significant" under CEQA and compliance with the thresholds normally will establish that the effect is less than "significant" under CEQA;

WHEREAS, the CEQA Thresholds of Significance set forth in Attachment A hereto are consistent with the principles and jurisprudence of CEQA law as set forth in CEQA, its implementing regulations, and applicable judicial interpretations;

WHEREAS, if the California Air Resources Board were to adopt CEQA thresholds of significance for greenhouse gas emissions at a future date, the District will reevaluate the adopted greenhouse gas thresholds of significance to ensure they are consistent with the California Air Resources Board;

WHEREAS, as SB 375 is implemented and the region develops a Sustainable Community Strategy, the District will reevaluate the adopted greenhouse gas thresholds of significance to ensure consistency with the intent of SB 375;

WHEREAS, District staff will work with cities and counties to provide technical resources and financial assistance to develop climate action plans and community risk reduction plans;

WHEREAS, the CEQA Thresholds of Significance set forth in Attachment A hereto are written and displayed so that their meaning can be easily understood by District staff and other agencies using them as a means to assess whether a project's environmental effects will be significant under CEQA;

WHEREAS, public meetings of the Board to consider adoption of the Thresholds of Significance were properly noticed and convened in accordance with all requirements of law, which public

meetings were held on November 18, 2009, December 2, 2009, January 6, 2010, May 5, 2010 and June 2, 2010;

WHEREAS, at the November 18, 2009, December 2, 2009, January 6, 2010, May 5, 2010 and June 2, 2010 public meetings, the subject matter of the Thresholds of Significance was discussed with interested persons in accordance with all provisions of law;

WHEREAS, the November 18, 2009, December 2, 2009, January 6, 2010, May 5, 2010 and June 2, 2010 public meetings and the other public review opportunities that the District has provided regarding the Thresholds of Significance, constitute a public review process as required by Section 15064.7;

WHEREAS, District staff has prepared and presented to this Board the May 3, 2010, Proposed Thresholds of Significance report, which has been considered by this Board and is incorporated herein by reference;

WHEREAS, the documents and other materials that constitute the record of the public review process under Section 15064.7 on which this Resolution is based are located at the Bay Area Air Quality Management District, 939 Ellis Street, San Francisco, 94109, and the custodian for these documents is Ms. Lisa Harper, Clerk of the Boards;

WHEREAS, District staff recommends adoption of the CEQA Thresholds of Significance set forth in Attachment A hereto;

WHEREAS, the Board of Directors concurs with District staff's recommendations and desires to adopt the CEQA Thresholds of Significance set forth in Attachment A hereto;

NOW, THEREFORE, BE IT RESOLVED that that the Board of Directors of the Bay Area Air Quality Management District does hereby adopt the CEQA Thresholds of Significance, pursuant to the authority granted by law, as set forth in Attachment A hereto, and discussed in the Proposed Thresholds of Significance report dated May 3, 2010, with instructions to staff to correct any typographical or formatting errors before final publication of the CEQA Thresholds of Significance.

BE IT FURTHER RESOLVED that it is the policy of the Bay Area Air Quality Management District that projects that do not comply with the CEQA Thresholds of Significance will normally be determined to have a significant effect on the environment for purposes of CEQA, and projects that comply with the CEQA Thresholds of Significance normally will be determined to have a less-than-significant effect on the environment for purposes of CEQA.

BE IT FURTHER RESOLVED that it is the policy of the Bay Area Air Quality Management District that Lead Agencies in the Bay Area apply the CEQA Thresholds of Significance, except for the Risk and Hazard thresholds for Receptor Projects, for Notices of Preparation issued, and environmental analyses begun, on or after the date of adoption of this Resolution.

BE IT FURTHER RESOLVED that it is the policy of the Bay Area Air Quality Management District that Lead Agencies in the Bay Area apply the CEQA Thresholds of Significance for the

Risk and Hazard thresholds for Receptor Projects for Notices of Preparation issued, and environmental analyses begun, after January 1, 2011.

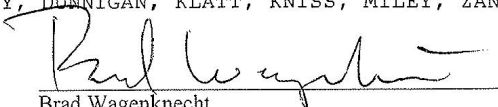
The foregoing Resolution was duly and regularly introduced, passed and adopted at a regular meeting of the Board of Directors of the Bay Area Air Quality Management District on the Motion of Director KALRA, seconded by Director UILKEMA, on the 2nd day of JUNE, 2010, by the following vote of the Board:

AYES: BATES, GARNER, GIOIA, GROOM, HOSTERMAN, HUDSON, KALRA, MAR, ROSS, SPERING, TORLIATT, UILKEMA, YEAGER, WAGENKNECHT

NOES: NONE

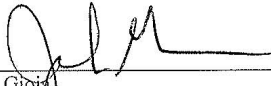
RECUSED: HAGGERTY

ABSENT: BROWN, DALY, DUNNIGAN, KLATT, KNISS, MILEY, ZANE



Brad Wagenknecht
Chairperson of the Board of Directors

ATTEST:



John Gioia
Secretary of the Board of Directors

ATTACHMENT A

Proposed Air Quality CEQA Thresholds of Significance (May 3, 2010)			
Pollutant		Construction-Related	Operational-Related
Project-Level			
Criteria Air Pollutants and Precursors (Regional)	Average Daily Emissions (lb/day)	Average Daily Emissions (lb/day)	Maximum Annual Emissions (tpy)
ROG	54	54	10
NO _x	54	54	10
PM ₁₀ (exhaust)	82	82	15
PM _{2.5} (exhaust)	54	54	10
PM ₁₀ /PM _{2.5} (fugitive dust)	Best Management Practices	None	
Local CO	None	9.0 ppm (8-hour average), 20.0 ppm (1-hour average)	
GHGs Projects other than Stationary Sources	None	Compliance with Qualified Greenhouse Gas Reduction Strategy OR 1,100 MT of CO ₂ e/yr OR 4.6 MT CO ₂ e/SP/yr (residents + employees)	
GHGs Stationary Sources	None	10,000 MT/yr	
Risks and Hazards – New Source (Individual Project)	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.3 µg/m ³ annual average <u>Zone of Influence:</u> 1,000-foot radius from fence line of source or receptor	
Risks and Hazards – New Receptor (Individual Project)	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 Hazard Index (Chronic or Acute) Ambient PM _{2.5} increase: > 0.3 µg/m ³ annual average <u>Zone of Influence:</u> 1,000-foot radius from fence line of source or receptor	
Risks and Hazards – New Source (Cumulative Thresholds)	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Cancer: > 100 in a million (from all local sources) Non-cancer: > 10.0 Hazard Index (from all local sources) (Chronic) PM _{2.5} : > 0.8 µg/m ³ annual average (from all local sources) <u>Zone of Influence:</u> 1,000-foot radius from fence line of source or receptor	

Proposed Air Quality CEQA Thresholds of Significance (May 3, 2010)		
Pollutant	Construction-Related	Operational-Related
Risks and Hazards – New Receptor (Cumulative Thresholds)	Same as Operational Thresholds*	Compliance with Qualified Community Risk Reduction Plan OR Cancer: > 100 in a million (from all local sources) Non-cancer: > 10.0 Hazard Index (from all local sources) (Chronic) PM _{2.5} : > 0.8 µg/m ³ annual average (from all local sources) <u>Zone of Influence:</u> 1,000-foot radius from fence line of source or receptor
Accidental Release of Acutely Hazardous Air Pollutants	None	Storage or use of acutely hazardous materials locating near receptors or receptors locating near stored or used acutely hazardous materials considered significant
Odors	None	Complaint History—5 confirmed complaints per year averaged over three years
Plan-Level		
Criteria Air Pollutants and Precursors	None	1. Consistency with Current Air Quality Plan control measures 2. Projected VMT or vehicle trip increase is less than or equal to projected population increase
GHGs	None	Compliance with Qualified Greenhouse Gas Reduction Strategy (or similar criteria included in a General Plan) OR 6.6 MT CO ₂ e/ SP/yr (residents + employees)
Risks and Hazards	None	1. Overlay zones around existing and planned sources of TACs (including adopted Risk Reduction Plan areas) 2. Overlay zones of at least 500 feet (or Air District-approved modeled distance) from all freeways and high volume roadways
Odors	None	Identify locations of odor sources in general plan
Accidental Release of Acutely Hazardous Air Pollutants	None	None
Regional Plans (Transportation and Air Quality Plans)		
GHGs, Criteria Air Pollutants and Precursors, and Toxic Air Contaminants	None	No net increase in emissions
Notes: CO = carbon monoxide; CO₂e = carbon dioxide equivalent; GHGs = greenhouse gases; lb/day = pounds per day; MT = metric tons; NO_x = oxides of nitrogen; PM_{2.5} = fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less; PM₁₀ = respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less; ppm = parts per million; ROG = reactive organic gases; SP = service population; tpy = tons per year; yr = year. * Note: The Air District recommends that for construction projects that are less than one year duration, Lead Agencies should annualize impacts over the scope of actual days that peak impacts are to occur, rather than the full year.		

7 GLOSSARY

Aerosol -- Particle of solid or liquid matter that can remain suspended in the air because of its small size (generally under one micrometer in diameter).

Air Quality Management District (AQMD) -- Local agency charged with controlling air pollution and attaining air quality standards. The Bay Area Air Quality Management District is the regional AQMD that includes Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo and Santa Clara Counties and the southern halves of Solano and Sonoma Counties.

Air Resources Board (ARB) -- The State of California agency responsible for air pollution control. Responsibilities include: establishing State ambient air quality standards, setting allowable emission levels for motor vehicles in California and oversight of local air quality management districts.

Area Sources -- Sources of air pollutants that individually emit relatively small quantities of air pollutants, but that may emit considerable quantities of emissions when aggregated over a large area. Examples include water heaters, lawn maintenance equipment, and consumer products.

Best Available Control Technology (BACT) -- The most stringent emissions control that has been achieved in practice, identified in a state implementation plan, or found by the Air District to be technologically feasible and cost-effective for a given class of sources.

California Clean Air Act (CCAA) -- Legislation enacted in 1988 mandating a planning process to attain state ambient air quality standards.

CALINE -- A model developed by the Air Resources Board that calculates carbon monoxide concentrations resulting from motor vehicle use.

Carbon Monoxide (CO) -- A colorless, odorless, toxic gas produced by the incomplete combustion of carbon-containing substances. It is emitted in large quantities by exhaust of gasoline-powered vehicles.

Carbon Dioxide (CO₂) -- A colorless, odorless gas that is an important contributor to Earth's greenhouse effect.

Carbon Dioxide Equivalent (CO₂E) -- A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential.

Chlorofluorocarbons (CFCs) -- A family of inert, nontoxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. CFCs drift into the upper atmosphere where their chlorine components destroy stratospheric ozone.

Clean Air Act (CAA) -- Long-standing federal legislation, last amended in 1990, that is the legal basis for the national clean air programs.

Conformity -- A requirement in federal law and administrative practice that requires that projects will not be approved if they do not conform with the State Implementation Plan by: causing or contributing to an increase in air pollutant emissions, violating an air pollutant standard, or increasing the frequency of violations of an air pollutant standard.

Criteria Air Pollutants -- Air pollutants for which the federal or State government has established ambient air quality standards, or criteria, for outdoor concentration in order to protect public health. Criteria pollutants include: ozone, carbon monoxide, sulfur dioxide PM10 (previously total suspended particulate), nitrogen oxide, and lead.

EMFAC -- The computer model developed by the California Air Resources Board to estimate composite on-road motor vehicle emission factors by vehicle class.

Emission Factor -- The amount of a specific pollutant emitted from a specified polluting source per unit quantity of material handled, processed, or burned.

Emission Inventory -- A list of air pollutants emitted over a determined area by type of source. Typically expressed in mass per unit time.

Environmental Protection Agency (EPA) -- The federal agency responsible for control of air and water pollution, toxic substances, solid waste, and cleanup of contaminated sites.

Exceedance -- A monitored level of concentration of any air contaminant higher than national or state ambient air quality standards.

Global Warming Potential (GWP) -- The index used to translate the level of emissions of various gases into a common measure in order to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emissions of one kilogram of a greenhouse gas to that from emission of one kilogram of carbon dioxide over a period of time (usually 100 years).

Greenhouse Gas (GHG) -- Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), halogenated fluorocarbons (HCFCs), ozone (O₃), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆) and hydrofluorocarbons (HFCs).

Hazardous Air Pollutants -- Federal terminology for air pollutants which are not covered by ambient air quality standards but may reasonably be expected to cause or contribute to serious illness or death (see NESHAPs).

Health Risk Assessment -- An analysis where human exposure to toxic substances is estimated, and considered together with information regarding the toxic potency of the substances, to provide quantitative estimates of health risk.

Hot Spot -- A location where emissions from specific sources may expose individuals and population groups to elevated risks of adverse health effects and contribute to the cumulative health risks of emissions from other sources in the area.

Hydrogen Sulfide (H₂S) -- A gas characterized by "rotten egg" smell, found in the vicinity of oil refineries, chemical plants and sewage treatment plants.

Impacted Communities -- Also known as priority communities, the Air District defines impacted communities within the Bay Area as having higher emitting sources, highest air concentrations, and nearby low income and sensitive populations. The Air District identified the following impacted communities: the

urban core areas of Concord, eastern San Francisco, western Alameda County, Redwood City/East Palo Alto, Richmond/San Pablo, and San Jose.

Indirect Sources – Land uses and facilities that attract or generate motor vehicle trips and thus result in air pollutant emissions, e.g., shopping centers, office buildings, and airports.

Inversion -- The phenomenon of a layer of warm air over cooler air below. This atmospheric condition resists the natural dispersion and dilution of air pollutants.

Level of Service (LOS) -- A transportation planning term for a method of measurement of traffic congestion. The LOS compares actual or projected traffic volume to the maximum capacity of the road under study. LOS ranges from A through F. LOS A describes free flow conditions, while LOS F describes the most congested conditions, up to or over the maximum capacity for which the road was designed.

Mobile Source -- Any motor vehicle that produces air pollution, e.g., cars, trucks, motorcycles (on-road mobile sources) or airplanes, trains and construction equipment (off-road mobile sources).

National Ambient Air Quality Standards (NAAQS) -- Health-based pollutant concentration limits established by EPA that apply to outdoor air (see Criteria Air Pollutants).

National Emissions Standards for Hazardous Air Pollutants (NESHAPs) – Emissions standards set by EPA for air pollutants not covered by NAAQS that may cause an increase in deaths or in serious, irreversible, or incapacitating illness.

Nitrogen Oxides (NO_x) -- Gases formed in great part from atmospheric nitrogen and oxygen when combustion takes place under conditions of high temperature and high pressure; NO_x is a precursor to the criteria air pollutant ozone.

Nonattainment Area -- Defined geographic area that does not meet one or more of the

Ambient Air Quality Standards for the criteria pollutants designated in the federal Clean Air Act and/or California Clean Air Act.

Ozone (O₃) -- A pungent, colorless, toxic gas. A product of complex photochemical processes, usually in the presence of sunlight. Tropospheric (lower atmosphere) ozone is a criteria air pollutant.

Particulate -- A particle of solid or liquid matter; soot, dust, aerosols, fumes and mists.

Photochemical Process -- The chemical changes brought about by the radiant energy of the sun acting upon various polluting substances. The products are known as photochemical smog.

PM_{2.5} -- Fine particulate matter (solid or liquid) with an aerodynamic diameter equal to or less than 2.5 micrometers. Individual particles of this size are small enough to be inhaled deeply into the lungs.

PM₁₀ -- Fine particulate matter (solid or liquid) with an aerodynamic diameter equal to or less than 10 micrometers. Individual particles of this size are small enough to be inhaled into human lungs; they are not visible to the human eye.

Precursor -- Compounds that change chemically or physically after being emitted into the air and eventually produce air pollutants. For example, organic compounds are precursors to ozone.

Prevention of Significant Deterioration (PSD) -- EPA program in which State and/or federal permits are required that are intended to restrict emissions for new or modified sources in places where air quality is already better than required to meet primary and secondary ambient air quality standards.

Reactive Organic Gases (ROG) -- Classes of organic compounds, especially olefins, substituted aromatics and aldehydes, that react rapidly in the atmosphere to form photochemical smog or ozone.

Sensitive Receptors -- Facilities or land uses that include members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses. Examples include schools, hospitals and residential areas.

State Implementation Plan (SIP) -- EPA-approved state plans for attaining and maintaining federal air quality standards.

Stationary Source -- A fixed, non-mobile source of air pollution, usually found at industrial or commercial facilities.

Sulfur Oxides (SO_x) -- Pungent, colorless gases formed primarily by the combustion of sulfur-containing fossil fuels, especially coal and oil. Considered a criteria air pollutant, sulfur oxides may damage the respiratory tract as well as vegetation.

Toxic Air Contaminants -- Air pollutants which cause illness or death in relatively small quantities. Non-criteria air contaminants that, upon exposure, ingestion, inhalation, or assimilation into organisms either directly from the environment or indirectly by ingestion through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions, or physical deformations in such organisms or their offspring.

Transportation Control Measures (TCMs) -- Measures to reduce traffic congestion and decrease emissions from motor vehicles by reducing vehicle use.

URBEMIS -- A computer model developed by the California Air Resources Board to estimate air pollutant emissions from motor vehicle trips associated with land use development.

866486.1

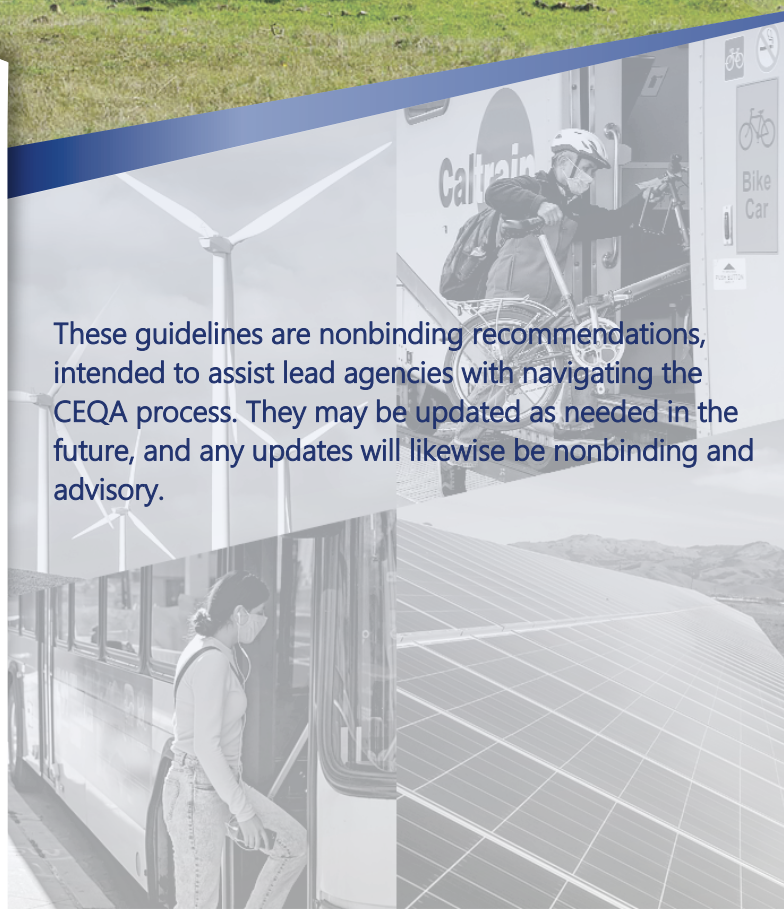


BAY AREA AIR QUALITY
MANAGEMENT DISTRICT

California Environmental Quality Act
Air Quality Guidelines
Appendix B:
**CEQA Thresholds for Evaluating
the Significance of Climate Impacts
From Land Use Projects and Plans**

April 2022

These guidelines are nonbinding recommendations, intended to assist lead agencies with navigating the CEQA process. They may be updated as needed in the future, and any updates will likewise be nonbinding and advisory.





BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Justification Report

CEQA Thresholds for Evaluating the Significance of Climate Impacts

Veronica Eady

Senior Deputy Executive Officer

Damian Breen

Senior Deputy Executive Officer

Greg Nudd

Deputy Air Pollution Control Officer

Adan Schwartz

Acting District Counsel

PRINCIPAL CONTRIBUTORS:**Henry Hilken**

Director of Planning and Climate Protection

Alexander "Sandy" Crockett

Acting Senior Assistant Counsel

Abby Young

Climate Protection Manager

Wendy Goodfriend, Ph.D.

Air Quality Planning Manager

Jakub Zielkiewicz

Senior Advanced Projects Advisor

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

375 Beale Street, Suite 600

San Francisco, CA 94105

415.749.5000

TECHNICAL ASSISTANCE FROM:**Honey Walters**

Principal-in-Charge

Poonam Boparai

Principal

Hannah Kornfeld, AICP

Project Manager

April 2022

TABLE OF CONTENTS

Section	Page
List of Abbreviations	B-iii
1 Introduction and Executive Summary.....	B-1
1.1 Thresholds for Land Use Projects.....	B-1
1.2 Thresholds for General Plans and Related Planning Documents	B-3
1.3 Important Considerations for Using These Thresholds.....	B-3
2 Framework for Analyzing Impacts under CEQA.....	B-4
3 Analyzing Impacts on Global Climate Change	B-6
4 Thresholds For Land Use Development Projects.....	B-7
4.1 The Supreme Court’s “Fair Share” Analysis and Consistency with California’s Long-Term Climate Goals	B-7
4.2 Using the Executive Order B-55-18 and the 2045 Carbon Neutrality Goal in the “Fair Share” Analysis.....	B-8
4.3 Determining a Land Use Project’s “Fair Share” for Getting to Carbon Neutrality by 2045	B-9
4.3.1 Building Energy Use.....	B-10
Electricity.....	B-11
Natural Gas	B-11
4.3.2 Transportation	B-13
EV Charging Infrastructure	B-14
Vehicle Miles Traveled	B-16
5 Thresholds for General Plans and Similar Long-Term Community-Wide Planning Documents	B-18
5.1 Reducing GHG Emissions to Meet GHG Reduction Targets.....	B-18
5.2 Climate Action Plans	B-19
6 References	B-21



List of Figures

Figure 1 Effectiveness of CEC-Modeled Electrification Scenarios at Achieving Carbon Neutrality
by 2045.....B-12

Figure 2 Statewide Light-Duty Vehicle Technology Penetration in the On-Road Fleet B-14

List of Tables

Table B-1 Per-Capita VMT Reductions Necessary to Attain 2050 GHG Reduction Target.....B-17



LIST OF ABBREVIATIONS

°C	degrees Celsius
AB	Assembly Bill
Air District	Bay Area Air Quality Management District
CALGreen	California Green Building Standards Code
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
DC	direct current
EIR	environmental impact report
EV	electric vehicle
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
OPR	Governor's Office of Planning and Research
RPS	Renewables Portfolio Standard
SB	Senate Bill
VAC	voltage of alternating current
VMT	vehicle miles traveled
ZEV	zero-emission vehicle

This page intentionally left blank.



1 INTRODUCTION AND EXECUTIVE SUMMARY

This report presents the Bay Area Air Quality Management District's (Air District's) recommended thresholds of significance for use in determining whether a proposed project will have a significant impact on climate change. The Air District recommends that these thresholds of significance be used by public agencies to comply with the California Environmental Quality Act (CEQA).

Evaluating climate impacts under CEQA can be challenging because global climate change is inherently a cumulative problem. Climate change is not caused by any individual emissions source but by a large number of sources around the world emitting greenhouse gases (GHGs) that collectively create a significant cumulative impact. CEQA requires agencies in California to analyze such impacts by evaluating whether a proposed project would make a "cumulatively considerable" contribution to the significant cumulative impact on climate change. (See CEQA Guidelines Sections 15064[h] and 15064.4[b].)¹ But CEQA does not provide any further definition of what constitutes a cumulatively considerable contribution in this context. These thresholds of significance are intended to assist public agencies in determining whether proposed projects they are considering would make a cumulatively considerable contribution to global climate change, as required by CEQA.

The Air District's recommended thresholds of significance are summarized below, with a detailed discussion of the basis for the thresholds presented in the remainder of this report. The information provided in this report is intended to provide the substantial evidence that lead agencies will need to support their determinations about significance using these thresholds. This information also provides the substantial evidence to support adoption of these thresholds by the Air District's Board of Directors. (See CEQA Guidelines Section 15064.7 [thresholds must be adopted by the Board of Directors through a public review process and be supported by substantial evidence].)

1.1 THRESHOLDS FOR LAND USE PROJECTS

For land use development projects, the Air District recommends using the approach endorsed by the California Supreme Court in *Center for Biological Diversity v. Department of Fish & Wildlife* (2015) (62 Cal.4th 204), which evaluates a project based on its effect on California's efforts to meet the State's long-term climate goals. As the Supreme Court held in that case, a project that would be consistent with meeting those goals can be found to have a less-than-significant impact on climate change under CEQA. If a project would contribute its "fair share" of what will be required to achieve those long-term climate goals, then a reviewing agency can find that the impact will not be significant because the project will help to solve the problem of global climate change (62 Cal.4th 220–223).

¹ The 2021 State CEQA Guidelines, including Appendices F and G, can be found at the following website: https://www.califaep.org/docs/CEQA_Handbook_2021.pdf.



Applying this approach, the Air District has analyzed what will be required of new land use development projects to achieve California’s long-term climate goal of carbon neutrality² by 2045. The Air District has found, based on this analysis, that a new land use development project being built today needs to incorporate the following design elements to do its “fair share” of implementing the goal of carbon neutrality by 2045:

Thresholds for Land Use Projects (Must Include A or B)

A. Projects must include, at a minimum, the following project design elements:

1. Buildings

- a. The project will not include natural gas appliances or natural gas plumbing (in both residential and nonresidential development).
- b. The project will not result in any wasteful, inefficient, or unnecessary energy usage as determined by the analysis required under CEQA Section 21100(b)(3) and Section 15126.2(b) of the State CEQA Guidelines.

2. Transportation

- a. Achieve a reduction in project-generated vehicle miles traveled (VMT) below the regional average consistent with the current version of the California Climate Change Scoping Plan (currently 15 percent) or meet a locally adopted Senate Bill 743 VMT target, reflecting the recommendations provided in the Governor’s Office of Planning and Research’s Technical Advisory on Evaluating Transportation Impacts in CEQA:
 - i. Residential projects: 15 percent below the existing VMT per capita
 - ii. Office projects: 15 percent below the existing VMT per employee
 - iii. Retail projects: no net increase in existing VMT
- b. Achieve compliance with off-street electric vehicle requirements in the most recently adopted version of CALGreen Tier 2.

B. Projects must be consistent with a local GHG reduction strategy that meets the criteria under State CEQA Guidelines Section 15183.5(b).

If a project is designed and built to incorporate these design elements, then it will contribute its portion of what is necessary to achieve California’s long-term climate goals—its “fair share”—and an agency reviewing the project under CEQA can conclude that the project will not make a cumulatively considerable contribution to global climate change. If the project does not incorporate these design elements, then it should be found to make a significant climate impact because it will hinder California’s efforts to address climate change. These recommended thresholds for land use projects are discussed in more detail in Section 4.

² “Carbon neutrality” is defined in Executive Order B-55-18 as the point at which the removal of carbon pollution from the atmosphere meets or exceeds carbon emissions. Carbon neutrality is achieved when carbon dioxide and other GHGs generated by sources such as transportation, power plants, and industrial processes are less than or equal to the amount of carbon dioxide that is stored, both in natural sinks and mechanical sequestration.

1.2 THRESHOLDS FOR GENERAL PLANS AND RELATED PLANNING DOCUMENTS

The Air District recommends a similar approach for cities and counties adopting general plans and related planning documents that will guide long-range development in their jurisdictions. The Air District recommends that cities and counties evaluate such plans based on whether they will be consistent with California's long-term climate goal of achieving carbon neutrality by 2045. To be consistent with this goal, these plans should reduce GHG emissions in the relevant jurisdiction to meet an interim milestone of 40 percent below the 1990 emission levels by 2030, consistent with Senate Bill (SB) 32, and to support the State's goal of carbon neutrality by 2045. Cities and counties planning to develop in a manner that is not consistent with meeting these GHG reduction targets will have a significant climate impact because they will hinder California's efforts to address climate change.

Thresholds for Plans (Must Include A or B)

- A. Meet the State's goals to reduce emissions to 40 percent below 1990 levels by 2030 and carbon neutrality by 2045; or
- B. Be consistent with a local GHG reduction strategy that meets the criteria under State CEQA Guidelines Section 15183.5(b).

The Air District also strongly recommends that cities and counties adopt climate action plans to document specific strategies and implementation measures to achieve these 2030 and 2045 goals. Robust climate action plans that meet the requirements of CEQA Guidelines Section 15183.5(b) can provide such jurisdictions with a number of benefits. If properly developed, they will provide the substantial evidence a jurisdiction needs to demonstrate that its general plan updates and related planning documents will not have a significant climate impact as outlined in the preceding paragraph. In addition, a jurisdiction can use a qualified climate action plan to evaluate individual land use projects under CEQA. This gives the local jurisdiction the flexibility to tailor requirements for land use projects in its community to the specific circumstances of that community rather than use the Air District's general thresholds for land use projects described above. In addition, a jurisdiction can adopt a climate action plan immediately, without having to wait for its next general plan update cycle.

Thresholds for general plans and related planning documents are discussed in more detail in Section 5. Guidance from the Air District on how to develop and adopt a comprehensive climate action plan that satisfies the detailed requirements of CEQA Guidelines Section 15183.5(b) is set forth in Appendix C to the Air District's Air Quality Guidelines.

1.3 Important Considerations for Using These Thresholds

The Air District has developed these thresholds of significance based on typical residential and commercial land use projects and typical long-term communitywide planning documents such as general plans and similar long-range development plans. As such, these thresholds may not be appropriate for other types of projects that do not fit into the mold of a typical residential or commercial project or general plan update. Lead agencies should keep this point in mind when evaluating other types of projects. A lead agency does

not necessarily need to use a threshold of significance if the analysis and justifications that were used to develop the threshold do not reflect the particular circumstances of the project under review. Accordingly, a lead agency should not use these thresholds if it is faced with a unique or unusual project for which the analyses supporting the thresholds as described in this report do not squarely apply. In such cases, the lead agency should develop an alternative approach that would be more appropriate for the particular project before it, considering all of the facts and circumstances of the project on a case-by-case basis.

In addition, lead agencies should keep in mind that the science of climate change – and California’s regulatory and policy responses to it – are constantly evolving. As the technical and policy considerations on which these thresholds of significance are based advance in the future, lead agencies may need to make adjustments to the thresholds as set forth herein to be consistent with the most current information. As the California Supreme Court has explained, lead agencies are required to “ensure that CEQA analysis stays in step with evolving scientific knowledge and state regulatory schemes” (*Cleveland National Forest Foundation v. SANDAG* (2017) 3 Cal.5th 497, 519). Making appropriate adjustments to these thresholds in light of future developments will ensure that lead agencies comply with this important CEQA mandate.

2 FRAMEWORK FOR ANALYZING IMPACTS UNDER CEQA

The central requirement of the CEQA environmental analysis is to determine whether implementing a project will result in any significant adverse impact on the environment, either individually or cumulatively.

This mandate requires the reviewing agency first to evaluate whether the project will have a significant impact by itself and then to consider whether the project may contribute to a significant cumulative impact in conjunction with other past, present, and reasonably foreseeable future projects that also contribute to the impact.³

In the cumulative context, the analysis has two parts. To evaluate cumulative impacts, the agency must assess (1) whether the overall cumulative impact will be significant and, (2) if the overall impact is significant, whether the incremental contribution that the individual project under review will add to the overall cumulative problem will be cumulatively considerable. As Section 15064(h)(1) of the CEQA Guidelines states:

When assessing whether a cumulative effect requires an EIR [environmental impact report], the lead agency shall consider whether the cumulative impact is significant and whether the effects of the project are cumulatively considerable. An EIR must be prepared if the cumulative impact may be significant and the project’s incremental effect, though individually limited, is cumulatively considerable.

Both parts of this test must be met for a project’s impact to be treated as significant under CEQA. If the overall cumulative impact does not rise to the level of a “significant” impact, or if the project’s incremental contribution is not cumulatively considerable, then the project’s impact is not treated as significant. (See *San Francisco Baykeeper, Inc. v. State Lands Commission* [2015] [242 Cal.App.4th 202, 222] [project not

³ A cumulative impact is the change in the environment that results from the incremental impact of the project under review in conjunction with other past, present, and reasonably foreseeable probable future projects (CEQA Guidelines Section 15355).

significant if “the cumulative impact is insignificant or if the project’s incremental contribution to the impact is not cumulatively considerable”]; see also CEQA Guidelines Sections 15130[a][3] and 15064[h].)

Cumulatively considerable means that the incremental effect of the specific project under review will be significant when viewed in the context of the overall cumulative problem (CEQA Section 21083[b][2]).

CEQA does not require that any incremental addition to a significant cumulative impact, no matter how small, must necessarily be treated as cumulatively considerable. The statute does not require a so-called “one additional molecule” standard, and some projects’ incremental contributions would be so minor that their impact does not have to be treated as significant even though the projects would add an additional amount to the significant cumulative impact (*Communities for a Better Environment v. California Resources Agency* [2002] [103 Cal.App.4th 98, 120]; see also CEQA Guidelines Section 15064[h][4].) The level at which the incremental addition becomes cumulatively considerable will depend on the nature of the particular cumulative impact being evaluated. The ultimate test is whether any additional amount should be considered significant in the context of the existing cumulative effect. (CEQA Section 21083[b][2]).)

Applying these principles, the environmental impact analysis under CEQA is a four-step process:

- ▶ **Step One: Determine the level at which an impact on the environmental resource under consideration becomes “significant.”** This is the touchstone for assessing whether the project may have a significant impact individually or may contribute to a cumulative impact that is significant. The level at which the impact becomes significant will depend on the nature of the environmental resource being evaluated.
- ▶ **Step Two: Evaluate whether the project under review would degrade the environmental resource to such an extent that there would be an impact exceeding the “significant” level determined during Step One.** If implementing the project would cause an impact to exceed that level all by itself, then the project’s impact is treated as significant under CEQA and the project requires preparation of an EIR, implementation of feasible mitigation measures to reduce the impact to a less-than-significant level, and consideration of alternatives that would avoid or lessen any significant impacts. If the project under review would not degrade the environmental resource to such an extent that there would be a significant impact, the analysis proceeds to Step Three.
- ▶ **Step Three: Determine whether the contribution of the project combined with the contributions of all other past, present, and reasonably foreseeable future projects would exceed the “significant” level determined during Step One.** If implementing the project would not cause a significant impact by itself, it still must be evaluated to determine whether it would make a cumulatively considerable contribution to a significant cumulative impact. The first element of that analysis is to assess the overall cumulative impact caused by the project in conjunction with other past, present, and reasonably foreseeable future projects affecting the same resource. If the overall cumulative impact exceeds the “significant” level determined during Step One, then the project would contribute to a significant cumulative impact, and the analysis proceeds to Step Four to determine whether that contribution is cumulatively considerable.
- ▶ **Step Four: Determine whether the project’s incremental contribution is cumulatively considerable.** The final step is to determine whether the project’s incremental contribution is cumulatively considerable in light of the overall cumulative impact. If implementing the project would make a cumulatively

considerable contribution to a significant cumulative impact, the impact is considered significant under CEQA and the agency must prepare an EIR, impose feasible mitigation measures to bring the incremental contribution below the cumulatively considerable level, and consider alternatives.

The CEQA analysis applies this four-step process to evaluating climate impacts just as it does for all other impacts.

3 ANALYZING IMPACTS ON GLOBAL CLIMATE CHANGE

CEQA requires agencies to consider a project's impacts on global climate change in the same manner that they consider impacts on other areas in the environmental review document. Climate change is unique, however, given the global nature of the problem.

Step One in the analysis requires determining the level at which climate change becomes a "significant" environmental problem. There is a general consensus that we need to limit the warming of the planet to no more than 1.5 degrees Celsius (°C) in order to maintain a sustainable global climate. Aiming to limit global warming to 1.5°C is a goal recognized by the Paris Agreement on Climate Change and in California's Executive Order B-55-18, and the Intergovernmental Panel on Climate Change (IPCC) has documented the serious adverse consequences that are expected if the climate warms by more than that amount (IPCC 2018). A 1.5°C rise in global temperatures is therefore an appropriate measure of the level at which climate change will become significant. A global temperature increase of more than that amount will constitute a significant climate impact.

Proceeding to Step Two in the analysis, it is clear that no individual project could have a significant climate impact all by itself, because no project by itself could cause the global temperature to rise by 1.5°C. Indeed, it is difficult to conceive of any project whose GHG emissions would cause global temperature to change in any detectable way. The California Supreme Court acknowledged this situation in its *Center for Biological Diversity* decision, explaining that "an individual project's emissions will most likely not have any appreciable impact on the global problem by themselves, but they will contribute to the significant cumulative impact caused by greenhouse gas emissions from other sources around the globe" (*Center for Biological Diversity v. Department of Fish & Wildlife* [2015] 62 Cal.4th 204, 219 [citation omitted]).

Moving on to the cumulative analysis, Step Three asks whether the project would contribute to a significant cumulative impact in conjunction with all other past, present, and foreseeable future projects that are contributing to the same impact. With respect to climate change, clearly the answer is yes. Climate change is a cumulative problem caused by millions or billions of individually minor sources all around the globe contributing to the global impact, and it is unquestionably a significant cumulative problem.⁴ The global climate has already

⁴ CEQA requires the cumulative analysis to consider the contributions from all projects that contribute to the impact (i.e., all projects that contribute to the degradation of the environmental resource being evaluated). (See *City of Long Beach v. Los Angeles Unified School Dist.* [2009] [176 Cal.App.4th 889, 907], *Bakersfield Citizens for Local Control v. City of Bakersfield* [2004] [124 Cal.App.4th 1184, 1219 fn. 10], and *Kings County Farm Bureau v. City of Hanford* [1990] [221 Cal.App.3d 692, 720]). In the context of global climate change, this means considering all sources of GHG emissions around the globe that contribute to the global problem. Given the large number of sources involved, the analysis needs to use the "summary of projections" method to assess the magnitude of the total cumulative impact, not the "list of projects" method. (See CEQA Guidelines Section 15130[b].)

warmed by approximately 1.0°C compared to a preindustrial baseline, and IPCC projects that continued growth in GHG emissions will cause that warming to reach 1.5 °C by 2030–2053 if nothing is done to limit it (IPCC 2018).

The analysis therefore focuses on Step Four: determining whether the project's GHG emissions would make a cumulatively considerable contribution to the significant problem of global climate change. As the Supreme Court noted in its *Center for Biological Diversity* decision, the question is "whether the project's incremental addition of greenhouse gases is 'cumulatively considerable' in light of the global problem, and thus significant" (*Center for Biological Diversity v. Department of Fish & Wildlife* [2015] 62 Cal.4th 219). This is the challenge that has faced lead agencies in undertaking the CEQA analysis: how to determine the level at which a project becomes cumulatively considerable.

4 THRESHOLDS FOR LAND USE DEVELOPMENT PROJECTS

4.1 THE SUPREME COURT'S "FAIR SHARE" ANALYSIS AND CONSISTENCY WITH CALIFORNIA'S LONG-TERM CLIMATE GOALS

The crucial question in the CEQA climate impact analysis is whether the project under review would make a cumulatively considerable contribution to the significant cumulative problem of global climate change. For land use development projects, the Air District recommends using the approach endorsed by the California Supreme Court in the *Center for Biological Diversity* decision, discussed above, which focuses on determining whether the project would be doing its "fair share" to implement California's ambitious long-term climate goals. This approach evaluates whether a project's GHG emissions are cumulatively considerable based on "their effect on the state's efforts to meet [those] goals...." (*Center for Biological Diversity v. Department of Fish & Wildlife* [2015] 62 Cal.4th 221.) If a new land use project would serve California's pressing need to provide housing, jobs, and related infrastructure in a manner that supports achieving those climate goals, then it would help to solve the climate change problem, and its GHG emissions should not be treated as cumulatively considerable. As the Supreme Court held, "consistency with meeting [those] statewide goals [is] a permissible significance criterion for project emissions" (*Center for Biological Diversity v. Department of Fish & Wildlife* [2015] 62 Cal.4th 220), and an agency's "choice to use that criterion does not violate CEQA" (*Center for Biological Diversity v. Department of Fish & Wildlife* [2015] 62 Cal.4th 223).

This approach is based on the principle inherent in CEQA that an individual project would make a less-than-cumulatively-considerable contribution if it would do its part to address the cumulative problem. As the Supreme Court explained, "if a plan is in place to address a cumulative problem, a new project's incremental addition to the problem will not be 'cumulatively considerable' if it is consistent with the plan and is doing its fair share to achieve the plan's goals" (*Center for Biological Diversity v. Department of Fish & Wildlife* [2015] 62 Cal.4th 223). No individual project needs to solve the entire cumulative problem by itself. Indeed, no individual project could, given that the problem is the result of such a large number of diverse emission sources. But each individual project does need to do what is required of it to ensure that the overall solution is implemented, and if it does that, then its impact on climate change can be treated as less than cumulatively considerable. As the Supreme Court put it in the climate context, "[t]o the extent a project incorporates efficiency and conservation measures sufficient to contribute its portion of the overall greenhouse gas

reductions necessary [to achieve the State’s climate goals], one can reasonably argue that the project’s impact is not cumulatively considerable, because it is helping to solve the cumulative problem...” (*Center for Biological Diversity v. Department of Fish & Wildlife* [2015] 62 Cal.4th 220 [internal quotation marks omitted]).

4.2 USING THE EXECUTIVE ORDER B-55-18 AND THE 2045 CARBON NEUTRALITY GOAL IN THE “FAIR SHARE” ANALYSIS

The *Center for Biological Diversity* case was decided in 2015, and it specifically addressed only the Assembly Bill (AB) 32 goal of attaining 1990 emission levels by 2020 statewide, not the longer-term goal for 2045. However, we are now past the 2020 milestone. At this point, the focus has shifted to the longer-term goals and ultimately to carbon neutrality by 2045. Moreover, the Supreme Court has recognized the necessity and appropriateness of using these longer-term goals as the touchstone for the CEQA analysis. As it held in *Cleveland National Forest Foundation v. SANDAG*, these longer-term goals express “what scientific research has determined to be the level of emissions reductions necessary to stabilize the climate by midcentury and thereby avoid catastrophic effects of climate change” (*Cleveland National Forest Foundation v. SANDAG* [2017] 3 Cal.5th 497, 513). They represent “the scientifically-supported level of emissions reduction needed to avoid significant disruption of the climate and [are] used as the long-term driver for state climate change policy development” (*Cleveland National Forest Foundation v. SANDAG* [2017] 3 Cal.5th 497, 513 (citation omitted)⁵).

The consistency analysis approved by the Supreme Court in *Center for Biological Diversity* can be applied to these longer-term goals in the same way it was applied to the AB 32 2020 goal. If a project would be consistent with meeting these long-term State climate goals, then its climate impact can be seen as less than cumulatively considerable “because it is helping to solve the cumulative problem of greenhouse gas emissions as envisioned by California law” (*Center for Biological Diversity v. Department of Fish & Wildlife* [2015] 62 Cal.4th 220 (citation omitted)).

Moreover, although the 2045 goal is set forth in an executive order and not in a statute, as with the 2020 AB 32 goal that the Supreme Court addressed in *Center for Biological Diversity*, the Executive Order B-55-18 goal is appropriate to use for developing a threshold of significance given the science supporting it. The Supreme Court explicitly rejected the argument that an executive order cannot be used for this purpose because it has not been adopted by statute in the *SANDAG* case. It explained that the executive order at issue there “expresses the pace and magnitude of reduction efforts that the scientific community believes is necessary to stabilize the climate. This scientific information has important value to policymakers and citizens in considering the emission impacts of a project...” (*Cleveland National Forest Foundation v. SANDAG* [2017] 3 Cal.5th 515). Agencies are required to design their CEQA analyses “based to the extent possible on scientific and factual data,” and if an executive order best embodies the current state of the scientific and factual data, an agency may use it as the basis for its CEQA analysis (*Ibid.* (quoting CEQA Guidelines Section 15064[b])).

⁵ These statements were referring to the older Executive Order S-3-05, which included an 80-percent reduction target by 2050, but they apply with equal force to the more recent Executive Order B-55-18.



4.3 DETERMINING A LAND USE PROJECT'S "FAIR SHARE" FOR GETTING TO CARBON NEUTRALITY BY 2045

The "fair share" analysis looks at how a new land use development project needs to be designed and built to ensure that it will be consistent with the goal of carbon neutrality by 2045. This is California's current articulation of what will be required to achieve long-term climate stabilization at a sustainable level, as articulated in Executive Order B-55-18. If a land use project incorporates all of the design elements necessary for it to be carbon neutral by 2045, then it will contribute its portion of what is needed to achieve the State's climate goals and will help to solve the cumulative problem. It can therefore be found to make a less-than-cumulatively-considerable climate impact.

A land use project's "fair share" will not necessarily include everything that will need to happen in order to achieve carbon neutrality by 2045. There will likely be certain aspects of achieving carbon neutrality that are beyond the scope of how a land use project is designed and thus cannot reasonably be allocated to its "fair share." For example, becoming carbon neutral by 2045 will require California's electrical power generators to shift to 100-percent carbon-free energy resources, which is not something that can be controlled through the design of new land use projects. But for those aspects that can be controlled or influenced by how such projects are designed, projects need to address those aspects in order to contribute their "fair share" of what is needed to attain carbon neutrality. If a project is not designed and built to ensure that it can be carbon neutral by 2045, then it will impede California's ability to achieve its long-term climate goals and should be treated as making a cumulatively considerable contribution to global climate change.

To determine the "fair share," the analysis should therefore focus on the design elements that need to be incorporated into the project in order to lay the foundation for achieving carbon neutrality by 2045. As GHG emissions from the land use sector come primarily from building energy use and from transportation, these are the areas that need to be evaluated to ensure that the project can and will be carbon neutral. With respect to building energy use, this can be achieved by replacing natural gas with electric power and by eliminating inefficient or wasteful energy usage. This will support California's transition away from fossil fuel-based energy sources and will bring the project's GHG emissions associated with building energy use down to zero as our electric supply becomes 100 percent carbon free. With respect to transportation, projects need to be designed to reduce project-generated VMT and to provide sufficient electric vehicle (EV) charging infrastructure to support the shift to EVs. As explained below, the Air District recommends using a threshold of a 15-percent reduction in project-generated VMT per capita compared with existing levels (or other, more current percentage to the extent further analysis shows that a different level of reduction is needed) and providing EV charging infrastructure as specified in the California Green Building Standards Code (CALGreen) Tier 2 standards. If a land use project being designed and built today incorporates the design elements necessary for the project to be carbon neutral by 2045, then it will contribute its "fair share" to achieving the State's climate goals. A lead agency can therefore conclude that it will make a less-than-cumulatively-considerable climate impact.

There is no proposed construction-related climate impact threshold at this time. Greenhouse gas emissions from construction represent a very small portion of a project's lifetime GHG emissions. The

proposed thresholds for land use projects are designed to address operational GHG emissions which represent the vast majority of project GHG emissions.

The following sections provide a more detailed discussion of the framework for evaluating the design elements necessary for a project to be consistent with California’s long-term climate goals. The Air District recommends that lead agencies use the design elements as the threshold of significance for land use projects under the Supreme Court’s “fair share” approach discussed above.

Thresholds for Land Use Projects (Must Include A or B)	
A. Projects must include, at a minimum, the following project design elements: 1. Buildings a. The project will not include natural gas appliances or natural gas plumbing (in both residential and nonresidential development). b. The project will not result in any wasteful, inefficient, or unnecessary energy usage as determined by the analysis required under CEQA Section 21100(b)(3) and Section 15126.2(b) of the State CEQA Guidelines. 2. Transportation a. Achieve a reduction in project-generated vehicle miles traveled (VMT) below the regional average consistent with the current version of the California Climate Change Scoping Plan (currently 15 percent) or meet a locally adopted Senate Bill 743 VMT target, reflecting the recommendations provided in the Governor’s Office of Planning and Research’s Technical Advisory on Evaluating Transportation Impacts in CEQA: i. Residential projects: 15 percent below the existing VMT per capita ii. Office projects: 15 percent below the existing VMT per employee iii. Retail projects: no net increase in existing VMT b. Achieve compliance with off-street electric vehicle requirements in the most recently adopted version of CALGreen Tier 2. <tr><td> B. Be consistent with a local GHG reduction strategy that meets the criteria under State CEQA Guidelines Section 15183.5(b). </td></tr>	B. Be consistent with a local GHG reduction strategy that meets the criteria under State CEQA Guidelines Section 15183.5(b).
B. Be consistent with a local GHG reduction strategy that meets the criteria under State CEQA Guidelines Section 15183.5(b).	

4.3.1 Building Energy Use

Energy used in residential and nonresidential buildings in California comes primarily from natural gas and electricity, the generation and consumption of which can result in GHG emissions. Natural gas usage emits GHGs directly when it is burned for space heating, cooking, hot water heating and similar uses, whereas electricity usage emits GHGs indirectly to the extent that it is generated by burning carbon-based fuels. For the building sector to achieve carbon neutrality, natural gas usage will need to be phased out and replaced with electricity usage, and electrical generation will need to shift to 100-percent carbon-free sources. To support these shifts, new projects need to be built without natural gas and with no inefficient or wasteful energy usage.

ELECTRICITY

Eliminating GHG emissions associated with building electricity usage will be achieved by decarbonizing California's electrical generation infrastructure. California has committed to achieving this goal by 2045 through SB 100, the 100 Percent Clean Energy Act of 2018. SB 100 strengthened the State's Renewables Portfolio Standard (RPS) by requiring that 60 percent of all electricity provided to retail users in California come from renewable sources by 2030 and that 100 percent come from carbon-free sources by 2045.

The land use sector will benefit from RPS because the electricity used in buildings will be increasingly carbon-free, but implementation does not depend (directly at least) on how buildings are designed and built. RPS will be implemented by the generators that produce and sell the electricity, not by the end users of that electricity. Implementing SB 100 is therefore not part of the "fair share" that falls to land use development projects to ensure that California reaches its 2045 carbon neutrality target.

Nevertheless, land use projects do have an important role to play on the demand side to ensure that SB 100 can feasibly be implemented. Inefficient electricity usage will hinder the shift to renewable power generation by requiring additional carbon-free generating resources to be developed, increasing the cost of shifting to renewables and other carbon-free energy sources, and delaying full implementation longer than necessary. Thus, to the extent that new land use projects have a role to play in ensuring that SB 100 is successfully implemented, that role is to maximize the efficiency with which they use electricity and to eliminate any wasteful or unnecessary usage. If a new land use project maximizes efficiency and eliminates wasteful and unnecessary usage, then it will implement its "fair share" in this area, consistent with achieving the State's long-term climate goals. Conversely, if a project is not designed to use electricity in an efficient manner, then it will hinder the successful implementation of SB 100 and the State's long-term climate goals.

CEQA requires lead agencies to evaluate a project's potential for wasteful, inefficient, or unnecessary energy usage under CEQA Section 21100(b)(3) and Section 15126.2(b) of the State CEQA Guidelines, along with State CEQA Guidelines Appendix F and Appendix G, Section VI. The Air District recommends using the results of this analysis to determine whether the project will implement its "fair share" with respect to supporting the implementation of SB 100. If the energy analysis required under CEQA Section 21100(b)(3) shows that a project will not result in any wasteful, inefficient, or unnecessary electrical usage, then it will be consistent with implementing SB 100 and will not make a cumulatively considerable climate impact with respect to building electrical usage. If the project is found to involve wasteful, inefficient, or unnecessary electrical usage, then the lead agency should conclude that it will make a cumulatively considerable impact and treat it as significant in this regard.

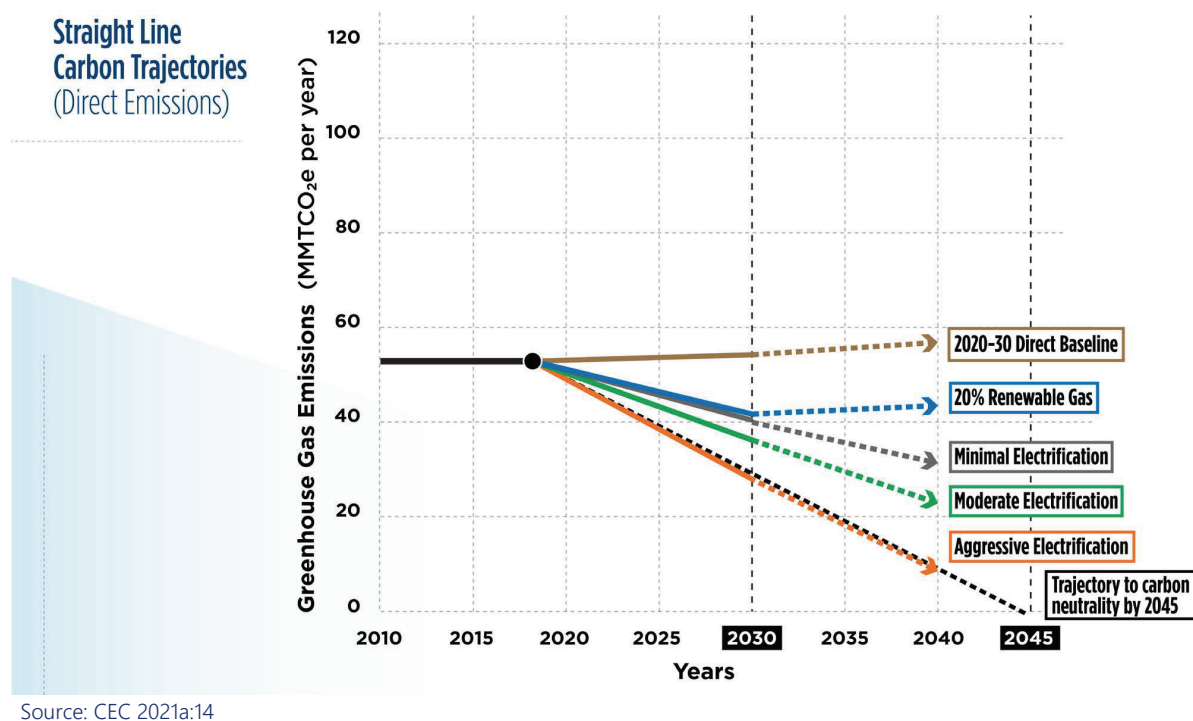
NATURAL GAS

Regarding natural gas usage, new land use development projects must be built without any natural gas infrastructure in order to be consistent with achieving the 2045 carbon neutrality goal. There is no practical way to eliminate the GHG emissions that are generated by burning natural gas, so the land use sector will need to fully eliminate natural gas usage in buildings in order to achieve the goal of carbon neutrality. Given the difficulty of retrofitting existing buildings to replace the use of natural gas with the use of electricity, California needs to stop building natural gas infrastructure in new buildings if it is going to be able to achieve full

electrification by the 2045 target date. Retrofitting an existing building to replace natural gas infrastructure with electrical service is far more difficult and expensive than simply building a new all-electric building (CEC 2021a; E3 2019). For California to successfully eliminate natural gas usage by 2045, it will need to focus available resources on retrofitting existing natural gas infrastructure. This task will become virtually impossible if we continue to build more natural gas infrastructure that will also need to be retrofit within the next few years.

This need to eliminate natural gas in new projects in order to achieve carbon neutrality in buildings by 2045 is demonstrated by analyses conducted by the California Energy Commission (CEC) in its California Building Decarbonization Assessment (CEC 2021a). CEC published the California Building Decarbonization Assessment primarily in response to the requirements of AB 3232, which required CEC to evaluate how the State can reduce GHG emissions from its residential and commercial building stock by at least 40 percent below 1990 levels by 2030. But CEC went beyond just analyzing that 2030 goal and evaluated what will be necessary to achieve the longer-term goal of carbon neutrality by 2045. The analysis considered a number of different scenarios and projected the total GHG emissions from residential and commercial buildings under each of them. The results of CEC's analysis are shown graphically in Figure 1.

Figure 1 Effectiveness of CEC-Modeled Electrification Scenarios at Achieving Carbon Neutrality by 2045



The CEC's analysis shows that only the most aggressive electrification scenario will put the building sector on track to reach carbon neutrality by 2045. Anything that hinders such aggressive efforts will jeopardize California's chances of achieving full building decarbonization by 2045 and impair the state's ability to reach its long-term climate goals. Installing natural gas infrastructure in new buildings will do so because it will add even more infrastructure that will need to be retrofit with electricity between now and 2045. New projects therefore need to eliminate natural gas in order to implement their "fair share" of achieving the long-term 2045 carbon neutrality goal. If a project does not use natural gas in its buildings, then a lead agency can conclude that it is consistent with achieving the 2045 carbon neutrality goal and will not have a cumulatively considerable impact on climate change. If a project does use natural gas, then it will hinder California's ability to decarbonize its building sector. In that case, the lead agency should conclude that it will make a cumulatively considerable impact and treat it as significant.

4.3.2 Transportation

The second principal source of GHG emissions associated with land use comes from transportation. Decarbonization of the transportation infrastructure serving land use development will come from shifting the motor vehicle fleet to EVs, coupled with a shift to carbon-free electricity to power those vehicles. Land use projects cannot directly control whether and how fast these shifts are implemented, but they can and do have an important indirect influence on California's transition to a zero-carbon transportation system.

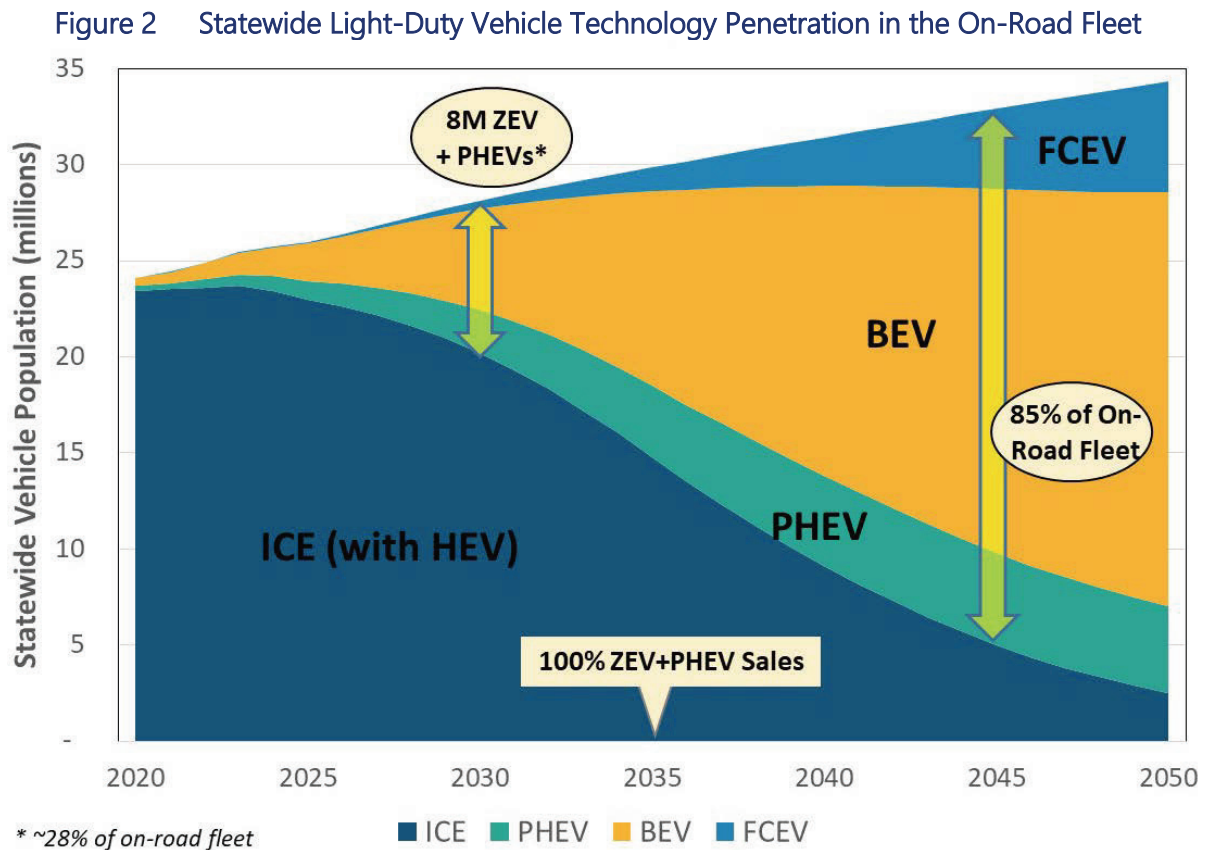
New land use development can influence transportation-related emissions in two areas related to how it is designed and built. First, new land use projects need to provide sufficient EV charging infrastructure to serve the needs of project users who will be driving EVs. If project users cannot find the charging infrastructure they need to charge their vehicles at the residential, commercial, and other buildings they frequent, they will be discouraged from switching to an EV. But if those buildings provide sufficient charging infrastructure to make driving an EV easy and efficient, then users will find it easy to choose to drive an EV, and the rate of EV penetration will be accelerated. It is therefore very important for land use projects to provide the EV charging infrastructure needed to support growing EV usage.

Second, new land use projects can influence transportation-related GHG emissions by reducing the amount of VMT associated with the project. Motor vehicle transportation does not need to be eliminated entirely in order for the land use sector to achieve carbon neutrality, as carbon-free vehicle technology can be used (e.g., EVs powered by carbon-free electricity sources). But for that goal to be realistically implemented by 2045, California will need to reduce its per-capita VMT. How land use development is designed and sited can have a significant influence on how much VMT the project will generate. New land use projects need to provide alternatives to motor vehicle-based transportation such that VMT per capita can be reduced to levels consistent with achieving carbon neutrality by 2045.

The design elements that new land use projects need to incorporate to address these two areas are outlined below.

EV CHARGING INFRASTRUCTURE

To implement the decarbonization of California’s motor vehicle transportation, the California Air Resources Board (CARB) has adopted a comprehensive Mobile Source Strategy incorporating a suite of policies to promote the shift away from fossil fuel-powered vehicles (CARB 2021b). These policies include aggressive targets for EV penetration, including Executive Order B-16-12’s goal of 1.5 million zero-emission vehicles (ZEVs) on the road by 2025 and Executive Order N-79-20’s call for all new light-duty vehicles sold in California to be battery electric or plug-in hybrid by 2035. CARB’s modeling projects that these efforts will result in as many as 8 million light-duty EVs in the statewide fleet by 2030 and that 85 percent of the on-road fleet will be EVs by 2045 (CARB 2021b:94–95). The results of CARB’s modeling for its 2020 Mobile Source Strategy scenario are shown in Figure 2, below.



Source: CARB 2021b

Notes: BEV = battery electric vehicle; FCEV = fuel cell electric vehicle; HEV = hybrid electric vehicle; ICE = internal combustion engine vehicle; PHEV = plug-in electric vehicle; ZEV = zero emission vehicle.

Implementing this widespread shift to EVs will require the installation of extensive EV charging infrastructure, and new development will need to provide its “fair share” of that infrastructure. Indeed, new development has an especially important role to play, as installing EV charging infrastructure in new buildings is far less expensive than retrofitting existing buildings. CARB has found that installing EV charging infrastructure in a new building can save an estimated \$7,000–\$8,000 per parking space compared with retrofitting it later (CARB 2019a:19).

The requirements for EV charging infrastructure in new land use development projects are governed by the CALGreen regulatory standards. These standards are set forth in Title 24 of the California Code of Regulations, and they are regularly updated on a 3-year cycle. The CALGreen standards consist of a set of mandatory standards that are legally required for new development, as well as two more aggressive sets of voluntary standards known as Tier 1 and Tier 2. Although the Tier 1 and Tier 2 standards are voluntary, they often form the basis of future mandatory standards adopted in subsequent updates.

The CalGreen standards have recently been updated (2022 version) and will be in effect from January 1, 2023, through December 31, 2025. The 2022 CALGreen standards seek to deploy additional EV chargers in various building types, including multifamily residential and nonresidential land uses. They include requirements for both EV capable parking spaces and the installation of Level 2 EV supply equipment for multifamily residential and nonresidential buildings. The 2022 CALGreen standards go beyond previous iterations and include requirements for both EV readiness and the actual installation of EV chargers. As with previous iterations, the 2022 CALGreen standards include both mandatory requirements and more aggressive voluntary Tier 1 and Tier 2 provisions.

The 2022 CALGreen mandatory standards were adopted based on what will be required to serve anticipated EV charging demand through the year 2025. CARB evaluated what will be required to serve demand through 2025 as part of its role in ensuring that the CALGreen standards support California's long-range climate goals pursuant to AB 341 (Health and Safety Code Section 18930.5[b]). CARB suggested a number of necessary revisions for the 2022 iteration of the standards, including an increase in the percent of parking spaces in certain types of projects that must be EV-capable from the earlier 6 percent to the current 10 percent. These revisions were based on CARB's assessment of the level of EV infrastructure that will be required to support the Executive Order B-16-12 target of 1.5 million ZEVs on the road by 2025. CARB conducted this analysis in 2019 using the Electric Vehicle Infrastructure Projection model (EVI-Pro) developed by the National Renewable Energy Laboratory and the California Energy Commission. Using EVI-Pro, CARB projected the amount of EV charging infrastructure required by 2025 and then calculated the amount of infrastructure expected by 2025 under existing mandatory codes and standards. The results of this analysis showed a gap between what would be achieved under existing codes and standards and what will be needed as of 2025 (CARB 2019a). The revised 2022 CALGreen mandatory standards adopted for the current 2023–2025 cycle are intended to close this gap and ensure that the charging infrastructure needs of 2025 will be met.

However, providing EV charging infrastructure to meet expected demand as of 2025 will not be sufficient to support the much more extensive level of EV penetration anticipated farther into the future. As shown in Figure 2, the number of EVs on the road is projected to grow exponentially, and the demand for EV charging infrastructure will increase accordingly. If a project provides only enough infrastructure to satisfy 2025 demand, it will fall well short of what project users will need as the State progresses toward 2045. The Air District therefore recommends using the more aggressive Tier 2 CALGreen standards to evaluate whether new land use development projects will provide their "fair share" of EV charging infrastructure. This approach is also consistent with CARB's assessment that the Tier 2 standards will need to be made mandatory in CALGreen to support the exponential increase in EV adoption rates as we move past 2025 (CARB 2019a:16).

Looking toward a post-2025 horizon is also appropriate because land use development projects have a long lifetime and will be in use in future years when extensive EV penetration is projected. To be consistent with implementing California's 2045 climate goals, such projects cannot simply provide a level of infrastructure aimed at 2025 levels of EV use, as is reflected in the current CALGreen mandatory standards. A new land use development project will need to implement the more aggressive Tier 2 CALGreen standard for its impact to be less than significant in this area.

VEHICLE MILES TRAVELED

With respect to VMT, CARB studies have shown that California will not be able to achieve its long-term climate goals if we continue our current high level of VMT per capita. The State will need to significantly reduce its VMT per capita in order to attain the goal of carbon neutrality by 2045 (CARB 2021b:105–126). New land use projects have an important role to play in doing so, as the way a project is sited and designed can significantly affect how the people who use the project will get around. For example, project siting and design can affect whether project users will be forced into making long car trips on a regular basis or whether they will be able to take advantage of alternative transportation options for their daily travel needs. New land use projects will need to be built with reduced levels of VMT per capita in order to implement their "fair share" of what it will take to eliminate GHG emissions from the transportation sector.

CARB has developed an analytical methodology for determining the level of VMT reduction that will be necessary to achieve California's long-term GHG emissions goals. This methodology calculates the total statewide VMT that California can accommodate and still hit its emissions targets and then divides that total statewide VMT by the State's projected population as of the target year. This calculation gives the amount of VMT per capita that the State can accommodate consistent with achieving the target. CARB's methodology then compares this targeted VMT-per-capita number with current VMT per capita to establish the reduction from current baseline levels necessary in order to hit the target.

CARB developed this methodology in conjunction with the VMT-per-capita threshold that the Governor's Office of Planning and Research (OPR) adopted for evaluating transportation impacts pursuant to SB 743 (see CEQA Guidelines Section 15064.3). SB 743 required lead agencies to abandon the old "level of service" metric for evaluating a project's transportation impacts, which was based solely on the amount of delay experienced by motor vehicles. This metric was criticized for prioritizing motor vehicle transportation and disincentivizing alternative modes, such as public transit, walking, and biking. SB 743 tasked OPR with developing an alternative metric to assess transportation impacts, and it directed OPR to base its alternative metric on factors such as reducing GHG emissions and developing multimodal transportation networks (CEQA Section 21099[b][1]). OPR concluded that the VMT-per-capita metric was the most appropriate for this purpose, and it published new Guidelines Section 15064.3 in November 2017.

CARB applied its methodology in support of OPR's VMT-per-capita metric to determine the appropriate level of VMT reduction that would allow the State to attain its long-term emissions goals, looking initially to the 2050 long-term target of an 80-percent reduction in GHG emissions compared to 1990 levels (CARB 2019b). CARB found that total statewide VMT would need to be limited to 1,035 million miles driven per day in order to achieve that target, consisting of 908 million light-duty-vehicle miles and 127 million heavy-duty-vehicle miles.

With the State’s population projected to grow to 49 million people by 2050, this works out to a per-capita VMT of 18.51 miles per day for light-duty vehicles and 21.09 miles per day for all vehicle types combined.⁶ Given current baseline per-capita VMT levels of 22.24 miles per day for light-duty vehicles and 24.61 miles per day for all vehicle types, the reductions needed to achieve the 2050 goal are 16.8 percent for light-duty vehicles and 14.3 percent for all vehicle types combined. CARB’s calculations are summarized in Table B-1.

Table B-1 Per-Capita VMT Reductions Necessary to Attain 2050 GHG Reduction Target

	Light-Duty Vehicles	All Vehicle Types
Baseline VMT/capita	22.24 miles per day	24.61 miles per day
2050 VMT/capita	18.5 miles per day	21.09 miles per day
Reduction needed	16.8%	14.3%

Based on this analysis (as well as other factors), OPR recommended using a 15-percent reduction in per-capita VMT as an appropriate threshold of significance for evaluating transportation impacts, as this level of VMT addresses transportation and corresponds to what would be needed to attain the State’s 2050 climate target (OPR 2018).⁷

CARB is currently updating this analysis for the 2045 carbon neutrality target in connection with its 2022 Scoping Plan Update. Although that work is ongoing and CARB has not finalized its revised analysis, CARB has suggested that it will use the same 15-percent-per-capita VMT reduction threshold that it derived in connection with the 2050 target. Specifically, in October 2021, CARB updated its Mobile Source Strategy, an important constituent of the Scoping Plan, using the same 15-percent reduction target as used in previous plans (CARB 2021b:105). The Air District therefore recommends that lead agencies use OPR’s 15-percent per-capita VMT reduction threshold for evaluating land use projects (OPR 2018). Alternatively, to the extent CARB determines that a different threshold would be more appropriate for purposes of the 2045 carbon neutrality target in connection with its work on the 2022 Scoping Plan Update, lead agencies should use that 2045-specific threshold instead. If a land use project is designed and built so that its associated VMT per capita is reduced to the extent determined to be necessary by CARB, then it will implement its “fair share” of the VMT reductions needed to attain the State’s long-term climate goals and can be found to have a less-than-significant climate impact.

Finally, it is worth noting that some local jurisdictions may have developed their own VMT-per-capita thresholds for use in CEQA transportation analyses pursuant to SB 743. If such a jurisdiction-specific VMT-per-capita threshold is available and applicable, the Air District recommends that lead agencies use it in their climate impact analyses, provided that it was established based on what it will take to achieve California’s long-term climate goals in a manner akin to the analysis outlined above. If an SB 743 transportation threshold is not established at a level commensurate with achieving those climate goals, then it would not be appropriate to use it to evaluate climate impacts. But if it is based on the level of VMT necessary for the local jurisdiction to attain climate neutrality by 2045, then a lead agency can use it to

⁶ Statewide population projections are provided by the California Department of Finance, and VMT projections are provided by CARB’s scenario planning tool, Vision (CARB 2019b:5).

⁷ The 15-percent reduction is compared to existing VMT per capita measured as either regional VMT per capita or city VMT per capita (OPR 2018:15).

evaluate whether a project is doing its “fair share” with respect to ensuring that VMT is reduced sufficient to achieve the State’s climate goals.

OPR has provided guidance to local jurisdictions on choosing appropriate local VMT reduction thresholds in its Technical Advisory on Evaluating Transportation Impacts in CEQA (OPR 2018). The advisory contains technical recommendations regarding assessment of VMT, thresholds of significance, and mitigation measures. It specifies recommended thresholds of significance for residential, office, and retail projects, which are reflected in the “Thresholds for Land Use Projects” section on page B-10 of this document. These types of projects reflect the vast majority of land use projects implemented in the Bay Area. For other types of projects, lead agencies should follow the guidance provided in the OPR advisory. OPR may update or supplement this advisory in the future in response to new information and advancements in modeling and methods, so lead agencies should continue to track the development of the advisory and always use the most recent version.

5 THRESHOLDS FOR GENERAL PLANS AND SIMILAR LONG-TERM COMMUNITY-WIDE PLANNING DOCUMENTS

Local governments are essential partners in achieving California’s goal to reduce GHG emissions. Local governments not only approve specific land use development projects but have primary authority to plan for and zone how and where land is developed within their jurisdiction to accommodate population growth and the changing needs of their communities. CEQA also applies to these planning decisions, and local governments are required to evaluate the climate impacts when adopting such plans.

Thresholds for Plans (Must Include A or B)

- A. Meet the State’s goals to reduce emissions to 40 percent below 1990 levels by 2030 and carbon neutrality by 2045; or
- B. Be consistent with a local GHG reduction strategy that meets the criteria under State CEQA Guidelines Section 15183.5(b).

5.1 REDUCING GHG EMISSIONS TO MEET GHG REDUCTION TARGETS

For long-term communitywide planning documents (e.g., general plans, long-range development plans, climate action plans) to have a less-than-significant climate impact, they must demonstrate that GHG emissions from the jurisdiction will decline consistent with California’s GHG reduction targets of 40 percent below 1990 levels by 2030 and carbon neutrality by 2045. A city or county that plans to develop in a manner that will cause emissions to exceed these targets will hinder the State’s ability to achieve its climate goals and thus will have a significant climate impact. Conversely, a city or county that will develop in a way that will meet those targets will support the State’s ability to achieve its climate goals and thus will have a less-than-significant impact on GHG emissions. Therefore, a communitywide long-term plan must demonstrate that the community will have GHG emissions 40 percent below its 1990 levels by 2030 and support the State’s goal of carbon neutrality by 2045.

5.2 CLIMATE ACTION PLANS

The Air District encourages local jurisdictions to develop climate action plans as a means of demonstrating that their communities—including existing and new buildings and infrastructure—will develop in accordance with meeting the statewide GHG reduction targets. A robust climate action plan identifies a land use design, a transportation network, goals, policies, and implementation measures that will achieve the required GHG emissions targets of 40 percent below 1990 levels by 2030 and support the State’s goal of achieving carbon neutrality by 2045. If a jurisdiction adopts such a climate action plan, it can then use that plan when it adopts its general plan updates and similar long-range planning documents to provide the basis for demonstrating that the jurisdiction’s GHG emissions will decline consistent with the State’s 2030 and 2045 targets. This demonstration will allow the jurisdiction to make the required CEQA determination that its general plan and similar planning documents will not have a significant climate impact, as discussed in Section 5.1, above.

Furthermore, a robust climate action plan developed and adopted in accordance with the requirements for a “plan for the reduction of greenhouse gas emissions” set forth in CEQA Guidelines Section 15183.5 will provide additional benefits related to approving specific development projects. Guidelines Section 15183.5(b)(2) provides that if a jurisdiction has adopted a climate action plan that satisfies all of the Section 15183.5 requirements, the jurisdiction can find that a project that is consistent with the plan will not make a cumulatively considerable contribution to global climate change under CEQA. Adopting a climate action plan with requirements and implementation measures governing specific types of projects—and what those projects must do to ensure that the jurisdiction’s GHG emissions achieve the required targets—can provide a great deal of certainty for project applicants and agency decision makers. A proposed project that complies with all the specified requirements and implementation measures will not be found to be significant under Guidelines Section 15183.5(b)(2). Local jurisdictions also will be able to tailor the applicable requirements and mitigation measures to their specific communities rather than rely on the Air District’s general thresholds for evaluating land use projects, discussed in Section 4, above.

CEQA Guidelines Section 15183.5(b)(1) lays out the specific criteria to be included in local GHG reduction strategies that can enable CEQA streamlining benefits for future land use projects. Such plans must:

- ▶ quantify GHG emissions, both existing and projected over a specified period, resulting from activities in a defined geographic area;
- ▶ establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable;
- ▶ identify and analyze the GHG emissions resulting from specific actions or categories of actions anticipated in the geographic area;
- ▶ specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;

- ▶ establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels; and
- ▶ be adopted in a public process following environmental review.

These requirements are somewhat vague in some cases, and the Air District cautions jurisdictions developing climate action plans to take care that their plans are comprehensive and fully satisfy the letter and the spirit of the Section 15183.5 process. Climate action plans that do not satisfy all of these required elements will not be eligible for use in approving later projects under Guidelines Section 15183.5(b)(2), and they will not provide the substantial evidence necessary to demonstrate that the jurisdiction's general plan updates and related long-range planning documents will have a less-than-significant impact as outlined in Section 5.1.

The Air District has published guidance on how a jurisdiction can develop a climate action plan that satisfies the requirements of Guidelines Section 15183.5(b)(1), which is included as Appendix C to the CEQA Air Quality Guidelines document. Jurisdictions developing climate action plans should refer to and follow that guidance to strengthen their plan's ability to comply with all Section 15183.5(b)(1) requirements and allow it to be used to evaluate climate impacts under Section 15183.5(b)(2).

The Air District strongly encourages jurisdictions to adopt local GHG reduction strategies—either as a stand-alone climate action or sustainability plans or as a part of the general plan—that meet the Section 15183.5(b)(1) criteria. Adopting a robust GHG reduction strategy that satisfies these requirements can bring many benefits to the community:

- ▶ It will identify measures that the city or county will need to take to ensure that its GHG emissions will be consistent with the statewide climate protection targets, that the jurisdiction can then use to make the consistency determination for its general plan updates.
- ▶ The city or county will be able to use the Section 15183.5(b)(1)–compliant GHG reduction strategy to approve specific land use development projects that are consistent with the strategy. This will provide a method for analyzing projects under CEQA that is tailored to the specific needs and policy goals of the individual jurisdiction, and it will allow the city or county to use that tailored methodology instead of the more general thresholds approach developed by the Air District for use regionwide.
- ▶ Cities and counties can develop Section 15183.5(b)(1) GHG reduction strategies immediately, without waiting for their next general plan update cycle.

This approach to local climate planning, tied to the SB 32 and carbon neutrality goals, promotes reductions on a plan level without impeding the implementation of GHG-efficient development, and recognizes the initiative of many Bay Area communities that have already developed or are developing a GHG reduction plan. A qualified climate action plan will provide the evidentiary basis for making CEQA findings that development consistent with the plan will result in feasible, measurable, and verifiable GHG reductions consistent with broad State goals such that projects approved under the plan will achieve their "fair share" of GHG emission reductions.

6 REFERENCES

BAAQMD. See Bay Area Air Quality Management District.

Bay Area Air Quality Management District. 2021 (March). *Bay Area Electric Vehicle Acceleration Plan*. Available: https://www.baaqmd.gov/~media/files/strategic-incentives/ev-acceleration/ev-acceleration-plan_3_2021-pdf.pdf?la=en. Accessed January 3, 2022.

BSC. See California Building Standards Commission.

California Air Resources Board. 2019a (November 15). EV Charging Infrastructure: Nonresidential Building Standards 2019/2020 Intervening Code Cycle: CARB Staff Technical and Cost Analysis.

———. 2019b (January). *2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals*.

———. 2021a. Proposed PATHWAYS Scenario Modeling Assumptions. Presented at 2022 Scoping Plan Update – Scenario Inputs Technical Workshop, September 30, 2021. Available: https://ww2.arb.ca.gov/sites/default/files/2021-09/Draft_2022SP_ScenarioAssumptions_30Sept.pdf. Accessed December 3, 2021.

———. 2021b (October 28). *2020 Mobile Source Strategy*. Available: https://ww2.arb.ca.gov/sites/default/files/2021-12/2020_Mobile_Source_Strategy.pdf. Accessed January 3, 2022.

———. 2021c (April 1). Attachment A: CARB Submission for EV Charging Infrastructure Provisions for Nonresidential Buildings in the California Green Building Standards (CALGreen) Code.

California Building Standards Commission. 2020. 2022 CALGreen Workshop Agenda Item 3A & 3B. Workshop held on December 9, 2020.

California Department of Housing and Community Development. 2021 (March). 45-Day Initial Statement of Reasons for Proposed Building Standards of the California Department of Housing and Community Development Regarding the 2022 California Green Building Standards Code California Code of Regulations, Title 24, Part 11.

California Energy Commission. 2021a (August). *Final Commission Report: California Building Decarbonization Assessment*. Publication Number CEC-400-2021-006-CMF.

———. 2021b. California Energy Commission Zero Emission Vehicle and Charger Statistics. Data last updated October 1, 2021. Available: <http://www.energy.ca.gov/zevstats>. Accessed December 30, 2021.

———. 2021c (July). Assembly Bill 2127 Electric Vehicle Charging Infrastructure Assessment: Analyzing Charging Needs to Support Zero-Emission Vehicles in 2030 – Commission Report. Publication Number CEC-600-2021-001-CMR.

CARB. See California Air Resources Board.

CEC. See California Energy Commission.

E3. See Energy and Environmental Economics.

Energy and Environmental Economics. 2019 (April). Residential Building Electrification in California. Available: www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf.

Governor's Office of Planning and Research. 2018 (December). *Technical Advisory on Evaluating Transportation Impacts in CEQA*.

HCD. See California Department of Housing and Community Development.

Intergovernmental Panel on Climate Change. 2018. *Global Warming of 1.5°C*. Available: <https://www.ipcc.ch/sr15/>.

IPCC. See Intergovernmental Panel on Climate Change.

Lerman, Sam. Air resources engineer. Sustainable Transportation and Communities Division, California Air Resources Board. August 25, 2021—email to Hannah Kornfeld of Ascent Environmental regarding multifamily development electric vehicle infrastructure under the Tiers 1 and 2 of the 2022 CALGreen Standards.

OPR. See Governor's Office of Planning and Research.



BAY AREA AIR QUALITY
MANAGEMENT DISTRICT

California Environmental Quality Act

Appendix C

Guidance for GHG Reduction Strategies

These guidelines are nonbinding recommendations, intended to assist lead agencies with navigating the CEQA process. They may be updated as needed in the future, and any updates will likewise be nonbinding and advisory.

TABLE OF CONTENTS

Section	Page
Table of Contents	C-i
List of Abbreviations	C-ii
1 Introduction.....	C-1
1.1 thresholds of significance for plans	C-3
1.2 Streamlining Under section 15183.5.....	C-3
1.3 Sub-section (b)(1)(a) and (c): Community-wide GHG Inventories and Forecasts.....	C-4
1.4 sub-section (b)(1)(b): GHG Emission Reduction Targets	C-10
1.5 sub-section (b)(1)(d): The Mitigation Strategy	C-11
1.6 sub-section (b)(1)(e): Implementation and Monitoring Strategy.....	C-17
1.7 sub-section (b)(1)(f): adoption in a public process after environmental review	C-17
1.8 Updating existing Plans to Align With this guidance.....	C-18
1.9 Early Consultation with the Air District	C-19

LIST OF ABBREVIATIONS

ABAG	Association of Bay Area Government's
BAU	business-as-usual
CARB	California Air Resources Board
CCA	community choice aggregation energy program
EVs	electric vehicles
F-gases	fluorinated gases
GHG	greenhouse gas
GWP	global warming potential
IPCC	Intergovernmental Panel on Climate Change
M-GHG-1	mitigation measure for GHG offsets
MT	metric tons
OPR	Office of Planning and Research
RHNA	Regional Housing Needs Assessment
RTAC	Regional Targets Advisory Committee
VMT	vehicle miles traveled



1 INTRODUCTION

This appendix is designed to assist users in developing community-scale greenhouse gas (GHG) reduction strategies, or plans, that are aligned with the State CEQA Guidelines Section 15183.5(b)(1) and (2) (see box below) that allow for CEQA streamlining for new projects and that meet the Air District’s plan-level threshold of significance for climate impacts. This additional guidance has been developed by the Air District to support local governments in developing robust GHG reduction strategies that align with State targets and guidance and to support streamlining under CEQA. In drafting this guidance, the Air District has drawn from established methodologies and practices and from its own experience reviewing and commenting on local strategies and plans for reducing GHG emissions. This guidance should be interpreted as recommended approaches rather than a formal protocol. This guidance will be updated as new tools, methodologies, and approaches are developed and refined. See Chapter 3 for a wider discussion on the Air District’s Thresholds of Significance.

The Governor’s Office of Planning and Research (OPR) develops resources for understanding and implementing CEQA. In 2010, OPR added the text in the box below to the State CEQA Guidelines, providing opportunities for development projects to streamline CEQA review for GHG emissions. This document refers to “Plans for the Reduction of Greenhouse Gas Emissions” as listed in the State CEQA Guidelines and the box below as “plan” for simplicity’s sake, which is consistent with the focus of Section 15183.5(a) and (b). Examples of plans that might fall under the term “plan” include climate action plans, sustainability plans, and general plans that include a robust strategy for reducing GHGs.

*State Office of Planning and Research CEQA Guidance on GHG Reduction Strategies**§15183.5. Tiering and Streamlining the Analysis of Greenhouse Gas Emissions.*

(a) Lead agencies may analyze and mitigate the significant effects of greenhouse gas emissions at a programmatic level, such as in a general plan, a long range development plan, or a separate plan to reduce greenhouse gas emissions. Later project-specific environmental documents may tier from and/or incorporate by reference that existing programmatic review. Project-specific environmental documents may rely on an EIR containing a programmatic analysis of greenhouse gas emissions as provided in section 15152 (tiering), 15167 (staged EIRs) 15168 (program EIRs), 15175-15179.5 (Master EIRs), 15182 (EIRs Prepared for Specific Plans), and 15183 (EIRs Prepared for General Plans, Community Plans, or Zoning).

(b) Plans for the Reduction of Greenhouse Gas Emissions. Public agencies may choose to analyze and mitigate significant greenhouse gas emissions in a plan for the reduction of greenhouse gas emissions or similar document. A plan to reduce greenhouse gas emissions may be used in a cumulative impacts analysis as set forth below. Pursuant to sections 15064(h)(3) and 15130(d), a lead agency may determine that a project's incremental contribution to a cumulative effect is not cumulatively considerable if the project complies with the requirements in a previously adopted plan or mitigation program under specified circumstances.

(1) Plan Elements. A plan for the reduction of greenhouse gas emissions should:

(A) Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;

(B) Establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable;

(C) Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area;

(D) Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;

(E) Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels;

(F) Be adopted in a public process following environmental review

(2) Use with Later Activities. A plan for the reduction of greenhouse gas emissions, once adopted following certification of an EIR or adoption of an environmental document, may be used in the cumulative impacts analysis of later projects. An environmental document that relies on a greenhouse gas reduction plan for a cumulative impacts analysis must identify those requirements specified in the plan that apply to the project, and, if those requirements are not otherwise binding and enforceable, incorporate those requirements as mitigation measures applicable to the project. If there is substantial evidence that the effects of a particular project may be cumulatively considerable notwithstanding the project's compliance with the specified requirements in the plan for the reduction of greenhouse gas emissions, an EIR must be prepared for the project.

CEQA Guidelines Section 15183.5(b)(1) and (2) lays out criteria for what a “plan for the reduction of greenhouse gases” must do to provide project-level streamlining benefits. Because OPR’s guidance under Section 15183.5 is very high level, there is little specific direction on what should be included in a local GHG reduction plan or how to ensure that plan will achieve its GHG reduction target.

A common industry term for a plan that supports streamlining under Section 15183.5 is a “qualified climate action plan.” The word “qualified” is not actually mentioned in Section 15183.5; this term was developed by planners and practitioners in recent years to refer to a climate action plan or similar GHG reduction strategy that meets the criteria spelled out in the State’s CEQA Guidelines. It is ultimately up to the lead agency to make the assertion that a local plan is “qualified” (i.e., meets the above criteria) and to support that assertion with substantial evidence.

The Air District has a long history of assisting local government staff in developing local plans to reduce GHG emissions and encourages streamlining from a local plan if it meets the criteria identified in Section 15183.5 as well as the additional guidance below. This additional guidance has been developed by the Air District to provide further support to local governments in developing robust GHG reduction strategies that align with State targets and guidance and to potentially support streamlining under CEQA.

This guidance is organized around Section 15183.5(a) and the (b)(1) Plan Elements that should be included in a plan to reduce greenhouse gas emissions in order to be considered for project streamlining benefits, as listed in the box above.

1.1 THRESHOLDS OF SIGNIFICANCE FOR PLANS

On April 20, 2022, the Air District Board of Directors adopted an updated threshold of significance for climate impacts for long-term communitywide planning documents (e.g., general plans, long-range development plans, climate action plans). To demonstrate a less-than-significant climate impact, the plan must demonstrate that the community will reduce GHG emissions at least 40 percent below 1990 levels by 2030 and support the State’s goal of achieving carbon neutrality by 2045, or meet the requirements for a GHG reduction strategy in Section 15183.5(b). A more detailed discussion of what it means to support the goal of carbon neutrality is available in sections 1.4 and 1.5 of this document. The term “community” as used in this document refers to a geographic area that aligns with a town, city or county, and the people/activities and municipal operations within that area.

1.2 STREAMLINING UNDER SECTION 15183.5

Streamlining is a way for lead agencies to reduce project-level environmental review by conducting a thorough evaluation at the programmatic level. CEQA Guidelines Section 15183.5(b) authorizes streamlined review of a project’s climate impacts if certain requirements are met (see also CEQA Guidelines §§ 15064(h)(3), 15064.4). The project must comply with or be consistent with a GHG reduction plan that meets the requirements of Section 15183.5(b)(1). Lead agencies (not the Air District) determine that a local GHG reduction plan meets the CEQA Guidelines’ definition of a qualified GHG reduction plan under Section 15183.5(b)(1). They also determine or assert that a development project is consistent with that plan for the purposes of CEQA streamlining (streamlining off the environmental document for the GHG reduction plan). These determinations must be

supported by substantial evidence. The Air District does not make either of these determinations, but it may opine on these points in a comment letter based on review of the plan or project as a technical expert.

Section 15183.5(b) specifies several plan elements that must be included in a GHG reduction plan for it to provide the basis for streamlined review. It also requires that a GHG reduction plan be adopted in a public process “following certification of an EIR or adoption of an environmental document.” Note that the CEQA Guidelines define “environmental documents” to include “initial studies, negative declarations, draft and final EIRs, documents prepared as substitutes for EIRs and negative declarations under a program certified pursuant to Public Resources Code Section 21080.5, and documents prepared under NEPA and used by a state or local agency in the place of an initial study, negative declaration, or an EIR” (CEQA Guidelines § 15361). Further discussion on this topic is included in section 1.7 below.

Section 15183.5(b)(2) explains what is required to determine the project’s consistency with the relevant GHG reduction plan. It states that, “An environmental document that relies on a greenhouse gas reduction plan for a cumulative impacts analysis must identify those requirements specified in the plan that apply to the project, and, if those requirements are not otherwise binding and enforceable, incorporate those requirements as mitigation measures applicable to the project.” According to this Section, all relevant measures in the plan must be incorporated into the CEQA project, whether or not explicitly required by the plan. If the plan is being implemented according to its own implementation strategy and the project is incorporating all relevant measures from the plan, then the project may be able to streamline off the environmental document prepared for the plan. In cases where a measure is included in the plan but its implementation date exceeds the date of a project (e.g., the plan calls for the adoption of a building code but a project is developed prior to the building code being adopted), the project does not have to incorporate that measure, as long as the plan accounted for that project in its quantified progress toward the target.

1.3 SUB-SECTION (b)(1)(A) AND (C): COMMUNITY-WIDE GHG INVENTORIES AND FORECASTS

Per Section 15183.5(b)(1)(A) and (C), the first and third Plan Elements relate to developing a GHG inventory and emissions forecast for a plan: “Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area” (inventory) and “Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area” (forecast). Local governments should develop their GHG inventory using “[The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions](#)” for community-wide emissions, per recommendations from the California Air Resources Board (CARB)¹ and OPR’s [General Plan Guidelines Update](#). Local governments can use the ClearPath tool to support inventories and climate action planning (<https://californiaseec.org/seec-clearpath/>).²

¹ CARB recommended the use of “The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions” in its 2017 Climate Change Scoping Plan. CARB did not provide different guidance in its 2022 Scoping Plan Update, which focuses primarily on mitigation actions for local governments.

² ICLEI-Local Governments for Sustainability USA (ICLEI) announced a new initiative to expand the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (USCP). ICLEI and stakeholders will create two new methods — the USCP Plus and USCP Dash — for local and regional governments to view and manage emissions and increase action. (<https://icleiusa.org/modernizing-the-uscp/>)

The Air District recommends specific approaches and assumptions related to the scoping and emissions calculation steps laid out in the U.S. Community Protocol, as discussed below. Based on research and consultation with practitioners, Air District staff has identified the following issues as important for local GHG inventories and forecasts that provide a basis for strong climate action plans.

Scoping Process Considerations

While the GHG inventory includes all relevant emissions within the defined geographic area for the plan, there may be large sources of emissions over which the local government may not have local control (CARB 2017:100; OPR 2017:228). Large sources of emissions within a community over which the local government has little or no control may include refineries, power plants, cement plants, etc.

Including these dominant sources in the community inventory can skew the inventory results in such a way that other important sources are minimized and not truly reflective of the community's contributions to GHG emissions. This can be problematic when developing GHG reduction targets and prioritizing GHG reduction measures. If a single large source over which the local government has no control or influence dominates the inventory, the source could be excluded from the inventory for the purposes of target-setting and developing the GHG reduction strategy. In some such situations, plans have provided two inventories – one with the dominant source included to demonstrate full GHG accounting for informational purposes, and one without the dominant source for the practical purposes of setting a realistic target and mitigation strategy designed to meet the target. This may not be practical for all situations, as some local governments may lack data and information on these large sources.

Emissions Calculations Considerations

Electricity emission factors

Different emission factors for determining the GHG content of the electricity used by the community can yield dramatically different results in a GHG inventory. Most (but not all) communities in the Bay Area fall under the power supply jurisdiction of a community choice aggregation energy program (CCA) or a municipal utility.³ In these cases, the local government should obtain the respective electricity emission factors from the appropriate electricity provider. Local governments will also need this information from PG&E, since customers within the jurisdiction of the CCA may still choose to opt out and receive power from PG&E.⁴ The electricity emission factor should reflect as much of the local generation mix as possible. Using eGRID or other sources that provide higher-level emissions factors – state, multi-state or national level – could decrease the accuracy of the community GHG inventory and may lead to developing a GHG reduction strategy that is not as effective as it could be if more local emission factors were used. One exception is using eGRID coefficients for direct access electricity use if local emission factors are not available.⁵

Annual vs. hourly emissions factors for electricity design elements

³ For an interactive map of Community Choice Aggregation programs in California, see The Climate Center Clean Power Exchange, <https://cleanpowerexchange.org/california-community-choice/>

⁴ To request community-wide electricity data from PG&E, send request to GHGDataRequests@pge.com

⁵ Direct Access (DA) service is retail electric service where customers purchase electricity from a competitive provider called an Electric Service Provider (ESP), instead of from a regulated electric utility.

The U.S. Community Protocol for GHG Inventories currently calls for using yearly averages, even though the carbon content of electricity on the grid can vary over the course of a day. Recently there has been discussion about gaining accuracy by using hourly emission factors for electricity. While this approach would improve the accuracy of the inventory, obtaining this detailed information could require a level of technical knowledge and additional effort that might be difficult for some local governments to meet. The Air District will track developments in this area and will update this guidance as necessary. For now, using annual emission factors for electricity is adequate.

The 15/15 Rule

The State of California has a privacy standard for utilities that helps ensure customer anonymity when energy data is released to third parties without customer consent. Referred to as “the 15/15 Rule,” this privacy standard requires that aggregated data – such as that requested by local governments when developing community GHG inventories – include a minimum of 15 customers and no single customer can account for more than 15% of total usage. This constraint often results in data being provided to local governments that is so highly aggregated it creates challenges for providing meaningful information for GHG inventories, or “blacking out” large sections of data in the energy use report. If the 15/15 Rule is creating “black boxes” on the standardized reports, a local government can submit a custom data request through PG&E’s Energy Data Request Portal (pge-energydatarequest.com), though there will still be some data privacy and aggregation rules applied. Additionally, if a local government is aware of which facility’s data is triggering the 15/15 Rule, they could request data to be shared directly from those facilities/organizations. For facilities that are large enough to fall under CARB’s Mandatory GHG Reporting Rule (25,000 metric tons per year), data is available at <https://ww2.arb.ca.gov/mrr-data>.

Global warming potential values and time horizons

The Intergovernmental Panel on Climate Change (IPCC) periodically releases “Assessment Reports” reflecting the latest climate science. These reports include lists of greenhouse gases and their global warming potentials (GWPs) – their potential to absorb infrared radiation and heat the atmosphere – relative to CO₂. Using the latest science to report emissions will likely result in better policy decisions, therefore it is recommended that the GWP values from the IPCC’s 5th Assessment Report (AR5, IPCC 2013) or 6th Assessment Report (AR6, IPCC 2021) are used. The GWP values in AR5 changed substantially from those in AR4, partly because important “carbon-climate feedback effects” were included. While the GWP values were also updated in AR6, the changes between the values in AR5 and AR6 for GHGs included in community inventories are not substantial. The Air District recognizes that CARB still uses 2007 IPCC AR4 GWPs for the 2000–2019 emission inventory. However, it is the Air District’s assertion that using GWPs that reflect the latest science is more important than reflecting consistency with CARB’s methodology.⁶

An added consideration when applying GWPs is the time horizon for which global warming is considered. In most cases, GHG emissions inventories are reported using 100-year GWP time horizons since historically the focus has been on reducing carbon dioxide, which is a long-lived climate pollutant. International best practice recommends using the 100-year GWP time horizon, and the State of California currently uses it for its inventory and 2022 Scoping Plan Update. As plans begin to acknowledge and include more strategies

⁶ See “Greenhouse Gas Emission Estimates and Draft Forecasts: Update and Work In Progress,” BAAQMD 2017, online report.

to reduce short-lived climate pollutants like methane and fluorinated gases (F-gases), a 20-year GWP time horizon may be more appropriate, especially when comparing the benefits of different mitigation measures across both short-lived and long-lived climate pollutants. To reduce global warming as soon as possible, measures with meaningful short-term benefits are necessary while we work to develop longer-term solutions. For local climate action plans, the Air District views the 100-year time horizon as adequate, while recognizing that some local governments may wish to use the shorter 20-year timeframe. The Air District encourages each local government to choose which time horizon (100-year or 20-year) is most suitable for their own plan and apply it consistently throughout (including inventory and emission reduction calculations), including a justification for their decision in publicly available documents.

For more background information on GWPs and time horizons, see [“Greenhouse Gas Emission Estimates and Draft Forecasts: Update and Work in Progress,”](#) (Air District, 2017)

Trip-based approach for determining VMT

There are two approaches to determining vehicle miles traveled (VMT) for the purposes of developing a GHG inventory. Historically, inventories took a geographic approach, accounting for the total VMT occurring within the geographic boundaries of the community. This approach does not take into account the purposes of trips, the local land use activity that influences the trip or the ability (or lack thereof) of local policies to impact VMT. Another approach is to only account for the VMT from trips that begin and/or end within the community. This “trip origin/destination” approach captures the VMT that can most likely be influenced by local land use decisions and policies.

The 2017 Scoping Plan suggests that transportation emissions in the inventory follow this trip origin/destination approach. (We refer to inventory-related guidance from the 2017 Scoping Plan, which provides detailed information on how local governments should conduct community GHG inventories. The 2022 Scoping Plan Update does not include specific direction on local GHG inventories, focusing more on higher level guidance on how local plans can align with the carbon neutrality goal.) The trip origin/destination methodology is also suggested by CARB’s Regional Targets Advisory Committee (RTAC), established as part of the implementation of SB 375 (Sustainable Communities and Climate Protection Act of 2008). GHG emission inventories should use the methodology established by RTAC for quantifying VMT and subsequent emissions that are attributable to the community. To facilitate this approach, the Air District has collaborated with MTC to produce the [VMT Data Portal](#), which provides local data specifically for the purposes of developing local GHG emissions inventories and forecasts, which follows the trip origin/destination methodology. The VMT Data Portal accounts for all passenger and light-duty VMT consistently across jurisdictions without double-counting.

Emission forecast years

After developing the baseline GHG inventory, the plan should include an emission forecast for the years 2030 and 2045 at a minimum. It may include additional forecast years which align with the local government’s relevant planning documents. For example, if a General Plan extends only to 2040, the climate action plan should include a target milestone for 2040, in addition to 2045.

Federal and state policies and how to include in the emissions forecast

Emissions forecasts are projected using a business-as-usual (BAU) scenario in which GHG emissions continue based on the community's current activities and grow or decrease into the future based on the chosen growth forecast data (changes to demographics, job growth, housing units consistent with Regional Housing Needs Assessment (RHNA) allocations, etc.) and the assumption that no new GHG reduction regulations or policies are implemented in the future at the local, state or federal levels. The growth forecast data should include data and/or growth factors regarding the community's future growth patterns that have been published through either the local government's adopted General Plan, Association of Bay Area Government's (ABAG) Growth Projections for the specific jurisdiction, or a commensurate published document.

There are two different ways that local emission reductions resulting from federal and state policies can be incorporated into the plan. They can either be incorporated into an "adjusted forecast," or into the GHG mitigation strategy/measures. The adjusted forecast starts with the BAU forecast, and then applies local emission reductions resulting from federal and state policies. Examples of such policies include the statewide Renewables Portfolio Standard and the Advanced Clean Cars program, which truly are implemented at the statewide level without specific roles at the local level. It is important to only deduct emission reductions from federal and state policies once – that is, if reductions are taken in the adjusted forecast to account for the Renewables Portfolio Standard, they cannot also be deducted as a GHG reduction measure in the plan (e.g., as a clean energy measure due to lower carbon content of electricity provided by the CCA, unless the CCA goes above and beyond the requirements of the RPS). Other state policies such as SB 375 have a distinct role for local implementation and may therefore be more appropriately included as local land-use measures versus being incorporated into the adjusted forecast. However, if VMT estimates from the VMT Data Portal are being used, VMT impacts from SB 375 are already being taken into account in the Portal outputs (since the VMT Data Portal reflects implementation of Plan Bay Area). It is up to the local government to decide how to account for emission reductions, whether in the adjusted forecast or the local GHG mitigation strategy.

State and federal policies that can be applied to the adjusted forecast include:

► State Policies

- SB 100 (Renewables Portfolio Standard)
- California's Building Energy Efficiency Standards (Title 24, Part 6)
- Advanced Clean Car Standards
- Truck and Bus Regulation

► Federal Policies

- Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles
- EPA Off-Road Compression-Ignition Engine Standards

A Performance-based Approach to Carbon Neutrality

While it has been traditional practice for GHG reduction plans to use the quantitative approach outlined above to establish baseline conditions and track progress toward achieving climate protection goals, there is increasing interest among local practitioners to pursue a more performance-based approach. Establishing quantitative

GHG inventories, forecasts and mitigation strategies and tracking and reporting on the quantitative progress being made requires a great deal of technical expertise and local government resources. Many local agencies have expressed a desire to redirect those resources toward implementation of critical policies and programs to reduce emissions and make progress toward goals. The statewide goal of achieving carbon neutrality lends itself to a performance-based approach to measuring progress. That is, if the ultimate goal is net zero emissions, then developing policies, standards, and programs aimed at eliminating GHG emissions altogether can provide a clearer pathway than measuring incremental progress of GHG tons reduced year after year.

A growing number of local government practitioners are focused on demonstrating progress toward carbon neutrality by tracking non-GHG performance metrics, such as the number of zero emission buildings, number of electric vehicles (EVs), percent mode shift away from internal combustion vehicles, etc. They are developing policies and best practices targeting these metrics that will lead to carbon neutrality. Communicating progress toward carbon neutrality in terms of performance metrics often resonates more directly with decision-makers and the public than speaking in terms of tons of GHG emissions reduced. Section 1.5 below provides additional discussion of the utility/value of this alternative approach.

Transparency Considerations

Any variation from the methodologies used in the U.S. Community Protocol are up to the discretion of the local government and should be clearly explained either in the text of the plan or an attached appendix that is available for public review. In addition, methodologies, emission factors, assumptions, and other important data should be included in publicly available plan documents.

Additional sources of data and information for GHG inventories

2017 Climate Change Scoping Plan (<https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2017-scoping-plan-documents>)

Governor's Office of Planning and Research (OPR) General Plan Guidelines Update (https://opr.ca.gov/docs/OPR_COMPLETE_7.31.17.pdf)

"The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions" (<https://iclei.usa.org/us-community-protocol/>)

The Climate Center Clean Power Exchange, <https://cleanpowerexchange.org/california-community-choice/>

Association of Bay Area Government's (ABAG) Growth Projections (<https://abag.ca.gov/our-work/land-use/forecasts-projections>)

IPCC Assessment Reports, (<https://www.ipcc.ch/reports/>)

Greenhouse Gas Emission Estimates and Draft Forecasts: Update and Work in Progress, (https://www.baaqmd.gov/~media/files/planning-and-research/plans/2017-clean-air-plan/ghg_emissions_and_forecasts_draft.pdf?la=en)

BAAQMD/MTC VMT Data Portal, (<http://capvmt.us-west-2.elasticbeanstalk.com/about>)

1.4 SUB-SECTION (b)(1)(B): GHG EMISSION REDUCTION TARGETS

The second Plan Element as listed in CEQA Guidelines Section 15183.5(b)(1)(B) is: *"Establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable."* The plan must include GHG emissions reduction targets that demonstrate consistency with statewide targets. Current statewide targets included in the 2017 Scoping Plan and 2022 Scoping Plan Update include:

- ▶ reducing GHG emissions by at least 40 percent below 1990 levels by 2030 (SB 32); and
- ▶ achieving carbon neutrality no later than 2045 (AB 1279⁷ and Executive Order B-55-18).

The plan should demonstrate, through aggressive GHG reduction measures and a robust implementation and monitoring strategy, how the community will meet the 2030 target for its overall community GHG emissions. The plan should also demonstrate that it will achieve as ambitious emission reductions as technologically and financially feasible by 2045, minimizing the residual amount of emissions needed to close the gap to carbon neutrality. The plan can demonstrate consistency with the statewide carbon neutrality target by minimizing residual emissions to the greatest extent possible as a result of including all applicable feasible measures, and by including a robust implementation strategy that maximizes the likelihood that the full GHG reduction strategy will be implemented. The plan must include a vigorous monitoring program that will continue to adjust and fine-tune the plan to ensure that it maximizes GHG reductions over time. The monitoring program should include adjusting the GHG reduction strategy as additional technologies become feasible and to account for emerging statewide policies and programs.

Target for plan to reduce GHG emissions by 2030

The plan should adopt a GHG reduction target for 2030 that is at least as stringent as the statewide target of at least 40 percent below 1990 levels by 2030. Recent climate action plans show that local governments have consistently been able to demonstrate how the 2030 target will be met.

Both the 2017 Scoping Plan and the 2022 Scoping Plan Update rely on emission reductions from all statewide emissions sectors (and sinks which remove carbon from the atmosphere), several of which are not under the control of local governments (e.g., interstate vehicle travel, large industrial operations, air and marine transport) to meet the statewide 2030 GHG reduction target. When translating the percent reduction in 2030 to actual tons of GHGs reduced, local governments should apply the percent reduction to local emissions sectors and sinks within the control or influence of local governments, which may exclude statewide emissions sectors and sinks that cannot be affected through a local GHG reduction plan (CARB 2017:100). It is up to the local jurisdiction to determine which emission sources are excluded and to explain why those sources are out of their control.

Consistency with the carbon neutrality target in a plan

Assembly Bill 1279 (AB 1279) requires the state to achieve carbon neutrality by 2045, and to accomplish that in part by reducing direct GHG emissions by 85% below 1990 levels. Either way one articulates this goal, this will be a challenge for local governments to meet. How does a community achieve carbon

⁷ AB 1279 requires the state to achieve carbon neutrality by 2045, and to accomplish that in part by reducing direct GHG emissions by 85% below 1990 levels.

neutrality? Being carbon neutral would require a community to produce zero net carbon emissions, so that the emissions it produces equal the emissions it removes from the atmosphere. A community could do this by eliminating 100% of its carbon emissions, or by significantly reducing its carbon emissions to the greatest extent feasible and enhancing carbon sequestration in its geographic boundaries, and then utilizing a minimal amount of verified carbon offsets to close the remaining emissions gap. For more information on offsets, see section 1.5 of this document.

Communities should aim for carbon neutrality and minimize their emissions gap as much as possible with robust, enforceable GHG reduction strategies and local sequestration. Different communities have different challenges and opportunities in pursuing this target. For example, some communities may have open natural spaces or agricultural lands which could be used for sequestration.⁸ Other communities may not have abundant sequestration opportunities and reducing GHG emissions to zero may not be currently feasible. And yet, we know from scientific reports released by the IPCC that we must achieve these GHG reduction goals in order to prevent cataclysmic climate change.

The 2022 Scoping Plan Update Appendix D: Local Actions includes broad guidance to local governments on important approaches to implement to support the State's carbon neutrality goal, rather than defining the specific role local communities must play in helping the State meet its carbon neutrality target. The best and most defensible way for a plan to demonstrate consistency with state targets is to show, through quantification, how implementation of the plan's GHG reduction measures will enable the community to meet the 40+ percent reduction by 2030, and to demonstrate that it will achieve as ambitious emission reductions as technologically and financially feasible by 2045, minimizing the residual amount of emissions needed to close the gap to carbon neutrality. This can be demonstrated by including a description of the decision-making process for how technological and financial impacts were taken into account.

To do this, plans should aggressively pursue GHG reductions with a preponderance of enforceable, mandatory measures that quantitatively get the community as close to carbon neutrality as possible by 2045 and include a robust implementation and monitoring strategy (see Section 1.6 below) that shows how the remaining emissions gap will reduce over time. Re-evaluation and adjusting/strengthening the GHG reduction strategy will be critical as advances in technologies and innovations, and additional State policies and actions, make statewide carbon neutrality achievable. While use of offsets is not necessary to demonstrate consistency with the 2045 target, if a local jurisdiction does employ them, they should consider the criteria discussed in section 1.5 of this document.

1.5 SUB-SECTION (b)(1)(D): THE MITIGATION STRATEGY

The fourth Plan Element as described in Section 15183.5(b)(1)(D) is: *"Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level."* The ability of the plan to meet its stated GHG emission reduction targets is reflected in the plan's mitigation strategy. The stronger

⁸ Carbon farming tools COMET Planner and COMET Farm, developed by Colorado State University, the Natural Resources Conservation Service, the Carbon Cycle Institute and the Marin Carbon Project, help quantify the GHG reduction benefits of different farming practices. (<https://www.carboncycle.org/carbon-farm-planning/>)

the mitigation strategy, the more likely the plan will be to achieve its goals, and the stronger the position the plan will be in to support CEQA streamlining for future development projects.

There are as many approaches to climate action plans as there are local governments. The specific approach a local government takes to compiling its GHG reduction plan depends upon local resources, challenges, and opportunities. Many local governments are also broadening the scope of their plans to address related important issues, such as multiple co-benefits of reducing GHG emissions, environmental and social justice and equity, climate adaptation and resilience, public health, etc. There is an increasing acknowledgement that addressing social and economic inequities is integral to meaningful climate action. Solutions developed in partnership with communities – particularly those communities most overburdened by pollution and other impacts – can result in more equitable and effective actions and also increase support for and implementation of the plan’s mitigation strategy. Many local governments are developing their plans with robust community input and strategic partnerships to inform and shape what this would look like and increase community support for their strategies.

Across the variety of plans, the elements that make for a strong mitigation strategy include:

- ▶ a preponderance of mandatory vs. voluntary measures, particularly for measures addressing new development;
- ▶ measures that address the largest GHG emission sources;
- ▶ a focus on quality (measures likely to reduce large amounts of emissions) over quantity (many measures with small impact);
- ▶ a minimal reliance on offsets, if any, with preference for those that achieve local benefits;
- ▶ transparency in methods of quantification (assumptions and their bases, emission factors, etc.);
- ▶ and a strong implementation and monitoring strategy.

The mitigation strategy should demonstrate how the community will meet the 2030 target for its overall community GHG emissions and achieve the most feasibly ambitious emissions reductions by 2045 to get the community as close to carbon neutrality by 2045 as possible.

Mandatory vs voluntary measures

A mandatory measure is one that either commits the local government to taking action or requires action on the part of the private sector (including the residential sector) that is binding and enforceable.

Mandatory measures use terms like, “shall” or “will,” whereas voluntary measures use terms like, “explore,” “consider,” or “promote.”

A measure that commits the local government to taking action could be a stated policy or investment, such as, “The City will meet LEED platinum standards in all new municipal construction,” or, “The City shall install EV charging stations at all public parking lots.” Measures framed in this manner are considered mandatory measures, as they are definitively stating that the local government will/shall take a binding action.

A measure that requires an action on the part of a private company or community member/household might be a policy to be enacted by the local government – “The County shall adopt an ordinance banning

the use of natural gas in new development," or "The City will change its current building code requiring minimum parking spaces to imposing maximum parking spaces."

Mandatory measures have higher levels of certainty that they will be implemented, and thus increased assurance that the estimated level of GHG reduction will be achieved. It is very difficult to estimate emission reductions with any degree of certainty for voluntary measures, as the timing, thoroughness, and overall efficacy of their implementation is less certain.

In addition to mandatory measures, incentive-based measures can also yield strong results and may be more appropriate for the existing built environment. While voluntary in nature, incentives such as rebates, cost reductions, grants or fee waivers can provide strong motivation for behavior change or technology uptake, and can be more likely to achieve their intended result than purely voluntary measures.

Measures address the largest GHG emission sources and focus on quality

There is no magic number or percentage of mandatory measures required in a plan to support streamlining under CEQA. Again, it is the ability of the mitigation strategy to clearly meet the GHG reduction target(s) that is considered in the plan's ability to support streamlining. This is where addressing the largest sources of GHG emissions and focusing on quality (e.g., achieve significant emissions reductions) over quantity can be helpful. For example, a plan that ignores, or lightly treats, transportation emissions may have a hard time making the case that it is consistent with the State's carbon neutrality target. This is reinforced by CARB's 2022 Scoping Plan Update Appendix D Local Actions, which highlights a short list of suggested actions prioritizing GHG reductions in the areas of building decarbonization, VMT reduction and support for EVs,

The Air District recommends that the four design elements from the project-level Climate Impact Threshold be included in the GHG reduction plan as important measures to address GHG emissions from new development and, to the extent appropriate, existing development, as these specific measures have been directly connected to the State's ability to achieve its 2030 and 2045 GHG reduction targets (see the Thresholds Justification Report, Appendix B). In addition, these four design elements closely track with the prioritized measures highlighted in Appendix D to the 2022 Scoping Plan Update. These design elements are:

1. The project will not include natural gas appliances or natural gas plumbing (in both residential and nonresidential development).
2. The project will not result in any wasteful, inefficient, or unnecessary energy usage as determined by the analysis required under CEQA Section 21100(b)(3) and Section 15126.2(b) of the State CEQA Guidelines.

[Appendix F to the State CEQA Guidelines, which summarizes the goal of this measure as the wise and efficient use of energy, achieved through: (1) decreasing overall per capita energy consumption, (2) decreasing reliance on fossil fuels, and (3) increasing reliance on renewable energy sources. It is important to include measures in the Plan that achieve these objectives.]

3. Achieve a reduction in project-generated vehicle miles traveled (VMT) below the regional average consistent with the Draft 2022 Scoping Plan Update (currently 15 percent) or meet a locally adopted Senate Bill 743 VMT target, reflecting the recommendations provided in the Governor's Office of Planning and Research's Technical Advisory on Evaluating Transportation Impacts in CEQA:

- i. Residential projects: 15 percent below the existing VMT per capita
- ii. Office projects: 15 percent below the existing VMT per employee
- iii. Retail projects: no net increase in existing VMT

[OPR's Technical Advisory provides guidance on how lead agencies may screen out VMT impacts for select project types using project size, maps, transit availability, and provision of affordable housing. It should also be noted that while this VMT approach is appropriate for determining significance for projects, it should not be used for the community GHG inventory – the SB375 trip-based approach should be used for inventories.]

- 4. Achieve compliance with off-street electric vehicle requirements in the most recently adopted version of CALGreen Tier 2.

Because of the importance of these four measures in supporting the statewide GHG reduction targets, in addition to including these measures in the plan, Air District staff strongly recommend that the implementation strategy for the plan call for their adoption/implementation as soon as possible.

Justification for voluntary measures

While it is critically important to include a preponderance of mandatory measures in the plan, it may not be realistic for 100% of the plan's measures to be mandatory. As discussed above, incentive-based voluntary measures are more likely to achieve the intended emission reductions than other types of voluntary measures. They might include adding funding to existing utility-sponsored incentive programs promoting energy efficiency or distributed renewable energy upgrades to commercial or residential buildings. Non-financial incentives might include permit relief or front-of-the-line privileges for building projects that meet voluntary green building standards. These types of benefits can increase the likelihood of uptake and help achieve the estimated amount of GHG reductions.

Substantiation for all voluntary measures – incentivized and non-incentivized – must be robust and include all assumptions about participation rates and outcomes. Substantiation and quantification of voluntary measures should include a discussion of how similar measures have been implemented elsewhere and be based on those outcomes. According to OPR's General Plan Guidelines,

"Although mandatory measures are preferred to establish the substantial evidence that a particular emissions reduction measure will have the stated benefit, there are some examples of incentive-based measures that could be considered mitigation. One example is proposed to expand an energy efficiency program that has been in place several years and has a proven emissions reduction track record. These types of measures can be included in reductions towards a target, as long as assumptions reflect the proven ability for that program to reduce emissions. In other words, there should be substantial evidence to support the calculations for the measure." (OPR General Plan Guidelines Chapter 8)

All evidence and substantiation for the estimated GHG reductions resulting from implementation of voluntary measures (as well as mandatory measures) should be included in publicly available documents.

Measures to ensure state mandates are met

Many local plans include measures in response to state mandates imposed on local governments. For example, SB 1383 requires that localities reduce organic waste disposal 75% by 2025. It is not enough to

simply include this target as a measure in the plan, assuming it will be met, with the associated GHG reductions. Meaning, if a community's GHG emissions related to organic waste are currently 100,000 metric tons (MT) per year, a measure in the plan stating that, due to the statewide SB 1383 organics diversion mandate, the local government will necessarily meet the mandate and that will result in a GHG reduction of 75,000 MT is not adequate. The measure should include a discussion of what policies, programs, and actions the local government will take to ensure that mandate is met, and the estimates of GHG emissions and other indicators should be supported with evidence.

Use of offsets

The Air District strongly recommends that GHG reduction targets be achieved from direct GHG emission reductions and sequestration occurring within the community to the greatest extent feasible. Specifically, offsets from GHG emission reductions taking place outside the community should be minimized, if used at all, in the mitigation strategy to achieve the 2030 target. Numerous local adopted plans demonstrate that the 2030 target can be achieved without use of offsets. They may be included to address the emissions gap remaining in 2045 after committing to all other feasible emission reduction and sequestration opportunities under the local government purview to achieve carbon neutrality by 2045. If some residual emissions remain for 2045, the plan should transparently and clearly explain what the sources of those emissions are and how they will be addressed moving forward. If the plan does include offsets, it must include a formal process and objective standards to ensure the offsets actually result in GHG emission reductions per case law as described below.

Local mitigations to reduce emissions and sequester carbon can accrue local co-benefits, such as improved air quality. Purchasing offsets (or credits that represent reductions or removals of GHGs by an activity) from outside the community would contribute to efforts to avoid cataclysmic climate change, so long as they meet rigorous standards as described below but would likely not bring co-benefits that would improve quality of life for members of the community. Furthermore, evolving case law has clarified what constitutes an adequate offset, which in turn may limit the type and quantity available for use in GHG reduction plans.

Golden Door Properties vs. County of San Diego (2020) 50 Cal.App.5th 467 (*Golden Door II*), while limited to the facts before the court, provides important guidance. There, the court ruled that a mitigation measure for GHG offsets (M-GHG-1) violated CEQA because it lacked enforceable performance standards and improperly deferred mitigation. The county argued that offsets under M-GHG-1 were adequate because they were "substantially similar" to those permitted under California's cap-and-trade program and that they would be real, permanent, quantifiable, verifiable, enforceable, and additional. The court disagreed, finding M-GHG-1 did not provide any enforceable standards, protocols, or safeguards to ensure these important requirements were actually met. It noted that for cap-and-trade, offsets must not only be purchased from CARB-approved registries but also that those registries must implement CARB approved protocols, which have been subject to CARB's rulemaking process as well as public notice, a comment period, and a public hearing. The court also emphasized the importance of additionality—meaning an offset is not already required by law or regulation or would not otherwise occur—to ensure GHG emissions actually decrease. It also flagged concerns regarding offsets arising outside California; such offsets, if permitted, should be subject to enforcement mechanisms at least as strict and enforceable as under California law. In particular, the court noted foreign offsets are vulnerable to corruption and fraud. The court also ruled M-GHG-1 improperly

deferred mitigation because it allowed deferred approval of unspecified offsets without providing objective performance standards to ensure GHG reduction goals are actually met.

In reading *Golden Door II*, it is important to note that CEQA does not require GHG mitigation to satisfy cap-and-trade requirements. The court analogized M-GHG-1 to cap-and-trade requirements because the mitigation measure's language and the county's arguments invited that comparison. The more universal takeaway from the case is that mitigation must include a formal process and objective standards to determine the validity of GHG offsets to ensure emission reductions actually occur. Accordingly, it is not adequate to generally state that adequate offsets will be acquired (e.g., simply state that they must be real, permanent, quantifiable, verifiable, enforceable, and additional); the mitigation must also include a process or protocol and objective standards to ensure the adequacy of procured offsets. This limits the type and quantity of offset projects that could be used to help plans meet their GHG reduction targets.

All of these factors should be taken into consideration if offsets are to be used to meet a plan's GHG reduction target.

Transparency and Other Considerations

All information regarding the methodology and calculations used to quantify the estimated GHG reductions achieved through each of the measures and any remaining emissions gap to carbon neutrality should be transparent, replicable, and publicly available. According to OPR's General Plan Guidelines, *"When addressing greenhouse gas emissions, like all other technical analysis, the methodology and calculations should be transparent and replicable with the goal of providing substantial evidence supporting the assumptions, analysis and conclusions. Measures should also be real and verifiable, through either full enforceability or through substantial evidence in the record supporting an agency's conclusion that mitigation will be effective"* (OPR 2017: 229). Case law has also addressed this topic – in *Communities for a Better Environment v. City of Richmond*, the court found that that to be adequate, a plan should include measures that are "known to be feasible," "coupled with specific and mandatory performance standards to ensure that the measures, as implemented, will be effective."

As previously mentioned, some local government practitioners are beginning to focus on leading indicators and performance metrics, such as reduced VMT or non-fossil fuel energy use, in addition to or in place of quantitative GHG emissions to track their progress towards carbon neutrality.⁹ For example, envisioning a carbon neutral future with zero carbon buildings, a large mode shift away from passenger vehicles and ubiquitous low- or zero-carbon transportation, and then focusing on the policies needed to be put in place today to achieve that future. Focusing on these metrics rather than on GHG emissions could help catalyze the necessary support for transformative climate action among diverse stakeholders who each have their own priorities. Plans that adopt this approach for post-2030 measures to achieve carbon neutrality by 2045 would still need to substantiate how the measures will result in zero emissions, transparently laying out assumptions, and outlining the quantifiable performance metrics for monitoring progress for each action. They must also include a robust implementation and monitoring strategy (as described in Section 1.6) that outlines a feasible data collection approach for metrics, including data sources and how frequently data points would be gathered.

⁹ "The State of Local Climate Planning," CityScale, 2021 (<https://cityscale.org/2021/05/20/the-state-of-local-climate-planning/>)

1.6 SUB-SECTION (b)(1)(E): IMPLEMENTATION AND MONITORING STRATEGY

Section 15183.5(b)(1)(E) describes the fifth Plan Element: *“Establish a mechanism to monitor the plan’s progress toward achieving the level and to require amendment if the plan is not achieving specified levels.”* The Implementation and Monitoring Strategy lays out how the local government will determine if the plan is adequately advancing the community toward achieving its GHG reduction targets and the steps to revise the plan as needed to ensure it is on track towards meeting those targets. It should include a review of the original mitigation strategy in the Plan and assess if the GHG reduction measures are being implemented according to the Plan’s original timeline and scale (e.g., are measures that were described as mandatory in the Plan being implemented that way). Any changes to the Plan’s original mitigation strategy and timeline should be transparently discussed and justified.

The Air District recommends that the Implementation and Monitoring Strategy include details on the following:

- ▶ A process for updating the emissions inventory and forecast – Air District staff recommend this be done every three years, as feasible;
- ▶ The timeline for implementing the measures in the mitigation strategy, including individual measure timelines, funding sources, lead departments/organizations, and tracking/monitoring mechanisms;
- ▶ Staffing and budgeting resources to support the implementation of the plan;
- ▶ Roles and responsibilities for implementing the plan, including dedicated staff to oversee the implementation, monitoring, and updating of the plan.
- ▶ Regular (annual if possible) public reporting of progress in implementing the plan’s mitigation strategy, including updates to the timeline, performance metrics and GHG reductions achieved;
- ▶ A process to update the plan every 3-5 years, particularly if needed to adjust for any emission reduction shortfalls, or shortfalls in meeting performance goals and revise the mitigation strategy to account for any measures which are not being implemented, are no longer relevant to the community, are underperforming, or should be updated or added due to new technologies or other advances, to ensure the plan is on track for meeting the GHG reduction targets;
- ▶ A checklist for development projects to easily determine consistency with the plan’s mitigation strategy.

1.7 SUB-SECTION (b)(1)(F): ADOPTION IN A PUBLIC PROCESS AFTER ENVIRONMENTAL REVIEW

Local plans that reduce GHG emissions must still undergo environmental review. While it may seem like a plan to reduce GHG emissions would be purely beneficial to a community, there could be trade-offs in the plan that have environmental consequences. For example, a measure calling for the installation of bike paths might require analysis of impacts to species or habitat. In addition, Section 15183.5(b)(2) requires

environmental review if the plan will be relied on later for future projects to tier off. That is, a lead agency may rely on the environmental analysis in the plan to forego CEQA analysis of greenhouse gas emissions on future projects if those projects are consistent with the plan.

Once an environmental analysis has been completed for the plan, the plan must be adopted in a public process. Public participation is a mandated and essential component of CEQA, as it leads to better informed decision-making. In order to meaningfully engage all populations and sectors of the community in the review and adoption process, lead agencies should undertake robust outreach and participation activities. Achieving a high level of participation from all segments of the community in the public review and adoption process can increase the likelihood that community interests and concerns are adequately addressed by the plan. Resources that may help lead agencies develop effective and strong public engagement processes include:

Promising Practices for EJ Methodologies in NEPA Reviews (Report of the Federal Interagency

Working Group on Environmental Justice & NEPA Committee, 2016,

https://www.epa.gov/sites/default/files/2016-08/documents/NEPA_promising_practices_document_2016.pdf

Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity (Chapter 5, CAPCOA 2022,

https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf

1.8 UPDATING EXISTING PLANS TO ALIGN WITH THIS GUIDANCE

Lead agencies with existing plans that pre-date these plan-level thresholds of significance focused on supporting the State's targets of a 40+ percent reduction in emissions by 2030 and achieving carbon neutrality by 2045, have options for bringing their existing plans into alignment with the thresholds.

Option A: Conduct a full update of the plan

If the timing is right, a lead agency may choose to conduct a full update of the existing plan, including updating the GHG inventories and forecasts, revisiting the GHG mitigation strategy, adding new components like an equity or adaptation section, etc. This can be a time-consuming and resource-intensive process, but most local governments do update their plans regularly and these new thresholds could provide a motivation to begin this process.

Option B: Conduct a partial update as an amendment to the plan

A less time- and resource-intensive option might be to update only the necessary portions of the plan to bring it into alignment with the new thresholds. Depending on the plan, these portions might include:

- ▶ updating the GHG forecast out to 2045
- ▶ extending quantification estimates for GHG reduction measures out to 2045
- ▶ adding additional GHG reduction measures to reduce residual emissions in 2045 as much as is technologically and financially feasible (particularly the four design elements listed in section 1.5 above)

- updating the implementation and monitoring plans to reflect implementation of the plan to-date and strengthen with any new best practices

Such an amendment should include a public engagement process and might require a new round of environmental review. Jurisdictions may make the case that outreach conducted on the existing plan is appropriate for alignment purposes. This option is most appropriate for pre-existing plans that were adopted relatively recently and thus might already be close to compliant with the new thresholds.

1.9 EARLY CONSULTATION WITH THE AIR DISTRICT

Early consultation with Air District staff is strongly encouraged. The importance of communicating with Air District staff early in the climate planning process cannot be over-emphasized. Air District staff is available to meet with local government planners, review methodologies, discuss approaches and key issues. Local government staff and their consultants are encouraged to contact the Air District's Climate Team at climate@baaqmd.gov.

This page intentionally left blank.



BAY AREA AIR QUALITY
MANAGEMENT DISTRICT

California Environmental Quality Act
Air Quality Guidelines
Appendix D:
Using CalEEMod for
Bay Area Projects

These guidelines are nonbinding recommendations, intended to assist lead agencies with navigating the CEQA process. They may be updated as needed in the future, and any updates will likewise be nonbinding and advisory.

TABLE OF CONTENTS

Section	Page
1 Introduction.....	D-1
2 Characteristics and Land Use Modules	D-4
2.1 Overview and Starting a Project	D-6
3 Construction Module	D-11
3.1 Construction Phases Screen	D-11
3.2 Off-Road Equipment Screen.....	D-12
3.3 Off-Road Equipment EF Screen	D-12
3.4 Dust from Material Movement Screen	D-13
3.5 Demolition Screen	D-14
3.6 Trips and VMT Screen	D-14
3.7 On-Road Fugitive Dust Screen	D-15
3.8 Architectural Coatings Screen	D-16
3.9 Paved Area Screen.....	D-16
3.10 Electricity Screen	D-17
4 Operations Module.....	D-17
4.1 Mobile Sources Submodule	D-17
4.1.1 Vehicle Data Screen.....	D-17
4.1.2 Fleet Mix Screen.....	D-18
4.1.3 Vehicle EF Screen.....	D-19
4.1.4 Road Dust Screen	D-19
4.2 Area Sources Submodule.....	D-21
4.2.1 Hearths Screen	D-21
4.2.2 Consumer Products Screen.....	D-21
4.2.3 Architectural Coatings Screen	D-21
4.2.4 Landscape Equipment Screen	D-21
4.3 Energy Use Submodule	D-22
4.4 Water and Wastewater Submodule.....	D-22
4.5 Solid Waste Submodule	D-22
4.6 Refrigerants Submodule.....	D-22
4.7 Off-Road Equipment Submodule.....	D-22

4.7.1	Off-Road Equipment Screen.....	D-22
4.7.2	Off-Road Equipment EF Screen.....	D-23
4.8	Stationary Sources Submodule.....	D-23
4.8.1	Emergency Generators and Fire Pumps Screen.....	D-23
4.8.2	Generators + Pumps EF Screen.....	D-24
4.8.3	Process Boilers Screen.....	D-24
4.8.4	Boilers EF Screen.....	D-24
4.9	User Defined Submodule.....	D-24
5	Vegetation Module.....	D-25
5.1	Land Use Change Screen.....	D-25
5.2	Sequestration Screen.....	D-25
6	Climate Risk Module.....	D-26
7	Measures Module.....	D-26
7.1	Emissions Reduction Submodule.....	D-29
7.1.1	Construction Screen.....	D-29
7.1.2	Transportation Screen.....	D-29
7.1.3	Energy Screen.....	D-29
7.1.4	Water Screen.....	D-29
7.1.5	Waste Screen.....	D-30
7.1.6	Refrigerants Screen.....	D-30
7.1.7	Natural Lands Screen.....	D-30
7.1.8	Area Source Screen.....	D-30
7.1.9	Miscellaneous Screen.....	D-30
7.2	Climate Risk Reduction Submodule.....	D-31
7.3	Health and Equity Submodule.....	D-31
8	Results Component.....	D-31
9	Reports Component.....	D-31
10	Resources.....	D-32
Attachment A	Fugitive Dust Guidance.....	D-33
D-A1	Unpaved Road Travel Speed.....	D-37
D-A2	Wind Screens.....	D-37

List of Figures

Figure 1	Release Notes Dialog Box.....	D-2
Figure 2	Icons Used throughout CalEEMod.....	D-3
Figure 3	Override Input Dialog Box and Information Icon	D-4
Figure 4	Justification for Changes Box.....	D-4
Figure 5	Model Navigation Panel.....	D-5
Figure 6	Structure of CalEEMod.....	D-6
Figure 7	View of the Location Information Screen before a Location Is Selected	D-7
Figure 8	View of the Location Information Screen after a Location Is Selected	D-7
Figure 9	Editing Construction Off-Road Equipment.....	D-12
Figure 10	Dust from Material Movement Screen	D-14
Figure 11	On-Road Fugitive Dust Screen.....	D-16
Figure 12	Vehicle Data Screen with Defaults Loaded	D-18
Figure 13	Vehicle Data Popup for Entering VMT and Trips Manually.....	D-18
Figure 14	Paved and Unpaved Road Dust Variables in Road Dust Screen.....	D-20
Figure 15	Adding Operational Off-Road Equipment.....	D-23
Figure 16	Exporting Data from the i-Tree Tool.....	D-26
Figure 17	Navigation Panel Options in the Measures Module.....	D-27
Figure 18	Construction Measures Screen	D-28
Figure 19	Report Output Screen.....	D-32
Figure DA-1	Input for Limiting Vehicle Speeds in the Measures Module	D-37

List of Tables

Table 1	Characteristics Module Inputs.....	D-8
Table 2	Land Use Module Inputs	D-10
Table DA-1	Air District Best Management Practices for Construction-Related Fugitive Dust Emissions. D-34	
Table DA-2	Unpaved Road Dust Reductions by Vehicle Speeds in the Measures Module.....	D-37

LIST OF ABBREVIATIONS

Air District	Bay Area Air Quality Management District
CalEEMod	California Emissions Estimator Model
CAPCOA	California Air Pollution Control Officers Association
CAPCOA Handbook	<i>Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers</i>
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CPUC	California Public Utilities Commission
CSTDM	California Statewide Travel Demand Model
EDFZ	Electricity Demand Forecast Zone
EF	emissions factor
EMFAC	California Air Resources Board EMISSIONS FACTOR model
g/L	grams per liter
g/m ²	grams per meter-squared
GHG	greenhouse gas
Guidelines	<i>CEQA Air Quality Guidelines</i>
GWP	global warming potential
IPCC	Intergovernmental Panel on Climate Change
MPO	metropolitan planning organization
PM _{2.5}	particulate matter with a diameter less than or equal to 2.5 microns
PM ₁₀	particulate matter with a diameter less than or equal to 10 microns

ROG	reactive organic gases
RTPA	Regional Transportation Planning Agency
TAZ	Traffic Analysis Zone
VMT	vehicle miles traveled
VOC	volatile organic compound

This page intentionally left blank.



1 INTRODUCTION

This appendix was designed by the Bay Area Air Quality Management District (Air District) to assist California Environmental Quality Act (CEQA) practitioners in using the California Emissions Estimator Model (CalEEMod) for projects located in the Bay Area.

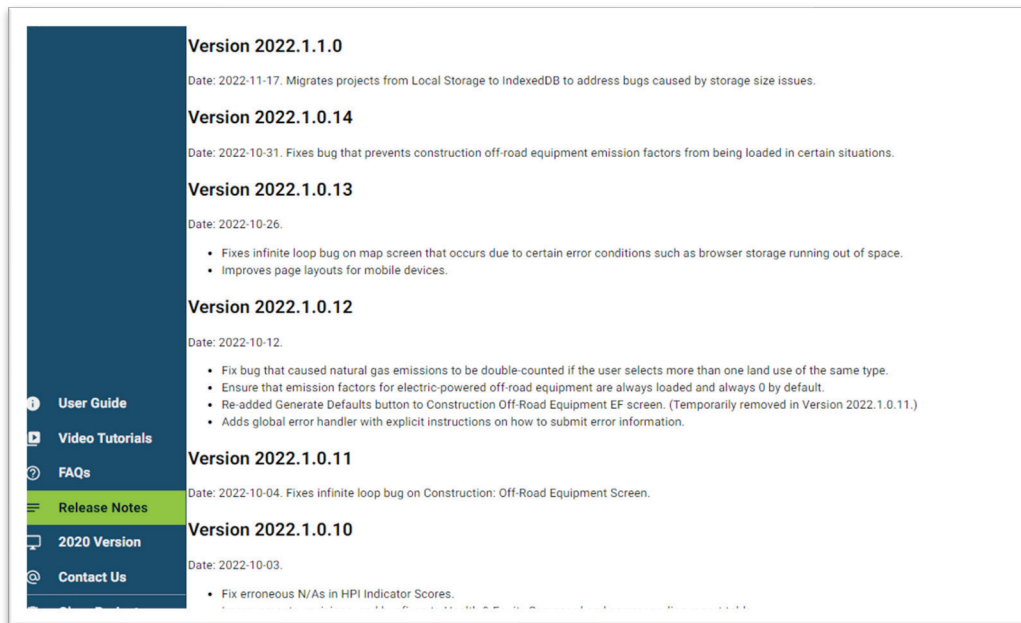
For proposed land use development projects, the Air District recommends using the latest version of CalEEMod to quantify construction emissions. CalEEMod is a statewide land use emissions model developed by the California Air Pollution Control Officers Association (CAPCOA) in collaboration with California air districts to quantify potential criteria air pollutant and greenhouse gas (GHG) emissions associated with construction and operations related to land use projects.

This appendix provides recommendations for the most recent version of CalEEMod Version 2022.1, which is web-based and available online at <https://www.caleemod.com/>. The preferred browsers for maximum functionality are Google Chrome and Microsoft Edge.

Note that the guidance and screenshots contained in this guide are based on Version 2022.1.1.0, which was released on November 17, 2022, to reflect updates to the modeling code. Although the model will continue to be updated over time based on user feedback, the guidance and screenshots in this appendix should remain mostly relevant barring substantial updates to the model interface, parameters, or methodologies.

Figure 1 shows the *Release Notes* dialog relevant at the time of this guidance formulation. As with all updates to the model, the model website, along with the *Release Notes* dialog, should be reviewed periodically to stay up to date with the model and associated data.

Figure 1 Release Notes Dialog Box



Note: Screenshot taken on November 21, 2022.

This appendix is not a user guide but does provide recommended selections specific to the Bay Area. For general model information, including the CalEEMod User Guide, technical documentation, and user tips, visit the CalEEMod website at <http://www.caleemod.com/user-guide>.

CalEEMod includes 138 emissions reduction measures, 99 climate risk reduction measures, and 50 health and equity measures. Most of these measures are based on quantification methods, assumptions, and defaults from CAPCOA's *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers* (CAPCOA Handbook), which was adopted by CAPCOA in December 2021.

The CAPCOA Handbook, which is available at <https://www.caleemod.com/handbook/index.html>, is referenced throughout this appendix because it and the update to CalEEMod were performed in tandem and in concert.

CalEEMod provides default values for estimating construction and operational emissions from Bay Area-specific projects. Although users may apply the default values, the Air District strongly recommends that default values be modified whenever project-specific information is available to obtain more accurate emissions quantification. When site-specific information is unavailable, the Air District recommends that the most conservative estimates be used for the type of construction equipment and number of pieces of equipment to be used, the hours of operation, and the distance to the nearest sensitive receptors.

When changing any default parameters, users must include notes and references in the *Justification for Changes* box, which will facilitate reviews by lead agencies and other stakeholders. Note that the model will not allow users to advance if there is no justification in the *Justification for Changes* box for changes made to defaults. The sections below discuss specific fields where inputs are required and/or where adjustments are recommended.

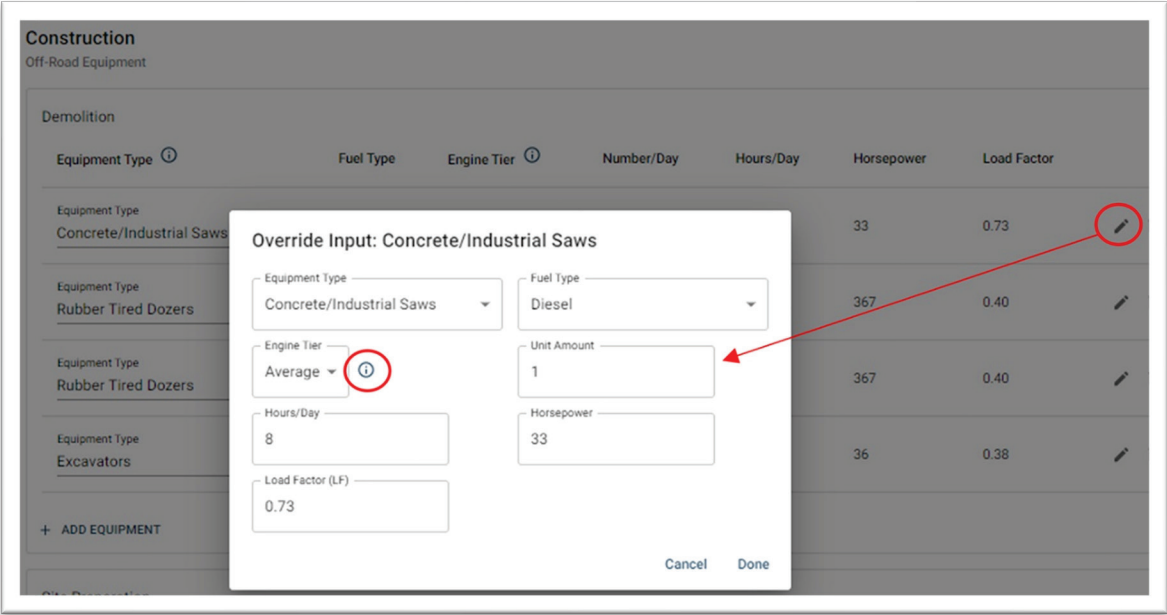
Some features and icons in CalEEMod appear on many of the screens. These icons are summarized in **Figure 2**.

Figure 2 Icons Used throughout CalEEMod**Edit icon****Trash icon****Information icon****Notepad icon**

The four major icons are as follows:

1. **Edit icon:** The user can select the edit icon to edit information in various modules. Clicking this icon will engage a new pop-up window in which the user can enter or edit information. The edit icon is in the form of a pencil. Figure 3 shows an example dialog box that appears after the edit icon is clicked.
2. **Trash icon:** The trash icon allows users to delete values, such as pieces of equipment, construction phases, and material volume quantities.
3. **Information icon:** The information icon appears as an "i" on many of the screens. The user can hover over the "i" icon, which provides the user additional content and instructions for certain variables and metrics in the model. **Figure 3** shows the "i" icon circled in red.
4. **Notepad icon:** In the Measures module (discussed in Section 7 of this appendix), the notepad icon appears next to measure titles. Clicking this icon links the user to that measure's factsheet or to the relevant description from the CAPCOA Handbook. The measure factsheet or description will open in a new tab in the user's web browser. The notepad icon looks like a document.

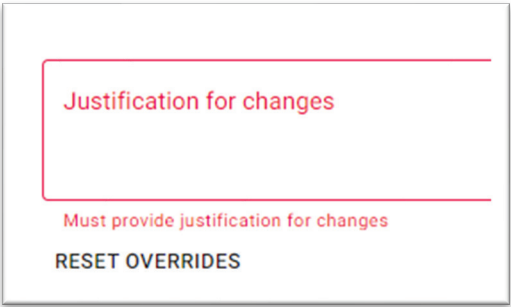
Figure 3 Override Input Dialog Box and Information Icon



When an edit is made in a module, the user can click the *Reset Overrides* text to reset a user change back to the model defaults. The *Reset Overrides* text appears only after a default has been changed. Note that clicking *Reset Overrides* resets *all* values in a module back to defaults.

Figure 4 shows the *Justification for Changes* box, along with the *Reset Overrides* option that appears when defaults are edited by the user. The box and associated text remain red until text is entered.

Figure 4 Justification for Changes Box

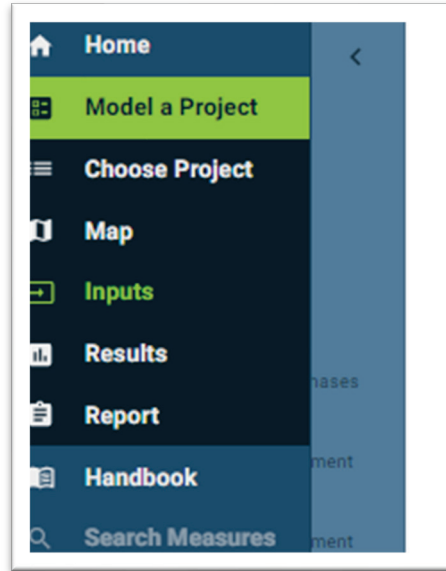


2 CHARACTERISTICS AND LAND USE MODULES

Because CalEEMod includes default parameters, the model can begin calculating emissions from a project after the first two screens, Project Detail and Land Use (found in the Characteristics and Land Use modules), are completed. Listed below are recommendations for specific input fields in the Project Detail and Land Use screens.

CalEEMod has five main components, as shown in the left-hand sidebar navigation panel of the tool: Home, Map, Inputs, Results, and Report. In addition, it has two components for initiating a project (either starting a new or loading an existing project), along with a link to the CAPCOA Handbook and a measure search tool, which allows users to search, filter, and explore the mitigation measures included in CalEEMod and in the CAPCOA Handbook. Figure 5 shows a screenshot of the model navigation panel.

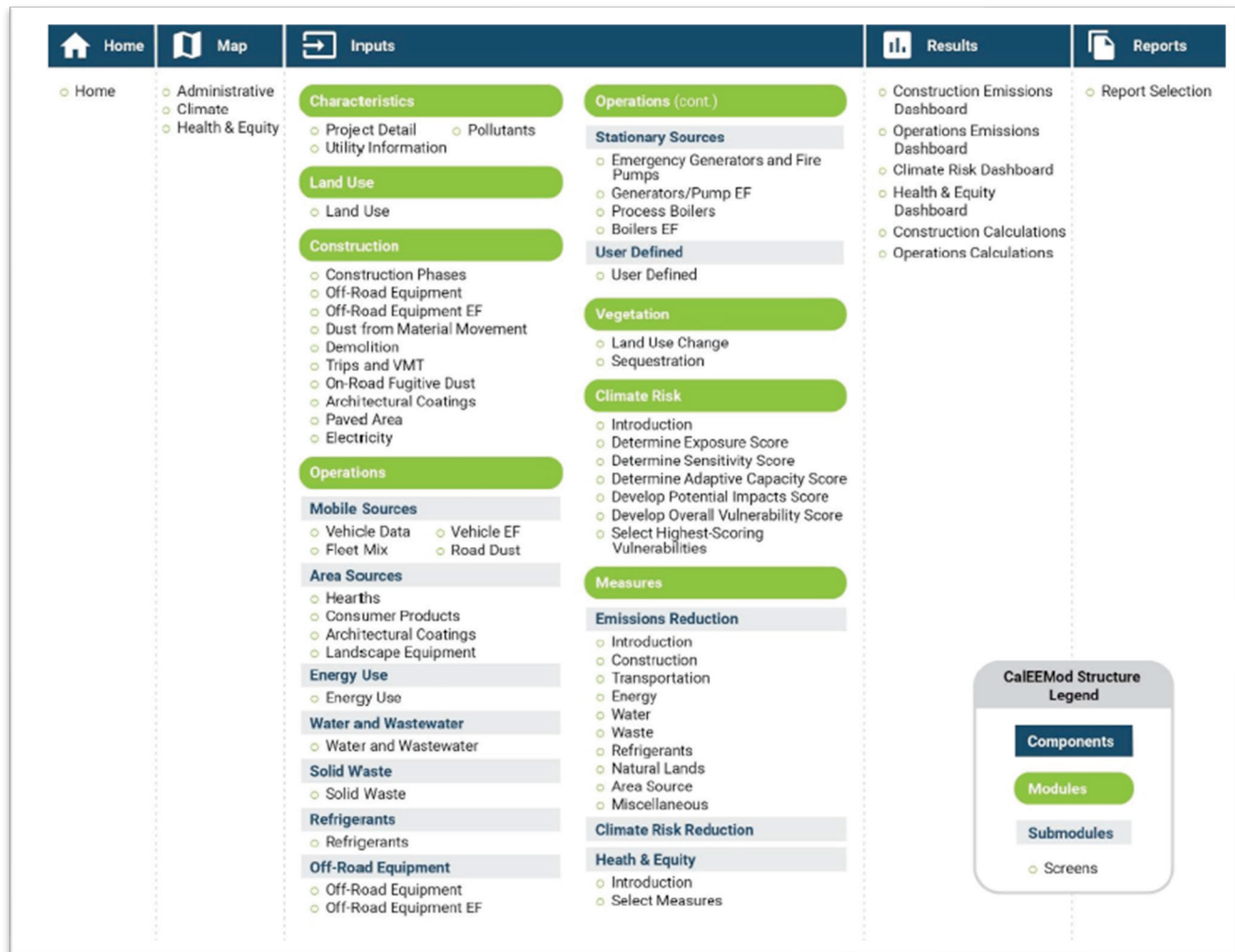
Figure 5 Model Navigation Panel



The Inputs component is the largest component in CalEEMod, requiring the user to input various required project data, review and/or adjust model defaults to estimate project-related emissions, and implement mitigation measures. Within the Inputs component, the various screens are grouped together under the following modules: Characteristics, Land Use, Construction, Operations, Vegetation, Climate Risk, and Measures.

The specific pages (or submodules) under each module are shown in **Figure 6**. An overview of key user considerations for each of these modules and submodules is provided below.

Figure 6 Structure of CalEEMod



Source: Figure 1 on page 4 of the April 2022 CalEEMod User Guide (<https://www.caleemod.com/user-guide>).

2.1 OVERVIEW AND STARTING A PROJECT

When CalEEMod is initiated, the user will begin entering the project information in the Home component. The user may start a new project or work on a previously saved model run. The model runs typically are saved in the cache of the internet browser. For additional redundancy, it is a best practice to periodically save the model run to reduce the possibility of data loss. The saved files have .json extensions and can be found in the user's computer. A description of how these files work is provided in Section 3.2 of the CalEEMod User Guide.

After a project is started or loaded, the first screen is the *Location Information* screen, which is used to collect location-specific model information based on the project's location. This screen opens up with a zoomed-out view of the northern California region, as shown in **Figure 7**. The user can navigate the map by clicking any place in the map to zoom, then moving the map around to find the specific project location, or by entering the project's street address or latitude/longitude coordinates. A screenshot of the *Location Information* screen after a location is selected is shown in **Figure 8**. In this example, the Mission District portion in the City of San Francisco was selected as the project location. After the location is selected, the user can navigate back to this module and click the *Change Location* button to change the location, if needed.

Figure 7 View of the Location Information Screen before a Location Is Selected

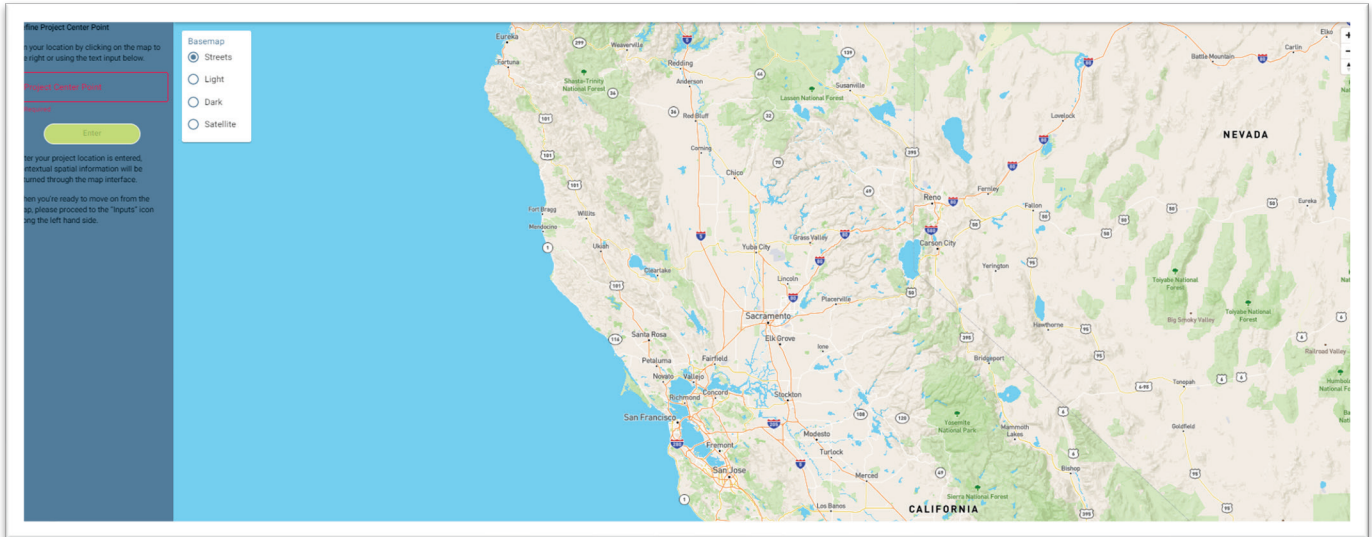
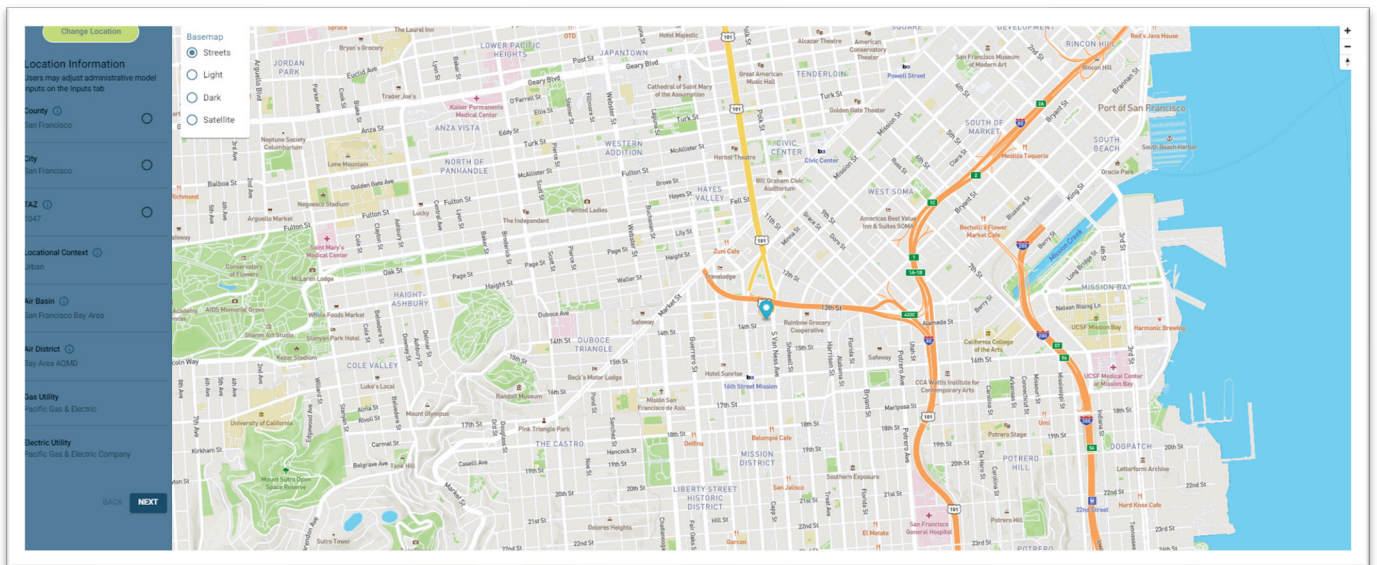


Figure 8 View of the Location Information Screen after a Location Is Selected



After the location is entered, the model populates a list of location-specific features, including:

- ▶ county of project,
- ▶ city of project,
- ▶ Traffic Analysis Zone (TAZ),
- ▶ locational context (urban, suburban, or rural),
- ▶ air basin,
- ▶ air district,
- ▶ gas utility, and
- ▶ electrical utility.

CalEEMod uses these location-specific metrics to automatically populate specific parameters, such as average wind speed, number of precipitation days, vehicle trip lengths, energy consumption, and electrical utility, that are used to estimate emissions in the model. Each of these items and their associated metrics can be overridden if project-specific information is known. Users are advised to be as precise as possible when selecting the project location. For larger development projects (such as general, master, or specific plans) and for linear projects (such as construction or modification of a bridge or overpass or new road construction or road widening), the user should identify the center point of the project site to define the project location.

When starting a project file in CalEEMod, the first two modules are the Characteristics and Land Use modules. **Table 1** presents recommendations for specific input fields in the Characteristics module, and **Table 2** presents recommendations for specific input fields in the Land Use module.

Table 1 Characteristics Module Inputs

Screen and Input Field	Recommendations
Project Detail	
Project Name	This is automatically populated based on the name entered in the <i>Start a New Project</i> page, but it can be modified if needed.
Automatic Updates to Default Values	This value affects how the model will treat programmed defaults in subsequent steps. The user can choose one of the following related to automatic updates: • <i>Always</i> (the model will override the user input if the user overrides a default with project-specific information but later changes a land use input). • <i>Never</i> (for users who wish to provide every model input with project-specific information (e.g., vehicle miles traveled, electricity consumption). The model will not populate default metrics, and the user must ensure consistency between screen inputs. • <i>Unless Overridden</i> (the model will provide default metrics, and if metrics are adjusted by the user based on project-specific information, the model will not override these inputs as the user navigates the model). The <i>Always</i> and <i>Unless Overridden</i> options are likely to be the most frequently used choices. Although this is an upgrade from previous versions of CalEEMod, which often overrode user-provided inputs with defaults without user consent, users are advised to be cautious and ensure that inputs are reflective of the project.
Lead Agency	Information can be entered in this field but is not necessary.
Quantify Emissions For	This allows the user to designate whether the model run is for construction or operations or both. For construction-only projects, the operations-specific modules on left-hand sidebar navigation panel will disappear. For operations-only projects, the construction-specific modules on left-hand sidebar navigation panel will disappear. Please note that the Air District does not recommend using CalEEMod to estimate operational emissions from sources permitted by the Air District.
Locational Context	This is automatically populated based on the location entered on the map. This assumption primarily affects the efficacy of certain transportation measures (mitigation measures). The user can modify this assumption using the drop-down menu, if appropriate, as long as justification is provided.
City	This is automatically populated based on the location entered on the map. The user can modify this assumption using the drop-down menu, if appropriate.
County	This is automatically populated based on the location entered on the map. The user can modify this assumption using the drop-down menu, if appropriate.

Screen and Input Field	Recommendations
	If the project is located in Solano County or Sonoma County, be sure that Solano-San Francisco or Sonoma-San Francisco, respectively, are populated to capture the portion of the county in the San Francisco Bay Area Air Basin. For larger development or linear projects that span multiple counties, the user should identify the center point of the project site to define the project location.
Air District	This is automatically populated based on the location entered on the map. The user can modify this assumption using the drop-down menu, if appropriate.
Air Basin	This is automatically populated based on the location entered on the map. The user can modify this assumption using the drop-down menu, if appropriate.
Wind Speed (meters per second)	This is automatically populated based on the location entered on the map. The model assigns the average wind speed from the nearest airport wind monitoring location. Wind speed is used to estimate fugitive dust emissions from truck loading during construction. Under certain circumstances, the user can modify the wind speed using site-specific monitoring data or data from another station if evidence is provided to justify this change. Monitoring stations and associated wind speeds are shown in CalEEMod Appendix G, Table G-1.
Precipitation Days per Year	This is automatically populated based on the location entered on the map. The model assigns the precipitation frequency (annual days greater than 0.1 inch) based on the nearest airport monitoring location. Precipitation frequency influences the intensity of emissions factors related to construction fugitive dust and from vehicles traveling on paved and unpaved roads during both construction and operation. Under certain circumstances, the user can modify the precipitation frequency using site-specific monitoring data or data from another station if evidence is provided to justify this change. Monitoring stations and precipitation days are shown in CalEEMod Appendix G, Table G-2.
CEC California Electricity Demand Forecast Zone	This is automatically populated based on the location entered on the map. The California Energy Commission has divided the state into 28 Electricity Demand Forecast Zones (EDFZs) based on climate and associated electricity consumption. The EDFZ influences default calculations for building energy consumption and the effectiveness of emissions reduction measures in the energy sector. The user can revise the default building energy consumption metrics (e.g., kilowatt-hours of electricity, therms of natural gas) if project-specific information is known.
Traffic Analysis Zone	This is automatically populated based on the location entered on the map. Traffic Analysis Zone (TAZ) locations are based on the 2015 California Statewide Travel Demand Model. The TAZ selection determines key default inputs related to construction trip lengths and operational vehicle miles traveled that are used to determine the vehicle trip purpose percentages and vehicle trip lengths. On the Vehicle Data screen in the Operations module, the user can change the trip length and trip purpose assumption to be based on Metropolitan Planning Organization or Regional Transportation Planning Agency data instead. Moreover, the user can enter vehicle miles traveled and trip data manually if these data are available from the project's traffic study.
Start of Construction	The user should select the earliest possible start date for construction.
Operational Year	The user should select the anticipated year when the project would be operational.
Utility Information	
Electric Utility	This is automatically populated based on the location entered on the map. The user can modify the utility name using the drop-down menu or add a User Defined name, if appropriate.
Gas Utility	This is automatically populated based on the location entered on the map. The user can modify the utility name using the drop-down menu or add a User Defined name, if appropriate.

Screen and Input Field	Recommendations
Operations GHG Emission Factors (electricity)	This is automatically populated based on the electrical utility assigned above. The default emissions factors are loaded in for the most recent year available at the time of programming (2019) and the forecasted future year of 2025. Note that forecasted future year rates are not available for every utility. The user can adjust these emissions factors based on project- or utility-specific information for other years (see the next item below).
Greenhouse gas pollutant intensity factors (lb/MWh)	These emissions factors (in pounds per megawatt-hour) are automatically populated based on the electrical utility and year (2019 or 2025) assigned above. Emissions factors for other years can be manually adjusted if those rates are available. In addition, although not incorporated in the model, emissions factors for each utility are provided in CalEEMod Appendix G, Table G-1, for all years through 2045.
Pollutants	
Pollutant	The user should select the pollutants to be quantified in the emissions modeling. It is recommended that users "Select All" pollutants.
Threshold	The user can choose to include daily, quarterly, and/or annual thresholds. These will appear in the report outputs but will not affect the emissions.

Table 2 Land Use Module Inputs

Input field	Recommendations
Land Use Type	The user should include all land use types that are part of the project site, including paved and landscaped areas. Select City Park for landscaped areas requiring irrigation, and zero any trips associated with landscaped areas unless the landscaped areas themselves would generate trips. There are options for nonlinear (such as office, retail, or residential uses) and linear (such as roadway) projects.
Land Use Subtype	The user should select the most applicable subtype. If User Defined is selected, the user must supply the necessary input data because no default values are associated with this option (include references in Remarks). For linear projects, the type of project (such as new road, road widening, bridge/overpass construction) will affect several construction assumptions.
Unit	The user should select the most applicable land use unit (e.g., acreage, 1,000 square feet, dwelling unit).
Size	This metric denotes the size of the land use.
Lot Acreage	Lot acreage is calculated based on the land use type and amount specified. The user should adjust as necessary for mixed-use buildings. See CalEEMod User Guide Section 4.2 for additional information.
Building Square Feet	Square footage is calculated based on the land use type and amount specified. The user should adjust as necessary for the project.
Landscape Area (square feet)	The user should include any landscape areas. The model will provide defaults for certain single-family housing. The size of landscape areas for all other land uses needs to be input manually. This metric affects outdoor water consumption.
Special Landscape Area (square feet)	This metric denotes the portion of the landscaped area dedicated to edible plants; areas irrigated with recycled water; water features using recycled water; and areas dedicated to active play, such as parks, sports fields, golf courses, and places where turf provides a playing surface.
Population	CalEEMod assigns a default population for residential land uses. The user can adjust this metric if project-specific population is known.
Description	This metric denotes any special notes that the user wants to show in the output. It is particularly useful for mixed-use projects with multiple land use types.

Input field	Recommendations
Predominant Soil/ Site Type	If a linear land use type is selected, a prompt asks the user to select the Predominant Soil/Site Type, which affects the construction phasing information in later modules. The California Geological Survey provides an online geologic map, which can help determine the appropriate option, at https://maps.conservation.ca.gov/cgs/gmc/ .

3 CONSTRUCTION MODULE

After the Characteristics and Land Use modules have been completed, the Construction module begins setting up the model to calculate the emissions associated with construction of the project. Construction has several different types of sources that contribute to emissions of pollutants, including off-road equipment use, on-road vehicle travel, fugitive dust, architectural coating, and paving off-gassing. The sections below discuss the specific input fields for the Construction module.

3.1 CONSTRUCTION PHASES SCREEN

CalEEMod includes the following construction phases: demolition, site preparation, grading, trenching, paving, building construction, and architectural coating. Based on the information entered on the screens in the Characteristics and Land Use modules, CalEEMod populates the construction phases and schedules.

For nonlinear land use types (such as office, retail, and residential uses), the construction phasing schedule (and equipment assignments, discussed below) are based on total project acreage (similar to previous versions of CalEEMod). For linear projects (such as construction or modification of a bridge or overpass or new road construction or widening roadways), the construction phasing schedule (and equipment assignments, discussed below) also are based on total project acreage. Default phases and durations are based on the total number of workdays and the predominant soil/site type, as input by the user in the Land Use screen.

Users may need to add or remove phases as appropriate. For example, a demolition phase should be included only if there is demolition of existing structures on-site, and a trenching phase should be included only if the project requires trenching, generally associated with underground utilities. It is recommended that users adjust the timing and duration of each phase based on the actual project construction schedule, including the start date, end date, and number of working days per week. The model uses specific preloaded emissions factors based on the averaged fleetwide engine year of equipment and the calendar year of the construction phase.

CalEEMod defaults to construction activity occurring 5 days per week (Monday through Friday). Users can select fewer (1–4 days per week) or more (6–7 days per week) using the dropdown box. The selected number of days per week influences the calculation of total workdays and can influence maximum daily emissions calculations (if a number of phases occur on the same day) and annual emissions calculations.

The user can toggle the Enable Auto Scheduler on (toggled to the right) if the user wants the model to automatically update phase start and end dates based on CalEEMod defaults as phases are added. If the user wants to control the construction schedule, then the user should ensure that the Enable Auto Scheduler option is toggled off (toggled to the left).

3.2 OFF-ROAD EQUIPMENT SCREEN

The Off-Road Equipment screen includes default construction equipment for each phase based on project acreage. The model loads equipment types, fuel type, engine tier, number of units, and number of hours per day for each phase of construction based on the project information loaded in previous fields (such as land use acreage) in the model and information (horsepower, load factor, emissions factors) from the California Air Resources Board's (CARB's) OFFROAD model. If project-specific information, such as equipment types, the number of pieces, the specific pieces of equipment, and whether pieces are nondiesel, is known, then the Air District recommends that the user edit this information using the pencil icon, which engages an *Override Input* dialog box. If the equipment type is not available in CalEEMod, users should calculate the emissions off-model using information from the manufacturer specifications and anticipated use.

Figure 9 shows the equipment inputs that the user can override using the pencil (editing) icon. The equipment inputs can be overridden for each piece of equipment if equipment-specific information (such as specific engine tier, or specific horsepower, and whether the number of pieces or hours of use per day need to be changed) is known.

Figure 9 Editing Construction Off-Road Equipment

The screenshot displays the 'Construction Off-Road Equipment' screen. It features a table with columns for Equipment Type, Fuel Type, Engine Tier, Number/Day, Hours/Day, Horsepower, and Load Factor. The table lists equipment for Demolition and Site Preparation phases. A red circle highlights the pencil icon in the top right corner of the table, which is used to edit the equipment inputs. An 'Override Input: Concrete/Industrial Saws' dialog box is open, showing fields for Equipment Type (Concrete/Industrial Saws), Fuel Type (Diesel), Engine Tier (Average), Unit Amount (1), Hours/Day (8), and Load Factor (0.73). The dialog box has 'Cancel' and 'Done' buttons at the bottom.

Equipment Type	Fuel Type	Engine Tier	Number/Day	Hours/Day	Horsepower	Load Factor
Concrete/Industrial Saws	Diesel	Average	1	8	33	0.73
Rubber Tired Dozers	Diesel	Average	1	1	367	0.40
Rubber Tired Dozers	Diesel	Average	1	8	367	0.40
Excavators	Diesel	Average	1	8	36	0.38
Tractors/Loaders/Backhoes	Diesel	Average	1	8	84	0.37

3.3 OFF-ROAD EQUIPMENT EF SCREEN

The Off-Road Equipment EF (for "emissions factor") screen summarizes the emissions factors for the off-road pieces that were loaded on the previous screen. These emissions factors are pulled from an OFFROAD database based on the construction years, equipment types, engine tier (default or tier), fuel type (e.g., diesel), and horsepower range. If equipment-specific emissions factor information is known, then the Air District recommends that the user edit this information using the pencil (edit) icon on this screen.

3.4 DUST FROM MATERIAL MOVEMENT SCREEN

The Dust from Material Movement screen calculates the fugitive dust emissions associated with site preparation and grading during construction. This screen calculates fugitive dust from dozers moving dirt, from graders or scrapers leveling land, and from dirt being loaded onto or unloaded from haul trucks. Users should enter the anticipated volume of material imported and exported, as well as the total acreage graded for the project. Various metrics, such as mean vehicle speed (7.1 mph), bulldozing material moisture content (7.9 percent), truck loading material moisture content (12 percent), and material silt content (6.9 percent) are preloaded defaults. Although not common practice, the user may adjust these details if site-specific information is known, provided justification is included.

The Water Exposed Area toggle allows the user to account for dust control as part of the project design, part of regulatory compliance, or part of best management practices as recommended by the Air District (see Section 5.2.2 of Chapter 5, "Project-Level Air Quality Impacts"). The user can select watering twice daily (61-percent reduction) or three times daily (74-percent reduction) or can select Other and load in another reduction percentage. If Other is selected, justification needs to be provided.

Figure 10 shows the layout of this screen, with the Water Exposed Area toggle and Frequency drop-down box highlighted. Appendix A of the CalEEMod User Guide includes a detailed discussion of the methods, variables, and assumptions related to fugitive dust calculations.

The Air District recommends the implementation of Basic Best Management Practices for Construction-Related Fugitive Dust Emissions for all projects, regardless of whether construction-related fugitive dust emissions would exceed applicable thresholds of significance.

There are two Basic Best Management Practices for Construction-Related Fugitive Dust Emissions that can be quantified within CalEEMod: B-1 states that all exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered twice per day, and B-4 states that all vehicle speeds on unpaved roads shall be limited to 15 mph.

Basic Best Management Practices for Construction-Related Fugitive Dust Emissions Measure B-1 (watering) is implemented on the Dust from Material Movement screen. Because this measure (watering) is applied in the Construction module instead of in the Measures module (discussed below), emissions reductions associated with watering will be included in the unmitigated emissions results. Consistent with Air District guidance, if a project's construction emissions would exceed the applicable thresholds of significance, then implementation of additional best management practices is required.

As noted, users are required to implement watering twice daily in the unmitigated analysis. If additional watering (e.g., watering three times daily) or other mitigation (e.g., use of dust suppressants) is required to reduce particulate matter with a diameter less than or equal to 10 microns (PM₁₀) or particulate matter with a diameter less than or equal to 2.5 microns (PM_{2.5}) impacts related to fugitive dust, users should implement additional reductions in the Measures module.

Basic Best Management Practices for Construction-Related Fugitive Dust Emissions Measure B-4 (speeds on unpaved roads) is reflected on the On-Road Fugitive Dust screen, discussed later in Section 3.7.

Figure 10 Dust from Material Movement Screen

Construction
Dust from Material Movement

☒ Water Exposed Area

Frequency: 2

PM10 (% Reduction): 61

PM2.5 (% Reduction): 61

Phase Name	Phase Type	Total Material Imported	Total Material Exported	Size Metric	Material Import/Export Phased?	Mean Vehicle Speed (mph)	Total Acres Graded	Material Moisture Content (%) Bulldozing	Material Moisture Content (%) Truck Loading	Material Silt Content (%)
Site Preparation	Site Preparation	0	1000	Cubic Yards	☐	7.1	15	7.9	12	6.9
Grading	Grading	0	0	Cubic Yards	☐	7.1	27.5	7.9	12	6.9
Dozing	Grading	0	0	Cubic Yards	☐	7.1	1.375	7.9	12	6.9
Linear, Grubbing & Land Clearing	Linear, Grubbing & Land Clearing	Material Importer Recommended	Material Exporter Recommended	Size Metric	☐	7.1	0	7.9	12	6.9
Linear, Grading & Excavation	Linear, Grading & Excavation	Material Importer Recommended	Material Exporter Recommended	Size Metric	☐	7.1	0	7.9	12	6.9
Linear, Drainage, Utilities, & Sub-Grade	Linear, Drainage, Utilities, & Sub-Grade	Material Importer Recommended	Material Exporter Recommended	Size Metric	☐	7.1	0	7.9	12	6.9

Add Phase

3.5 DEMOLITION SCREEN

The Demolition screen allows users to enter the amount of demolished material expected at the project site that would generate dust emissions during mechanical and explosive demolition, site removal of debris, and on-site truck traffic on paved and unpaved roads. Users should enter the debris tonnage or building square footage to allow the model to correctly calculate fugitive dust emissions and truck trips generated from demolition.

The Water Demolished Area toggle allows the user to account for dust control as part of the project design, part of regulatory compliance, or part of best management practices recommended by the Air District. The user can select watering twice daily (36-percent reduction) or select Other and load in another reduction percentage. If Other is selected, justification needs to be provided.

For projects involving demolition of structures containing asbestos, the project sponsor must obtain a permit from the Air District and properly remove asbestos material following the requirements under Air District Regulation 11-2: Asbestos Demolition, Renovation, and Manufacturing.

3.6 TRIPS AND VMT SCREEN

The Trips and VMT (for "vehicle miles traveled") screen allows users to enter the number and length of on-road vehicle trips for workers, vendors, and haulers for each construction phase. Hauling trips assume that a truck can hold 20 short tons (16 cubic yards) of material per load, and the default haul trip length is 20 miles per one-way trip. Users can override defaults to modify the number of trips, haul trip length (if a specific destination is known), and vehicle fleet to match the anticipated construction trip data for the project.

Vendor (material delivery) trips are preloaded only for building construction phases. For all other phases (e.g., grading, paving), vendor trips are zero by default but can be manually input.

3.7 ON-ROAD FUGITIVE DUST SCREEN

The On-Road Fugitive Dust screen allows users to define the variables that will be used to determine the fugitive dust emissions from on-road vehicles driving over paved and unpaved roads during construction. CalEEMod automatically populates the data fields based on the construction phase. The calculations use emissions factors from the U.S. Environmental Protection Agency's AP-42 for paved and unpaved roads.^{1,2} The defaults for road dust (e.g., material silt content, material moisture content, and mean vehicle speed) are statewide averages, but users can override the defaults if data specific to the project are known. In CalEEMod, all roads in the Bay Area are assumed to be paved, so the model does not calculate emissions from unpaved road travel. The user must enter site-specific assumptions if a project includes on-site truck trips or unpaved road travel.

The amount of fugitive dust emissions depends on the quantity of silt present on the roadway, called silt loading. Freeways have low silt loading because high volumes of traffic prevent the buildup of silt on the roadway, whereas local streets, which are used by fewer vehicles, have a much higher silt loading factor. The CalEEMod default silt loading factor (grams per meter squared [g/m^2]) for paved roads is $0.1 \text{ g}/\text{m}^2$ based on Section 13.2.1 of AP-42, which corresponds to vehicle travel on roads with at least 5,000 vehicle per day under *normal* conditions.

For the construction analysis, users should modify this variable in CalEEMod to use a silt loading factor of $0.5 \text{ g}/\text{m}^2$ for all roadways, which corresponds to vehicle travel on roads with at least 5,000 vehicle per day under *worst-case* conditions (defined in AP-42 as representative of conditions such as post-winter-storm or areas with substantial mud/dirt carryout consistent with typical construction activities).

This approach is designed to ensure adequate health protection to local residents nearest the project site, who would be affected from on-road vehicle emissions as workers, vendors, and haulers travel to and from the construction site. Weighted silt loading factors can be used in cases where construction vehicles travel exclusively on nonlocal roads, such as freeways or arterials.

Note that the guidance for silt loading is different for operations. See Section 4.1.4 for that discussion.

Regarding Basic Best Management Practices for Construction-Related Fugitive Dust Emissions, B-4 (limiting unpaved travel speed to 15 mph) is implemented on the On-Road Fugitive Dust screen. The default unpaved road travel speed in CalEEMod is 40 mph. The user adjusts this speed to 15 mph on this screen, as shown in **Figure 11**. Because this measure is being applied in the Construction module instead of in the Measures module (discussed below), emissions reductions associated with limiting unpaved travel speed will be included in the unmitigated emissions results. Consistent with Air District guidance, if a project's construction emissions would exceed the applicable thresholds of significance, then implementation of Enhanced Best Management Practices for Construction-Related Fugitive Dust Emissions is required. As with all adjustments to defaults, the user must provide a justification for the travel speed change before proceeding to the next page. The user should cite Air District Best Management Practices for Construction-Related Fugitive Dust Emissions as the reason for the change. Also, as noted above, all roads in the Bay Area are assumed to be paved; thus, by default, CalEEMod will not estimate any unpaved road dust emissions unless the user

¹ Section 13.2.1, "Paved Roads." Available: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.1_paved_roads.pdf.

² Section 13.2.2, "Unpaved Roads." Available: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.2_unpaved_roads.pdf.

specifies otherwise. If there are no unpaved roads for the project in question, then the mean travel speed does not need to be revised, because the change would have no bearing on the emissions calculations.

Figure 11 On-Road Fugitive Dust Screen

Construction
On-Road Fugitive Dust

Control Strategy 1

Phase Name	Percent (%) of Travel on Paved Roads				Roadway Characteristics			Vehicle Characteristics	
	% Pave Worker	% Pave Vendor	% Pave Hauling	% Pave Onsite Truck	Road Silt Loading (g/m ²)	Material Silt Content (%)	Material Moisture Content (%)	Average Vehicle Weight (tons)	Mean Vehicle Speed (mph)
Demolition	100	100	100	0	0.1	8.5	0.5	2.400000953674316	15
Site Preparation	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Grading	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Building Construction	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Paving	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Architectural Coating	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Dozing	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Linear, Grubbing & Land Clearing	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Linear, Grading & Excavation	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Linear, Drainage, Utilities, & Sub-Grade	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40
Linear, Paving	100	100	100	0	0.1	8.5	0.5	2.400000953674316	40

Justification for changes:
BAAQMD Basic BMP - 15 mph unpaved travel speed

RESET / VIEW PDF

3.8 ARCHITECTURAL COATINGS SCREEN

The Architectural Coatings screen is intended to calculate reactive organic gases (ROG) (or volatile organic compounds [VOC]) emissions associated with painting the interior and exterior of residential and nonresidential buildings, as well as calculate emissions from parking lot painting or striping. Users can modify the Air District's default for residential and nonresidential interior and exterior coatings using project information if more stringent coatings would be used. In accordance with Air District's Regulation 8-3: Architectural Coatings,³ residential and nonresidential interior coatings are preloaded into CalEEMod at 100 grams per liter (g/L), whereas exterior coatings are set at 150 g/L. Likewise, the architectural coating limit for parking areas is also set at 100 g/L in CalEEMod.

3.9 PAVED AREA SCREEN

The Paved Area screen is intended to calculate ROG (or VOC) off-gassing emissions associated with asphalt paving. Paved acreage is calculated automatically based on the land use inputs, but it can be manually adjusted by the user. The emissions area is estimated by multiplying the paved area of each parking stall with the capacity of the parking lot or the number of parking stalls. Parking areas can be either asphalt (which emits ROG or VOC emissions during application) or concrete (which does not emit ROG or VOC emissions during application). The CalEEMod default is 100-percent asphalt for all Linear and Parking land use subtypes (except for the *Non-Asphalted Surfaces* land use option) and 0 percent for all

³ Regulation 8-3 is available at the following link: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-8-rule-3-architectural-coatings>.

other land use types. The user can specify the percentage of paving that is asphalt, although it is not recommended that users revise the default emissions factors of 2.62 pounds per acre.

3.10 ELECTRICITY SCREEN

The Electricity screen calculates electricity emissions for the construction phase. The utility and emissions factors are preloaded based on the utility confirmed in the Characteristics module. The user can input the estimated electricity consumption (in kilowatt-hours) for each year of construction.

4 OPERATIONS MODULE

The Operations module calculates emissions from mobile sources, area sources, energy use, waste and wastewater, solid waste, off-road equipment, and stationary sources. CalEEMod should not be used to estimate emissions from stationary sources that require an Air District permit to operate, such as gas stations, standby and prime generators, boilers, and fire pumps. Instead, users should estimate emissions from these sources following the methodology outlined in the Air District's Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>. The sections below discuss the specific input fields for the Operations module where an Air District permit is not required.

4.1 MOBILE SOURCES SUBMODULE

4.1.1 Vehicle Data Screen

The Vehicle Data screen includes several data fields related to vehicles trips and VMT. Daily trip rates affect the calculation of starting exhaust and evaporative emissions. VMT is used in the calculation of running exhaust, brake wear, tire wear, and fugitive dust from paved and unpaved roads.

The user can define the project vehicle trip and VMT data using model defaults or using project-specific trip and VMT inputs from a traffic study,

Weekday, Saturday, and Sunday vehicle trip rates are automatically generated based on the corresponding land uses in the Institute of Transportation Engineers Trip Generation Manual (10th Edition). It is highly recommended that users adjust the trip rates if a traffic study was completed for the project.

Default trip lengths are based on TAZ-specific data from the California Statewide Travel Demand Model (CSTDm) when the user entered the project location, but they can be changed to refer to Metropolitan Planning Organization/Regional Transportation Planning Agency (MPO/RTPA) data instead. In addition, if a project-specific traffic study was completed that estimates VMT on a per-trip basis, that information should be used instead of the default data. This information can be input by clicking the *Enter VMT and Trips Manually Instead* option, which initiates a new page. **Figure 12** shows the layout of the Vehicle Data screen with the default CSTDm data populated. The circled area in the top-right corner shows the toggle option between CSTDm trip lengths (default) and the MPO/RTPA trip lengths. The circled area on the left is where the user can select to enter VMT and trips manually instead of using default data. If this is clicked,

a separate page opens on which the user can enter project-specific trip and VMT data. This page, as it appears when it first opens up (with all values blank), is shown in **Figure 13**.

When entering VMT and trips manually, the user can choose to enter *daily* trips and VMT estimates then click Calculate Annual Trips from Daily, enter *annual* trips and VMT then click Calculate Daily Trips from Annual, or enter both daily and annual data if those data are available from the traffic study.

Figure 12 Vehicle Data Screen with Defaults Loaded

Operations Vehicle Data

Your project is located in an area for which default trip purpose splits and trip lengths are available from the local Metropolitan Planning Organization (MPO) or Regional Transportation Planning Agency (RTPA). Would you like to use the MPO/RTPA data to estimate VMT? CSTD MPO/RTPA

Enter VMT and Trips Manually Instead

Rates and Lengths

Land Use Sub Type	Size	Weekday Trip Rate (size/day)	Saturday Trip Rate (size/day)	Sunday Trip Rate (size/day)	Res H-W Trip Length (miles)	Res H-S Trip Length (miles)	Res H-O Trip Length (miles)	Non Res H-W Trip Length (miles)	Non Res W-O Trip Length (miles)	Non Res O-O Trip Length (miles)
Strip Mall	1000sqft	44.3199996948242	42.0400009155273	20.4300003051757	0	0	0	12.21133377	6.911913208	3.194303522
Apartments Low Rise	Dwelling Unit	7.32000017166137	8.14000034332275	6.28000020980835	13.01236635	2.482680903	2.727759598	0	0	0

Purpose and Percentages

Land Use Sub Type	Size	Weekday Primary Trip (%)	Weekday Divert Trip (%)	Weekday Pass By Trip (%)	Saturday Primary Trip (%)	Saturday Divert Trip (%)	Saturday Pass By Trip (%)	Sunday Primary Trip (%)	Sunday Divert Trip (%)	Sunday Pass By Trip (%)	Res H-W Trip (%)	Res H-S Trip (%)	Res H-O T (%)
Strip Mall	1000sqft	100	0	0	100	0	0	100	0	0	0	0	0
Apartments Low Rise	Dwelling Unit	100	0	0	100	0	0	100	0	0	25.758764699	22.8781167	51.36311

Figure 13 Vehicle Data Popup for Entering VMT and Trips Manually

Operations Vehicle Data

Generate Default VMT and Trips Instead

Trips per weekday

Trips per Saturday

Trips per Sunday

VMT per weekday

VMT per Saturday

VMT per Sunday

Calculate Daily Trips from Annual Reset

Annual Trips

Annual VMT

Calculate Annual Trips from Daily Reset

4.1.2 Fleet Mix Screen

The default fleet mix draws on CARB's Emission FACtor (EMFAC) Model 2021 based on the project location and operational year information provided. Users should adjust the fleet mix based on the anticipated fleet

mix if it is provided in the project's traffic study. The user must ensure that the latest version of EMFAC is being used and updated accordingly because new versions of EMFAC become available from CARB.

CARB provides both a web-based and a stand-alone (downloadable) software tool for EMFAC. The emissions factors are the same in each, but the downloadable software (which is installed on the user's PC) provides more customization options. For most project-level analyses, the web tool will provide the necessary data.

The web tool is available at <https://arb.ca.gov/emfac/emissions-inventory>.

The entire EMFAC package, which includes background, tutorials, and related resources, is available at <https://arb.ca.gov/emfac/>.

4.1.3 Vehicle EF Screen

The Vehicle EF screen draws on EMFAC 2021 based on the project location and operational year information provided. Users should adjust the emissions factors manually if a more recent version of EMFAC becomes available or if project-specific fleet information is available.

4.1.4 Road Dust Screen

The Road Dust screen allows users to define the variables that will be used to determine the fugitive dust emissions from on-road vehicles driving over paved and unpaved roads during operations. The formulas and variables here are similar to the those used on the On-Road Fugitive Dust screen in the Construction module, discussed in Section 3.7, above. On paved roads, the amount of fugitive dust emissions depends on the quantity of silt present on the roadway, called silt loading. The CalEEMod default silt loading factor (g/m^2) for paved roads is $0.1 \text{ g}/\text{m}^2$, which corresponds to vehicle travel on roads with at least 5,000 vehicle per day under normal conditions. Unlike for construction, users do not need to modify the silt loading assumption of $0.1 \text{ g}/\text{m}^2$, because the "normal conditions" assumption is applicable to long-term operations in roadways in the Bay Area.

In CalEEMod, all roads in the Bay Area are assumed to be paved under operations unless the user specifies that portions of roads traveled by project-related vehicles are unpaved. By default, the model assumes 100 percent of roads in the Bay Area are paved unless the user specifies otherwise. The average vehicle weight assumption (2.4 tons for the Bay Area), which factors into paved road calculations, should not be revised, per AP-42 guidance.

Other default factors, including material silt content (4.3 percent), material moisture content (0.5 percent), and mean vehicle speed (40 mph) variables used to estimate emissions from unpaved road travel, can be modified to incorporate project-specific information when available. Specifically, vehicle speed can be revised if the project design and approval require different travel speeds. Adjustments to the travel speed will also result in changes to unmitigated unpaved road dust emissions. Note that unpaved and paved road percentages when summed should equal 100 percent. **Figure 14** shows the variables specific to calculations for paved road dust (on the left) and unpaved road dust (on the right).

Figure 14 Paved and Unpaved Road Dust Variables in Road Dust Screen

Operations
Road Dust

☐ CARB Unmitigated Unpaved Road Statewide Emission Inventory Method: Use CARB's 2.0 (lbs PM10/VMT) and 0.2 (lbs PM2.5/VMT)

Roadway Characteristics			Vehicle Characteristics		
% Paved	Road Silt Loading (g/m ³)	Average Vehicle Weight (tons)	Material Silt Content (%)	Material Moisture Content (%)	Mean Vehicle Speed (mph)
100	0.1	2.4	4.3	0.5	40

Paved Road Dust variables

Unpaved Road Dust variables

4.2 AREA SOURCES SUBMODULE

4.2.1 Hearths Screen

The Hearths screen allows users to modify the types and amount of fuel burned in fireplaces and wood stoves. The default number of hearths and stoves reflects Air District Regulation 6-3: Wood-Burning Devices.⁴ The defaults for residential projects in the Bay Area are as follows: 20 percent of single-family and 51 percent of multifamily dwelling units include natural gas fireplaces, 80 percent of single-family and 49 percent of multifamily dwelling do not include any fireplaces, and no wood-burning fireplaces or wood stoves are assumed. In addition, no hearths are assumed for nonresidential uses, but the user can input fireplace and wood stove data if they are available for the project.

4.2.2 Consumer Products Screen

The Consumer Products screen allows users to modify emissions factors for consumer products that emit ROG. Some consumer products include solvents used in nonindustrial applications, such as cleaning supplies and kitchen aerosols, as well as pesticides and fertilizers.

4.2.3 Architectural Coatings Screen

The Architectural Coatings screen is intended to calculate ROG/VOC emissions associated with periodic painting of residential and nonresidential building interiors and exteriors, as well as calculate emissions from parking lot painting or striping. Users can modify the Air District's default for residential and nonresidential interior and exterior coatings using project information if more stringent coatings would be used. In accordance with the Air District's Regulation 8-3,⁵ the default for residential and nonresidential interior coatings is set at 100 g/L, the default for residential and nonresidential exterior coatings is set at 150 g/L, and the default for parking areas is set at 100 g/L.

4.2.4 Landscape Equipment Screen

The Landscape Equipment screen allows users to enter the number of snow days and summer days to allow the model to calculate the number of days landscaping equipment would be used at the project site. Users can generate defaults that estimate landscaping-related emissions based on the number of summer and snow days combined with the project-specific land use. The model defaults to zero for snow days and 180 for summer days for projects in the Bay Area. In addition, instead of using the number of snow and summer days, the user can choose to manually enter specific landscaping equipment and associated information (e.g., fuel type, number of days per year) if this information is known (such as for a golf course or city park).

⁴ Regulation 6-3 is available at the following link: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-6-rule-3-woodburning-devices>.

⁵ Regulation 8-3 is available at the following link: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-8-rule-3-architectural-coatings>.

4.3 ENERGY USE SUBMODULE

The Energy Use screen in the Energy Use submodule allows users to modify the energy intensity for electricity and natural gas. CalEEMod generates default electricity and natural gas consumption based on the Electricity Demand Forecast Zone (EDFZ) input on the Project Detail screen and on the land use subtypes and building square footage inputs in the Land Use module. CalEEMod energy defaults are based on the results of multiple sources, including the California Energy Commission's (CEC's) Commercial Forecast database and CEC's 2019 Residential Appliance Saturation Survey. Some land uses, such as golf courses, parks, and recreational pools, have no default energy consumption values. The user can modify the estimated energy consumption if this project-specific information is known.

4.4 WATER AND WASTEWATER SUBMODULE

The Water and Wastewater screen in the Water and Wastewater submodule estimates the emissions associated with supplying water and treating wastewater. Users can modify the amount of water in gallons used indoors and outdoors for each land use subtype.

4.5 SOLID WASTE SUBMODULE

The Solid Waste screen in the Solid Waste submodule estimates the emissions associated with disposal of solid waste. Users can modify the solid waste generation rate and associated landfill gas capture rates.

4.6 REFRIGERANTS SUBMODULE

Refrigerants are substances used in equipment for air conditioning and refrigeration. CalEEMod quantifies refrigerant GHG emissions from leaks during regular operation and routine servicing over the equipment lifetime. The user can modify the key variables, such as equipment charge size, operation and service leak rate, and equipment lifetime, if this information is known.

4.7 OFF-ROAD EQUIPMENT SUBMODULE

4.7.1 Off-Road Equipment Screen

The Off-Road Equipment screen in the Off-Road Equipment submodule allows users to select off-road equipment that may be used as part of the operations at the site. The user can select from the list of off-road equipment listed in the Construction module (see Section 3.2) and then modify key variables, such as fuel type, engine tier, daily and annual use, horsepower, and load factor, to reflect specific equipment conditions at the site.

To add operational off-road equipment, the user can select the + Add Equipment text on the right side of this screen, which initiates a pop-up box. The pop-up box opens with minimal data populated, as shown in **Figure 15**. The user is required to input certain data, including equipment type, number of pieces of equipment used per day, horsepower, and load factor, and the user can modify data that are automatically populated, including fuel type, engine tier, hours per day, and days per year. The user can input these data based on the equipment specifications, if they are known, or input the data based on the CalEEMod default

data used in the Construction module (Section 3.2). The CalEEMod default data are available in Appendix G of the model.⁶ Appendix G is an Excel workbook that includes defaults for every input in the model.

Figure 15 Adding Operational Off-Road Equipment

The screenshot shows the 'Operations' screen in CalEEMod. At the top, there's a header 'operations' and a sub-header 'Off-Road Equipment'. Below this is a table with columns: Equipment Type, Fuel Type, Engine Tier, # Per Day, Hours/Day, Days/Year, Horsepower, and Load Factor. A modal dialog box is open in the center, titled 'Equipment Type'. It contains the following fields: 'Equipment Type' (dropdown), 'Fuel Type' (dropdown, set to 'Diesel'), 'Engine Tier' (dropdown, set to 'Average'), '# Per Day' (text input), 'Hours/Day' (text input, set to '8'), 'Days/Year' (text input, set to '260'), 'Horsepower' (text input), and 'Load Factor (LF)' (text input). There are 'Cancel' and 'Done' buttons at the bottom of the dialog. In the top right corner of the main screen, there is a red button labeled '+ ADD EQUIPMENT', which is circled in red. A red arrow points from this button to the dialog box.

4.7.2 Off-Road Equipment EF Screen

The Off-Road Equipment EF screen summarizes the emissions factors for the off-road equipment added or selected on the Off-Road Equipment screen. These emissions factors come from OFFROAD2021 and are based on the operational year, equipment types, engine tier (default or specific tier), fuel type (e.g., diesel), and horsepower range. If equipment-specific emissions factor information is known, the Air District recommends that the user enter this information using the pencil (edit) icon on this screen.

4.8 STATIONARY SOURCES SUBMODULE

4.8.1 Emergency Generators and Fire Pumps Screen

The Emergency Generators and Fire Pumps screen allows users to input any emergency generators or fire pumps that would be included in the project. Users should check the Air District's rules and regulations regarding obtaining an authority to construct/permit to operate for any stationary sources associated with the project. CalEEMod should not be used to estimate emissions from standby and prime generators and fire pumps that require an Air District permit to operate. Instead, users should estimate emissions from these sources following the methodology outlined in the Air District's Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>. To estimate emissions for backup generators, the Air District recommends that users combine the emissions from operations or

⁶ Appendix G of the CalEEMod User Guide, which summarizes model defaults and emission factors used in CalEEMod, is available at https://www.caleemod.com/documents/user-guide/08_Appendix%20G.xlsx.

emergency use (nontesting and nonmaintenance) with the allowable testing and maintenance hours. In this instance, the user can include an additional 100 hours per year for each generator for nontesting and nonmaintenance purposes. Alternatively, the user can substantiate use of site-specific nontesting and nonmaintenance hours for backup generator operation. The user can also obtain information on backup generator use from the California Public Utilities Commission (CPUC) Emergency Load Reduction Program and CPUC information on temporary emergency generation use. Additional information can be referenced from Chapter 5, Section 5.2.4, "Impact Analysis."

4.8.2 Generators + Pumps EF Screen

The Generators + Pumps EF screen summarizes the emissions factors for the emergency generators or fire pumps that were loaded on the previous screen. These emissions factors are pulled from an OFFROAD database based on the operational year, equipment types, engine tier (default or tier), fuel type (e.g., diesel), and horsepower range. If equipment-specific emissions factor information is known, then the Air District recommends that the user edit this information using the pencil (edit) icon on this screen. The user should ensure that the emissions factors selected for all generators and fire pumps are consistent with the values recommended in the Air District's Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>.

4.8.3 Process Boilers Screen

The Process Boilers screen allows users to input any process boilers that would be included in the project. Users should check the Air District's rules and regulations regarding obtaining an authority to construct/permit to operate for any stationary sources associated with the project. CalEEMod should not be used to estimate emissions from boilers that require an Air District permit to operate. Users should review and follow the methodology presented in the Air District Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>.

4.8.4 Boilers EF Screen

The Boilers EF screen summarizes the emissions factors for the process boilers that were loaded on the previous screen. These emissions factors are pulled from a database based on the process boiler fuel type and heat rating. If equipment-specific emissions factor information is known, then the Air District recommends that the user edit this information using the pencil (edit) icon on this screen. The user should ensure that the emissions factors selected for boilers are consistent with the values recommended in the Air District's Permit Handbook, available at <https://www.baaqmd.gov/permits/permitting-manuals/permit-handbook>.

4.9 USER DEFINED SUBMODULE

The User Defined screen in the User Defined submodule allows users to input other operational sources of emissions that do not fit into the previous categories. The user must provide all input information specific to the source, including equipment type; fuel type; and actual emissions estimates, in pounds per day (for both criteria pollutants and GHGs), tons per year (for criteria pollutants), and metric tons per year (for GHGs).

Because CalEEMod does not provide information documenting the methodology used to estimate the emissions, the Air District recommends that the user perform a separate off-model emissions calculation for any sources not included in CalEEMod. Supporting references and justification should also be provided.

5 VEGETATION MODULE

The Vegetation module allows users to estimate the one-time change in carbon sequestration capacity attributable to a project as a result of land use change (e.g., conversion from grassland to urban) or as a result of the removal or planting of trees.

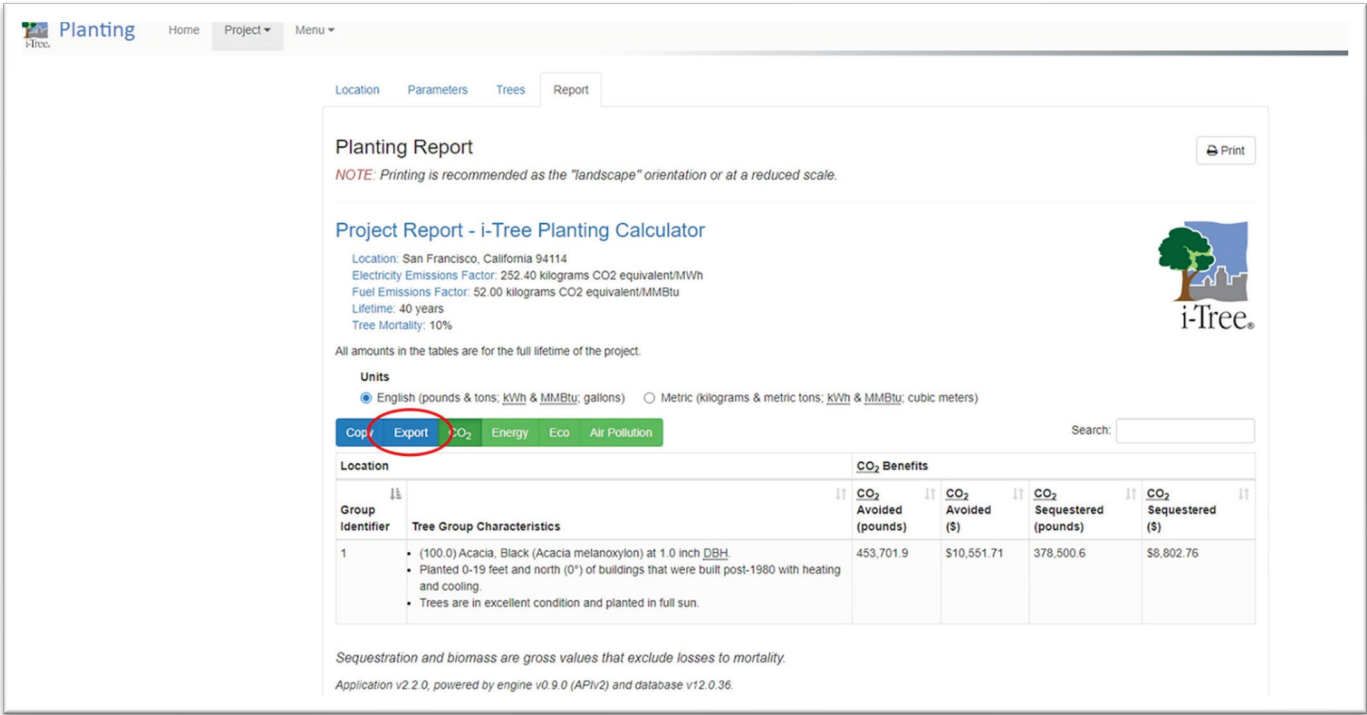
5.1 LAND USE CHANGE SCREEN

The Land Use Change screen estimates the change in carbon dioxide attributable to a change in vegetation resulting from the project. Estimates can be provided for soil carbon accumulation and for aboveground and belowground biomass carbon accumulation. The user can enter the vegetation land use type, the vegetation soil type, the initial and final acreage of the vegetation land use type, and the annual carbon dioxide accumulation per acre. This screen provides a link to ensure that the correct soil type is selected for the project site.

5.2 SEQUESTRATION SCREEN

The Sequestration screen estimates changes in GHGs, criteria pollutants, and energy from tree planting and removal. Users can enter the project lifetime (in years), the tree types and number of trees, and the carbon sequestration rate. This screen provides a link to the i-Tree Planting Calculator, which can be used to determine the changes in GHGs, criteria pollutants, and energy from tree planting and removal. The user must manually input the output data from the i-Tree tool onto this screen. The tool is available at <https://planting.itreetools.org/>. In the i-Tree tool, the user selects the location, tree species, and number of trees being affected. As shown in **Figure 16**, on the Report page, the user should click the Export icon and make a PDF file of the page. The PDF file is to be included in the administrative record for the project.

Figure 16 Exporting Data from the i-Tree Tool



6 CLIMATE RISK MODULE

The Climate Risk module provides a high-level assessment of the elements contributing to a project’s climate vulnerabilities, including exposure, sensitivity, and existing adaptive capacity to projected climate hazards. The various metrics are based on the project’s location, selected in the initial stages of the model run (see Section 2.1). The Air District is not providing guidance on this module at this time.

7 MEASURES MODULE

The Measures module allows users to select emissions reduction measures that the project would implement to reduce emissions from construction or operations. CEQA requires that all feasible mitigation measures be adopted to lessen or avoid significant impacts. When imposing the mitigation, the lead agency must ensure that a connection exists between the adopted mitigation and the significant impact and ensure that the mitigation is not part of the original project design. All mitigation measures must be feasible and fully enforceable, and all feasible mitigation must be imposed by the lead agency.

Users must follow the guidance below when developing the mitigation measures:

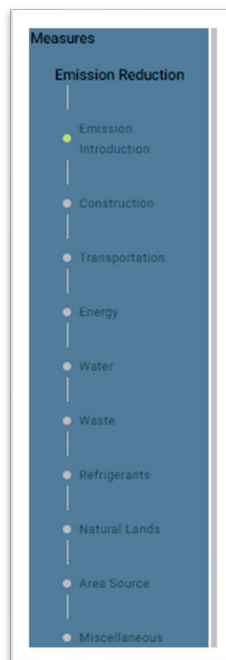
- ▶ Do not defer mitigation measure to a later time. It is important to identify the timing of implementation of each mitigation measure. If the mitigation is time dependent and cannot be in place as specified in the analysis, then either the user should propose a more reliable mitigation measure or the impact may be significant and unavoidable.

- ▶ Ensure that the mitigation measures are fully enforceable through legally binding instruments and are independently measurable. The mitigation should be site appropriate, accurate, and sufficiently detailed to be effective at the time it is applied at the project site. Avoid mitigation measures that are intended solely to provide information or educate the project sponsor, employees, workers, and the public.
- ▶ Ensure that the mitigation measures are consistent with all applicable constitutional requirements and are above and beyond existing laws, regulations, and requirements. If a federal, state, or local law already addresses the impact, compliance with the law should be discussed in the analysis but should not be identified as a mitigation measure.
- ▶ Ensure that the mitigation measures address only significant environmental impacts identified in the analysis and not preexisting environmental conditions.
- ▶ Ensure that the mitigation allows for some flexibility, where appropriate, related to changes in site conditions, and identify contingencies that include implementation of mitigation measures other than those adopted in the analysis that are just as effective as the adopted measures in avoiding the significant impact.

Embedded in CalEEMod are emissions reduction measures grouped into nine sectors corresponding to the primary emission sources or processes. These measures are verified, and most are quantified in CalEEMod.

Figure 17 shows the pages available in the left-hand navigation panel in the Measures module. To navigate, users must click on the sector title in the left-hand navigation panel to view available reduction measures. Except for some Area Source measures, all the measures come directly from the CAPCOA Handbook.

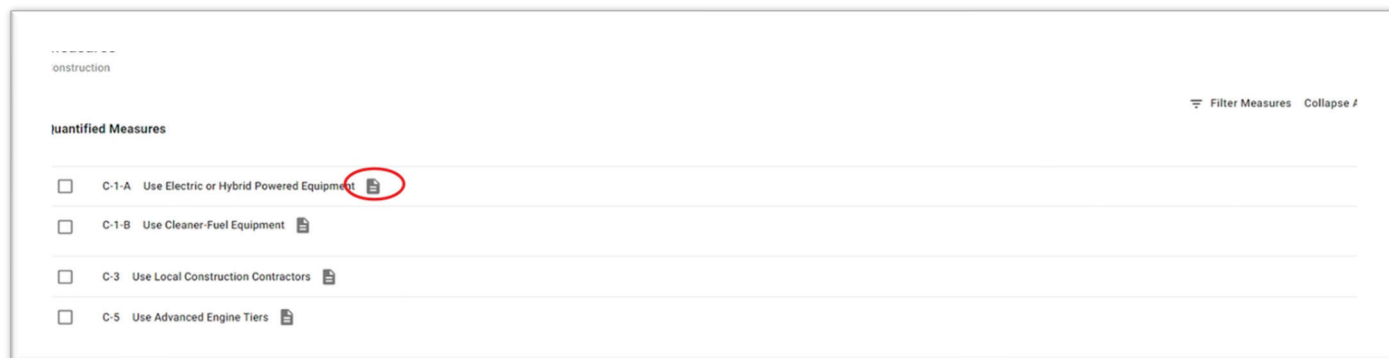
Figure 17 Navigation Panel Options in the Measures Module



There is a link to the CAPCOA Handbook in the navigation panel on the left side of the screen. In addition, in each page in the Measures module, the notepad icon to the right of a measure title links to the measure factsheet or description in the CAPCOA Handbook. When the user clicks on the icon, the measure factsheet or description opens in a new tab in the user's web browser. The icon is shown in **Figure 2**.

An example of how listed measures and the related notepad icons appear is shown in **Figure 18**, with the notepad icon circled in red.

Figure 18 Construction Measures Screen



The sectors used in the Measures module match the emissions sectors above (e.g., construction, transportation, energy). Some measures are categorized as “Quantified,” and some are “Qualitative or Supporting Measures.” The discussion below is a general overview of the Measures module. Users should refer to the CAPCOA Handbook for a more thorough discussion of the various measures.

After a measure is selected, the user may be prompted for additional information to enable quantification. Where available, default values are shown in the input boxes. Emissions reductions achieved by several measures may be quantified by equally applying the reduction efficacy to all land use subtypes in the project run or through targeted application to specific land use subtypes.

Quantified Reductions

The discussion below addresses the Air District measures that are quantifiable in CalEEMod. Approximately 80 of the measures in CalEEMod are quantifiable. Of these, only two of the Air District’s Basic Best Management Practices for Construction-Related Fugitive Dust Emissions are quantifiable in CalEEMod. Others, such as the quantification of wind screens, should be performed outside of CalEEMod.

Nonquantified Reductions

Most of the Air District’s Best Management Practices for Construction-Related Fugitive Dust Emissions (Basic and Enhanced) are not quantifiable in CalEEMod. These specific measures, such as requiring truck cargo to be covered, limiting trackout, and limiting activities on windy days, are not quantifiable because these metrics required specific information that is typically not available for most projects. Although they are not quantifiable, these measures should be included in the project design because they do achieve reductions in the real world.

An overview of the Air District’s Basic Best Management Practices for Construction-Related Fugitive Dust Emissions and Enhanced Best Management Practices to Control Construction-Related Fugitive Dust Construction Mitigation Measures and how they can or cannot be implemented in CalEEMod is provided in Attachment 1.

7.1 EMISSIONS REDUCTION SUBMODULE

7.1.1 Construction Screen

The Construction screen calculates emissions reductions based on the selected mitigation measures for the project. CalEEMod includes 14 quantified construction measures. Measures C-1-A through C-8 reduce combustion emissions, whereas Measures C-9 through C-12 reduce fugitive dust. Measure C-13 (Low-VOC Paints for Construction) reduces VOC emissions from architectural coatings. Note that some measures (e.g., watering exposed surfaces, using cleaner-fuel equipment), may require the selection of additional details. In some instances these additional details will not be selectable if these measures are included in the unmitigated scenario in the previous modules.

7.1.2 Transportation Screen

The Transportation screen allows users to select from 27 quantified transportation measures aimed primarily at reducing VMT and encouraging mode shifts from single-occupancy vehicles to shared (e.g., transit) or active modes of transportation (e.g., bicycle). If a traffic study was completed for the project and used to modify the trip generation rates and/or VMT estimates, then the traffic study may have already accounted for some potential reductions affecting VMT and mode shifts. This may be the case for projects for which VMT was estimated using a regional model that accounts for shared or active modes of transport in the specific area (e.g., in walkable area near a major transit station). Emissions reduction measures included in the traffic study should not be considered mitigation measures, because they are incorporated into the project. If reductions are not already accounted for in the traffic study, the Transportation screen provides options to adjust land use, site enhancement, and commute patterns and calculate reductions based on the corresponding measures described in the CAPCOA Handbook.

7.1.3 Energy Screen

The Energy screen allows users to estimate the emissions reductions from 14 quantified energy measures aimed at improving building energy efficiency, increasing renewable energy generation, and electrifying building end uses. CalEEMod includes a series of rules embedded in its logic, but many emissions reduction metrics can be manually adjusted by the user if project-specific information, such as the specific emissions factor for an alternate energy supplier, is available.

7.1.4 Water Screen

The Water screen allows users to estimate the emissions reductions from seven quantified measures aimed at water conservation. Similar to other sources, CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with water savings, but many emissions reduction metrics can be manually adjusted by the user if project-specific information is available. Users should ensure that their projects comply with local water conservation efforts and regulations.

7.1.5 Waste Screen

The Waste screen allows users to estimate the emissions reductions from one quantified solid waste measure in order to reduce the amount of waste sent to the landfill. CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with waste reductions, but the reduction metrics can be manually adjusted by the user if project-specific information is available.

7.1.6 Refrigerants Screen

The Refrigerants screen allows users to estimate the emissions reductions from six quantified measures in order to decrease the charge size and/or leak rate of equipment or replace the baseline refrigerant with a lower global warming potential (GWP)⁷ refrigerant. CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with refrigerants, but some reduction metrics can be manually adjusted by the user if project-specific information is available.

7.1.7 Natural Lands Screen

The Natural Lands screen allows users to estimate the emissions reductions from two quantified natural lands measures in order to create new vegetated open space and plant trees. Green space overall has been proven to improve people's physical and mental health by encouraging an active lifestyle and access to exercise opportunities. CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with vegetation and tree planting, but some reduction metrics can be manually adjusted by the user if project-specific information is available.

7.1.8 Area Source Screen

The Area Source screen allows users to select measures that reduce emissions from areawide sources. CalEEMod includes four quantified area source measures, including use of low-VOC cleaning supplies, use of low-VOC paints, and use of zero-emission landscaping equipment. CalEEMod includes a series of rules embedded in its logic to quantify emissions reductions associated with area sources, but some reduction metrics can be manually adjusted by the user if project-specific information is available.

7.1.9 Miscellaneous Screen

The Miscellaneous screen allows users to select from measures that reduce emissions from overall project activities. CalEEMod includes three quantified miscellaneous options:

- ▶ Establish a Carbon Sequestration Project.
- ▶ Establish Off-Site Mitigation.
- ▶ Implement an Innovative Strategy for GHG Mitigation.

⁷ Each GHG has a GWP value that reflects the climate forcing of a kilogram of emissions relative to the same mass of carbon dioxide. This number is calculated by the Intergovernmental Panel on Climate Change (IPCC), based on the intensity of infrared absorption by each GHG and how long emissions remain in the atmosphere. GWP values are calculated using a set time horizon. All GWP values used for GHG inventory purposes are considered over a 100-year timeframe. CalEEMod uses GWP values from IPCC's (2007) Fourth Assessment Report.

No defaults are available for these measures, so the user must input the amount of pollutant reduced per year based on project evaluations. Two qualitative or supporting measures are also available:

- ▶ Require Environmentally Responsible Purchasing.
- ▶ Fund Incentives for Green Technologies.

7.2 CLIMATE RISK REDUCTION SUBMODULE

The Climate Risk Reduction screen on the Climate Risk Reduction submodule presents the available climate risk reduction measures for user selection and analysis. Measures that address these priority hazards are shown first in the list of available measures on this screen. The icons for priority hazards are also shown in a larger font. The Air District is not providing guidance on this topic at this time.

7.3 HEALTH AND EQUITY SUBMODULE

The Health and Equity screen in the Health and Equity submodule includes two screens with 50 available health and equity measures that seek to promote health and equity; progress toward racial equity; and inclusion of and solidarity with marginalized, underrepresented, and vulnerable communities. The Air District is not providing guidance on this topic at this time.

8 RESULTS COMPONENT

The Results component includes various options to view emissions summaries. The page loads the Construction Emissions Dashboard first. An Operational Emissions Dashboard is also available. This page allows the user to see the emissions estimates, compare unmitigated to mitigated emissions, and spotlight a key pollutant without having to export or download results. The user can select Construction Calculations or Operations Calculations to see a summary of emissions estimate inputs by source (equipment, material movement, truck travel) and by season (summer, winter, and annually). The Results component is used primarily to view results and to verify that results look accurate.

9 REPORTS COMPONENT

The Reports component includes various options for downloading reports: Summary Report, Quarterly Report, Detailed Report, and Custom Report. The most common report will be the Detailed Report. The user can select to download a report as a PDF, a CSV, or an Excel file. The reports provide a summary of all emission calculations included in the model run at the maximum daily, average daily, and annual time scale. The PDF option is ideal for technical appendices to CEQA documents and technical reports because the file is formatted and includes all emissions sources. However, CEQA practitioners may also want to download the Excel version, which will assist in postprocessing results for the CEQA documentation or for subsequent analysis (such as for a health risk assessment).

The Air District recommends downloading a PDF version of the Detailed Report and including it as part of the administrative record. These options are shown in **Figure 19**.

Because the Air District's metric for the daily criteria air pollutant emissions threshold is *average* pounds per day, the user should compare the *average* pounds per day summaries in the CalEEMod output to the Air District's criteria air pollutant thresholds of significance (see Chapter 3 of the Guidelines).

Figure 19 Report Output Screen

Data Field	Value
Project Name	Test - Mission District Mixed Use
Lead Agency	
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	3.90
Precipitation (days)	41.8
Location	37.7688015440435, -122.41840395123413

10 RESOURCES

Bay Area Air Quality Management District. Regulation 8-3: Architectural Coatings. Available: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-8-rule-3-architectural-coatings>.

Bay Area Air Quality Management District. Regulation 6-3: Wood-Burning Devices. Available: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-6-rule-3-woodburning-devices>.

———. 2018 (June). Staff Report – Particulate Matter. New Regulation 6, Rule 6: Prohibition of Trackout. Available: https://www.baaqmd.gov/~media/dotgov/files/rules/archive-2018-regulation-6/bundled-documents/20180801_91_fsr_0606-pdf.pdf?la=e.

California Air Pollution Control Officers Association. Appendix G of the CalEEMod User Guide. Available: https://www.caleemod.com/documents/user-guide/08_Appendix%20G.xlsx.

Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report.

U.S. Environmental Protection Agency. AP-42. Section 13.2.1, "Paved Roads." Available: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.1_paved_roads.pdf.

U.S. Environmental Protection Agency. AP-42. Section 13.2.2, "Unpaved Roads." Available: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.2_unpaved_roads.pdf.

ATTACHMENT A FUGITIVE DUST GUIDANCE

This attachment provides an overview of the Air District's Basic Best Management Practices for Construction-Related Fugitive Dust Emissions and Enhanced Best Management Practices to Control Construction-Related Fugitive Dust Construction Mitigation Measures and how they can or cannot be implemented in CalEEMod.

Table DA-1 presents the best management practices that are implementable in CalEEMod, and Sections D-A1 and D-A2 discuss additional adjustments and calculations for two best management practices: unpaved road travel speeds and wind screens.

Table DA-1 Air District Best Management Practices for Construction-Related Fugitive Dust Emissions

Measure ID/Source	Measure Description	Implementable in CalEEMod?	Fugitive PM Reduction	Applicable Sector	Notes
Basic Measures					
B-1 ⁺	All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.	Yes. The user should specify twice-per-day watering as a best management practice on the Dust from Material Movement screen in the Construction module. Results will populate in the unmitigated emissions summary.	61%	Earthmoving, including site grading and bulldozing	All users are required to implement twice-per-day watering in the unmitigated analysis. If additional watering or other mitigation is required to reduce dust impacts, the user should implement additional reductions in the Measures module.
B-2 ⁺	All haul trucks transporting soil, sand, or other loose material off-site shall be covered.	No	—	—	—
B-3 ⁺	All visible mud or dirt trackout onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.	No	—	—	—
B-4 ⁺	All vehicle speeds on unpaved roads shall be limited to 15 mph.	Yes. The user should specify a 15-mph mean vehicle speed as a best management practice on the On-Road Fugitive Dust screen in the Construction module. Results will populate in the unmitigated emissions summary.	See Table DA-2, below.	Unpaved road dust travel. This strategy is applicable only if the percentage of paved on-site truck travel is greater than 0.	The default unpaved road travel speed in CalEEMod is 40 mph. The user can adjust the speed on the Dust from Material Movement screen in the Construction module to implement the measure as part of the unmitigated analysis. If additional speed or other mitigation is required, the user should implement additional reductions in the Measures module.

Measure ID/Source	Measure Description	Implementable in CalEEMod?	Fugitive PM Reduction	Applicable Sector	Notes
B-5 ⁺	All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.	No	—	—	—
B-6 ^t	All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.	No	—	—	—
B-7 [^]	All trucks and equipment, including their tires, shall be washed off prior to leaving the site.	No	—	—	—
B-8 ^t	Unpaved roads providing access to sites located 100 feet or further from a paved road shall be treated with a 6- to 12-inch layer of compacted layer of wood chips, mulch, or gravel.	No	—	—	—
B-9 ⁺	Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's General Air Pollution Complaints number shall also be visible to ensure compliance with applicable regulations.	No	—	—	—

Measure ID/Source	Measure Description	Implementable in CalEEMod?	Fugitive PM Reduction	Applicable Sector	Notes
Enhanced Measures					
E-1[^]	Limit the simultaneous occurrence of excavation, grading, and other ground-disturbing construction activities.	No	—	—	—
E-2[^]	Install wind breaks (e.g., trees, fences) on the windward side(s) of actively disturbed areas of construction and storage piles. Wind breaks shall be a minimum of three-sided installed fencing the predominant wind direction, have at maximum 50-percent air porosity, and be at least equal in height to storage pile heights.	No	See Section D-A2, "Wind Screens," below.	—	—
E-3^t	Plant vegetative ground cover (e.g., fast-germinating native grass seed) in disturbed areas as soon as possible and watered appropriately until vegetation is established.	No	—	—	—
E-4^t	Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than 1 percent.	No	—	—	—
E-5[^]	Minimize the amount of excavated material or waste materials stored at the site.	No	—	—	—
E-6[^]	Hydroseed or apply nontoxic soil stabilizers to construction areas, including previously graded areas, that are inactive for at least 10 calendar days.	No	—	—	—

⁺ 2017 Air District CEQA Guidelines, Basic Construction Mitigation Measures

^t 2017 Air District CEQA Guidelines, Enhanced Construction Mitigation Measures

[^] Adapted from San Francisco Dust Control Ordinance, SEC. 1242 (c)

D-A1 UNPAVED ROAD TRAVEL SPEED

CalEEMod assumes a linear relationship between particulate matter (PM) emissions and unpaved road vehicle speed. The CalEEMod default travel speed is 40 mph. As discussed in Section 3.7, the Air District's Basic Best Management Practices for Construction-Related Fugitive Dust Emissions require users to adjust the travel speed to 15 mph on the On-Road Fugitive Dust screen (see **Figure 11**). If the project would include unpaved road travel, the change in vehicle speed will be reflected in the unmitigated analysis. If the project would exceed applicable thresholds of significance after implementing Basic and Enhanced Best Management Practices for Construction-Related Fugitive Dust Emissions, additional mitigation may be required.

In the Measures module in CalEEMod, the user can input the PM reduction from limiting vehicle speeds. The user is not asked to input the vehicle speed so that the model would perform the calculation. Instead, the user must input the reduction (**Figure DA-1**). This reduction is relative to the unmitigated analysis. If the unmitigated analysis assumed a 15-mph travel speed, then reductions from slower speeds (e.g., 10 mph, 5 mph) should be relative to the 15-mph travel speed. If the unmitigated analysis assumed a CalEEMod default 40-mph travel speed, then reductions from slower speeds (e.g., 35 mph and below) should be relative to the 40-mph travel speed.

Figure DA-1 Input for Limiting Vehicle Speeds in the Measures Module

The screenshot shows the 'C-11 Limit Vehicle Speeds on Unpaved Roads' measure in the CalEEMod Measures module. Two input fields are highlighted with red ovals: 'PM10 (% Reduction)' with a value of 33, and 'PM2.5 (% Reduction)' with a value of 33.

Reductions to assume for lower unpaved road are summarized in Table DA-2. As noted above, there are two reduction options. The user needs to ensure that the most appropriate reduction is applied depending on what speed was assumed in the unmitigated analysis.

Table DA-2 Unpaved Road Dust Reductions by Vehicle Speeds in the Measures Module

Speed (in mph)	Reduction % from Basic Mitigation Measure Requirement of 15 mph
10	33%
5	67%

D-A2 WIND SCREENS

Use of a wind screen can reduce the effective wind velocity by 50 percent. If the wind speed at a given location is 10 mph, then the effective wind speed behind a wind screen is likely to be 5 mph.

Fugitive dust from wind erosion occurs when wind speeds reach or exceed what is known as the "friction threshold velocity," which is the wind speed required to initiate the first windblown fugitive dust particle. Although CalEEMod does not quantify emissions from inactive storage piles (only for active piles associated

with truck loading), the approximate effect of a wind screen can be estimated using the 50-percent-reduction assumption and the truck loading formula from CalEEMod, which includes wind speed as a key variable.

The formula, taken from AP-42, is as follows:

$$EF_D = k \times (0.0032) \times \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where k is the particle size multiplier (constant), M is the material moisture content (assumed to be 12 percent for truck loading and piles), and U is the mean wind speed. Based on this formula, a 50-percent reduction in wind speed (U) would reduce the fugitive PM₁₀ and PM_{2.5} emissions factor from truck loading by 59 percent. This reduction applies regardless of the baseline wind speed.



BAY AREA AIR QUALITY
MANAGEMENT DISTRICT

California Environmental Quality Act

Air Quality Guidelines

Appendix E:

Recommended Methods

For Screening and

Modeling Local Risks

and Hazards

These guidelines are nonbinding recommendations, intended to assist lead agencies with navigating the CEQA process. They may be updated as needed in the future, and any updates will likewise be nonbinding and advisory.

TABLE OF CONTENTS

Section	Page
Executive Summary.....	E-1
1 Introduction.....	E-5
1.1 Health Concerns.....	E-7
1.2 CEQA Thresholds.....	E-9
1.3 CEQA Exemptions.....	E-9
1.4 Process Overview	E-10
1.5 Starting Point.....	E-11
2 Identifying Receptors, Surrounding Sources, and Project Radius.....	E-13
2.1 Identifying Receptors.....	E-13
2.2 Determining the Project Radius.....	E-15
2.3 Identifying Sources for the Cumulative Analysis.....	E-16
2.4 Assessing Impacts from Overlapping Activities	E-18
3 General Air Dispersion Modeling Concepts	E-21
3.1 Recommended Air Dispersion Models	E-22
3.2 Coordinate System	E-24
3.3 Terrain.....	E-24
3.4 Urban or Rural Conditions	E-27
3.5 Receptor Grid	E-29
3.6 Averaging Times.....	E-32
3.7 Building Impacts.....	E-34
3.8 Meteorology.....	E-35
3.9 Multiple Sources.....	E-39
3.10 Multipollutant Concentrations.....	E-40
3.11 Fumigation.....	E-41
4 Source Types Used in Modeling.....	E-43
4.1 Point Sources.....	E-43
4.2 Area Sources.....	E-44
4.3 Volume Sources.....	E-45
4.4 Line Sources	E-47
5 Stationary Source Analysis	E-49
5.1 Source Emissions.....	E-49
5.2 Release Parameters	E-51

5.3	Modeling Construction Impacts.....	E-53
6	Roadway Analysis.....	E-57
6.1	Emission Estimates.....	E-57
6.2	Modeling Configuration.....	E-58
7	Passenger Rail Analysis.....	E-61
8	Commuter Ferry Analysis.....	E-65
8.1	Emissions Methodology.....	E-65
8.2	Modeling Configuration.....	E-68
9	CEQA Screening MAPs.....	E-71
9.1	Stationary Source Screening MAP.....	E-71
9.2	Roadways Screening Map.....	E-76
9.3	Rail lines for Passenger, Commuter, and Freight.....	E-85
9.4	Select Railyards.....	E-92
9.5	Distance Decay Factors.....	E-96
10	Estimating Health Risk and Hazard.....	E-101
10.1	Cancer Risk.....	E-102
10.2	Chronic Noncancer Hazard.....	E-107
10.3	Acute Noncancer Hazard.....	E-109
11	Cumulative Analysis.....	E-111
12	References.....	E-113

FIGURES

Figure ES-1	Risk and Hazard Analysis Process Flow Chart.....	E-3
Figure 1	Constructing the Cumulative Impacts Project Radius.....	E-16
Figure 2	Illustration of How to Assess Impacts from Overlapping Activities.....	E-20
Figure 3	Generalized Process for Performing a Refined Air Dispersion Modeling Analysis.....	E-22
Figure 4	Complex Terrain Conditions.....	E-25
Figure 5	Two Types of Simple Terrain Conditions.....	E-26
Figure 6	Example of a Cartesian Grid.....	E-30
Figure 7	Sample Combination Grid System with Two Types of Receptor Spacing.....	E-30
Figure 8	Example of a Polar Grid.....	E-31
Figure 9	Dispersion Pattern Attributable to Building Downwash.....	E-34
Figure 10	Unitized Emission Rate (Left) and Summation (Right) Concepts.....	E-41
Figure 11	Railyards in West Oakland and Richmond.....	E-93

TABLES

Table 1	Thresholds of Significance for Local Community Risk and Hazard Impacts.....	E-9
Table 2	NLCD_2016 Land Cover Categories.....	E-28
Table 3	Stability Classes	E-36
Table 4	Meteorological Conditions That Define Each Stability Class.....	E-36
Table 5	Locations of Meteorological Stations in the Bay Area	E-38
Table 6	Modeling Parameters for Point Sources	E-44
Table 7	Modeling Parameters for Area Sources	E-45
Table 8	Modeling Parameters for Volume Sources	E-46
Table 9	Modeling Parameters for Line Sources	E-47
Table 10	Default Modeling Parameters for Common Stationary Sources ¹	E-53
Table 11	Recommended Volume Source Configuration for Construction Projects.....	E-54
Table 12	Default Release Parameters for Passenger Rail Lines.....	E-63
Table 13	Bay Area Ferry Route by Operator.....	E-66
Table 14	Major Excursion Vessel Operators and Berth.....	E-66
Table 15	Statewide Ferry and Excursion Vessel Operating Parameters	E-67
Table 16	Bay Area 2017 Average Vessel Operating Parameters ¹	E-68
Table 17	Default Volume Release Parameters for Commuter and Excursion Vessels.....	E-69
Table 18	Area-Specific Chi/Q for GDFs	E-74
Table 19	Emission and Vehicle Categories for Roadway Emissions ¹	E-77
Table 20	Cross-Reference of Road Type Classification Schemes Used in This Analysis	E-78
Table 21	Travel Activity Parameters and Associated Data Sources Used for Estimating Emissions from On-Road Mobile Sources.....	E-78
Table 22	Road Surface Silt Loading Factor (sL) by Road Type Used in CARB Method to Estimate Emission Factors from Road Dust Emissions	E-81
Table 23	Annual Rainfall Days Where 0.01 Inch or Greater Precipitation Was Recorded by County	E-81
Table 24	Freight Subdivision Lines Operating in the Bay Area	E-87
Table 25	Amtrak Activity by Route.....	E-88
Table 26	Diesel PM Emission Factor (EF) and Average Speeds by Amtrak Service/Route.....	E-88
Table 27	Summary of Activity Level for Each Commuter Service	E-90
Table 28	Diesel PM Emission Factor (EF) and Average Speeds by Commuter Service	E-91
Table 29	Diesel PM Emission Factor (EF) and Average Speeds for Caltrain.....	E-91
Table 30	Railyard Sources and Emissions Modeled under AB 617.....	E-95
Table 31	Gas Station Decay Factors	E-97
Table 32	Diesel Engine Decay Factors	E-98
Table 33	Generic Decay Factors.....	E-99
Table 34	Exposure Factors.....	E-103
Table 35	Exposure Pathways.....	E-105

LIST OF ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
AADT	annual average daily traffic
AB 617	California Assembly Bill 617
AB	Assembly Bill
AP	Air Pollution
ADMRT	Air Dispersion Modeling and Risk Assessment Tool
ADT	average daily traffic
AERMOD	American Meteorological Society
AERMIC	U.S. Environmental Protection Agency Regulatory Model Improvement Committee
Air District	Bay Area Air Quality Management District
AP	Air Pollution
BAAQMD	Bay Area Air Quality Management District
BNSF	Burlington Northern Santa Fe Corporation
CalEEMod	California Emissions Estimator Model
CAP	Community Action Plan
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CEIDARS	California Emission Inventory Development and Reporting System
CEQA	California Environmental Quality Act
CPUC	California Public Utilities Commission
CRRP	community risk reduction plan
DEM	Digital Elevation Model
DEM format	USGS "Blue Book" standard DEM format
diesel PM	diesel particulate matter
District	Bay Area Air Quality Management District
EICs	Emissions Inventory Codes
EF	Emission Factor
EIC	Emissions Inventory Code
EMFAC	California Air Resources Board Emissions FACTor model
EPA	U.S. Environmental Protection Agency
facility ID	facility identification
FAH	fraction of time at home
FHWA	Federal Highway Administration
FT	fuel type

g/s	gram per second
GDF	gas-dispensing facility
GEP	good engineering practice
Guidelines	<i>CEQA Air Quality Guidelines</i>
HARP	Hotspots Analysis and Reporting Program
HARP2	California Air Resources Board Hot Spots Analysis and Reporting Program Version 2
HI	hazard index
HQ	hazard quotients
HRA	health risk assessment
MRLC	Multi-Resolution Land Characteristics Consortium
NAD83	North American Datum of 1983
NAD84	North American Datum of 1984
NED	U.S. Geological Survey National Elevation Dataset
NLCD	U.S. Geological Survey National Land Cover Database
NO _x	nitrogen oxides
NSR	New Source Review
OEHHA	California Office of Environmental Health Hazard Assessment
OGRE	Oakland Global Rail Enterprise
OIG	Oakland International Gateway
PAH	polycyclic aromatic hydrocarbon
PBW	projected building width
PCB	polychlorinated biphenyl
PeMS	California Department of Transportation Performance Measurement Systems
PHEV	Plug-in Hybrid Electric Vehicles
PM ₁₀	particulate matter with a diameter less than or equal to 10 microns
PM _{2.5}	particulate matter with a diameter less than or equal to 2.5 microns
Pol	pollutant
Port	Port of Oakland
Pr	emissions process
PSD	Prevention of Significant Deterioration
RAST	Health Risk Assessment Standalone Tool
REL	reference exposure level
SCRAM	U.S. Environmental Protection Agency Support Center for Regulatory Atmospheric Modeling
<i>Syint</i>	Initial lateral dimension
<i>Szinit</i>	initial vertical dimension

TAC	toxic air contaminant
TIGER	Topographically Integrated Geographic Encoding and Referencing
TOD	Time of Day
TOG	total organic gases
UFP	ultrafine particles
UP	Union Pacific
UPS	United Parcel Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
VC	vehicle class
VHT	vehicle hours traveled
VMT	vehicle miles traveled
VOC	volatile organic compound
WAF	worker adjustment factor
WETA	San Francisco Bay Area Water Emergency Transportation Authority
WGS84	World Geodetic System of 1984
WRF	Weather Research and Forecasting



EXECUTIVE SUMMARY

The purpose of the “Recommended Methods for Screening and Modeling Local Risks and Hazards” is to assist project sponsors with conducting individual project and cumulative cancer risk and hazard analyses as part of their California Environmental Quality Act (CEQA) environmental review for proposed land use projects. This document provides the methodology used to perform preliminary screening and, if needed, detailed air quality analysis to assess potential cancer risk and hazard impacts.

This document should be used in conjunction with the Bay Area Air Quality Management District’s (Air District’s) *CEQA Air Quality Guidelines* (Guidelines) (BAAQMD 2022). When applying the methods presented in this document, the project sponsor should understand the modeling terms and methodology presented in Sections 2–8 to assess project-level impacts before using the screening maps in Section 9 to determine cumulative impacts. The cumulative assessment requires that the risks and hazards from the project be combined with the health impacts from surrounding sources, such as industrial facilities, rail, roadways, and marine vessels. The following screening maps have been developed¹ to assist project sponsors with quantifying the cumulative impacts from surrounding sources to determine whether further refinement is needed:

- **Updated Stationary Source Screening Map:** This web-based application maps the locations of stationary sources permitted by the Air District, including backup generators, gas stations, boilers, and auto body shops. For each source, the application lists the facility information and identifies conservative screening-level cancer risks, concentrations of particulate matter with a diameter less than or equal to 2.5 microns (PM_{2.5}) concentrations, and chronic hazard.

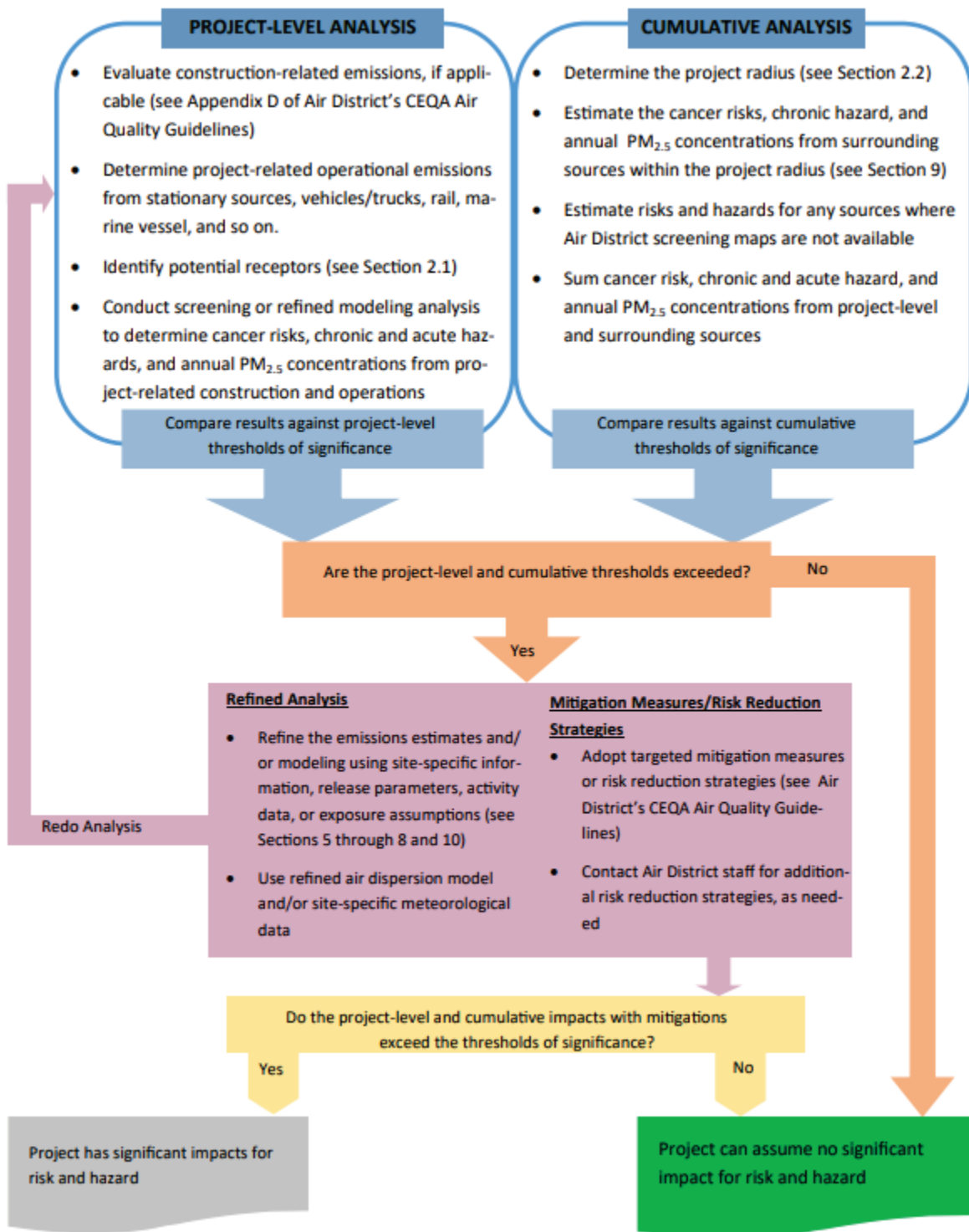
¹ Not all the maps described here will be available by the time this report is published. Please check the Air District CEQA tools website for updates.

- ▶ **Updated Roadway Screening Map:** This web-based application presents the modeled PM_{2.5} concentrations, cancer risks, and chronic hazard indices from highways and surface streets, across a receptor grid.
- ▶ **New Rail Sources Screening Map:** The District developed a new web-based application that estimates cancer risks, PM_{2.5} concentrations, and chronic hazards across the Bay Area from diesel locomotives used to transport freight along Class I rail lines, to transport people along commuter/passenger rail lines, and for goods movements at railyards in West Oakland and Richmond/North Richmond/San Pablo. The railyards were analyzed as part of the detailed community-scale modeling assessment under California Assembly Bill 617 (AB 617). These railyards serve as gateways for ferrying goods into the Bay Area and across the country. The assumptions and modeling parameters used for these screening tools are described in Section 9. These tools reflect the most current data at the time of publication. The tools may be periodically updated, and any changes will be reflected in updated versions of this document. For a detailed, step-by-step reference guide outlining the project-level and cumulative screening processes, see Figure ES-1, "Risk and Hazard Analysis Process Flow Chart."

If, after the screening process, the project-level or cumulative impacts exceed the District's recommended thresholds of significance, the project sponsor may choose to conduct a more refined modeling analysis for the proposed project or of surrounding sources. The suggested methodology for refining the analysis is provided in Sections 5–8 by source type and includes guidance on selecting the appropriate modeling tools and release parameters and addressing project-specific conditions. The risk assessment methodology is based on standard procedures developed by the California Office of Environmental Health Hazard Assessment (OEHHA) and is consistent with the District's permitting procedures, as appropriate. Project sponsors may deviate from the methods described in this document as necessary, provided that the justification is well documented.

It should be noted that health risk assessments (HRAs) used in project-level and cumulative analyses are decision-making tools used by health professionals for assessing public health impacts; they do not necessarily link an individual's exposures to environmental pollution to manifestation of a disease. Even the most detailed project or cumulative risk assessments could not evaluate the magnitude and interactions of all stressors and their effects on an individual. At best, the risk estimates of a risk assessment are an attempt to quantify the public health impact from known sources that can affect a community and offer alternatives and mitigation measures to reduce these stressors on the public.

Figure ES-1 Risk and Hazard Analysis Process Flow Chart



This page intentionally left blank.



1 INTRODUCTION

The Air District is providing this appendix, which replaces the 2012 document and incorporates revised and expanded descriptions of currently available screening tools and acceptable modeling methodologies for conducting a site-specific HRA. The purpose of this appendix is to provide recommended methodologies for assessing individual project and cumulative risks and hazards at a local, or community scale from air pollutants emitted from significant sources located close to nearby receptors. These methodologies are designed to assist lead agencies and project sponsors with assessing air quality impacts associated with exposures to toxic air contaminants (TACs) and PM_{2.5}.

In developing this update, the Air District created new tools and updated methodologies in response to common questions raised by practitioners, including:

- ▶ new section on how to assess impacts from overlapping construction and operation activities;
- ▶ new screening map to address impacts from passenger and freight rail;
- ▶ new screening map for select railyards in the Bay Area;
- ▶ new distance dilution factors for general sources;
- ▶ new modeling methodologies for conducting refined analysis for construction, rail, and marine vessels;
- ▶ new section on estimating emissions and modeling impacts from stationary sources;
- ▶ revised modeling approach for roadway impacts; and
- ▶ updated exposure factors for discrete receptors.

The methodologies continue to follow a tiered approach. The level of effort and requirements for more site-specific information generally increase as the project sponsor progressively moves through each tier. Each tier provides concentrations and risks that are directly comparable to the applicable thresholds of significance, although it is important to note that incorporating more site-specific modeling data will produce more accurate results. Also, progression from one tier to the next in a sequential fashion is not necessary, and a refined modeling analysis can be conducted at any time. For projects that exceed the thresholds of significance, the Air District has compiled a list of feasible mitigation measures in the Guidelines to assist project sponsors in reducing their project's impact on the environment.

This document includes guidance on the following topics:

- ▶ **Modeling Concepts and Source Types** introduces basic modeling concepts and defines source types commonly used in air dispersion modeling. Project sponsors should be familiar with these terms before they perform a screening or refined modeling analysis.
- ▶ **Source-Specific Modeling Methodology** describes the methodology for performing air dispersion modeling by source type (stationary source, roadway, rail, and commute ferry) and can be used in the project-level or cumulative analysis. The section has been expanded to include an approach for developing an emissions inventory using activity data and default modeling parameters when site-specific information is not available.
- ▶ **Screening Maps** provides an easy-to-use initial screening of nearby stationary sources, rail lines, railyards, or roadways to determine if the cumulative thresholds are exceeded. The section describes the methodology used to develop the screening maps. Project sponsors can also apply the same methodology used in creating the screening maps to develop source emissions for their project, as appropriate.
- ▶ **Cancer Risks** describes the methodology for estimating the incremental lifetime cancer risk using age-appropriate exposure factors for various receptor types.
- ▶ **Chronic Noncancer Hazard and Acute Noncancer Hazard** describes the methodologies for estimating long-term chronic noncancer health impacts and short-term 1-hour acute exposures, respectively.

Although the original modeling methodology relied heavily on the California Air Pollution Control Officers Association (CAPCOA)'s *Health Risk Assessments for Proposed Land Use Projects* (CAPCOA 2009), the revised modeling methodology has been updated to be consistent with Air District's permitting requirements and specific Bay Area air quality modeling practices.

The risk assessment components are based on the procedures developed by OEHHA and is consistent with the Air District's Regulation 2-5: New Sources Review of Toxics Air Contaminants and Regulation 11-18: Reduction of Risk from Air Toxic Emissions at Existing Facilities.² These calculation methodologies may change over time as OEHHA further refines its exposure guidelines. **It is important that the project sponsor use the most current risk assessment methodology and toxicity factors from OEHHA's HRA guidelines.**

² District rules are available at the following link: <https://www.baaqmd.gov/rules-and-compliance/current-rules>.

For those practitioners familiar with the 2012 document, some significant recommended changes should be noted:

- ▶ AERMOD, AERSCREEN, and SCREEN are the only accepted air dispersion models for performing a screening or refined analysis.
- ▶ Quantification of construction-related fugitive dust in addition to exhaust emissions to evaluate the project's local risks and hazards impact is at the discretion of the lead agency (See Chapter 5, Air Quality Impacts). Project sponsors can use CalEEMod to estimate fugitive dust emissions from construction activities following the guidance provided in Appendix D of the Guidelines. Fugitive dust emissions from facility operations can be estimated using the Air District's *Permit Handbook*.
- ▶ Sensitive receptors have been expanded to include off-site workers and students, consistent with the Air District's permitting requirements.
- ▶ Emissions from emergency use and non-testing and non-maintenance hours should be included in the assessment for backup/standby generators.
- ▶ Use of the student scenario is recommended in all air quality analysis when a school is located within 1,000 feet of the project site.
- ▶ Default release parameters for modeling purposes are provided for select source types.
- ▶ The "maximum potential to emit" emissions from new stationary sources should be used in the project analysis.

This appendix addresses only health impacts related to exposures to TACs and PM_{2.5}. Project sponsors can review the Guidelines for methods to evaluate health impacts related to criteria air pollutants.

1.1 HEALTH CONCERNS

Despite improvements in air quality, air pollution concentrations continue to remain elevated in some Bay Area locations near major air pollution sources, such as freeways or large industrial facilities. Residents living in these areas may experience adverse health outcomes from their exposures to unhealthy levels of air pollution. The focus of this guidance is to provide lead agencies and project sponsors with the necessary tools for evaluating local community risk and hazard impacts associated with exposures to TACs and PM_{2.5} because they pose the greatest risk to people's health in the Bay Area. This appendix presents methods for assessing the potential health impacts from directly emitted PM_{2.5} and TACs emissions, not those formed through secondary reactions in the atmosphere, which requires complex photochemical modeling over large-scale, regional areas.

These compounds and their health impacts are summarized as follows:

- ▶ **Toxic air contaminants (TACs):** The California Air Resources Board (CARB) is responsible for identifying TACs, which are defined as pollutants "which may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health." TACs are emitted into the air from a wide range of sources in the Bay Area, including diesel engines, cars, trucks, industrial processes, and gas stations. Types of TACs include diesel particulates, lead, benzene, formaldehyde, and hexavalent chromium. Diesel particulate matter

(diesel PM) is the most significant TAC, accounting for roughly 85 percent of the cancer risk from air toxics in the region. Exposure to TACs can cause serious health effects, including cancer and birth defects. Other adverse health effects can include damage to the immune system, neurological, reproductive (reduced fertility), development, and respiratory problems.

- **Fine particulate matter (PM_{2.5}):** Epidemiological studies have established that exposures to PM_{2.5} have serious adverse health impacts. PM_{2.5} can travel deep into lungs and enter the bloodstream. Fine PM originates from a variety of sources, including fossil fuel combustion, residential wood burning and cooking, and natural sources, such as wildfires and dust. Researchers established long ago that exposure to PM_{2.5} has negative effects on the respiratory system, such as triggering asthma attacks, aggravating bronchitis, and diminishing lung function. More recent studies have found that PM_{2.5} can also harm the cardiovascular system and may cause atherosclerosis (hardening of the arteries), ischemic strokes (cause by an obstruction of the blood supply to the brain), and heart attacks. Because of the serious cardiovascular effects of exposure to PM_{2.5}, studies have found a clear correlation between PM_{2.5} levels and exposure, and mortality. Studies also indicate that exposure to PM_{2.5} may be related to other negative health effects, including impacts on the brain, such as reduced cognitive function, as well as increased risk of diabetes. Recent research in the United States and internationally has begun to examine the potential health effects of even smaller particles, known as ultrafine particles (UFP), which are particles less than 1.0 micron in diameter. Findings to date demonstrate that UFPs can evade the body's defense mechanisms and penetrate deeply into lungs, the bloodstream, and organs. Exposure to PM_{2.5} remains the leading public health risk and contributor to premature death from air pollution in the Bay Area. More information on PM_{2.5} and associated health effects can be found in the Air District's informational report entitled *Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area* (BAAQMD 2012).

In the Bay Area, some urban and industrialized communities have higher TACs and PM_{2.5} concentrations compared to the rest of the Bay Area. These same communities are often faced with other environmental and socioeconomic hardships that further stress their residents and result in poor health outcomes. The air quality conditions in these affected communities are partially the result of past decisions related to land use and transportation planning. This methodology is designed to assist local jurisdiction in identifying and avoiding future land use conflicts to ensure health protection of all residents in a community.

In addition to the guidance provided herein, local jurisdictions also have the option of developing community risk reduction plans (CRRPs) as a means of reducing the overall exposure to TAC and PM_{2.5} emissions and concentrations in an entire community from new and existing sources. The goal of a CRRP is to cumulatively reduce TAC and PM_{2.5} concentrations for the entire community by following the comprehensive plan adopted by the local jurisdiction. This approach provides local agencies with a proactive alternative to address communities with high levels of risk on a project-by-project approach. The screening maps presented in Section 9 can be used as the basis of the community baseline conditions, or local agencies can apply the methodology from Section 9 to develop their own risks and hazards map. This proactive approach is encouraged for all communities, and especially those that are overburdened.

1.2 CEQA THRESHOLDS

Under the Guidelines, the Air District developed thresholds of significance for air pollutants emitted from a new project and for cumulative exposures that include emissions from a new project in combination with existing sources. The goal of the thresholds is to ensure that no source creates, and no resident endures, a significant adverse impact from any individual project and that the total exposure from all nearby sources does not result in a significant adverse impact. If a project exceeds the identified project-level significance thresholds, its emissions would be cumulatively considerable, resulting in significant adverse air quality impacts. Additionally, the thresholds were developed with the understanding that some areas may already be near or at the level of impact. A project would have a significant impact if the aggregate total of all surrounding significant sources plus the contribution from the project exceeds the cumulative thresholds.

The thresholds for local risks and hazards from TAC and PM_{2.5} are intended to apply to all sources of emissions, including both stationary sources and on- and off-road mobile sources, such as sources related to construction, busy roadways, or freight movements. The thresholds of significance for TAC and PM_{2.5} are listed in Table 1 and can also be found in Chapter 3 of the Guidelines (<https://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/updated-ceqa-guidelines>).

Table 1 Thresholds of Significance for Local Community Risk and Hazard Impacts

Analysis	Thresholds of Significance
Individual project: construction and/or operations	Compliance with qualified community risk reduction plan, or ▶ increased cancer risk of > 10.0 cases in a million¹ ▶ increased noncancer risk of > 1.0 Hazard Index (Chronic and Acute) ▶ ambient PM_{2.5} increase > 0.3 µg/m³ annual average
Cumulative impacts	Compliance with qualified community risk reduction plan, or ▶ cancer risk > 100 cases in a million (from all sources) ▶ noncancer risk > 10.0 Hazard Index (from all local sources) (Chronic) ▶ PM_{2.5} > 0.8 µg/m³ annual average (from all local sources)

Notes: µg/m³ = micrograms per cubic meter; PM_{2.5} = particulate matter with a diameter less than or equal to 2.5 microns.

¹ The CEQA thresholds of significance do not reflect recent amendments adopted in 2021 to Regulation 2-5 that lower the cancer risk threshold to six cases in a million in overburdened communities. Project sponsors should contact the lead agency to determine the appropriate thresholds to use for their project.

1.3 CEQA EXEMPTIONS

All the screening maps provided by the Air District are designed to help project sponsors and lead agencies determine whether there are any potentially significant environmental effects associated with a project under CEQA. The first step is to determine whether the project is statutorily or categorically exempt from CEQA such that an environmental clearance document or disclosure is not required. There are no exceptions to statutorily exempt projects; however, certain projects that are categorically exempt under the Air District guidelines may emit toxic emissions or may be affected by existing toxic sources. Project sponsors should refer to Chapter 1 of the Guidelines (<https://www.baaqmd.gov/ceqa-guidelines>) for more information on categorical exemptions and the common sense exemption, or contact the Air District's Planning Division at ceqa@baaqmd.gov.

1.4 PROCESS OVERVIEW

When performing the air quality analysis under CEQA, the Air District recommends that the project sponsor follow a tiered approach where at each successive step, the project's impacts (i.e., annual $\text{PM}_{2.5}$ concentrations, cancer risks, and hazards) and the combined cumulative impacts from surrounding sources are compared to the CEQA thresholds of significance. For the first tier, a screening model is recommended that requires minimal site-specific data. The first tier uses the screening methodology to estimate the project's impact and then combines the results from the screening maps to compare against applicable thresholds. If the thresholds are exceeded at the screening level (Tier 1), project sponsors can refine the analysis further by following Tier 2 recommendations and using complex air dispersion models, source-specific release parameters, and area-specific meteorology.

The tiered approach is flexible, and project sponsors can mix and match tier methodologies to suit the project needs. For example, Tier 2 refined models can be used to assess the project's impact, whereas the screening maps can be used to evaluate cumulative impacts. Both tiers are designed to address health impacts from new sources of TAC or $\text{PM}_{2.5}$ proposed for the project and surrounding area. Examples of new sources of TAC emissions include gasoline-dispensing facilities (i.e., gasoline stations), concrete batch plants, and auto body shops. Less obvious sources of TAC include diesel backup generators that are housed in the basement of hospitals, governmental agencies, and fire stations for use in case of power outages. Diesel PM is a TAC that is emitted into the atmosphere in the form of $\text{PM}_{2.5}$ through combustion of diesel fuel, but $\text{PM}_{2.5}$ can also be the sole pollutant emitted from a new source, as is the case for sandblasting, storage silo/piles, and aggregate handling.

As a first step, the project site-specific characteristics and surrounding conditions are used to evaluate the potential cancer risk, hazard, and $\text{PM}_{2.5}$ concentrations posed by the project to sensitive receptors. The project sponsors will need to determine the project radius and identify significant sources and receptors within that radius. The project's risk and hazard can then be compared to the project-level thresholds. CEQA requires that in addition to evaluating the individual project impact, the project sponsor must evaluate the cumulative impacts—the risks and hazards of the project combined with those from surrounding TAC and $\text{PM}_{2.5}$ sources. Impacts from the surrounding sources can be assessed using the screening maps. Project sponsors can then determine whether the health impacts from stationary and mobile sources within a 1,000-foot radius of the project, when added to the project's contribution, may have a significant cumulative impact. The project radius may be extended to include sources beyond 1,000 feet depending on the magnitude of their emissions, local meteorology, and contaminant fate and transport.

If project-level or cumulative thresholds of significance are exceeded, the project sponsor can conduct more refined modeling analysis by incorporating site-specific information into an approved air dispersion model. Project sponsors can also implement all feasible measures to mitigate the potential health impacts. The subsequent sections provide more detailed information on emissions methodology, screening maps, and air dispersion models for conducting a project-level and cumulative analysis.

1.5 STARTING POINT

The most current documentation (including this appendix), datasets for screening and modeling, and Air District staff contact information are available online at <https://www.baaqmd.gov/ceqa-resources>. This website serves as the starting point for all CEQA maps, methodology documentation, and data related to Air District-recommended screening and modeling of local risks and hazards. For questions on data availability and screening and modeling methods, please contact the Air District's Planning Section at ceqa@baaqmd.gov.

This page intentionally left blank.



2 IDENTIFYING RECEPTORS, SURROUNDING SOURCES, AND PROJECT RADIUS

The recommended methods to evaluate local risks and hazards rely on several key definitions to identify the pollution sources and the receptors of potential concern and to establish the area where potential impacts are evaluated.

- ▶ What receptors should be considered?
- ▶ How is the zone of influence determined?
- ▶ What surrounding sources should be included in the cumulative analysis?
- ▶ How are impacts assessed when construction and operations activities overlap?

This section provides some key definitions and recommended methods for making these preliminary determinations.

2.1 IDENTIFYING RECEPTORS

As part of the project-level analysis, project sponsors are required to identify receptors that may potentially be affected by the proposed project. The receptors closest to the project site may not in all cases be the most affected, because numerous factors, such as release height of the emission sources, the magnitude of the emissions, and the local meteorology and terrain, can play important roles in determining a pollutant's fate and transport. For the purpose of this appendix, receptors are defined as people—children, adults, and seniors—occupying or residing in:

- ▶ residential dwellings, including apartments, houses, condominiums, single-room occupancy units, and residential hotels;
- ▶ places of business;
- ▶ schools, colleges, and universities;
- ▶ daycare centers;
- ▶ hospitals;
- ▶ temporary housing, shelters, or encampments,
- ▶ detention centers or correctional facilities and
- ▶ senior-care facilities.

Consistent with the Air District's permitting requirements, the Air District recommends that project sponsors consider the following receptors in their assessment, as applicable:

- ▶ **Residential receptors** are receptors in off-site locations, either indoor or outdoor areas, where people live or spend most of their day. Residential locations include current residential land uses and areas that may be developed for residential uses in the future, given existing and planned zoning.
- ▶ **Worker receptors** are off-site locations where people work, including indoor and outdoor areas and commercial/industrial areas currently zoned or planned to be zoned for manufacturing, light or heavy industry, office, or retail activity.
- ▶ **Acute receptors** are receptors at off-site locations where individuals may be exposed to TACs for durations as short as 1 hour. An acute receptor location could be an off-property location (occasionally, it may be an on-site property) that is accessible to people. The project sponsor should use discretion in determining the likelihood of exposure and exclude areas such as roadways, bodies of water, rail tracks, steep terrain, and so on where people are unlikely to spend much time. The potential for even intermittent public exposure (e.g., beaches, picnic areas, playgrounds, sports fields, dog walking areas, outdoor event pavilions) is the determining factor when designating acute receptor locations.
- ▶ **Sensitive receptors** are individuals more susceptible to poor air quality (i.e., children, the elderly, and those with preexisting serious health problems affected by air quality). Land uses where sensitive individuals are most likely to spend time include schools and schoolyards, parks and playgrounds, daycare centers and preschools, hospices, dormitories, correctional facilities, nursing homes, hospitals, and residential communities. Students at K–12 schools are considered sensitive receptors for any project proposed within 1,000 feet of the school property. **The Air District recommends that a student scenario be included in the HRA when a school is located within 1,000 feet of the project.**
- ▶ **On-site receptors** are receptors inside the facility boundary that may be evaluated in cases when:
 - residents sleep or spend part of their day in an on-site building (e.g., work-provided on-site housing, dormitories at colleges, and housing on military bases);

- residents sleep or spend part of their day in an on-site residential building that is not owned by, leased, or monetarily tied to the facility or project being evaluated;
- sensitive receptors at on-site school, daycare, hospital, or adult/elderly care facility where people sleep or spend most of their day; or
- workers at an on-site area where people work but are not employed by or monetarily tied to the facility being evaluated (e.g., employees of restaurants in hotels, casinos, recreational/entertainment area, or airports).

The recommendation is that the health assessment be consistent with the Air District's permitting requirements and include evaluation of all possible receptors, as applicable. These locations can either be modeled as discrete receptor (individual receptor points) or encompassed within a larger receptor grid. The purpose is to ensure that the analysis is sufficiently health protective of the most vulnerable populations and captures the location where an individual will receive the highest exposure of TAC and PM_{2.5} emissions from the proposed project. Lead agencies at their discretion may recommend inclusion of areas zoned for residential use even if no residential development currently exists, to ensure health protection of future residents.

2.2 DETERMINING THE PROJECT RADIUS

There are two project radii: one determined for the project-level analysis and another one for evaluating cumulative impacts. For assessing the *individual project* impacts of a new source or sources, no specific project radius is recommended. The project sponsor must ensure that the project radius encompasses all potential sources associated with the project and addresses the health impacts on receptors in the Bay Area. The project sponsor must ensure that its project's impacts have been fully characterized along all possible transportation routes, as well as identify receptors that may be affected. The location of maximum risk, hazard, and PM_{2.5} concentration affecting a receptor should be identified regardless of distance from the project site. For example, projects involving ocean-going vessels may be required to include transiting emissions up to 11 nautical miles from the entrance of Golden Gate Bridge.³

For assessing the *cumulative* impacts from a project's source(s) in combination with existing sources, a specific project radius is recommended. The Air District recommends that the cumulative analysis combine the risks and hazards from existing sources within 1,000 feet of the project's source(s) with the risks and hazards from the project's source(s). After the location of the maximally affected receptor is identified for the project's source(s), impacts from surrounding sources within the project radius are then assessed to determine their cumulative impact on the maximally affected receptor. Assessments should sum individual hazards or risks to find the cumulative impact at the location of the maximally affected receptor from the project's source(s). However, the 1,000-foot radius is not an absolute rule for excluding sources located beyond the radius of influence. The project radius may be expanded beyond 1,000 feet to include sources that are significant contributors to the overall cumulative risks and hazards at the maximum affected

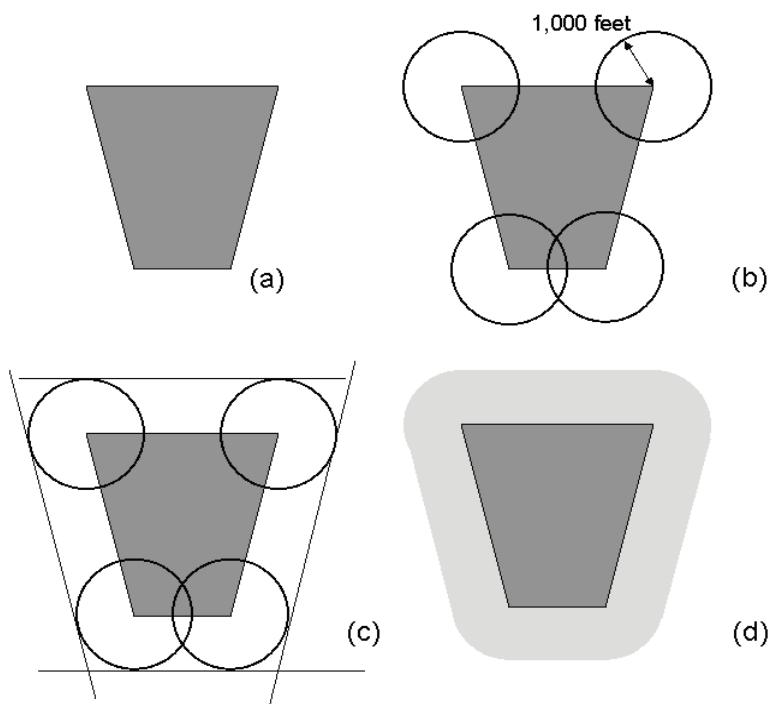
³ Under Regulation 2-2-610, all emissions from cargo carriers while they operate in the San Francisco Bay Area, or within California coastal waters up to 11 nautical miles from the Golden Gate Bridge (and any additional areas of California coastal waters adjacent to the San Francisco Bay Area if cargo carrier emissions in such areas would have substantial impact on air quality within the San Francisco Bay Area Air Basin), should be included as part of the source's emissions. Facilities must comply with this requirement if applying for offsets under Regulation 2-2.

receptor. For large, complex sources, such as those listed in Section 2.3, a larger radius may be appropriate, but the specifics should be determined on case-by-case basis.

To construct the cumulative impacts project radius, a polygon should be formed that is 1,000 feet from the property boundary of the new development. Geographic information system–based mapping programs provide a proximity feature for constructing such polygons based on linear distance. The polygon may be constructed by hand using the following steps (Figure 1):

1. Create a map to scale representing the property boundary of the proposed project.
2. On the map, construct circles centered on the corners of the property boundary.
3. Form a polygon by drawing straight lines that are tangent to adjacent circles.

Figure 1 Constructing the Cumulative Impacts Project Radius



The shaded polygon (a) represents the property boundary. Circles of 1,000-foot radii (b) are added with centers at the polygon corners. Line segments (c) are drawn tangent to the circles. Line segments are truncated at the points of tangency to create the project radius (d).

2.3 IDENTIFYING SOURCES FOR THE CUMULATIVE ANALYSIS

There are numerous sources of air pollution, and this section discusses which sources surrounding a project should be included in the cumulative assessment. A source is referred to as the locality where toxic emissions originate and are released into the atmosphere. It can refer to a physical device producing emissions or the location where project activities produce emissions, such as a construction site or roadway. Project sponsors are responsible for ensuring that every source of emissions from their project are included in the air quality analysis and are compliant with existing regulations. The Air District's *Permit*

Handbook (BAAQMD 2006) is a good reference guide for project sponsors seeking permits for new sources. Project sponsors can also use the methodology described in Sections 6–8 to estimate emissions and model air quality impacts from mobile sources associated with the project.

For the cumulative analysis, the Air District groups sources into three categories: common sources, complex sources, and minor- or low-impact sources. Common sources emit TACs or PM_{2.5} in significant enough quantity to warrant consideration but are simple enough as to lend themselves to simplified risk screening tools. Some common sources are:

- ▶ major roadways;
- ▶ gas stations;
- ▶ stationary diesel engines, such as stand-by backup generators;
- ▶ crematories;
- ▶ spray-booths;
- ▶ construction projects; and
- ▶ railroad tracks for locomotive diesel engines.

Because most of these sources are permitted, the Air District provides preliminary screening values based on their reported emissions or their maximum potential to emit for new sources (see Section 9.1). This appendix also presents methodologies for analyzing impacts from common sources because most of them are located close to residents and pose the greatest risks to Bay Area communities.

Complex sources pose the most significant risk, but because of their complexity or otherwise unique nature, they do not lend themselves to simplified screening maps or even modeling analysis that can be easily generalized. Examples of complex sources that generate significant pollution are:

- ▶ railyards;
- ▶ distribution centers and truck-related businesses;
- ▶ airports;
- ▶ oil refineries;
- ▶ chemical processing plants;
- ▶ power plants;
- ▶ marine vessels, including ocean-going vessels, ferries, tugboats, tankers, and barges;
- ▶ metal melting facilities; and
- ▶ cement plants.

Because some of these facilities are permitted by the Air District, conservative risks and hazards have been assigned to these facilities in the screening maps. The facility-specific screening values are based on the

emissions from the Air District permit⁴ but exclude emissions from most mobile sources supporting the facility, such as trucks, rail, construction equipment, airplanes, and marine sources. Quantification of emissions from these types of sources is complex and requires comprehensive knowledge of the sources of emissions, the number of sources, the activity level, and the types of pollutants emitted. Project sponsors can perform a refined modeling analysis for some of these sources using information presented in Sections 5–9 and reviewing the Air District's *Permit Handbook*. Completed HRAs are available from the Air District for select railyards under AB 617 and for large facilities under Regulation 11-18.

The last source type is minor or low-impact sources, which are unlikely to pose significant risks. The Air District has identified several sources that do not pose a significant health impact even in combination with other nearby sources. These determinations were made through extensive modeling, source tests, and evaluation of their TAC and PM_{2.5} emissions. Minor, low-impact sources include:

- ▶ nondiesel standby generators and boilers,
- ▶ petroleum-based solvents used in dry-cleaning operations, and
- ▶ space-heating equipment.

These sources can be excluded from the analysis of local risks and hazards impacts.

2.4 ASSESSING IMPACTS FROM OVERLAPPING ACTIVITIES

Some projects, given their size, may require a phased construction schedule that allows residents and businesses to begin occupation on newly finished buildings while construction continues on other phases. Workers and residents in this case would be affected from ongoing construction activities combined with emissions from newly constructed access roads, as well as operations from new businesses. The analysis becomes complex because the location of the maximally exposed receptor (workers, residents, and possibly students) moves as each development and construction phase is completed.

The Air District recommends for any project involving overlapping activities (i.e., concurrent construction and operations) that the project sponsor identify the maximally exposed individual after each phase is completed. The Air District proposes the following approach for analyzing the health impact for projects with multiple overlapping activities (Figure 2).

Part I: When construction begins and no residents and workers are on-site:

- ▶ Evaluate the cancer risk, the hazard, and PM_{2.5} concentrations for the maximally exposed off-site worker/resident at location A (the locations may be different depending on the receptor) based on the first phase of construction.
- ▶ Include any mitigation measures required by the lead agency as conditions of approval.
- ▶ Use the appropriate exposure factors to be consistent with the construction phase being analyzed.

⁴ The current Stationary Source Screening Map is based on the latest 2020 emissions. Because emissions vary per year, the Air District periodically updates the screening maps to incorporate the latest emission inventory, noting the emission year.

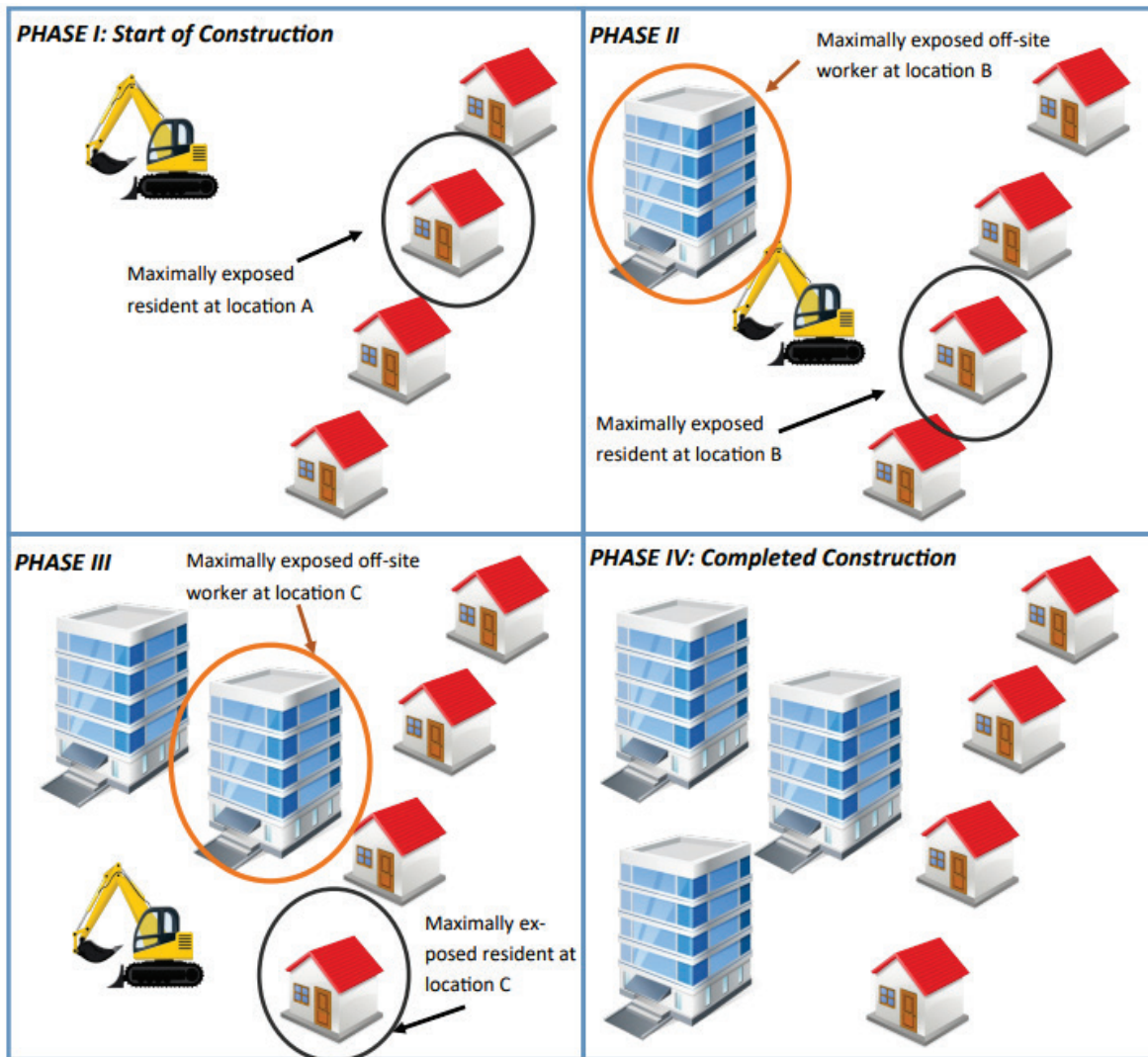
Part II: After the first phase is completed, residents/workers are on-site, and the second phase of construction begins:

- ▶ Evaluate the construction emissions from the second phase for the maximally exposed on-site worker/resident at location B (the locations may be different depending on the receptor).
- ▶ Evaluate operational emissions from new businesses within the project radius for workers/residents at location B. Include likely emissions from common sources found at most businesses, such as standby diesel generators, boilers, and trucks trips.
- ▶ Include any mitigation measures required by the lead agency as conditions of development.
- ▶ Determine the highest annual PM_{2.5} concentration for workers/residents at location B from the combined impact from construction and operations.
- ▶ Estimate the health impact from the combined construction and operation impacts for the workers/residents at location B. Care should be taken to ensure that appropriate exposure factors are used to represent the exposure duration consistent with the phase of development.
- ▶ When identifying the location B with the highest worker/resident exposures, the Air District recommends initially modeling the impacts from construction and operations separately using a fine receptor grid that extends beyond the site boundary and includes, at a minimum, the location of the maximally exposed off-site receptor (location A). Modeled concentrations from construction and operations are then combined at each receptor location to determine the maximally exposed worker/resident at location B.
- ▶ The project sponsor should additionally track the impact on the maximally exposed off-site receptor at location A that will be exposed to the emissions from the completed phase and ongoing construction activities. The cancer risks and chronic hazard are cumulative, so the risks should be added from the start of the construction (Part I) to the end of the second phase of construction. Please note that the maximally exposed off-site worker/resident during Phases I and II may be found at the same location.

Part III: For the next completed phase of development:

- ▶ The analysis will follow an iterative process as described above for Part II whereby impacts are determined for a new maximally exposed worker/resident at location C (the locations may be different depending on the receptor).
- ▶ It is recommended that the project sponsor continue to cumulatively aggregate the health impacts for receptors at locations A and B from impacts associated with the next phase of development. The project sponsor can discontinue tracking successive phases of development for previous maximally exposed receptors from other phases after maximum exposure duration for cancer risks and chronic hazards has been reached. (When this appendix was published, the acceptable exposure duration for residents was 30 years.)
- ▶ The next maximally exposed worker/resident is identified after each completed phase of development following this iterative process.

Figure 2 Illustration of How to Assess Impacts from Overlapping Activities



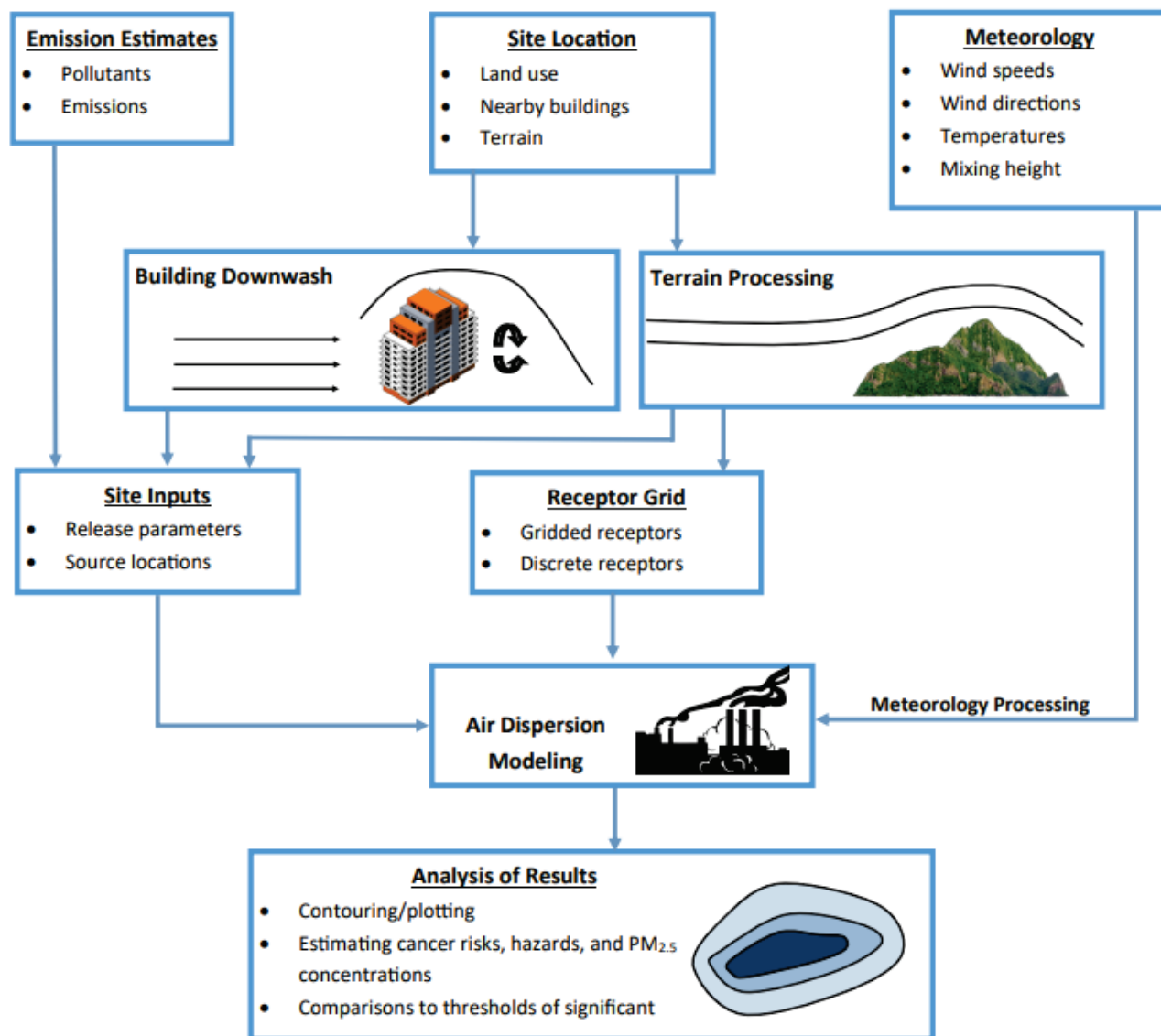


3 GENERAL AIR DISPERSION MODELING CONCEPTS

Air dispersion modeling is the mathematical estimation of pollutant impacts from emissions sources to a receptor location. Most projects rely on air dispersion modeling to estimate exposure concentrations to receptors from project-related and/or cumulative sources. Many of the concepts presented in this section are relevant whether a screening or refined modeling analysis is being performed.

Several factors determine the transport of pollutants in the atmosphere, including meteorological conditions, site configuration, emission release characteristics, surrounding terrain, and source types. Figure 3 presents a general overview of the process typically followed for performing an air dispersion modeling assessment. This section assumes that the project sponsor has some familiarity with air dispersion modeling terms and concepts and that additional information can be found in the users' guide of specific models. The following sections highlight key concepts that need to be defined before an air dispersion modeling analysis is conducted.

Figure 3 Generalized Process for Performing a Refined Air Dispersion Modeling Analysis



Source: CAPCOA 2009.

3.1 RECOMMENDED AIR DISPERSION MODELS

Several air dispersion models approved by federal and state agencies are available depending on the type of source being modeled and site conditions. The Air District recommends for CEQA purposes that either the SCREEN3 model (EPA 1995) or AERSCREEN be used for screening Tier 1 analysis and that the American Meteorological Society/U.S. Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) Regulatory Model, AERMOD (EPA 1998; Paine et al. 2003; Cimorelli et al. 2002), be used in a refined Tier 2 modeling analysis. AERMOD is currently the U.S. Environmental Protection Agency's (EPA's) preferred near-field air dispersion model (Guideline on Air Quality Models in 40 CFR Part 51, Appendix W; EPA 2001) and is required on any HRA submitted to the Air District in support of a permit application. Note that project sponsors are not required to consistently use only screening models in Tier 1 and refined

models in Tier 2; at any time, project sponsors can mix and match which model to apply depending on the sources associated with their project and the available information.

The advantages of using a screening model include ease of use and the possibility of eliminating insignificant sources from further analysis. Both SCREEN3 and AERSCREEN⁵ predict the maximum 1-hour concentrations at specified receptor distances based on minimal project information and default worst-case meteorological conditions. If the source is found to be an insignificant contributor to the overall health impacts from the project, then it could be eliminated from further analysis because the screening analysis incorporates relatively conservative assumptions to ensure that the health impacts are not underestimated. If the results of the screening analysis exceed the thresholds, then a refined Tier 2 analysis can be performed, requiring detailed information on site operations and local meteorology.

The SCREEN3 model is a single-source Gaussian plume model that provides maximum ground-level concentrations from point, area, volume, and flare sources (see Section 4 for details describing each source type), as well as concentrations in the cavity zone, and concentrations related to inversion breakup and shoreline fumigation. The model includes worst-case default meteorological data that incorporates the full combinations of wind speeds and stability classes. The model also allows inputs on building downwash, terrain, and fumigations. AERSCREEN incorporates some of the improved modeling algorithms used in AERMOD and, being more current, differs from SCREEN3 by having additional modules that can handle building wake effects; user-defined meteorological conditions, such as surface characteristics and temperatures; and terrain.

The main limitation of both screening models is that they are designed to estimate the worst-case concentration representing the value from the plume centerline regardless of the source-receptor-wind direction orientation. There is an option in the recommended refined model, AERMOD, to input terrain and building data while in the screening mode. In general, the AERSCREEN program will produce slightly more conservative results than the screening mode of AERMOD because AERSCREEN and SCREEN3 perform a more precise search to isolate the receptor distance with the highest concentration.

More sophisticated models are highlighted in the next tier of analysis where multiple sources and site-specific meteorological data can be used. Refined models, such as AERMOD, require much more site-specific information, allowing for greater characterization and more representative results. The models require some familiarity with air dispersion modeling concepts, as well as site conditions and emission release characteristics of the sources to be modeled. Subsequent sections discuss some key modeling concepts that can be applied, as applicable, to both the screening and Tier 2 air modeling analyses. The project sponsor should refer to the air model user's guide for additional information.

⁵ The SCREEN3 and AERSCREEN models can be downloaded from the EPA web site at <https://www.epa.gov/scram/air-quality-dispersion-modeling-screening-models>. User's guides for both models can also be downloaded from this website. A user-friendly interface is also available for SCREEN3 as a free download from Lakes Environmental web site at <https://www.weblakes.com/products/screen/index.html>.

3.2 COORDINATE SYSTEM

Any modeling assessment requires a consistent coordinate system for defining locations of the receptors and sources and, where necessary, for considering other geographical features. Using a standard coordinate system for a project increases the efficiency of the review process while providing real-world information about the site location.

Most air dispersion models use the Universal Transverse Mercator (UTM) coordinates, which divide the world into zones, number sequentially, and span six degrees of longitude or latitude/longitude (in decimal degrees). The UTM system uses meters as its basic unit of measurement, which makes it easier for identifying specific locations in local assessments than latitude/longitude. The Bay Area and most of northern California are located in Zone 10. The project sponsor should ensure that a consistent horizontal datum (e.g., NAD84 [North American Datum of 1984] or WGS84 [World Geodetic System of 1984]) is used for all elements (receptors, sources, buildings, terrain) defined for the project. Using different datums within the same assessment may lead to significant errors and relative location differences of up to 200 meters.⁶

For a localized assessment, the project sponsor may use relative coordinates based on distance from reference datum point and not based on a geographic standard. For example, a facility may reference the northwest corner of the perimeter of the property boundary as the origin (0,0) of the coordinate system and have all other locations identified based on its location relative to this defined reference point. All facility buildings and sources are then related spatially to this origin, and all site measurements are estimated relative to the local coordinate system.

The only caveat to using the local coordinate system is that it cannot be compared or spatially mapped to other sources, receptors, or other geographic features in the actual world. For this reason, it is advantageous to consider a geographic coordinate system that can specify the location of any object anywhere in the world with precision.

3.3 TERRAIN

Terrain elevation is defined as the elevation relative to the facility base elevation. Terrain elevations can have a large impact on the air dispersion and deposition modeling results and therefore on the estimates of potential risk and hazard to human health and the environment. The terrain type is based on the project area and can be characterized as being either complex or simple, described as follows:

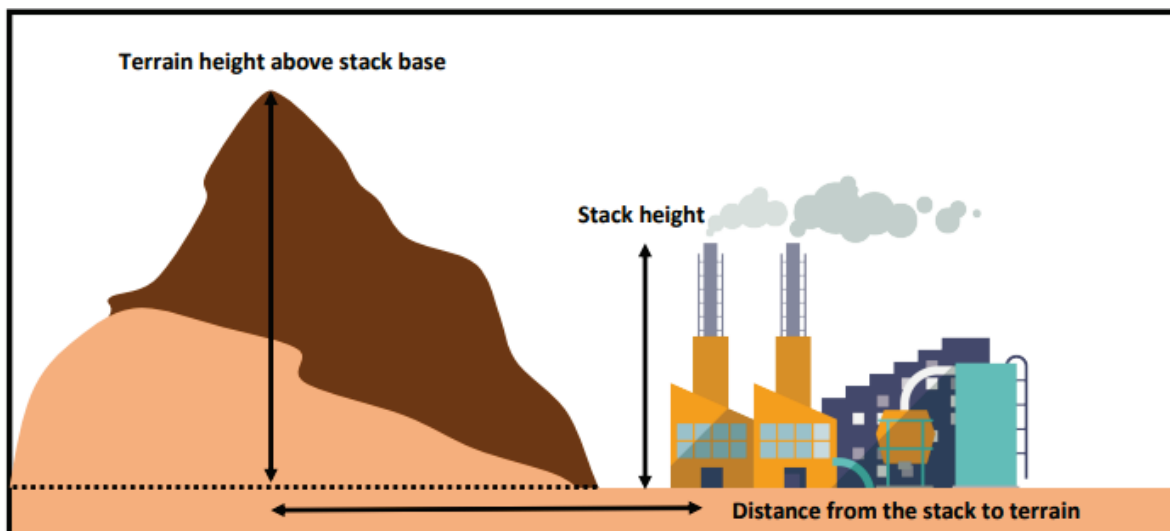
- ▶ Complex terrain: The terrain elevations within 50 kilometers of the stack are above the top of the source stack being evaluated in the air modeling analysis (Figure 4).
- ▶ Simple terrain: The terrain elevations within 50 kilometers of the stack are below the top of the source stack being evaluated in the air modeling analysis. The "Simple" terrain can be divided further into two categories:

⁶ For example, NAD27 (North American Datum of 1927) is based on location of a fixed reference station, whereas NAD83 (North American Datum for 1983) uses an earth-centered reference. The difference between the two datums ranges from 10 to more than 200 meters, depending on the location.

- Simple flat terrain is used where terrain elevations are assumed not to exceed stack base elevation. If this option is used, then terrain height is considered to be 0 meters.
- Simple elevated terrain, as illustrated in Figure 5 is used where terrain elevations exceed stack base but are below stack height.

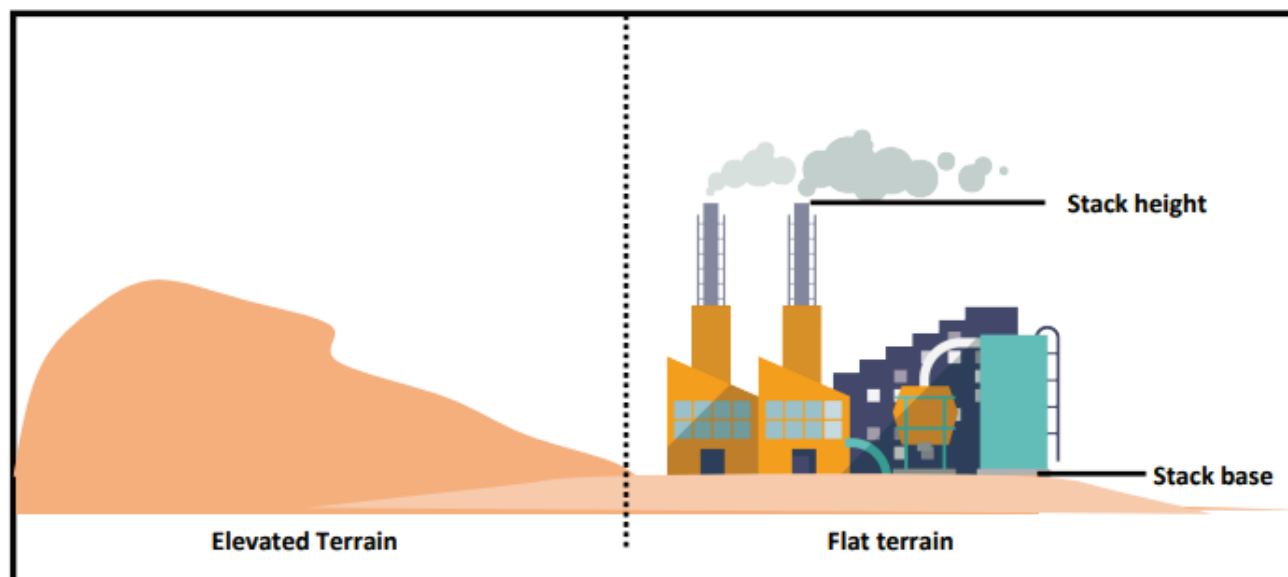
Each air dispersion model has algorithms to incorporate different terrain types found at a project site. Care should be taken to accurately identify terrain conditions surrounding the project as it defines how the pollutant will disperse in the environment. Information on the surrounding terrain is required for any regulatory modeling applications for both simple and complex situations. SCREEN3 supports flat, elevated, and complex terrain. If the simple flat terrain is selected, the terrain heights must not exceed stack base elevation. In most cases, the terrain height is considered at ground level (0 meters). In a simple elevated terrain where the terrain heights exceed the stack base but are below stack height, the terrain height above stack base should be entered. If elevated or complex terrain is used, distance and terrain heights must be provided.

Figure 4 Complex Terrain Conditions



Source: CAPCOA 2009

Figure 5 Two Types of Simple Terrain Conditions



Source: CAPCOA 2009

Digital terrain data can be read by modules in both AERSCREEN and AERMOD. The preprocessor program, AERMAP (EPA 2018), uses terrain data to determine base elevations at each receptor and source for use in AERMOD. Digital elevation data or other geographic data sources processed through AERMAP can be used to determine the appropriate terrain for a project site. Digital elevation terrain data are available from a variety of vendors in several different formats. AERMAP accepts terrain data in the following formats:

- ▶ U.S. Geological Survey (USGS) National Elevation Dataset (NED) data are seamless bare earth elevation layer of The National Map set at one-third arc second (10 meter) resolution. NED is the highest-resolution, best-quality Digital Elevation Model (DEM) data across the United States in a seamless raster format that combines the USGS 1:24,000-scale DEM for the conterminous United States and 1:63,360-scale DEM data for Alaska. NED data are available for importing into widely used commercial software packages in several formats, such as ArcGrid, GridFloat, IMG, BILS, and GeoTIFF.
- ▶ USGS "Blue Book" standard DEM format (herein referred to as the DEM format) consists of an overall header followed by terrain profiles that have location-based subheaders and evenly spaced terrain elevation points called nodes. Each DEM file covers a section of land based on latitude and longitude coordinates. Only Level 2 or 3 quality DEM data are recommended for use because these datasets have been smoothed and systematics errors removed.
- ▶ XYZ format is a text file of horizontal location and elevation data that can be converted to "Blue Book" DEM format using a program available on EPA's Support Center for Regulatory Atmospheric Modeling (SCRAM) website.

AERSCREEN allows the project sponsor to incorporate terrain impacts by reading DEM or NED files. To use this option, the project sponsor must create a demlist.txt file where the first line describes the type of terrain file being used (i.e., DEM or NED). The second line is blank, and the third line lists the location of the file in NAD coordinates. The fourth line begins the list of terrain files with each file on a separate line.

When AERSCREEN is run, the project sponsor will be prompted to provide source coordinates and associated NAD datum before creating the required terrain file for modeling.

For refined modeling, AERMAP is programmed to read NED or DEM formatted files using UTM coordinate system for sources and receptors. NED data can be obtained from the Multi-Resolution Land Characteristics Consortium (MRLC) (<http://www.mrlc.gov/>) in GeoTiff format.⁷ DEM data files for California with 30 x 30 meter resolution are available for free downloads from CARB.⁸ The DEM files are in 7.5-minute format, compatible for use in CARB's Hotspots Analysis and Reporting Program (HARP). DEM data can also be obtained from commercial sites on the Internet.⁹

The Air District recommends using NED data first in GeoTIFF format as input into AERMAP if available or, alternatively, using either the DEM 1 arc-second (approximately 30-meter resolution) or one-third arc-second (10-meter resolution) if NED data are not available. The project sponsor should ensure that the reference datum for the NED and DEM files are based on NAD83 (North American Datum of 1983) or WGS84.

There are different requirements for importing NED and DEM files into refined air models. The project sponsor should review the specific model's user's manual to determine whether the format is compatible or whether files need to be exported to another program for preprocessing. The AERMAP User's Guide (EPA 2018) also has recommendations regarding the dimensions of the NED/DEM array required to accurately characterize the terrain surrounding a project. The guide states that terrain features exceeding a 10 percent elevation slope from any given receptor be included in the array. The project sponsor should plan for additional time as needed to process the terrain data if the array is expanded. The lead agency may also be consulted to make a case-by-case determination regarding the array size needed for a project.

When using the AERMOD dispersion model, it should be noted that there is no distinction in the model between elevated terrain below the release height of the pollutants and terrain above the release height. A parameter called hill height scale must be included with the receptor elevation for any location with elevated terrain for AERMOD to properly model dispersion in that area. Hill height scale is the terrain height and location that has the largest effect on dispersion for every receptor in a complex terrain scenario. AERMAP generates hill height scale, along with base elevation, for every receptor.

3.4 URBAN OR RURAL CONDITIONS

Screening and refined modeling consider two types of land use categories: urban and rural. The land use category determines how the air dispersion model accounts for the dispersive nature of the "convective-like" boundary layer that forms during nighttime conditions because of the urban heat island effect. The classification of a site as urban or rural can be determined using one of the procedures suggested by Irwin in EPA's document Guideline on Air Quality Models (EPA 2001). Of the two procedures—Auer's land use procedure and the population density procedure—the land use procedure is the preferred method. The land use method classifies the land use within the total area surrounding the source following the meteorological

⁷ Instructions for downloading NED data in a GeoTIFF format from MRLC is described here: https://static.azure.gov/aqd/how_2_download_%20ned_data.pdf.

⁸ DEM files from CARB are available at <https://ww2.arb.ca.gov/resources/documents/harp-digital-elevation-model-files>.

⁹ It should be noted that websites change over time and that the data may have been migrated to other websites in the future since the publication of this report.

land use scheme from Auer. However, the Auer method is manually intensive and relies on subjective interpretation of the results by the project sponsor. Instead, the Air District recommends using the AERSURFACE tool (EPA 2008), which determines surface characteristics required by AERMET. AERSURFACE reads and processes land cover data from the USGS National Land Cover Database (NLCD). The Air District recommends using NLCD for 2016 (NLCD_2016) because it is the most comprehensive land cover data currently available and is compliant with the Air District's HRA Modeling Protocol (BAAQMD 2020). The NLCD_2016 can be used to determine the types of land cover present at and around the project-specific location. AERSURFACE matches the NLCD_2016 land cover categories to the surface characteristics of the land cover in the project area and assigns land cover counts for each category. Project sponsors enter the project coordinates, datum, and study radius (3 kilometers from project site centroid) into AERSURFACE, and the tool counts the number of 30x30-meter grid cells that fall into each of the 20 land use classifications. Only four of the 20 categories relate to developed land (Table 2).

Table 2 NLCD_2016 Land Cover Categories

Type	Use and Structures	Description
21	Developed, Open Space	Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
22	Developed, Low Intensity	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
23	Developed, Medium Density	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
24	Developed, High Intensity	Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.

The Air District classifies NLCD_2016 categories 23 (Developed, Medium Intensity) and 24 (Developed, High Intensity) as "urban" for the purpose of determining AERMOD dispersion algorithms. If over 50 percent of the grids are assigned to categories 23 and 24, then the area is classified as urban; otherwise, the area is classified as rural. For simplicity, the project sponsor can model both urban and rural land uses and use the most conservative concentrations predicted from the two analyses.

It should be noted that the dispersion model, AERMOD, allows rural and urban terrain to be selected for different sources within the same model run. However, Section 6.2.1.1 of EPA's Guideline on Air Quality Models (Appendix W) recommends modeling all sources within an urban complex using the urban option even if some sources may be defined as rural based on the land use procedures. For example, some sources may be within an urban area but close enough to a body of water or other nonurban land use category to result in a predominantly rural classification within 3 kilometers of the source. Treating such sources as urban is consistent with the fact that the urban heat island is not a local effect but is more regional in character.

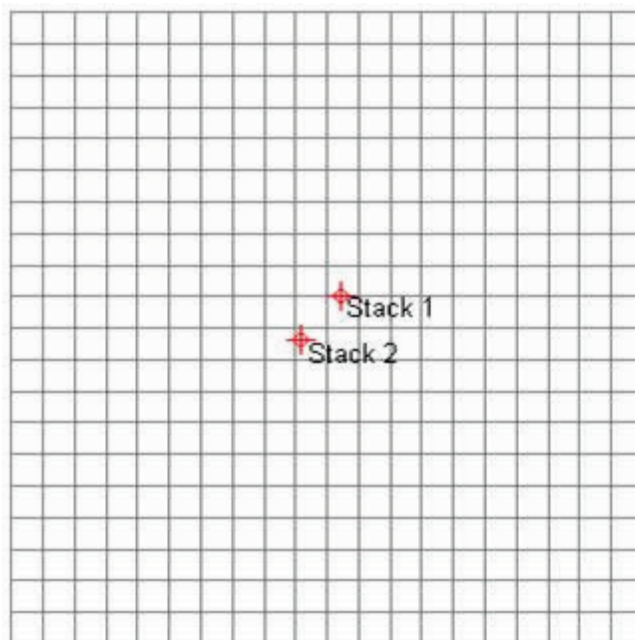
3.5 RECEPTOR GRID

Exposure point concentrations are estimated by the air dispersion model at user-defined discrete receptor locations and at each point of a receptor grid. A receptor grid is used to identify a uniform series of receptor locations where air concentrations will be predicted. The receptor grid does not correspond to actual locations of sensitive receptors but is a means of developing isopleths that illustrate the dispersion pattern of the source emissions and anticipated exposure concentrations in the community or project radius. Discrete receptors are used in the model to represent actual individualized locations where people work or reside (see Section 2.1 for the definition of receptors). Fence line receptors, which correspond to the placement of receptors along the perimeter of the project's property, address off-site worker exposures from neighboring properties and if residential developments are built near the project in the future.

Several techniques can be used in air dispersion modeling for defining a receptor grid. For screening purposes, a simple straight line of receptors that are spaced equal distances from the source may suffice. Refined modeling commonly uses Cartesian receptor grid, which is defined by an origin with receptor points evenly (uniform) or unevenly (nonuniform) spaced around the origin. Figure 6 illustrates a sample uniform Cartesian receptor grid. The grid should encompass the entire area of the project radius and be spaced appropriately to identify the most affected receptor. A Cartesian grid should be designed with a receptor spacing of 20 meters out to a minimum distance of 325 meters (1,000 feet) from the property boundary. A larger grid spacing can be applied for distances greater than 325 meters. For example, a 50-meter spacing could be applied between 325 meters and 500 meters from the boundary and 100-meter spacing for distances beyond 500 meters. Using a combination of fine, tightly spaced receptors near the source and coarse grid of receptors located outside of the fine grid reduces the modeling time but maintains sufficient resolution for identifying the maximum impact area (Figure 7). Fenceline receptor spacing should not exceed 20 meters along the property perimeter. However, tighter grid spacing may be warranted to ensure that the modeling captures all areas that may potentially be affected by the project. Situations may arise where these distances may not apply and alternative spacing is used, such as with high stacks, where the impacts occur far away from the source so receptors are placed at distances greater than 2,000 meters, or short stacks, where a tighter grid spacing may be required near the source.

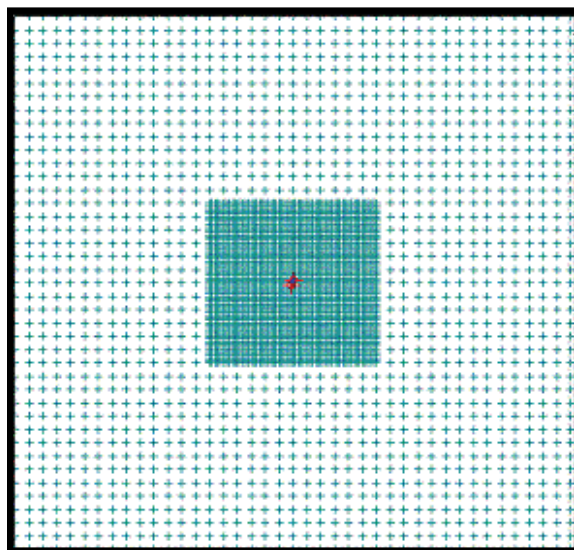
Another less commonly used receptor grid is a polar grid system, which is characterized by an origin with receptor points defined by the intersection of concentric rings, which have defined distances in meters from the origin, with direction radials that are separated by specified degree spacing. Figure 8 illustrates a sample uniform polar receptor grid. Polar grids are used when only one source or one dominant source is being modeled. However, for facilities with a number of significant emissions sources, receptor spacing can become too coarse (receptor points are too far apart) when using polar grids such that the maximally exposed individual is not clearly identified. As a result, polar grids should generally be used in conjunction with a Cartesian grid to ensure adequate coverage for defining plume dispersion and exposure concentrations.

Figure 6 Example of a Cartesian Grid



Source: CAPCOA 2009

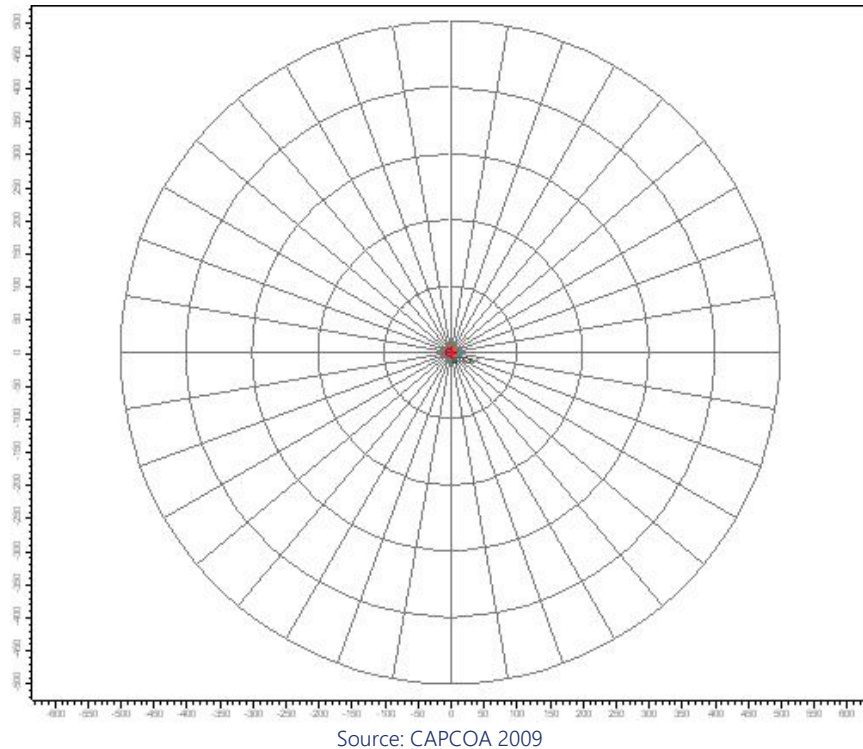
Figure 7 Sample Combination Grid System with Two Types of Receptor Spacing



Source: CAPCOA 2009

Whichever receptor grid is used, the ultimate goal is to ensure that all potential exposures to residential and workers have been evaluated. The concentration estimated at each receptor location represents a person's exposure through inhalation of pollutants emitted from the project and, accordingly, a flagpole height of 1.5 meters,¹⁰ representing the average breathing zone, is recommended for all receptors. The flagpole height may be adjusted as necessary to address impacts on specific receptors such as students or young children. Project sponsors also have the option of using flagpole receptor height of zero, which will produce the most conservative exposure concentrations.

Figure 8 Example of a Polar Grid



¹⁰ The flagpole receptor height of 1.5 meters is consistent with the District's permitting procedures under Regulation 2-5. Receptor heights of 1.8 meters were used in the West Oakland and Richmond-North Richmond-San Pablo Community Action Plans under AB 617.

3.6 AVERAGING TIMES

“Averaging time” refers to three different time increments: (1) for comparisons to the thresholds of significance (30 years, annual, or 1 hour), (2) for a receptor that is exposed to air pollution from a project, and (3) for situations when a facility or source is emitting pollution into the environment. All three conditions must be well understood before a project-level assessment is started.

The Air District has defined different thresholds depending on the health effects and time of exposure. Cancer risks and chronic noncancer hazard are assessed for long-term exposures. Acute noncancer health effects are usually based on a maximum 1-hour exposure. PM_{2.5} concentrations are based on annual average exposures. The ability to assess air quality using the most appropriate effects-based averaging time means the refined air dispersion models provide a more representative assessment of health and environmental impacts of air emissions from a project. Screening models (e.g., SCREEN3 or AERSCREEN) generally estimate the worst-case 1-hour concentrations from the centerline of the plume. The 1-hour concentration is then multiplied by time-averaging factors to produce concentrations for other time increments. For example, multiplying the 1-hour concentration by 0.1 is an approximation of the annual average concentration.

The averaging time defined in the thresholds of significance describes the length of time during which the receptor is exposed to the project-level and cumulative impacts. Two important factors are required for a receptor to be exposed to pollution: (1) the receptor must be present while (2) a source is emitting pollutants. “Averaging time” is a term used to describe both situations when a source and receptor are present. In the first instance, averaging time expresses the time during which a receptor is exposed to pollution. Residents are assumed to be exposed for 24 hours a day, 350 days per year (assuming 15 days of vacation). Other receptors are anticipated to have lower exposures because they spend less time at one location. For example, workers typically work 5 days per week, and their corresponding exposures would be 250 days per year. The project sponsor is cautioned to thoroughly review and understand the factors used in estimating the risks and hazards because some recommended factors (i.e., worker 8-hour breathing rates) already incorporate receptor-specific exposures and activity patterns. More detailed discussions on the exposure factors are presented in Section 10.

The second use of averaging time defines the source emissions and facility operations. Some facilities operate 24 hours a day, 365 days per year, whereas others operate when employees are present. Refinements can be made in the modeling to more accurately predict exposure concentration by incorporating project-specific conditions, such as variable source emission rates or limited hours of operation. For example, a source that operates intermittently can be modeled by matching the hours of operation to the corresponding hours of meteorological data. The Air District cautions that if adjustments are made to reduce the emissions to less than 24 hours of operation, corresponding adjustments must be made to the emission factors to ensure that the modeled emissions are equivalent to the project’s annual emissions. An example is provided in the box below for adjusting the emissions for noncontinuous operation, and more information can be found in AERMOD’s user’s guide. It should be emphasized that any adjustments taken in the modeling analysis that restricts the hours of operation of a source will be required as a permit condition after the environmental document is certified.

Example of Modeling Emissions from a Noncontinuous Operating Source

For most modeling runs, the source emissions will be set at a unit emission rate of 1 g/sec, equivalent to 31,536 kg/year (i.e., 1 g/sec x 3,600 sec/hr x 8,760 hr/year for 24 hrs/day, 365 days per year of operation).

For every hour that the source is not emitting, the operating hours must be adjusted accordingly so that the total annual unit emission rate still equals the annual emissions of 31,536 kg/year. The project sponsor can vary emissions from different time periods, including hourly, daily, monthly, and seasonally in AERMOD. Typically, this option is used to characterize routine shutdowns and startups of sources related to maintenance and operating schedules. When adjusting the hourly emission rate, the hour of day displayed in AERMOD corresponds to the hour ending at the time of display. For example, hour 7 corresponds to the hour from 6 a.m. to 7 a.m.

If a source emits only 12 hours per day, from 6 a.m. to 6 p.m., 365 days per year, then the project sponsor must make an adjustment to the hour of day (HROFDY) emission factor in the AERMOD configuration file. The emission factor of two (EMISFACT HROFDY 2.0) should be used for hours when the source is operating and an emission factor of 0 for hours when the source is not operating. As long as the emission rate is kept at 1 g/sec, the total daily emissions would remain consistent for 24 hours of operation. This methodology applies only to assessments evaluating annual average or chronic exposures. The project sponsor should be cautious when restricting the hours of operations in the modeling because the project will be required to accept these hours as part of the permit conditions for the project.

A second dispersion analysis is required to evaluate short-term exposures, such as acute health hazards. In this case, the user must enter a value of 1 for emission factor for the hours during which the source is emitting and 0 for the hours when the source is not emitting. If a value greater than 1 is used, the acute hazard index will be overestimated by the model.

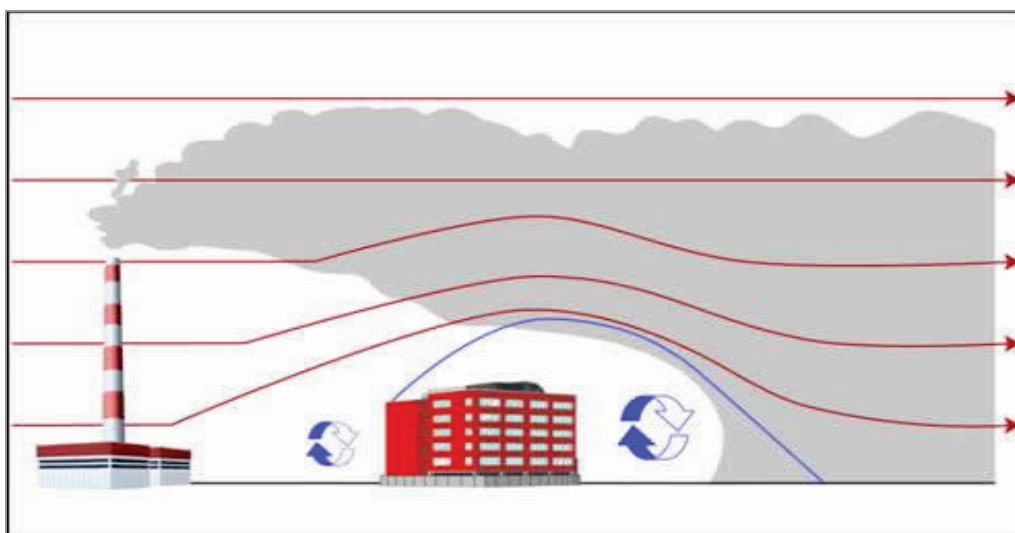
In addition, the exposure concentration accounts for the length of time during which the source is emitting for comparison to the threshold. This issue is particularly relevant for construction emissions because operational emissions are assumed to remain constant over the assessment term of the threshold. For construction, most projects are intermittent and are completed before reaching the typical residential assessment term of 30 years. In these cases, the Air District recommends analyzing the project for only the duration when emissions are produced.¹¹ For the remaining years, emissions are set to 0. For example, suppose a housing construction project that is anticipated to start in the beginning 2020 and finish at the end of 2021 will start housing residents by 2022. Emissions associated with the construction will be based on 2 years of activity (annual assessments of PM_{2.5} concentrations from 2020 to 2021). For the residential evaluation, the maximum exposed individual will be exposed to 2 years of construction emissions and 28 years of operations resulting in cumulative 30-year exposure. The 1-year PM_{2.5} evaluation will be based on highest annual PM_{2.5} emissions from construction or operations.). The lead agency may consider lowering the cancer risk threshold for short-term exposures as suggested by OEHHHA because higher exposures over a short period may pose a greater risk than similar exposure spread over a much longer period.

¹¹ For projects subject to permitting requirements under the District's Regulation 2-5: New Source Review of Toxics Air Contaminants or 11-18: Reduction of Risk from Air Toxic Emissions at Existing Facilities, cancer risk must be evaluated for no less than 3 years.

3.7 BUILDING IMPACTS

Both screening and refined air dispersion modeling are capable of modeling impacts from neighboring buildings. Buildings and other structures near a relatively short stack can have a substantial effect on plume transport and dispersion and on the resulting ground-level concentrations. When the airflow meets a building (or other obstruction), it is forced up and over the building. On the lee side of the building, the flow separates, leaving a closed circulation containing lower wind speeds. Farther downwind, the air flows downward again. In addition, the presence of buildings increases the amount of *wind shear* and, as a result, turbulence, as seen in a *turbulent wake zone* (Figure 9).

Figure 9 Dispersion Pattern Attributable to Building Downwash



Source: CAPCOA 2009

If a plume gets caught in the *cavity* caused by buildings, very high concentrations can result. If the plume escapes the cavity but remains in the turbulent wake, it may be carried downward and dispersed more rapidly by the turbulence. This can result in either higher (reduced mixing) or lower concentrations (enhanced mixing) than would occur without the building, depending on whether the reduced height or the increased turbulent diffusion has the greater effect.

There has long been a “rule of thumb” that a stack should be at least 2.5 times the height of adjacent buildings. This is called the “good engineering practice” (GEP) stack height. EPA (1990) states, “If stacks for new or existing major sources are found to be less than the height defined by EPA’s refined formula for determining GEP height, then air quality impacts associated with cavity or wake effects due to the nearby building structures should be determined.”

EPA’s refined formula for determining GEP stack height is:

$$GEP = H + 1.5 \cdot L$$

where:

GEP = Good Engineering Practice

H = Building/Tier Height measured from ground to the highest point

L = Lesser of the Building Height or Projected Building Width (PBW)

EPA recommends evaluating building downwash only when the building is considered sufficiently close to a stack to cause wake effects. Building effects should be considered only when the distance between the stack and the nearest part of the building is less than or equal to five times the lesser of the building height or the projected width of the building (L).

$$\text{Distance of stack to building} \leq 5 \cdot L$$

The projected building width is the maximum length of a building that could affect air flow around and over the structure. It is the responsibility of the project sponsor to identify whether any building in the vicinity of the project meets the GEP requirements and building downwash effects should be considered. The recommended refined models incorporate algorithms to handle building downwash. The screening model, SCREEN3, considers the effects of a single building, and the project sponsor is prompted to enter the building height, minimum horizontal building dimension, and maximum horizontal building dimension in meters. If automated distances or the discrete distances option is used in the SCREEN3 model, wake effects are included in the calculations. More information on modeling building effects can be found in the SCREEN3 User's Guide (EPA 1995).

The more refined models, such as AERMOD and the screening model, AERSCREEN, can model the effects of complicated sites consisting of up to hundreds of buildings. AERMOD requires the following information to perform building downwash analysis:

- ▶ X and Y locations in UTM coordinates for all stacks and building corners;
- ▶ height for all stacks and buildings (meters); for buildings with more than one height or roofline, identify each height (tier); and
- ▶ base elevations for all stacks and buildings.

For buildings with more than one height or roofline, the corner coordinates and heights are required along each building tier. Base elevations can be obtained from the terrain array processed in AERMAP (see Section 3.3) or entered directly into the program where baseline elevations may have changed because of new construction.

3.8 METEOROLOGY

Meteorology (e.g., prevailing wind direction) plays an important role in determining the downwind concentration and the location of the greatest affected receptor. In addition, the amount of turbulence in the atmosphere increases the entrainment and mixing of unpolluted air into the plume and thereby acts to reduce the concentration of pollutants in the plume (i.e., enhances the plume dispersion). The amount of atmospheric turbulence is categorized into six stability classes: A, B, C, D, E and F. Class A is the most unstable, or most turbulent, class, and class F is the most stable, or least turbulent, class. Table 3 lists the six classes, and Table 4 provides the meteorological conditions that define each class.

Table 3 Stability Classes

Stability Class	Definition
A	Very stable
B	Unstable
C	Slightly unstable
D	Neutral
E	Slightly stable
F	Stable

Table 4 Meteorological Conditions That Define Each Stability Class

Surface Wind Speed (m/sec)	Daytime Incoming Solar Radiation Strong	Daytime Incoming Solar Radiation Moderate	Daytime Incoming Solar Radiation Slight	Nighttime Cloud Cover > 50%	Nighttime Cloud Cover < 50%
<2	A	A, B	B	E	F
2–3	A, B	B	C	E	F
3–5	B	B, C	C	D	E
5–6	C	C, D	D	D	D
>6	C	D	D	D	D

SCREEN3 allows project sponsors to either select a combination of stability class and wind speeds or input a single stability class and wind speed combination. These options are described as follows:

- ▶ *Full meteorology (all stability classes and wind speeds)* uses a combination of all six stability classes (five for urban sources) and their associated wind speeds to identify the worst-case meteorological conditions (i.e., the combination of wind speed and stability that results in the maximum ground-level concentrations).
- ▶ *Single stability class* uses a selected stability class to be used (A through F) with a range of wind speeds to determine ground-level concentrations.
- ▶ *Single stability class and wind speed* uses a selected stability class and wind speed to estimate the ground-level concentrations.

The Air District recommends running SCREEN3 using the full meteorological data. The project sponsor should be aware that SCREEN3 predicts the maximum 1-hour concentration at each receptor location. The 1-hour concentration is then multiplied by 0.1 to convert to an annual concentration for comparison to the thresholds. To use the annual average conversion factor, SCREEN3 must be run using the full meteorological dataset.

AERSCREEN uses the MAKEMET program to generate specific worst-case meteorological matrix based on representative ambient air temperatures; minimum wind speed; and site-specific surface characteristics, such as albedo, Bowen ratio, and surface roughness. CARB¹² provides air basin-wide temperature tables representing maximum and minimum temperatures for 2004–2013 by season for all valid meteorological monitoring stations in the air basin. AERSCREEN then integrates the terrain and building downwash algorithms to perform the modeling run. AERSCREEN estimates the worst-case 1-hour concentrations from a single source but can also identify impacts from 3-hour, 8-hour, 24-hour, and annual averaging periods using ratios applied against the 1-hour concentration.

Refined models use measured meteorological data (e.g., winds, air temperature, atmospheric stability, mixed layer heights) collected from stations to simulate the transport and dispersion of air pollutants. The Air District maintains AERMOD-ready meteorological data sets for 35 sites in the Bay Area consisting of 11 sites at airports, 14 sites from major facilities, and 10 sites operated by the Air District. Table 5 summarizes the stations where the Air District has processed AERMOD-ready meteorological data files that can be obtained through a public records request.¹³

The Air District processes the raw meteorological data sets, consisting of hourly wind and temperature data using the AERMET software. Consistent with EPA guidance, the data are reviewed to ensure that less than 10 percent of the data and 15 percent of the calm hours are missing per quarter. Only one radiosonde station, Oakland International Airport, operates in northern California and supplies all upper air data used for every refined air dispersion modeling application for the Bay Area.

ADJ_U* is a regulatory option in AERMOD modeling systems that adjusts the surface friction velocity parameter in the surface file to improve model performance for sources that have peak concentrations under low wind, stable atmospheric conditions. The ADJ_U* option is not required for stations that collect local turbulence data as part of the meteorological data. For the stations listed in Table 5, only the airport data are required to use the ADJ_U* option in AERMET because those sites do not provide local turbulence data in the publicly available data sets.

¹² AERSCREEN data from CARB is available at <https://ww2.arb.ca.gov/resources/documents/harp-aerscreen-meteorological-data>.

¹³ Public records can be submitted electronically at <https://www.baaqmd.gov/contact-us/request-public-records>.

Table 5 **Locations of Meteorological Stations in the Bay Area**

Airports ¹	Major Facilities	Air District Meteorological Stations
Concord-Buchanan Field	Chevron Refinery	Concord
Gnoss Field	Conoco Phillips Carbon Plant (closed 2014)	Fort Funston (inactive as of 5/13/2016)
Hayward Air Terminal	Conoco Phillips Cummings	Livermore Rincon
Livermore Municipal Airport	Conoco Phillips Hillcrest	Napa College
Moffet Federal Airfield	Conoco Phillips Rodeo	San Carlos
Napa County Airport	Former Golden Eagle Refinery ²	San Martin
Oakland International Airport	Former Shell Refinery East ³	Santa Rosa (closed 2014)
San Francisco International Airport	Former Shell Refinery West ³	Sonoma Baylands
San Jose International Airport	Valero Administration Building	Suisun Sewage Treatment Plant
Sonoma County Airport	Valero Warehouse	Vallejo
Travis Air Force Base	Contra Costa Power (closed 2018)	Former NUMMI Plant (closed 2010) ⁴
	Dow Chemical	
	Pittsburg Pacific Gas and Electric Company (closed 2012)	
	Oakland Sewage Treatment Plant	

¹ The ADJ_U* option must be selected in AERMET if project sponsors are using airport meteorological data.

² Although Golden Eagle Refinery was purchased by Marathon in 2018, the Air District continues to assign the former refinery name to processed AERMET files collected from this station.

³ The Air District continues to assign the former refinery name to processed AERMET files although Shell Refinery was purchased by PBF Energy in 2020.

⁴ The NUMMI meteorological tower was removed when the facility was sold to Tesla. Four years of processed AERMET is available from this station that can be used for CEQA projects proposed in the Fremont area.

A representative meteorological dataset for refined modeling is selected on a case-by-case basis because of the uneven coverage of meteorological towers and the complex terrain in the Bay Area. The most appropriate meteorological station for a project matches the meteorological conditions (wind speeds and directions), terrain, and surrounding land use of the project and is not necessarily the meteorological station closest to a project site. When a representative meteorological dataset for a project is selected, the following steps should be performed:

- ▶ The wind rose and terrain elevation should be evaluated together when selecting a meteorological set for AERMOD. Investigate the wind rose at all representative meteorological sites in surrounding areas of the project, and determine whether the wind speeds and directions are similar at the project. Note any differences or similarities in terrain elevation between the project and the meteorological sites, especially if there are any barriers separating the two locations.
- ▶ If there are significant differences in terrain elevation or land use between the project and the closest meteorological tower, the air dispersion model should be run multiple times using meteorological data from all nearby stations. The resulting concentration estimates should be compared against each other and can serve as upper and lower bounds of the possible exposure concentration.
- ▶ If the land use is considerably different between the project site and the meteorological station, the recommendation is for the project sponsor to assess whether this difference would significantly affect the model results. Land use parameters (surface roughness, albedo, and Bowen ratio)

processed using the processor, AERSURFACE, are used in AERMET to characterize the mixing height, vertical temperature gradient, and mechanical mixing of the pollutant plume as it disperses and mixes in the atmosphere.¹⁴ The comparison should evaluate whether the mixing height and the vertical temperature gradient are not significantly different within 10–20 miles of the station. The project sponsor may observe significant differences in the mechanical mixing because of differences between the nearby upwind land use and the terrain roughness. If the land use is different but the roughness is similar in scale, such as water versus open or grassy flat terrain, mechanical mixing may not be significantly different.

- Project sponsors have the option of using the default worst-case meteorological datasets if there are no meteorological stations close to the project site or if a terrain barrier exists between the project and the station, in which case none of the comparisons suggested above can be performed. The project sponsor may consider using data from a meteorological station further away from the project site if it can demonstrate that the station is located in an area with terrain and land use similar to those of the project site.

The report accompanying the modeling should provide a detailed technical justification for the meteorological station selected and used in the dispersion modeling and HRA. The project sponsor should also ensure that sufficient meteorological data are available at the selected station to ensure that the worst-case meteorological conditions are adequately represented in the modeled results. Regulatory programs administered by the Air District, including the Prevention of Significant Deterioration (PSD) and New Source Review (NSR) for major facilities, require 5 years of meteorological data when available to support the HRA. For CEQA, the Air District recommends use of a representative 1 year of meteorological data, consistent with procedures for conducting HRAs under Regulation 2-5. The lead agency can request that additional years of meteorology be used to ensure that meteorological conditions are adequately represented in the air quality analysis.

3.9 MULTIPLE SOURCES

When evaluating the air quality impacts from a project, the assessment evaluates the health impacts from all sources associated with the project but also includes a cumulative analysis where the impacts from all significant sources, such as industrial facilities and roadways surrounding the project or receptor, are combined with the project impacts and compared to applicable thresholds. When the plumes from multiple sources emerge, the plume rise can be enhanced, because of combined wake effects, which can make the resulting downwind concentration different from the summed results from individual model simulations. Source groups in refined models enable the creation of the source group “ALL,” which accounts for all the sources at the same time. Analysis of individual groups of sources in either model can be performed by using the SRCGROUP option. One example may be assigning each source to a separate source group to determine the maximum concentration generated by each individual source.

¹⁴ The three land use characteristics (surface roughness, albedo, and Bowen ratio) are already incorporated into Air District-processed AERMOD-ready meteorological data sets.

Screening models predict concentrations from one source at a time; consequently, the output from multiple runs must be summed if more than one source is affecting a project or receptor (i.e., sum the maximum concentration from individual source runs to determine impacts from multiple sources). The concentrations are estimated following the procedures outlined in EPA's document *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources* (1992).

3.10 MULTIPOLLUTANT CONCENTRATIONS

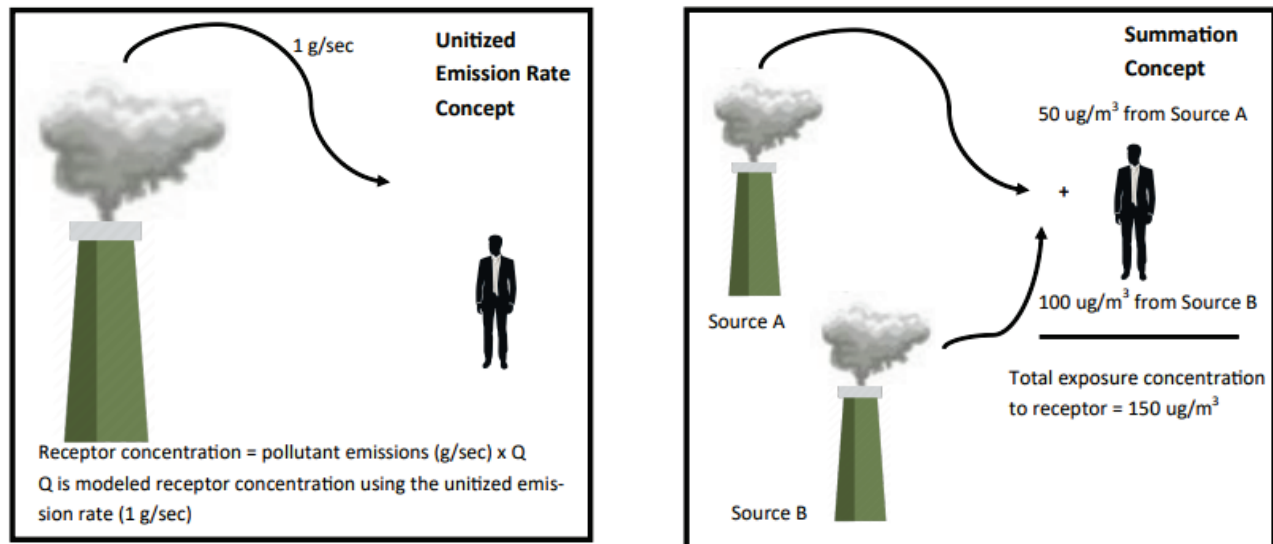
Air dispersion models (screening and refined models) are not equipped to automatically address emissions of multiple pollutants from a shared emission source when emission rates vary between different pollutants, by season, or by time of day. One approach to address this issue is to model each scenario in separate model runs for each specific pollutant type and/or year of meteorological data. This approach requires extensive modeling times and organizational effort to track the results of each separate run.

A simpler solution is to apply unitized, or normalized, emission rates in which the results from the model can be scaled by the actual chemical-specific emissions rate. Then individual pollutant concentrations may be summed. For determining the multiyear averages for estimating cancer risk, the procedure becomes more complex. Discussions on how to perform each of these methods are provided below.

Both the screening and refined models produce a Gaussian (bell-shaped) dispersion pattern. The model incorporates the hourly meteorological conditions, terrain elevations, and site characteristics to estimate the downwind concentration. Although the dispersion is nonlinear, predicted concentrations scale linearly with emissions. This relationship allows the project sponsor to input a unit emission of 1 gram per second (g/s) to be emitted at the source that can then be multiplied by the actual emission rate for each chemical to predict the downwind concentration of that pollutant at that specific receptor location. This methodology can be applied when using either the screening or refined models. Figure 10 (left image) helps visualize this concept, using an emission rate of 1 g/s.

The unitized emission rate concept applies only to single sources. For assessments with multiple sources, the project sponsor can model each source independently by using a unitized emission rate of 1 g/s. The unitized emission rate is 1 g/s for point or volume source and 1 gram per second per square meter for area source. The concentration at the receptor can then be multiplied by the actual chemical emission rate (in unit matching those used in the modeling), and the final receptor concentration is the sum of the exposure concentrations from all sources. This is called the summation concept, whereby the concentration and deposition fluxes at a receptor are the linear addition of the resulting values from each source. Figure 10 (right image) depicts the summation concept for a point or volume sources, but a similar methodology can be applied to area sources. The project sponsor can use a postprocessor, such as CARB's HARP2 program (<https://ww2.arb.ca.gov/our-work/programs/hot-spots-analysis-reporting-program>) to automatically process model results that have been predicted using a unitized emission rate.

Figure 10 Unitized Emission Rate (Left) and Summation (Right) Concepts



Note: The same dispersion runs can be used to estimate acute hazard index, chronic hazard index, cancer risk, and $\text{PM}_{2.5}$ concentrations if the model output includes the maximum one hour and the annual average concentrations.

3.11 FUMIGATION

The screening models can be used to assess impacts from fumigation. Fumigation occurs when a plume that was originally emitted into a stable layer is mixed rapidly to ground level when unstable air below the plume reaches plume level. The fumigation option is available only for point and flare source types if:

- ▶ the rural dispersion coefficient was selected (for rural inland sites), and
- ▶ the stack height ≥ 10 meters.

The fumigation option can also be used to model shoreline fumigation effects by entering the distance to the shoreline. Both SCREEN3 and AERSCREEN (using the SCREEN3 fumigation algorithm) can model marine conditions near the shoreline. Most refined models, such as AERMOD, are designed to model typical land conditions where surfaces heat up during the day and cool off at night, resulting in unstable weather patterns during the day and stable conditions at night. Large temperature fluctuations usually are not experienced near large bodies of water, where it takes longer for the surrounding land to heat up and dissipate the heat after the heat source is gone. Selecting the appropriate stability class in the meteorology may be difficult because the stability in marine boundary layer is dependent on the temperature difference between air and water, whereas the heating and cooling of the land surface determine the stability class for land areas. This can result in large differences between the two atmospheric layers at the shoreline interface. Modeling the turbulent dispersion along coastal areas is beyond the algorithms currently available in AERMOD. It is recommended that projects near the shoreline with stacks exceeding 10 meters use SCREEN3 or AERSCREEN to evaluate shoreline fumigation and inversion breakup.

This page intentionally left blank.



4 SOURCE TYPES USED IN MODELING

If using screening or refined models, the project sponsor must select an appropriate source type that best characterizes how source emissions are released from the project and/or surrounding facilities. After the source release type is selected, the project sponsor must gather the required source parameters that define the physical features of the source or plume. Most of the common source types are available in both screening and refined models. Further descriptions of each of the source types are provided in the following sections.

4.1 POINT SOURCES

A point source is a single, identifiable source of air emissions, such as releases from stacks and isolated vents. Typically, vents from gas dispensers at gasoline stations, diesel prime and backup generators, boilers, coffee roasters, crematoriums, paint strippers, tanks, and soil extraction units are modeled as point sources. The outlet can be located on the roof or side of the building while the device itself is located at the ground level or in the garage, which is the case for most diesel backup generators. Input requirements for point sources in screening mode are presented in Table 6.

Table 6 Modeling Parameters for Point Sources

Parameter	Units	Description
Emission Rate	gram/sec	Emission rate of the pollutant from the stack
Stack Height	meters	Stack height above the ground
Stack Inside Diameter	meters	Inner diameter of the stack emitting the pollutant
Stack Gas Exit Velocity	meters/sec	If exit velocity is not provided by the operator, the exit velocity (V_s) can be determined using the stack gas exit flow rate (V ; m ³ /sec) and stack diameter (d_s ; m) as follows: $V_s = \frac{4 \cdot V}{\pi \cdot d_s^2}$
Stack Gas Temperature	°K	Temperature of the released gas
Ambient Air Temperature	°K	Average atmospheric temperature in the vicinity of the source. If no ambient temperature data are available, assume a default of 293°K. For nonbuoyant releases, the stack temperature may be the same as the ambient temperature.

Notes: °K = degrees Kelvin

If a fixed rain cap (e.g., open- sided conical structure) is on top of the stack such that the vertical release is diverted horizontally, the stack parameters will need to be modified to account for changes in the plume's buoyancy and momentum. No adjustment to the release parameters is required if a hinged rain flap (or cap) is installed as it does not impede the vertical flow of the exhaust plume. Project sponsors should refer to Attachment 1 of CAPCOA's *Health Risk Assessments for Proposed Land Use Projects* (CAPCOA 2009) for additional guidance.

4.2 AREA SOURCES

An area source is a two-dimensional source of diffused air pollutant emissions emitted at a uniform height, such as a landfill, storage pile, slag dump, lagoon or ponds, or liquid spills. AERSCREEN and SCREEN3 define the rectangular area source to align with the north-south axes where the angle of the source relative to north is automatically set to 0 degrees. The long dimension of the area source is in the x-direction, whereas the short dimension is along the y-direction. AERMOD and other refined models have the ability to define area sources as nonrectangular polygons that can be rotated relative to the north-south axis. The Air District typically models emissions from landfills as an area source. Table 7 presents a list of parameters required to model area sources.

Area sources are assumed to be rectangular or square with a maximum length/width aspect ratio of 10:1. For irregularly shaped emission sources, project sponsor can select the AREAPOLY for polygon areas or AREACIRC for circular-shaped area sources. Please refer to the AERMOD User's Guide for more information.

Table 7 Modeling Parameters for Area Sources

Parameter	Units	Description
Emission Rate	gram/sec-m ²	Emission rate of the pollutant per unit area
Source Release Height	meters	Source height above ground
Longer Side Length of Rectangular Area	meters	Longer side of the rectangular source
Shorter Side Length of Rectangular Area	meters	Shorter side of the rectangular source
Angle	degrees	Orientation angle for the rectangular area from north, measured positive in the clockwise direction. If the angle is greater than 0, the source will be rotated clockwise around the southwest corner.
Initial Vertical Dimension of Plume (<i>Szinit</i> ; AERSCREEN Only)	meters	▶ For surface-based emissions, divide the vertical dimension of the source by 2.15. ▶ For an elevated source on or adjacent to a building, divide the building height by 2.15. ▶ For an elevated source not on or adjacent to a building, divide the vertical dimension of the source by 4.3.
Receptor Height Above Ground	meters	This may be used to model impacts on “flagpole” receptors where the receptor is located above ground level (e.g., to represent the roof or second story of a building). The default value is assumed to be 1.5 meters (i.e., breathing zone), but the project sponsor may enter 0.0 meter to represent ground level, the breathing zone of an adult.
Wind Direction Search Option (SCREEN3 Only)		Because the concentration at a particular distance downwind from a rectangular area is dependent on the orientation of the area relative to the wind direction, the SCREEN3 model provides the project sponsor with two options for treating wind direction. The regulatory default option is “yes,” which results in a search of a range of wind directions is recommended (see Section 3.8).

4.3 VOLUME SOURCES

A volume source is a three-dimensional source of diffuse air pollutant emissions that is used to model releases unrestricted by any physical means from a variety of industrial sources, such as building roof monitors, fugitive leaks, multiple vents, conveyor belts, rail lines, and roads. Another example would be the emissions from an automobile paint shop with multiple roof vents or multiple open windows. EPA recommends modeling entrained road dust from haul trucks as adjacent volume sources unless receptors are located within the exclusion zone (EPA 2012). Typically, the Air District uses the volume source option to model emissions from gas dispensers at gasoline stations and vehicle emissions from roadways and rail lines. Table 8 presents the parameters required to model volume sources in AERMOD.

Table 8 Modeling Parameters for Volume Sources

Parameter	Units	Description
Emission Rate	gram/sec	Emission rate of the pollutant
Plume Height	meters	Initial vertical dimension of the sources: ▶ If source is in motion, Plume Height = Source Height • 1.7 ▶ If source is stationary, Plume Height = Stationary Height
Source Release Height	meters	Release Height = 0.5 • Plume Height
Side length	meters	Length of the side of the volume side. An additional 6 meters should be added to the width to account for wake effects if roadways or rail lines are being modeled.
Initial Lateral Dimension (<i>Syinit</i>)	meters	▶ For a single volume source, divide the side length by 4.3. ▶ For line sources represented by adjacent volume sources, divide the side length by 2.15. ▶ For line sources represented by separated volume sources, divide the center-to-center distance between sources by 2.15.
Initial Vertical Dimension (<i>Szinit</i>)	meters	▶ For a surface-based source, divide the vertical dimension (Plume Height) of the source by 2.15. ▶ For an elevated source on or adjacent to a building, divide the building height by 2.15. ▶ For an elevated source not on or adjacent to a building, divide the vertical dimension (Plume Height) of the source by 4.3.
Receptor Height Above Ground	meters	This may be used to model impacts on “flagpole” receptors where the receptor is located above ground level (e.g., to represent the roof or second story of a building). The default value is assumed to be 1.5 meters (i.e., breathing zone), but the project sponsor may enter 0.0 meter to represent ground level, the breathing zone of an adult.

For sources in motion, such as rail and vehicles, the plume height is adjusted to account for the effects of vehicle-induced turbulences. For all adjacent volume sources, the initial vertical dispersion coefficient is estimated as follows (AERMOD User’s Guide for surface-based sources):

$$Szinit = \frac{H \cdot \gamma}{2.15}$$

where the initial vertical dimension of the source is equal to the average source height (H) multiplied by the motion-induced turbulence effects (γ), which equals 1 when the sources are not moving or 1.7 when vehicles are in motion (EPA 2015a). In addition, EPA recommends that an additional 6 meters be added to the width to account for wake effects. Unlike other sources, AERMOD does not calculate results for receptors located within the exclusion zone surrounding volume sources. The radius of the exclusion zone from the centroid of the volume is estimated as:

$$r_{EZ} = (2.15 \cdot Syinit) + 1.0_m$$

If receptors are to be placed as close as 5 meters from the roadway, the maximum width of the roadway to be modeled in AERMOD should be 8 meters because the exclusion zone would be 9 meters. (The distance from the centroid of the volume source to the end of the roadway is 4 meters, and the distance from the roadway to

the receptor is 5 meters.) A series of volume sources can be used to represent each traffic lane to ensure that the full extent of the roadway is modeled and to avoid placement of receptors within the exclusion zone.

4.4 LINE SOURCES

The line (also called line area) source is used to model releases from a variety of sources that are in motion, such as horizontal conveyor belts, rail lines, and roadways. AERMOD uses the same algorithms for line sources that are used for area sources and will produce identical results for equivalent source parameters inputs. Roadways and rail lines are routinely modeled as either line or volume sources, and each approach has its advantages and disadvantages. If a line source is used, the advantages include placement of receptors within the exclusion zone; the use of fewer user-defined inputs; and uniform emission density across the roadway, which may be more realistic under certain conditions. Alternatively, a volume source contains a meander algorithm and mimics an initial, well-mixed plume but cannot calculate concentrations for receptors within the exclusion zone. The Air District encourages the project sponsor to select an appropriate source type that will achieve the most conservative results for their project analysis. The only exception is when modeling entrains road dust from haul trucks, in which case EPA recommends that adjacent volume sources be used. Line source parameter inputs are listed in Table 9.

Table 9 Modeling Parameters for Line Sources

Parameter	Units	Description
Emission Rate	gram/sec-m ²	Emission rate of the pollutant per unit area
Starting Coordinates	meters	UTM Easting and Northing locations for the start of the line source
Ending Coordinates	meters	UTM Easting and Northing locations for the end of the line source
Plume Height	meters	Initial vertical dimension of the sources: ► If source is in motion, Plume Height = Source Height • 1.7 ► If source is stationary, Plume Height = Source Height
Source Release Height	meters	Release Height = 0.5 • Plume Height
Width	meters	Width of the source (minimum is 1 meter). An additional 6 meters should be added to the width to account for wake effects if roadways or rail lines are being modeled.
Initial Vertical Dimension (<i>Szinit</i>)	meters	► For a surface-based source, divide the vertical dimension (Plume Height) of the source by 2.15. ► For an elevated source on or adjacent to a building, divide the building height by 2.15. ► For an elevated source not on or adjacent to a building, divide the vertical dimension (Plume Height) of the source by 4.3.
Receptor Height Above Ground	meters	This may be used to model impacts on “flagpole” receptors where the receptor is located above ground level (e.g., to represent the roof or second story of a building). The default value is assumed to be 1.5 meters (i.e., breathing zone), but the project sponsor may enter 0.0 meter to represent ground level, the breathing zone of an adult.

Notes: g/sec-m² = grams per second per meter squared.

When Should a Source Be Modeled as a Line Rather Than a Volume?

Sources that travel along designated routes (paths), such as paved roadways, rail lines, and shipping lanes, typically are modeled as a line or volume source. The selection of the appropriate source type when modeling is important because the predicted concentrations can vary by as much as 60 percent. When selecting the appropriate source type, the choice depends how the source plume will disperse after it enters the environment. For example, sources that have limited vertical dispersion but expand laterally can be modeled as a line source. Sources that release plumes that expand vertically and laterally are better represented as volume sources.

For project sponsors less familiar with modeling, the Air District has the following recommendations:

- ▶ If the receptor is located downwind of the heavily traveled roadway or railroad tracks, the road/rail line can be modeled as a line source.
- ▶ If the receptor is located upwind of the heavily traveled roadway or railroad tracks, then the recommendation is to model the road/rail line as a volume source.
- ▶ If the receptor is located within the exclusion zone (see Section 4.3) and emissions from the mobile source have limited dispersion, then mobile sources can be modeled as a line source.
- ▶ Mobile sources operating at construction sites and quarries should be modeled as volume sources.
- ▶ Ships and other ocean-going vessels should be modeled as volume sources.



5 STATIONARY SOURCE ANALYSIS

Stationary sources are defined as sources that remain in a single location while they are operating; however, some sources, such as portable engines, are considered stationary sources even though they are moved, as needed, from one location to another. These sources are generally permitted by the Air District; thus, the recommendation to analyze the impacts from these sources follows guidance in the Air District's *Permit Handbook*.

5.1 SOURCE EMISSIONS

The Air District recommends that the project sponsor quantify emissions of PM_{2.5} and toxics from the following project-related sources:

- ▶ new sources that will require permits;
- ▶ permitted sources that are subject to change because of the project;
- ▶ sources exempt from permitting requirement that are part of the project;
- ▶ rail service operating on the project site (see Sections 7 and 9.3);
- ▶ ships, barges, tugs, and other vessels that will be used during operations;
- ▶ off-road equipment (e.g., forklifts, cranes, loaders, generator sets) used for operations at the project site (see Appendix D of the Guidelines);
- ▶ on-road mobile source emissions from residents, workers, customers, and vendors visiting or operating at the project site (see Sections 6 and 9.2);
- ▶ fugitive emissions from sources such as permitted sources, stockpiles, and road dust; and

- ▶ significant area sources, if applicable (e.g., landscaping equipment)

For stationary sources that will be permitted by the Air District, their emissions should be estimated following the methodology outlined in the Air District's *Permit Handbook*. This includes most standby and prime generators, pumps, boilers, gas stations, turbines, autobody shops, heaters, and so on. For new sources, the emissions will be based on the maximum potential to emit, estimated in the permit application to the Air District. An additional requirement outside of permitting is being recommended for diesel-powered standby and backup generators under CEQA. These generators are used by data centers, grocery stores, office buildings, retail stores, cell towers, fire stations, and others to supply emergency electrical power during utility outages. The generators are tested monthly and must be properly maintained based on strict limits set forth in their permit. Although the hours for emergency use are exempt from permitting, the Air District recommends combining the emissions (PM_{2.5} and diesel PM) from operations or emergency use (nontesting and nonmaintenance) with the allowable testing and maintenance hours for any generators evaluated in the air quality analysis under CEQA. This approach is consistent with EPA and Air District requirements when determining whether a generator triggers New Source Review or Title V permitting requirements.

Backup generators are also being used for electricity generation during Public Safety Power Shutoff events to reduce the risks of wildfires caused by electricity transmission and distribution networks (CARB n.d.). In this instance, a project sponsor can include an additional 100 hours per year for each generator for nontesting and nonmaintenance purposes. Alternatively, project sponsors can substantiate use of site-specific nontesting and nonmaintenance hours for standby generator operation. Project sponsors can also obtain information on standby generator use from the CPUC Emergency Load Reduction Program and CPUC information on temporary emergency generation use.

Any incremental emissions above the baseline levels will be disclosed and included in the project-level analysis. A project that requires the installation and operation of new sources must be evaluated at its maximum potential to emit, which is consistent with the Air District's permitting requirements. Thus, the entire project emissions include:

- ▶ newly permitted equipment at the potential to emit level,
- ▶ new or modified permit-exempt sources,
- ▶ new nonpermitted sources, and
- ▶ existing sources that would be modified under the project.

Emissions from existing sources and equipment operating at the facility but not related to the project will be included in the cumulative assessment (see Section 11).

5.2 RELEASE PARAMETERS

Stationary facilities that produce air pollution—including complex sources, such as metal smelting, wastewater treatment plants, and refineries, as well as smaller facilities, such as diesel generators, gasoline-dispensing facilities (gas stations), and boilers—are regulated and subject to permit conditions established by the Air District. Where the sources are known, the project sponsor will present detailed source-specific information on their emissions and physical release parameters as part of the project analysis. Projects involving development of retail or commercial space may not have foreknowledge of the future occupants and their sources, making it difficult to quantify the potential risks and hazards. Project sponsoring following the tiered methodology may find it difficult to obtain the required detailed facility information necessary to improve the accuracy of the screening results.

To assist project sponsors, the Air District is developing a centralized electronic database to store source-specific information and release parameters used in HRAs under Regulations 2-5 and 11-18. Unfortunately, the database will be available for only a limited number of facilities, such as: (1) facilities located within the modeling domain of a completed Community Scale Technical Assessment¹⁵ under AB 617, (2) facilities requesting a permit modification that triggered an HRA under Regulation 2-5, and (3) facilities completing an HRA under Regulation 11-18. In many cases, even for facilities where release information is available, the data may be incomplete or obsolete.

Until the database is available, some modeling parameters can be found through a detailed review of the Air District's permit files for each facility. Another source of historic release parameters is the California Emission Inventory Development and Reporting System (CEIDARS) data submitted to CARB annually, but given the age of the information and lack of quality assurance, the Air District is not recommending its use unless the values are confirmed in the permit files. There remain other permitted sources for which detailed information is not available because:

- ▶ sources are exempt,
- ▶ the Air District does not have jurisdiction to regulate these sources,
- ▶ source emissions are below the trigger levels specified in Regulation 2-5,
- ▶ source emissions are below the standards set forth in the regulation,
- ▶ sources were permitted before the adoption of Regulation 2-5,
- ▶ sources do not emit toxic air pollutants recognized by OEHHA,
- ▶ sources are registered,
- ▶ abatement devices have been installed that may affect emission release parameters, or
- ▶ emissions are generated from a complex emission train involving multiple fugitive and controlled processes that are grouped into a single source category for permitting purposes.

¹⁵ The District completed a Community Action Plan for West Oakland in 2019 and will complete a similar analysis for Richmond-North Richmond-San Pablo in 2023.

To assist project sponsors with collecting the necessary information for the modeling analysis, the Air District worked with a consultant to develop general default parameters for the most common source categories. The process involved reviewing numerous permit files and extracting release parameters from the highest-emitting sources in each source category. A mean value for each parameter was selected from the collective source information contained in the permit files as representative default value. The default values are not meant to be conservative but representative of typical, recent conditions because many of the historic sources lacked release information because they were permitted before the adoption of Regulation 2-5.

Gas-Dispensing Facilities. Gas-dispensing facilities (GDFs), both retail and nonretail, are permitted by the Air District following an HRA demonstrating compliance with Regulation 2-5 thresholds. Emissions are estimated through multiple sources and release points to account for losses from loading, breathing, refueling, hose permeation, and spillage. CARB recently released the *Gasoline Service Station Industrywide Risk Assessment Technical Guidance* (CARB 2021a), which includes default release parameters used to develop their screening tool. Project sponsors can use the default parameters to conduct a refined modeling analysis or use the gas station risk assessment look-up tool, available at <https://ww2.arb.ca.gov/resources/documents/gasoline-service-station-industrywide-risk-assessment-guidance>. If they use the look-up tool, project sponsors may contact the Air District's Engineering Section to obtain information necessary to use the tool, including the facility's annual throughput limit. Output from the tool includes estimated maximum cancer risks to residents and workers and chronic and acute hazard indices.

All Other Stationary Sources. The most common stationary sources permitted by the Air District are generators (prime and standby) followed by various other sources such as GDFs, paint booths, autobody shops, solvent cleaners, and printers. Some release parameters may be available in the permit file, particularly for generators and soil vapor extraction operations, which emit pollutants exceeding the trigger levels specified in Regulation 2-5. However, for any facility permitted before adoption of Regulation 2-5, release parameters will not be available.

To fill this data gap, the Air District conducted various surveys to gather release parameters for the highest emitting generators. Significant effort was put forth to obtain release parameters from generators commonly used in office buildings, grocery stores, box stores, and data centers to supply emergency power when utilities are down. Many older pre-tier and Tier 0 engines are still in operation because of their low use and high replacement costs. Default parameters were developed for these generators based on responses from surveys in addition to review of available permit files. As noted, these values are not meant to be conservative or typical as generator emission exhaust comes from numerous locations (e.g., vertically from the roof of skyscrapers to the garage). There is no single set of parameters that can be used to represent the possible range of emission points from all generators. The project sponsor is cautioned to use these defaults only when available permit files yield no additional information.

General default release parameters are available for sources that release pollutants through a stack or point, such as boilers, coffee roasters, crematoriums, paint strippers, tanks, and soil vapor extraction units. Most of these sources are subject to Regulation 2-5; thus, a thorough review of the permit files is recommended before default parameters are applied. When the release mechanism for a source is unknown or multiple release types are present, a volume source can be used to characterize the emissions.

Default parameters (used only when no other sources of information are available) are presented in Table 10 and can be applied in the screening or refined modeling analysis.

The default parameters should be used for common sources only if no other data source is available. Project sponsors should use Table 11 only in cases when the future occupants at the project site are unknown or project sponsors are refining the health impacts from surrounding facilities in the cumulative analysis after exceeding the screening level cumulative thresholds and a comprehensive review of the Air District's permit files was conducted. For large, complex sources, such as refineries, chemical plants, landfills, wastewater treatment plants, and foundries, the project sponsor should initially review the permit files because some modeling data will be available from past HRAs conducted under Regulation 2-5 and full site inventories and assessments conducted under Regulations 12-15 and 11-18.

Table 10 Default Modeling Parameters for Common Stationary Sources¹

Source Description	Source Type	Default Parameter	Default Value
Prime or standby generator	Point	Stack height Stack diameter Exit temperature Exit velocity	3.66 m (12 ft) 0.183 m (0.6 ft) 467°C (872°F) 45.3 m/sec (8,923 ft/min)
Sources with incomplete modeling information	Point	Stack height Stack diameter Exit temperature Exit velocity	6.1 m (20 ft) 0.305 m (1 ft) 371°C (700°F) 17.8 m/sec (3,500 ft/min)
No information available	Volume	Release height Initial lateral dimension Initial vertical dimension	1.8 m 10 m 1 m

Notes: °C = degrees Celsius; ft = feet; ft/min = feet per minute; m = meter.

¹ These values should be applied only when no other modeling information is available. The source type indicates the type of sources in AERMOD that should be used for dispersion modeling.

5.3 MODELING CONSTRUCTION IMPACTS

The Air District recommends using CalEEMod (caleemod.com and see Appendix D) to estimate project-generated exhaust and fugitive emissions from construction activities. After emissions are estimated using CalEEMod (combined with any off-model calculations), the project sponsor can then start the air dispersion modeling analysis to assess the potential risk and hazards associated with construction-related activities for the individual project. The Air District recommends the following comparisons:

- ▶ Ensure that the daily mass emissions derived from CalEEMod for particulate matter with a diameter less than or equal to 10 microns (PM₁₀) and PM_{2.5} are aggregated with the daily emissions from other construction-related activities.
- ▶ Compare the annual average PM_{2.5} concentrations for every year of construction to the thresholds of significance. PM_{2.5} is emitted directly from equipment/vehicle exhaust or as fugitive emissions from soil disturbance, demolition, brake and tire wear, and resuspended road dust. PM_{2.5} emissions from each of these activities are quantified by CalEEMod. Project sponsors can use either a screening model or a refined model to predict the annual average downwind concentrations of PM_{2.5} based on source emissions from CalEEMod. If a screening model is used, the annual average

concentration is estimated by multiplying the maximum 1-hour concentration by 0.1. Both off-site workers and residents should be considered potential receptors (see Section 2.1).

- Compare the cancer risks and hazards from toxic compounds from construction activities to the thresholds of significance. Sources of toxic emissions at construction sites include off-road and on-road equipment/trucks powered by diesel fuel, generators powered by diesel, natural gas, or propane, and gasoline-powered vehicles. Fugitive emissions from resuspended road dust may also contain toxic emissions if the soil surrounding the site contains known toxic contamination or during demolition of structures containing asbestos. PM₁₀ emissions from diesel fuel-powered vehicles and equipment may be used as a surrogate for diesel PM. Either a screening model or a refined model can be used to estimate the downwind exposure concentrations at each receptor. The final risk and hazard modeled should represent the cumulative exposures anticipated from all construction-related activities.¹⁶

When construction impacts are modeled using either a refined model or a screening model, area or volume sources are commonly used to represent specific construction activities and equipment. Area sources are used to characterize construction activities, such as demolition, site preparation, grading, paving, and building construction. The area sources will match the dimensions and locations of the construction activities being modeled. Volume sources are used to represent the on-site property movement of off-road equipment and vehicles and off-site trips of haulers, vendors, and workers. Use of adjacent volume sources, equally distanced, to characterize vehicle movements is consistent with EPA’s Haul Road Workgroup Final Report (EPA 2012) and gives project sponsors flexibility to customize the modeling by adjusting the height of the vehicles and the width of the roadway. It should be noted that extensive computation time is required when modeling roadways and on-site activities as adjacent volume sources, and project sponsors should plan accordingly. The Air District recommends using project-specific vehicle heights, if available, in the modeling. A separate modeling analysis will need to be run for each vehicle class (e.g., haul truck, worker truck) on the project because of differences in their release parameters. Table 11 presents the recommended source parameters when roadways are modeled as volume sources if site-specific information is not available.

Table 11 Recommended Volume Source Configuration for Construction Projects

Modeling Parameters	Recommended Value If Site-Specific Data Are Not Available
Vehicle Height	4.0 meters for trucks 1.53 meters for nontrucks
Plume Height	6.8 meters for trucks 2.6 meters for nontrucks
Source Release Height	3.4 meters for trucks 1.3 meters for nontrucks
Width of Plume	Width of different lanes of traffic + 6 meters for wake effects. Recommended maximum 8-meter width for adjacent volume sources with additional volumes added, as necessary, to cover the width of the road and wake.
Initial Lateral Dimension (<i>Syinit</i>)	Width of plume/2.15

¹⁶ The Air District’s Air Toxics Control Programs Health Risk Assessment Guidelines requires the average daily dose for short-term exposure lasts a minimum of 3 years for projects lasting 3 years or less. The Air District does not recommend a minimum exposure time for construction analyses

Modeling Parameters	Recommended Value If Site-Specific Data Are Not Available
Initial Vertical Dimension (<i>Sz_{init}</i>)	3.16 meters for trucks 1.21 meters for nontrucks
Emissions	Grams/sec

The emission rates used in the model are derived by converting the annual emission rates from CalEEMod to units of grams per second based on the number of hours and days during which construction activity would occur. The rate is then further divided by the number of volume sources representing each roadway link and entered as the emissions for each volume source comprising the roadway link. If using the refined model, AERMOD, the project sponsor should ensure that receptors are not placed within the volume source exclusion zone (see Section 4.3). This issue can be avoided by representing the different travel lanes using a series of adjacent volume sources.

Fugitive sources should be modeled as area sources or volume sources, depending on the emission source. Vehicle-related fugitive emissions from brake and tire wear and resuspended dust should be modeled as adjacent volume sources following the methodology discussed above. The PM_{2.5} emissions from these vehicle-related fugitive sources can be combined with the PM_{2.5} exhaust emissions so no additional modeling analysis is required. However, fugitive emissions from brake and tire wear and resuspended dust are excluded from the toxic evaluation to assess cancer risk because these emissions are not associated with combustion of diesel fuel. Area sources can be used to model most other types of general construction activities. The modeled area should match the approximate location of the expected construction activities on-site. Care should be taken to include only areas of expected activities and exclude areas with limited to no construction activities because this will underpredict exposures to the community.

The modeling should account for all receptor locations within 1,000 feet, extended as appropriate, surrounding the construction site boundary using a receptor grid spacing of 20 meters. Fenceline receptors should be included in the analysis if sensitive receptors are located along or close to the property boundary. The flagpole height for all receptors of 1.5 meters should be used to be consistent with Air District's permitting procedures under Regulation 2-5. The Air District recommends conducting a student analysis for any school located within 1,000 feet of the construction project.

In most cases, the construction and operational emissions and values will be compared separately to the applicable thresholds unless construction and operational activities overlap, such as when construction occurs in phases, and residents begin living in one phase of the development while the next construction phase begins. In this example, the overlapping emissions from construction and operations would be summed and compared against the applicable thresholds.

This page intentionally left blank.



6 ROADWAY ANALYSIS

The Air District's screening map identifies risks, hazards, and annual $PM_{2.5}$ concentrations for all paved roadways in the nine counties of the Bay Area as described in Section 9.2, along with the assumptions and default datasets used to prepare the map. These assumptions and defaults ensure complete coverage of all roadways and efficiency in estimating emissions and conducting air quality dispersion modeling. However, because defaults may not be representative of local conditions, project sponsors can further improve the accuracy of the modeling results by incorporating local conditions in the air quality analysis. Project sponsors can follow the methodology presented in Section 9.2 to conduct a project-specific roadway analysis or refine the default assumptions to improve the accuracy of the health impacts identified in the cumulative analysis. Project sponsors can use the assumptions from the screening map to support Tier 1 analysis (see Section 9.2). This section provides a methodology for performing a more detailed Tier 2 assessment for roadway impacts using local activity data other than the defaults used in the screening map to improve the emissions estimate and modeling configuration.

6.1 EMISSION ESTIMATES

Depending on the availability of local data, the Air District recommends that project sponsors follow the methodology outlined in Section 9.2 to estimate link-level $PM_{2.5}$ and TAC emissions from all processes while substituting underlying default datasets with site-specific information, including the following detail.

Vintage. The screening map was developed with a base year of 2022. All the activity and emissions data were collected and prepared to represent the 2022 level and then hold consistent for the 30-year span for risk analysis. Project sponsors may consider a base year more representative of the project year. They can also consider developing 30-year baseline emissions that incorporate per mile emission changes per year resulting from adoption of federal, state, and local regulations and fluctuating activity (volume) levels.

Traffic Activity (Volume, Speed, Fleet Mix). The screening map was developed using telematics-based volume and speed data purchased from Bentley Systems (Bentley; Teralytics acquired the mobility data from Bentley Systems in 2022), as well as a fleet mix derived from Caltrans's Performance Measurement Systems (PeMS)¹⁷ data and the EMFAC2021 model. The Air District performed validation on traffic volume and speed only for limited highway links when the measured traffic data from PeMS were available. Project sponsors can apply site-specific traffic activity, including measured or modeled traffic data (by vehicle class, if possible) from the local transportation authority, such as city/county engineering, congestion management, or transportation department, and special study data with field measurements to further improve the air quality analysis.

Emission Factors. The emission factors will change as a result of changes to technology, regulations, and methodology that have occurred since the development of the screening map. The roadway screening values incorporate EMFAC2021 emission factors that include the latest county vehicle registration data, regulations implemented since EMFAC2017, and results from a new research study for brake wear PM emissions. Because the EMFAC model is periodically updated, project sponsors should ensure that they are using the most up-to-date emissions factors released by CARB. They may also use lower emission factors for projects surrounding ports by selecting the Port Truck (POAK) vehicle class in EMFAC as a surrogate of freight trucks.

For road dust emissions, if the roadway conditions within the project radius are different from the county default, the project sponsor is encouraged to develop the site-specific emission factors following equations in Section 9.2. For example, if the roadways have new pavements and a more frequent schedule of street sweeping, project sponsors could conduct road surface sampling to derive their own silt loading data. They may use a different fleet average weight if only certain types of vehicles travel on the roadways (e.g., light-duty commuter vehicles).

6.2 MODELING CONFIGURATION

The air quality dispersion modeling conducted during the development of screening maps requires complex analysis that evaluates the impacts from thousands of roadway links. Most of the recommended model configurations are applicable only to AERMOD because the screening models do not have these options available. Project sponsors could perform a more focused AERMOD analysis using local inputs as described below.

Volume or Line Source. The Air District configured the roadway screening map using a series of line sources. However, the same analysis can be performed using adjacent volume sources that extend across each roadway. (Further discussion is presented at the end of Section 4.4.) Volume sources can be placed following the geometry of roadway centerlines. Project sponsors can reconfigure the volume source locations using third-party software (e.g., AERMOD View) that uses a graphic user interface combined with aerial maps to more accurately follow the roadway geometry. This way, project sponsors can control the size and interval of volume sources and ensure their representativeness to the roadways being modeled.

¹⁷ Available at <https://dot.ca.gov/programs/traffic-operations/mpr/pems-source>.

Project sponsors also should ensure that if either volume or line sources are used to represent roadways in the air dispersion modeling, the results are conservative and protective of local residents' health.

Diurnal Profile. The diurnal profiles used in the screening map were derived from hourly traffic volumes obtained from Bentley and PeMS data. Although minor, the impacts from vehicle speeds on hourly emissions of certain processes are not reflected in the model. Project sponsors can develop diurnal profiles based on actual hourly emissions, especially for projects that would significantly improve congestion on local streets.

Temporal Variation. The roadway screening map was based on an aggregated temporal level where daily activity was based on average activity over the year. With fewer links within the radius of influence, project sponsors could conduct a more refined scale modeling. For example, if traffic activity of the roadways has different seasonal or weekday/weekend patterns, the modeling could be performed by season and/or weekday/weekends and then aggregated to predict annual pollutant concentrations in the risk analysis.

These refinements are meant to improve the representativeness of the project analysis and increase the accuracy of results. The impact on the analysis results (e.g., reduce or increase the risk) will be case by case and subject to the characteristics of the project itself.

This page intentionally left blank.



7 PASSENGER RAIL ANALYSIS

The Air District provides a screening map for most Class I rail lines based on annual fuel consumption rates and commuter/passenger rail lines using diesel locomotives. Descriptions of the assumptions and timetables used to develop the screening tool are provided in Section 9.3. Because train frequencies and arrival/departure schedules are adjusted annually to accommodate commuter demands, the prepared screening values may no longer be representative of expected risks along each rail line. This section provides a methodology for performing a more detailed Tier 2 assessment, if warranted for passenger and commuter lines, to assess cumulative impacts because most project-level analysis does not address commuter/passenger rail service. The Air District is not providing guidance for conducting a more detailed Tier 2 assessment of Class I rail lines, found in some project-level analysis, because it requires detailed activity data and equipment inventory information that are not publicly available.

To estimate health impacts related to Amtrak passenger rail or commuter service, project sponsors can rely on the posted train schedule to estimate activity level emissions following the methodology outlined in Section 9.3. The approach calls for estimating diesel PM emissions from locomotive exhaust and idling by rail link as a function of the number of locomotives per day that run along each link, average speed, and frequency of stops. The timetables provide the number of train stops at each station, as well as the times and frequency of the train stops.

Use the following approach to estimate the emissions along each rail link:

1. Estimate the number of locomotives per day at each stop within a minimal 500-meter radius of the project site. Project sponsors should be prepared to expand this radius, as needed, to ensure that all significant rail emissions near the project site are included. Use the posted timetable and

schedule to estimate the daily number of trains that travel on the line per weekday versus weekend. The level of service is assumed to remain constant in this analysis.

2. Estimate a weighted average daily number of trains that travel along the line by multiplying the number of weekday trains by 5/7 added to the number of weekend trains multiplied by 2/7. The level of service and number of trains are assumed to remain constant.

$$\text{Daily Trains} = \text{Weekday Trains per day} \cdot \frac{5}{7} + \text{Weekend Trains per day} \cdot \frac{2}{7}$$

3. Determine the locomotive idling times at stations within the 500-meter (or more) radius of the project site. Typically, idling times vary from 2 to 10 minutes to accommodate timed connections to other public transportation. If the project is located near the end or beginning of the rail lines, include the time required to power on (power down) the engines; a minimum of 20 minutes can be used if the time is unknown.
4. Calculate the diesel PM emissions from locomotives based on idling at stations or turnarounds and running exhaust between stations. Use the following equation to estimate the daily running exhaust emissions of diesel PM along the rail lines:

$$E_{\text{Running}} = \frac{1}{S} (EF_{\text{Running}} \cdot N \cdot L)$$

where:

E_{Running}	=	emissions of diesel PM per rail link per day (g)
S	=	average speed (mph)
EF_{Running}	=	emission factor by rail link (g/h)
N	=	number of locomotives that travel on the rail link per day (unitless; from Step 2)
L	=	length of rail link (mi)

Available speeds and emissions factors are presented in Tables 25, 27, and 28, but the project sponsor should ensure that the latest regulatory approved emission factors are used. The average speed can be estimated by dividing the distance between stations by the elapsed time based on the scheduled departure and arrival times. For stations located along the rail link, the running emissions are assumed to occur uniformly across the link except within a 500-foot radius of the station where idling emissions will dominate. Idling emissions are estimated by multiplying the emission factor by the number of stops on each link and the length of time spent at each stop:

$$E_{\text{Idling}} = EF_{\text{Idling}} \cdot N \cdot T$$

where:

E_{Idling}	=	emissions of diesel PM per rail link per day (g)
EF_{Idling}	=	emission factor for diesel PM by rail link (g/h)
N	=	number of locomotives that travel on the rail link per day (unitless; from Step 2)
T	=	idling time for each stop or turnaround on rail link per day (h)

The emission factors presented in Tables 25, 27, and 28 are based on a fleet mix of GP4x and Dash 9 locomotives achieving Tier 1 emission standards. As the locomotive fleet turns over, the project sponsor should ensure that fleet mix and corresponding emission factors are representative of locomotives used on the rail lines. The emissions are then the sum of emissions associated with exhaust from the locomotive and idling emissions emitted while passengers are boarding or disembarking locomotives at stations.

After emissions are estimated, the emissions can then be used in the screening or refined models to estimate the exposure concentrations in the cumulative analysis. The rail lines can be modeled as adjacent volume sources or line sources. If site-specific release data are not available, Table 12 presents acceptable defaults that can be used.

The project sponsor can use a unit emission rate or the estimated emissions in the dispersion model. However, care should be taken to ensure that the individual source (volume) emissions used in the model are equal to the total emissions when summed for the entire rail link. This is addressed by dividing the total emissions for the link by the number of volume sources used to model the link. For line sources, the emissions are estimated per line source and are dependent on the area of emissions. Even though activity levels on each rail route vary per hour, diurnal changes are not taken into account using this methodology because emissions are assumed to remain constant all day. Use a receptor grid spacing of 20 meters out to a distance of at least 325 meters to ensure that all receptors of interest and the project area are positioned within the grid.

Table 12 Default Release Parameters for Passenger Rail Lines

Parameter	Values
Source Release Height	4.06 - 5.9 meters ¹
Source Width	11 meters
Initial Lateral Dimension	5.12 meters (applicable only for volume source)
Initial Vertical Dimension	3.78 meters
Receptor Height Above Ground	1.5 meters

Notes:

¹Represents range of acceptable release heights used in assessments to evaluate emissions from railyards located in Richmond and Oakland, California.

This page intentionally left blank.



8 COMMUTER FERRY ANALYSIS

Marine sources are defined as vessels used in moving people and commodities across water bodies. As with the commuter rail lines, the methodology presented in this section pertains to estimating cumulative impacts, except when a project specifically involves marine vessels. Marine vessels are classified into three distinct categories: ocean-going vessels, commercial harbor craft (e.g., ferries, excursion vessels, fishing boats, tugboats, barges), and recreational/pleasure craft. This section focuses on passenger ferries, although other harbor craft can be assessed using the methods discussed below. The main engines are propulsion engines used for transit while auxiliary engines, usually generators, provide on-board electrical power. Most ferries rely on diesel fuel to power both the main and auxiliary engines, producing diesel exhaust and fine particulate matter that can affect shoreline communities. Because these engines are larger and often less regulated, they tend to emit more air pollutants than most land-based engines.

Accurately modeling emissions from marine sources requires extensive engine-specific information and activity data, such as engine age, engine displacement/power ratings, load factors, and hours of operations, and routes. This section provides the project sponsor with a methodology for conducting a refined assessment of commuter ferries and excursion vessels as their activity data and fleet information are publicly available. Other types of commercial harbor craft, including fishing boats, tugboats, and barges, require boat-specific activity data available only through contact with individual owners.

8.1 EMISSIONS METHODOLOGY

There are numerous public and private ferry and excursion vessel operators that offer commuter transport and/or excursions in and about the San Francisco Bay Area. Commuter ferries travel on fixed routes at a set schedule, operating at the highest practical speed consistent with weather/sea conditions and fuel

efficiency. Currently, high-speed ferry service runs between nine cities and San Francisco; commute-hour between Oakland/Alameda and South San Francisco; and new service to Redwood City, Berkeley and Martinez is being considered (Table 13). Alameda hosts three ferry berths. San Francisco operates a terminal year around at the Ferry Building in addition to two seasonal terminals at Oracle Park and Chase Center during San Francisco Giants baseball games and Warrior basketball games.

Excursion vessels operate on more flexible routes and schedules and may include low speed or idling on the water as part of the excursion. Most excursion vessels are used for sightseeing historic landmarks, such as Alcatraz and Angel Island, and/or for outings/venues, such as whale watching or wine tasting in Bay Area waters. Most of these operators berth in San Francisco with the exception of Commodore Cruises, which operates from a private berth in Alameda. A list of the major operators and their home berths is provided in Table 14.

Table 13 Bay Area Ferry Route by Operator

Ferry Operator	Ferry Route Connecting Cities
San Francisco Bay Area Water Emergency Transportation Authority	Alameda/Oakland–San Francisco Harbor Bay (Alameda)–San Francisco* Richmond–San Francisco South San Francisco–Alameda/Oakland South San Francisco–Harbor Bay (Alameda) ¹ Vallejo/Mare Island–San Francisco
Golden Gate Ferry	Larkspur–San Francisco Tiburon–San Francisco Sausalito–San Francisco
Tideline	Berkeley–San Francisco*

¹ Service along these routes is temporary suspended due to the COVID-19 pandemic.

² Small private operators, such as Tideline, use smaller ferries and have fewer scheduled trips; thus, default parameters presented in this section cannot be applied to these vessels

Table 14 Major Excursion Vessel Operators and Berth

Excursion Vessel Operator ¹	Berth
Red and White Fleet	San Francisco
Blue and Gold Fleet	San Francisco
Commodore Cruise and Events	Alameda
Hornblower Cruises and Events	San Francisco

¹ Other small excursion fleets, including San Francisco Bay Adventures, Wine Tasting on the Bay, Golden Gate Bay Cruise, and San Francisco Bay Adventures, have fewer scheduled trips or trips are booked as needed. The default parameters presented in this section cannot be applied to these vessels.

Both the commuter ferries and the excursion vessels emit pollutants while transiting or navigating the Bay waters and while at berth, loading and unloading passengers. The Air District recommends following the emissions calculations presented in CARB's report Appendix H: 2021 Update to the Emission Inventory for Commercial Harbor Craft: Methodology and Results (CARB 2021b). Much of the information required to estimate the emissions can be obtained from CARB, San Francisco Bay Area Water Emergency Transportation Authority (WETA), and ferry and excursion vessel schedules.

PM₁₀ emissions can be estimated using the following equation (CARB 2021b):

$$E_{PM10} = EF_0 \cdot F \cdot [1 + D \cdot \frac{A}{UL}] \cdot HP \cdot LF \cdot T_o$$

where:

E_{PM10} = Emissions of PM₁₀ by vessel (g)

EF_0 = Zero-hour PM emission factor as a function of model year, horsepower, and engine use (propulsion or auxiliary) [g/(hp-hr)]

F = Fuel correction factor (to account for emission reductions from burning cleaner fuel) (unitless)

D = Engine deterioration factor (percentage increase of emissions when the engine is at the end of its useful life) as a function of horsepower (unitless)

A = Current age of engine (yrs)

UL = Engine useful life as a function of vessel type and engine use (unitless)

HP = Engine horsepower rating (hp)

LF = Engine load factor as a function of vessel type and engine use (unitless)

T_o = Operating hours for activity (hrs)

CARB's methodology requires using engine-specific emission factors by horsepower and model year in addition to a deterioration rate and a fuel correction factor. Because vessel-specific information is not always available, statewide and Bay Area average factors can be used from CARB and WETA. Statewide average factors from CARB (2021b) for emission factor, load factor, deterioration factor, number of engines per vessel, engine useful life, and fuel correction factor are shown in Table 15. Information on engine age and horsepower, which is not provided in CARB's 2021b report, can be obtained by contacting the vessel operators. This is especially recommended as operators begin complying with CARB's Commercial Harbor Craft regulations by integrating both zero emission vessels and vessels with EPA/CARB Tier 4 compliant engines with diesel particulate filters. If vessel-specific data are not available, default values shown in Table 16, which represent Bay Area-specific average factors collected in 2017 from CARB's statewide commercial harbor craft survey, can be used.

Table 15 Statewide Ferry and Excursion Vessel Operating Parameters

Vessel Type	Engine	N	EF [g/(hp-hr)]	F	D	LF	UL (years)
Ferry	Main	2.01	0.36	0.82	0.67	0.875	20
	Auxiliary	1.23	0.22	0.80	0.44	0.43	20
Excursion	Main	2.01	0.08	0.82	0.67	0.42	20
	Auxiliary	1.23	0.58	0.80	0.44	0.43	20

Notes: D = engine deterioration factor; EF = emission factor; F = fuel correction factor; g/hp-hr = grams per horsepower-hour; LF = load factor; N = average number of engines of each type per vessel based on CARB's inventory; UL = useful life.

Table 16 Bay Area 2017 Average Vessel Operating Parameters¹

Vessel Type	Engine	A (year)	HP
Ferry	Main	12	1,526
	Auxiliary	9	158
Excursion	Main	4	520
	Auxiliary	13	70

Notes: A = engine age; HP = horsepower.

¹ Personal communications with CARB staff in 2017. Staff provided the summary table based on the Statewide Commercial Harbor Craft Survey.

Operating hours are route specific and can be estimated by determining the number of vessel arrivals and departures at each terminal based on the posted schedule. Care should be taken to tally weekday and weekend hours separately, including vessel calls to seasonal venues, and then to aggregate the individual results to determine the total annual operating hours.

The project sponsor should follow a similar methodology for estimating emissions from berthing. Berthing emissions occur when the vessels are docked at a terminal temporarily to load and unload passengers. To estimate emissions from berthing, the project sponsor can estimate the number of trip visits at each terminal based on the posted schedule. If a posted schedule is not available, as is the case for excursion vessels, average annual operating hours may be available from the vessel operators or through CARB's database via a request to CARB. If this information is unavailable, the default operating hours for excursion vessels are 1,843 hours for the main, propulsion engine and 1,254 hours for the auxiliary engine.

Although berthing time may vary depending on the terminal and number of passengers, the Air District found that on average, commuter ferries berth for approximately 10 minutes at each terminal. Berthing time may vary by terminal, and project sponsors may consider collecting this information through an on-site field study. Ferry and excursion vessels operate both the main and auxiliary engines during transiting and idling. The emissions from the main and auxiliary engines should be estimated separately using the parameters provided in Tables 14 and 15 and then combined in the modeling and risk analysis. All previous defaults provided above and the emission equation can be used to estimate emissions associated with berthing.

Diesel PM emissions can be assumed to be equal to the PM₁₀ emissions while PM_{2.5} emissions are estimated by multiplying the diesel PM emissions by the size fraction factor of 0.97.

8.2 MODELING CONFIGURATION

Navigational routes from commuter ferries and excursion vessels are modeled as adjacent volume sources during transiting and area source while at berth. A network map showing ferry and excursion routes can be found through satellite imagery from Google Earth. Because of their similar size, release parameters can be applied to both commuter ferries and excursion vessels. The beam of the vessel, provided by WETA¹⁸, can be used as the width of vessels.

¹⁸ Available from the WETA San Francisco Bay Fleet information at <https://sanfranciscobayferry.com/sites/default/files/SFBFfleet.pdf>.

The stack height, used to estimate the release height in modeling, is determined by vessel design. Some vessels have stack height/exhaust pipes situated just above the water line at the rear of vessel, whereas others have pipes routed vertically to release pollutants well above the vessel top deck. The stack heights are measured with respect to the waterline, which is set at the zero mark. For an accurate stack height, the project sponsor will need to obtain information from the operator regarding which vessels typically provide service at or near the project site, and the stack height of these vessels. Golden Gate Ferry vessels all have stack heights of approximately 1 meter, whereas vessels operated by WETA and excursion services have stack heights of either 1 meter or approximately 7.6 meters above the water line. If release height is not available or observable, the Air District recommends using a release height of 7.6 meters.

The remaining modeling parameters can be derived based on the vessel's stack height and width. Because the vessels are in motion during transiting, the release height and initial vertical dispersion coefficient are adjusted with an added factor γ , equal to 1.7, to account for the effects of motion-induced turbulence (Table 17).

Table 17 Default Volume Release Parameters for Commuter and Excursion Vessels

Parameter	Values
Source Stack Height (H)	1 or 7.6 meters ¹
Source Width (W)	8.8 to 12 meters ²
Source Release Height	$0.5 \cdot PH = 0.5 \cdot \gamma \cdot \frac{H}{2.15}$
Initial Horizontal Dispersion Coefficients (S_{yinit})	$\frac{W}{2.15}$
Initial Vertical Dispersion Coefficients (S_{zinit})	$\frac{PH}{2.15} = H \cdot \frac{\gamma}{2.15}$

Notes: H = source stack height; PH = plume height, which is equal to 1.7 multiplied by the stack height; W = source width.

¹ Golden Gate Ferry vessels have a stack height of 1 meter, whereas vessels operated by WETA and excursion services have stack heights of either 1 meter or 7.6 meters above the water line. If release height is unknown, the Air District recommends using 7.6 meters in the modeling analysis.

² The shortest beam vessel of 8.7 meters was retired in 2017.

The project sponsor can use a unit emission rate or the estimated emissions in the dispersion model. However, care should be taken to ensure that the individual volume source emissions used in the model are equal the total emissions when summed over the entire transit route. This is addressed by dividing the total emissions for the route by the number of volume sources used to model the route in AERMOD. To match the activity level to the meteorological conditions, emissions for commuter ferries and excursion vessels can be allocated in the modeling based on their operating schedules by day of week; this would reflect only the operating hours of the ferries and excursion vessels and not necessarily the level of activity by hour.

Berth impacts can be modeled as a point or area source depending on the available data. The area source represents the area where the vessels will be docked while loading or unloading passengers. Because of the orientation of the exhaust stacks on some vessels, the release height can be set as the physical height of the stack. Since berthing vessels are stationary, the initial vertical dispersion coefficient and release height are estimated using $\gamma = 1$ (assuming no motion-induced turbulence that will increase initial dispersion). For point-source release, the project sponsor will need to estimate the exit velocity (or flow rate), temperature, and diameter of the exhaust stack. A more expansive receptor grid is recommended that encompasses all coastal residential areas that may be affected by these vessels along the transit route and surrounding terminals.

This page intentionally left blank.



9 CEQA SCREENING MAPS

The CEQA screening maps are designed to assist project sponsors in estimating risks and hazards from surrounding sources as part of the cumulative analysis (available at <https://www.baaqmd.gov/ceqa-resources>). The screening maps provide conservative estimates for cancer risk, PM_{2.5}, and chronic hazard that are directly comparable to the CEQA thresholds. Project sponsors can also use these methods replacing default parameters with site factors to develop source emissions specific for their project. Acute hazards are not addressed in the screening maps because a cumulative threshold for such hazards has not been adopted.

9.1 STATIONARY SOURCE SCREENING MAP

Stationary facilities that produce air pollution—including complex sources, such as metal smelting, wastewater treatment plants, and refineries as well as smaller facilities, such as diesel generators, gasoline-dispensing facilities (gas stations), and boilers—are regulated and subject to permit conditions established by the Air District. The Air District maintains a database of its permitted facilities and their associated emissions. These emissions are determined either through direct measurement via source test or by engineering calculation based on process throughput and source-specific emission factors. Emissions from all permitted facilities are reported annually to CARB under CEIDARS¹⁹ and, subsequently, reported to EPA to supplement the National Emissions Inventory database²⁰.

The current version of the stationary source screening map is based on the CEIDARS report for 2020. Subsequent updates of the permitted source screening map will rely on the most recent emissions data

¹⁹ The CEIDARS 2.5 Database Structure can be found at <https://www.arb.ca.gov/ei/drei/maintain/dbstruct.htm>.

²⁰ The EPA National Emissions Inventory web page can be found at <https://www.epa.gov/air-emissions-inventories>.

from CEIDARS, and the emission inventory year will be referenced in the map and attached meta file. The emissions inventory focused on PM_{2.5} and TACs emissions, including diesel PM. Diesel PM is used as a surrogate to represent all carcinogenic compounds associated with the combustion of diesel fuel commonly used by standby generators and fire pumps. Speciated toxic compounds where CARB speciation profiles were applied to total organic gases (TOG) and/or PM emissions to proportion individual chemical contribution are included in the inventory for most sources, such as solvents and coatings, formulated gasoline from retail and nonretail stations, and generators powered by nondiesel fuels.

The stationary source screening map contains all the facilities in the Bay Area where a permit has been issued and that emit one or more TACs. The map was developed using the approved emissions data for permitted sources to estimate the cancer risks, chronic hazard index, and PM_{2.5} concentrations. The risks and hazards shown at the facility centroid were estimated by aggregating individual source emissions for that facility. The screening level cancer risks and PM_{2.5} concentrations are estimated to be intentionally conservative and are based on worst-case assumptions. These values do not represent the true risk values from a facility.

The stationary source screening maps contains the following information:

- ▶ **Facility ID:** The unique facility identification (facility ID) as assigned by the Air District. If the Facility ID is in the form of "facility ID – source ID," it represents the location and corresponding risks and PM_{2.5} concentrations for a specific standby diesel generator that responded to the Air District's 2011 survey. "Facility number – REM" denotes the "remaining" risks and PM_{2.5} concentration when contributions from individual generators were subtracted from the total estimated for the facility.
- ▶ **Facility name:** The facility name as listed in the Air District's permit.
- ▶ **Address, city, state, and zip code:** In most cases, the full address refers to the physical location of the facility except when multiple buildings are assigned to one permit (such as campuses). In that case, the physical location refers to the main building of the campus.
- ▶ **County:** The county is the location where the permitted facility is operating based on its physical address.
- ▶ **Latitude and longitude:** Latitude and longitude of the centroid location of the facility based on their physical address in decimal degrees (datum WGS84).
- ▶ **Cancer Risk:** The cancer risk (in millions), estimated using conservative assumptions aggregated from all permitted sources related to the facility.
- ▶ **Chronic_Hazard Index:** The chronic hazard (unitless), estimated using conservative assumptions if the facility emits TACs with assigned chronic reference doses.
- ▶ **PM_{2.5}:** Conservatively estimated annual PM_{2.5} concentrations assigned to the facility in units of micrograms per cubic meter (µg/m³).
- ▶ **Details:** Assists project sponsors in identifying whether a facility is a gas-dispensing facility or if the only permitted sources are generators/pumps to ensure that the appropriate source-specific distance decay factors (see in Section 9.5) are used.

- ▶ **NAICS Code**²¹: A hierarchical identification system used by Federal statistical agencies that provides a common industry definition for businesses in Canada, Mexico, and the United States.
- ▶ **NAICS Sector**: The first 2-digits in the code that defines the economic sector.
- ▶ **NAICS Subsector**: The 3rd-digit in the code that defines the production level within an economic sector.
- ▶ **NAICS Industry Group**: The 4th-digit in the code that further defines the production stream.

The screening-level health risk impacts in the stationary source screening table are calculated using health effect values adopted by OEHHA; health-protective assumptions relating to the extent of a resident's exposure, including age-specific exposure factors; and a conservative modeling procedure to establish the extent to which a TAC is dispersed into the atmosphere after its release from the source.

For stationary source categories other than GDFs,²² the screening-level impacts for health risk and PM_{2.5} concentrations in the stationary source screening map are consistent with the methodology used to develop the trigger levels in the Air District's Regulation 2-5.²³ The modeling uses a cavity effects screening procedure whereby dispersion is affected by aerodynamic downwash from a nearby building and relates emission rate to 1-hour average ambient air concentrations. The cavity region occurs immediately adjacent to the lee side of the building and is often the "worst-case" dispersion scenario where receptor areas are close to the source being evaluated. From EPA's *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources* (EPA 1992), the cavity equation is as follows:

$$Conc = \frac{Q}{1.5 \cdot A \cdot u}$$

where:

- Conc* = 1-hour maximum concentration (µg/m³) at the fenceline of facility
Q = Emission rate (g/sec)
A = Cross section area of the building normal to the wind (m²)
u = Wind speed (m/sec)

The cavity effects equation requires the selection of the crosswind building area and the average wind speed. Building cross section was assumed to be 25 feet high by 40 feet wide, approximately 92.7 square meters. Calm winds of 2 meters per second, taken from EPA's screening modeling guidelines, was used. The maximum 1-hour concentration, estimated by applying these factors, was then multiplied by 0.1 to convert the 1-hour concentration to an annual average concentration, for determining risks and hazards comparable to the thresholds.

An alternative screening methodology was developed to address the multiple emission points associated with gas stations where losses occur through spills, pipe vents, and pumps. Various hypothetical scenarios were run using AERMOD to determine worst-case ground-level annual concentrations. AERMOD

²¹ U.S Census NAICS System 2022 manual: https://www.census.gov/naics/reference_files_tools/2022_NAICS_Manual.pdf

²² Cavity effects screening procedures were not applied to GDFs because of the complexity of the emission sources. A detailed explanation of the methodology used for gas stations is described further in this section.

²³ <http://www.baaqmd.gov/Divisions/Planning-and-Research/Rules-and-Regulations.aspx>.

compatible meteorological files were processed using AERMET for representative Bay Area cities, including Concord; Hunters Point in San Francisco; Oakland Airport; Petaluma Airport; the University of California, Richmond campus; and San Jose Airport. Building downwash effects were modeled for over two dozen different building configurations. Emissions were apportioned so that most of the losses (92.7 percent) were assigned to dispensers and the remaining fraction (7.3 percent) was assigned to vents. Given that most gas stations have similarly sized vents from their underground tanks, storage tank vents were modeled as point sources that were 10 feet in height and 2 inches in diameter, with 0.00035-meter-per-second exhaust gas velocity and an exhaust temperature of 294 degrees Kelvin. For each modeling scenario, six point sources representing dispensers were modeled along with a single volume source of lateral dimension of 2.3 feet to depict losses from refueling and spillage.

For each building configuration and meteorological dataset, the annual average atmospheric dispersion factor (also known as Chi/Q) for gas stations was estimated based on the modeling results from AERMOD. The Chi/Q factor, the ratio of the pollutant ground-level concentration (Chi) to the source emission (Q) at specified distances and directions from the source, describes the dilution and dispersal effects caused by the atmosphere after the pollutant is released. County-specific Chi/Q factors (Table 18) were estimated based on the most conservative modeling scenarios using the county-specific meteorology. The chemical-specific emissions were then multiplied by the Chi/Q factor for each county to produce conservative ground-level concentrations for each air pollutant. Future iterations of the GDF screening values starting in July 2022 will be derived following the recommended procedures for preparing gas station emission inventories and HRAs outlined in CARB's *Gasoline Service Station Industrywide Risk Assessment Technical Guidance* (CARB 2021a). Project sponsors can opt out of using the Air District's CEQA screening map and instead use CARB's gas station screening tool to estimate cancer risk and chronic and acute hazards.

Table 18 **Area-Specific Chi/Q for GDFs**

County	Chi/Q ($\mu\text{g}/\text{m}^3$ per gram/sec)
Alameda	3,782
Contra Costa	5,287
Marin	6,236
Napa	6,236
San Francisco	4,585
San Mateo	6,236
Santa Clara	3,420
Solano	6,236
Sonoma	6,236

Notes: $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter; GDF = gasoline dispensing facility; gram/sec = gram per second; Q = emission rate.

To quantify emissions for each permitted gas station, the Air District used reported annual throughputs collected during facility inspections. Because inspection throughputs were unavailable, maximum allowable throughputs were used, although most stations operate well below their allowable permit limit. Individual

chemical emissions²⁴ were estimated by multiplying the gas station throughput by the TOG speciation profile from CARB for evaporative losses from gasoline.

Cancer risks were estimated by multiplying the Chi/Q factor by the chemical-specific emissions, residential exposure factors, and chemical-specific potency factors as described in Section 10.1. Cancer risks were calculated over an assumed 30-year lifetime exposure duration. In accordance with OEHHA Guidelines (OEHHA 2015), the intake methodology includes age-sensitivity factors that address children's greater sensitivity from early exposure to carcinogenic compounds.

The screening map also provides estimated hazards based on chronic exposures to noncarcinogenic compounds and annual PM_{2.5} concentrations. The chronic noncancer hazards were calculated by dividing the long-term exposure levels and intake by the chronic reference exposure levels following the methodology in Section 10.2. Multipathway toxicity factors and reference exposure levels were used, when they were available from OEHHA, to account for additional exposures through noninhalation pathways. To ensure a conservative conclusion, facility hazards represent the sum of hazard quotients across all permitted sources at the facility. As noted above, estimates of acute hazard are not provided in the screening maps. Project sponsors can use CARB's Gas Station Risk Assessment Lookup Tool (CARB 2021a) to estimate acute hazard using the gas station's annual permitted throughput. Throughput information can be obtained from the Air District's permit via a public records request.

The modeled screening values shown in the stationary source map are not representative of actual health risks. Rather, the values are upper-bound estimates at the facility centroid for assessing whether a site-specific HRA is warranted. The screening approach relies on numerous conservative default assumptions that are not facility specific, and the estimates are not reflective of actual cancer risks likely to be experienced by nearby receptors. To adjust the screening values based on distance from the source to the receptor, the Air District provides source-specific distance decay factors in Section 9.5. If a facility's screening values (adjusted using the decay factors, as appropriate) are below the threshold, it is likely that the facility would pass a more site-specific, detailed modeling analysis.

A more refined analysis relying on source-specific release information and meteorological data is expected to result in lower and more accurate values than those found in the stationary source screening map. The screening map may be used to determine which facilities to include in the cumulative analysis. The impacts from the significant emitting facilities can then be summed and compared to the cumulative thresholds to determine whether further analysis is required. Note that the coordinates represent only a single point at the facility centroid, which is not the actual source locations and may not be the point closest to the project. Also, the datum for the coordinates in the screening map may not be the same for all facilities. Coordinates for some facilities may be referenced to NAD27, whereas others are referenced to WGS84 (i.e., NAD83). Potential distance offsets may be as great as 220 meters. To ensure that all relevant facilities are included, the distance used to identify facilities from the permitted source screening map should extend a reasonable distance beyond the distance specified in the Guidelines, and actual facility locations should be verified using the provided address in the screening map.

²⁴ Common chemicals found in gasoline include benzene, toluene, ethylbenzene, naphthalene, xylenes, and hexane. Additional chemicals may be present at lower percentages.

9.2 ROADWAYS SCREENING MAP

The roadway screening map provides estimated cancer risks, hazards, and PM_{2.5} concentrations for all Bay Area highways and surface streets. A fine-scale emissions inventory of PM₁₀, PM_{2.5} and TACs, which formed the foundation of the screening map, has been developed with a bottom-up approach relying on county-specific vehicle splits for surface streets and truck fractions from Caltrans's PeMS²⁵ for California freeways. The emissions for each roadway segment²⁶ (referred to as a "link") were then modeled in AERMOD, using wind field data generated from the Weather Research and Forecasting (WRF) modeling tool²⁷ and risk exposure assumptions. Note that the screening map was developed using the same methodology recommended for refined analysis, although default data were used for some parameters that may not match project conditions. Therefore, the project sponsor can incorporate site-specific data, such as vehicle speeds, vehicle counts, vehicle types, diurnal profiles, and meteorological data, to further improve the analysis, as described in Section 6.

Two types of emissions were estimated for roadways in the screening map: operational on-road mobile emissions and re-entrained road dust emissions.

Operational on-road mobile emissions (referred to as operational emissions) result from the consumption of fuel or from wear of vehicle-related materials.²⁸ The emissions processes include:

- ▶ running exhaust, when pollutants are emitted from the tailpipe of the vehicle as the fuel is combusted;
- ▶ running loss, when hot fuel vapors escape from the fuel system or overwhelm the carbon canister during the vehicle's operation;
- ▶ tire wear, when PM is emitted as a result of a vehicle's tires contact with the road surface; and
- ▶ brake wear, when PM is emitted as a result of wear of brake materials as the vehicle's brakes are applied.

Emission factors from the four processes²⁹ were estimated using the latest version of the EMFAC2021, which is developed and maintained by CARB.

Entrained road dust emissions (referred as road dust) are particulate matter from resuspended road surface material (dust) that is entrained by vehicles traveling on roads. Road dust emission factors were estimated following CARB's methodology for paved road dust (CARB 2021c), where roadway types of surface streets were assigned based on the average daily traffic (ADT) counts following the relationship from EPA's Air Pollution (AP) report *AP-42 Compilation of Air Pollutant Emissions Factors, Volume I: Chapter 13.2.1, "Paved Roads"* (EPA 2011).

²⁵ Available at <http://pems.dot.ca.gov/>.

²⁶ Roadways are represented by multiple aligned roadway links or segments.

²⁷ Description of the WRF model is available at <https://www.mmm.ucar.edu/weather-research-and-forecasting-model>.

²⁸ In this analysis, emissions from transport refrigeration units on trucks (Port Trucks or non-Port Trucks) were not included.

²⁹ The emissions from other processes of on-road mobile sources, such as from start exhaust and resting evaporative loss, were not included in the bottom-up inventory; these emissions are generally a small portion of the total emissions for PM_{2.5} and diesel PM.

Operational emissions from on-road mobile sources are calculated by source category, which is a combination of vehicle class, fuel type, emission process, and control technology. For this screening analysis, the four emission processes listed above and all the vehicle classes and fuel types defined in EMFAC2021 User Guide Appendix 4 were included (CARB 2021d). Appendix 4 also defines the EMFAC vehicle categories, which are groups of vehicle classes as summarized in Table 19. Collectively, the combined truck-related categories—Truck 1 and Truck 2—are referred to as “Trucks.” Road dust emissions are calculated based on the entire fleet (i.e., all vehicles together). It is important to estimate emissions at this level of detail in order to support the estimation of air toxic emissions (see Section 9.2).

Table 19 Emission and Vehicle Categories for Roadway Emissions¹

Emissions Category	Vehicle Category	Description/Vehicle Types
Operational on-road mobile	Non-Truck	Passenger cars, light-duty trucks, medium-duty trucks (GVWR ≤ 8,500 lbs), buses, motorcycles, motor homes, motor coaches
	Truck 1	Light-Heavy Duty Trucks (GVWR 8,501–14,000 lbs)
	Truck 2	Medium-Heavy Duty Trucks (GVWR 14,001–33,000 lbs) and Heavy-Heavy Duty Trucks (GVWR > 33,000 lbs)-
Road dust	All	Entrained road dust (PM ₁₀ and PM _{2.5}) on paved roads

Notes: GVWR = gross vehicle weight rating; PM₁₀ = particulate matter with a diameter less than or equal to 10 microns; PM_{2.5} = particulate matter with a diameter less than or equal to 2.5 microns.; lbs = pounds

¹ As defined in EMFAC2021, vehicle categories are generally based on gross vehicle weight rating.

A bottom-up fine-scale emissions inventory was developed using information on (1) the roadway network, (2) vehicle travel activity, and (3) emissions factors. The roadway network and the majority of travel activity data used for the screening map were purchased from Bentley. For all nine Bay Area counties, Bentley provided a geodatabase containing the roadway network with roadway attributes (e.g., length, the number of lanes), and travel activity (volume and speed) for 2019 by hour of the day for four-day types (Monday–Thursday, Friday, Saturday, and Sunday).

A description of the parameters from Bentley and other data sources used to develop a source-category specific emissions inventory is presented in the following sections.

Roadway Network. Bentley uses the HERE roadway network, which includes the roadway geometry and supporting data such as the number of lanes, roadway length, roadway elevation, and roadway functional class for each link. The roadway width, necessary for air dispersion modeling, was not provided by Bentley, so the roadway functional classes from Bentley were matched to corresponding roadway types (Table 20) from the Federal Highway Administration (FHWA) that establish standards for roadway construction. The width of each link was then estimated by multiplying the number of lanes (provided by Bentley) by the lane width based on the FHWA roadway type. The width per lane was based on guidance for roadways in urban areas as classified by FHWA (Table 20): 3.6 meters for freeways, 3.0 meters for arterials, and 2.7 meters for local roads (ASSHTO 2018).

Table 20 Cross-Reference of Road Type Classification Schemes Used in This Analysis

Bentley Functional Class	CARB Road Type	FHWA Road Type	Road Category
2 - Major Highways	Freeways	Freeway	Highway
3 - Minor Highways	Major Streets	Arterial	Surface Street
4 - Minor Streets	Collector Streets	Arterial	Surface Street
5 - Local Roads	Local Streets	Local	Surface Street

Notes: Functional classes were obtained from Bentley Systems and mapped to FHWA road type (AASHTO 2018), used to determine roadway width. Silt loading factors from CARB (2021c) were assigned by roadway type based on the ADT to estimate road dust emissions (see Section 9.2).

Travel Activity. Vehicle travel activity data, including the traffic volume, vehicle speed, and the fleet mix, were used to develop the emission inventory. These parameters are further described in Table 21.

Table 21 Travel Activity Parameters and Associated Data Sources Used for Estimating Emissions from On-Road Mobile Sources

Parameter	Description	Purpose	Reference/Data Source
Volume	Average total traffic fleet volume	Calculate vehicle miles traveled (VMT) and vehicles hours traveled (VHT), which are used to estimate emissions from all processes (operational and road dust).	Bentley Systems
Speed	Average total traffic fleet speed	(a) Estimate running exhaust and brake wear emissions (emission factors are speed dependent), and (b) estimate VHT.	Bentley Systems
Fleet Mix	Composition of vehicle fleet (i.e., volume or VMT fraction for each vehicle class and fuel type)	Apportion fleet-total VMT to each vehicle class and fuel type.	Caltrans PeMS, county-specific VMT-based fractions by vehicle class and fuel type from EMFAC2021

Notes: Parameters can vary hourly and by roadway link.

Volume and Speed. For each link, hourly traffic volume and speed by day type purchased from Bentley were used to calculate:

- ▶ VMT: the mileage of all vehicles traveling on a link over a specific period (e.g., hourly, daily) estimated as the product of volume (count) and link length (miles); VMT is used to estimate emissions from running exhaust, tire wear, brake wear, and road dust, and
- ▶ VHT: the travel time of all vehicles traveling on a link over a specific period (e.g., hourly, daily); VHT, which was estimated by dividing VMT (miles) by speed (mph), was used to estimate running loss emissions.

To improve the efficiency of AERMOD modeling, the two-way directional traffic data were merged into a single roadway representing the approximate centerline of the roadway if the geometries of the two links are identical. In this step, the number of lanes and traffic volumes in both directions were summed, while the hourly traffic speeds were averaged (weighted by hourly volume). The number of lanes was rounded down for links where the number of lanes was not a whole number because the fractional lane represented existing street parking.

The day type–specific traffic volume (Monday–Thursday, Friday, Saturday, and Sunday) was aggregated to derive annual average day volumes. Average day diurnal profiles for each link were developed by combining hourly traffic volumes across all day types. Similarly, the day type–specific vehicle speed was averaged using volume as a weighting factor. For each roadway link, two-way merged hourly VMT and VHT on an annual average day were calculated, and were then allocated to EMFAC2021 vehicle classes and fuel types by using fleet mix information (see “Fleet Mix” below).

Fleet Mix. The annual average fleet mix data were derived by road category (Table 20) based on several data sources as follows:

- ▶ For highways: The fractions of Truck and Non-Truck were first derived from the station-level traffic flow and truck flow in the 2019 annual average Time of Day (TOD) performance data from Caltrans PeMS system, which uses sensors to record traffic and truck flow on freeways³⁰, as described below. After assigning the vehicle fractions to each highway link, the Truck and Non-Truck fractions were further split based on 2022 county-specific VMT fractions following EMFAC2021 vehicle classes and fuel types, assuming 2022 Truck and Non-Truck fractions are the same as 2019.
 - The Air District performed an initial quality assurance by excluding PeMS stations with invalid data (e.g., truck flow and traffic flow are identical for all 24 hours). The hourly truck fractions were then derived for each PeMS station by ratioing the truck flow by traffic flow. The PeMS stations with unrealistically high truck fractions were removed if their average daily truck fractions are above a cut-off value of 0.1178 estimated as the 95th confidence interval of all truck fractions in the Bay Area.
 - The truck fraction from PeMS were assigned to highway links based on their spatial proximity to the corresponding PeMS stations with the same highway name and direction. For links without corresponding PeMS stations, the average truck fractions of the corresponding highway corridor (i.e., the traffic flow weighted average truck fractions of all PeMS stations for the same highway in the county) were used to fill the gap. Highways lacking PeMS stations were assigned the average truck fraction estimated from all PeMS stations within the county. For bridges (e.g., Golden Gate Bridge, Bay Bridge, San Mateo Bridge), a uniform truck fraction specific to each bridge were develop by averaging across all PeMS stations spanning the bridge to ensure continuity and consistency over the bridge span.
 - Non-Truck fraction is the difference of one minus the truck fraction for each link.
- ▶ For surface streets: The 2022 county-specific VMT fractions by vehicle class and fuel type were derived from VMT data produced by EMFAC2021 based on the vehicle registrations in each county. All surface streets within each county were assigned the same 2022 county-specific fleet mix. The only exception is Port of Oakland, where Trucks dominate the daily traffic volume within the Port boundary. Therefore, the Air District assumed that only drayage trucks travel on roadway links within the Port of Oakland property. The assumption is conservative but more representative for the local condition.

³⁰ The PeMS system estimates truck flow at each detector based on the measured 5-minute, lane-by-lane values of flow and occupancy if they don't report truck volumes.

Emission Factors. 2022 annual average emission factors for each emission process were developed for PM_{2.5} and TOG as described below.

Operational Emission Factors. 2022 annual average PM₁₀, PM_{2.5}, TOG and ammonia emission factors³¹ by vehicle class, fuel type, and emission process for each county were generated from EMFAC2021 PL module.

Road Dust Emission Factors. For road dust, there are only PM emissions. PM₁₀ and PM_{2.5} emission factors were estimated for each roadway link following the CARB (2021c) methodology, which is reproduced below:

$$EF_{fleet} = k \cdot sL^{0.91} \cdot W_{fleet}^{1.02} \cdot \left(1 - \frac{P}{4N}\right)$$

where:

EF_{fleet} = road dust emission factor (lb/mi)

k = particle size multiplier (0.00033 lb/VMT for PM_{2.5})

sL = road surface silt loading factor, based on CARB road type (Table 22) (g/m²)

W_{fleet} = fleet average vehicle weight (California default [2.4 tons] or calculated using the equations below)

P = number of “wet” (precipitation ≥ 0.01 in) days in averaging period (days) (Table 23)

N = total number of days in averaging period (days) (N = 365 days for annual analysis)

Entrained Road Dust on Paved Roads

The methodology for estimating entrained road dust along paved roads follows the approach outlined in EPA’s AP-42. Using CARB’s (2021c) or EPA’s recommend default values results in emissions that differ by as much as 200 percent. Reducing the uncertainties between the two sets of factors is important because non-exhaust emissions (i.e., brake wear and entrained road dust) are anticipated to dominate roadway emissions as exhaust emissions continue to decline. The Air District’s recommendation is to apply EPA’s default recommended values when project sources are subject to the Air District’s permitting requirements or regulations. For land use projects not subject to the Air District’s rules or regulations, project sponsors may apply CARB’s default factors for entrained road dust. Special considerations should be made to ensure that the appropriate factors for silt loading and vehicle weight, as defined in the project details, are used and justified in the report. The roadway screening map relies on CARB’s default factors as the purpose of the map was to evaluate cumulative impacts from existing roadways, which are not subject to the Air District’s permitting requirements or regulations.

³¹ PM₁₀ is included to estimate emissions of diesel PM.

For each link, the fleet average vehicle weight was calculated as follows, where subscripts denote vehicle aggregation levels: vehicle class (VC) (e.g., light-duty auto, light-duty truck) or the entire fleet (fleet) (i.e., all vehicle classes), where $x \in \{fleet, VC\}$:

$$F_{VC} = \frac{VMT_{VC}}{VMT_{fleet}}$$

$$W_{fleet} = \sum_{VC} W_{VC} \cdot F_{VC}$$

where

F_{VC} = VMT-based weighting factor for the vehicle class (unitless)

VMT_x = VMT of all vehicles at vehicle aggregation level x (miles)

W_x = weight of vehicle at vehicle aggregation level x (tons)

Therefore, the fleet average vehicle weight is simply the weighted average of all vehicle weights. Vehicle weights were taken from EMFAC2021. F_{VC} is the link-specific fleet mix developed from Caltrans's PeMS traffic activity and EMFAC2021 as described in "Travel Activity."

The silting loading factor was assigned to each link based on its road type, as defined by the ADT. Initially, the Air District completed the modeling using the functional class assigned by Bentley following CARB's methodology (2021c), resulting in some surface streets having higher exposure concentrations than freeways. The Air District corrected the anomaly by assigning roadway type based on the ADT rather than the functional class. The ADT count assigned to each link by Bentley was cross-referenced to CARB's Road Types following EPA's AP-42 roadway definitions based on vehicle counts. Table 22 presents CARB Road Type classification and corresponding ADT and silt loading factor used to estimate road dust emission factors for each link. Table 23 presents the Annual Rainfall Days used to estimate road dust emission factors by County.

Table 22 Road Surface Silt Loading Factor (sL) by Road Type Used in CARB Method to Estimate Emission Factors from Road Dust Emissions

CARB Road Type	Average Daily Traffic Count	sL (g/m ²)
Freeways	$\geq 10,000$	0.015
Major Streets	$\geq 5,000$ and $< 10,000$	0.032
Collector Streets	≥ 500 and $< 5,000$	0.032
Local Streets	< 500	0.320

Notes: CARB = California Air Resources Board; g/m² = grams per meter square; sL = silt loading factor. Values taken from California Air Resources Board (2021c).

Table 23 Annual Rainfall Days (P) Where 0.01 Inch or Greater Precipitation Was Recorded by County

County	P (days)
Alameda	61
Contra Costa	60
Marin	66
Napa	68

County	<i>P</i> (days)
San Francisco	67
San Mateo	60
Santa Clara	64
Solano	54
Sonoma	69

Notes: *P* = annual rainfall days

Values taken from CARB (2021c).

Emissions. 2022 annual average daily emissions of PM₁₀, PM_{2.5}, TOG and ammonia were calculated as the product of traffic activity and emission factors, with more details provided in this section.

PM and TOG. For operational emissions from on-road mobile sources, annual average daily emissions of PM₁₀, PM_{2.5}, TOG, and ammonia were estimated by roadway link by vehicle class (VC), and fuel type (FT), for each emissions process (Pr).

First, the annual average daily emissions (*E*) were calculated by link (*L*), vehicle class (VC) and fuel type (FT) for each of the emission process (Pr) and pollutant (Pol).

- For running exhaust, tire wear, and brake wear:

$$E_{VC,FT,Pr,Pol,L} = \sum_{h=1}^{24} VMT(h)_{VC,FT,L} \cdot EF(s(h))_{VC,FT,Pr,Pol}$$

where emissions (*E*, in g) are the product of hourly VMT and emission factors (EF) and then summed over all hours (*h*) of the day, and for running exhaust and brake wear, the emission factor is a function of speed (*s*), which varies by hour of day.

- For running loss:

$$E_{VC,FT,Pr,Pol,L} = \sum_{h=1}^{24} VHT(h)_{VC,FT,L} \cdot EF_{VC,FT,Pr,Pol}$$

where the emissions are the product of the hourly VHT and emission factors (EF) and then summed over all hours (*h*) of the day.

For road dust from paved roadways, annual average daily emissions were estimated for the entire fleet by link.

- For road dust emissions on each link,

$$E_{fleet} = \sum_{h=1}^{24} VMT(h)_{fleet} \cdot EF_{fleet}$$

where the total fleet PM₁₀ and PM_{2.5} emissions are the product of hourly VMT and link-specific emission factors (EF) and then summed over all hours (*h*) of the day.

TACs. To evaluate risk and exposure from roadways, the annual average daily TAC emissions were also estimated for each link. CARB's PM and organic gas speciation profiles³² were applied on PM and TOG emissions calculated in "Emissions" to estimate TAC emissions, except for diesel PM.

Diesel PM (DPM) is emitted only from diesel-powered vehicles. Its emissions were produced by simply filtering out running exhaust PM₁₀ emissions of vehicles whose fuel type is diesel.

The emissions of other TACs were estimated following the steps below:

- ▶ Assign CARB's Emissions Inventory Codes (EICs)³³ to the PM₁₀ and TOG emissions based on the vehicle class, fuel type, emission process, and control technology. The Air District assumed that all gasoline and Plug-in Hybrid Electric Vehicles (PHEV) have catalytic converters. This is because EMFAC2021 default suggests that the last model year of gasoline vehicles with non-catalytic converters is model year 1975. Considering the lifetime of vehicles, there should be little non-catalytic controlled vehicles remaining in the fleet in 2019 and later.
- ▶ Retrieve CARB's chemical speciation profiles and assignment files.³⁴ The speciation profiles contain the fractions of each chemical species (including TACs) in PM₁₀ or TOG for a specific type of source. The assignment files specify which speciation profile should be applied to each EIC code.
- ▶ Join the PM₁₀ and TOG emissions with PM₁₀ or TOG speciation profiles as the assignment files specify. The emissions of each TAC pollutant were then calculated by multiplying PM₁₀ or TOG emissions by the fraction of the TAC species in the corresponding profile.

For each link, the emissions from all processes were summed to generate annual average daily emissions by pollutant and emission/vehicle category (i.e., Road dust, Truck, Non-truck). The emissions were then converted to emission rates (g/s) representing the average hour of the annual average day, which is the emissions input for the postmodeling process, along with corresponding diurnal activity profiles as described in "Modeling Methodology."

Modeling Methodology. The on-road modeling follows the methodology from EPA's PM hot-spot analyses for transportation projects (EPA 2015b, 2015c).³⁵ On-road mobile sources were modeled as line-area sources in AERMOD. The location of the line sources (centroids) aligned with the roadway network provided by Bentley. A combination of the roadway functional class and the number of lanes (from Bentley) was used to approximate the total roadway width, extended 6.0 meters to address vehicle turbulence (EPA 2012). The width per lane was based on guidance for roadways in urban areas as classified by FHWA (see "Roadway Network"). The total width was taken as the number of lanes times the width per lane.

Two separate AERMOD dispersion modeling runs were performed because of the different release parameters and associated diurnal (activity) profiles for Non-Trucks and Trucks. For a given roadway

³² Available at <https://ww2.arb.ca.gov/speciation-profiles-used-carb-modeling>.

³³ Download EIC description from CARB's website: <https://ww2.arb.ca.gov/emission-inventory-documentation>.

³⁴ A brief description of assignment files is available on CARB's website: <https://ww2.arb.ca.gov/source-code-assignment-speciation-profiles>. Please contact CARB staff listed in footnote 13 for the actual files.

³⁵ That being said, because this analysis is not a formal PM hot-spot analysis, some aspects of the modeling approach differed.

segment, Non-Trucks and Trucks were modeled separately, keeping the location of the line sources constant between each model run.

For all line-area sources, the initial vertical dispersion coefficient was based on the AERMOD User's Guide for surface-based sources (EPA 2018):

$$\begin{aligned} Sz_{init} &= PH / 2.15 \\ &= (H \cdot \gamma) / 2.15 \end{aligned}$$

where *PH* is the initial vertical dimension of the source plume (plume height), *H* is the average source (vehicle) height, and γ is a parameter to account for the effects of vehicle-induced turbulence, which equals 1 when vehicles are not moving or 1.7 when vehicles are in motion (EPA 2015a). *H* depends on the vehicle category and was taken as 1.53 meters for Non-Trucks and 4.0 meters for Trucks. Therefore, *Sz_{init}* was set to 1.21 meters for Non-Trucks and 3.16 meters for Trucks. Finally, the release height was estimated as the midpoint of the initial vertical dimension (i.e., *Relhgt* = 0.5 • *PH*). Therefore, *Relhgt* was initially set to 1.3 meters for Non-Trucks and 3.4 meters for Trucks. For sources that were not at grade, *Relhgt* was then adjusted based on the height of the elevated roadway or freeway.

The diurnal profiles for each link by vehicle category were developed based on hourly traffic volumes. For Non-Trucks, diurnal profiles for freeways and surface streets were developed using Bentley activity data. For Trucks, diurnal profiles for freeway links were developed based on data from the nearest PeMS site, or based on data of all PeMS sites for a specific freeway within a county if the freeway links are too far away from a PeMS site. County average diurnal profiles across all PeMS sites within a county were calculated and applied to surface streets. The only exception is Port of Oakland, where Trucks dominate the daily traffic volume within the Port boundary. Therefore, the diurnal profiles for roadway links in Port of Oakland were developed using Bentley volume which is more representative for the local conditions. For each link and vehicle category, the diurnal activity profile is composed of 24 values, and each is the ratio of hourly traffic volume over the average hourly traffic volume. These values are then used to scale the unit emission rate during the AERMOD run so that the hourly unit emission rate reflects the hourly variation of the actual emission rates.

Meteorological inputs to AERMOD are usually developed from data collected at meteorological stations. However, the coverage of such stations across the Bay Area is not sufficient to provide representative meteorological data for all roadways. Therefore, outputs from WRF Model version 3.8 were used to prepare the meteorological inputs to AERMOD. The Air District uses the WRF model to prepare meteorological data for regional modeling applications, assimilating observations into the model to minimize the difference between generated wind field data and real-world measurements. In addition, a model performance evaluation is conducted to ensure that WRF outputs are suitable for use in air quality modeling. The most recent WRF run available was for 2018, and required AERMOD parameters, such as hourly wind speed and direction, were extracted from this simulation. The Air District used a similar WRF-based approach to model potential impacts from emissions sources in the Richmond-North Richmond-San Pablo community as part of an emissions reduction plan being developed under AB 617.

Risk Estimates. Cancer risks were estimated by combining the pollutant concentrations at each receptor location by the residential exposure factors and chemical-specific potency factors as described in Section 10. Cancer risks were calculated over an assumed 30-year lifetime exposure duration. In accordance with

OEHHA's HRA guidelines, the intake methodology addresses health impacts from children's greater sensitivity from early exposure to carcinogenic compounds.

The screening map also provides estimated hazards based on chronic exposures to noncarcinogenic compounds and annual PM_{2.5} concentrations. The chronic noncancer hazards were calculated by dividing the long-term exposure levels and intake by the chronic reference exposure levels following the methodology in Section 10. Multipathway toxicity factors and reference exposure levels were used, when available from OEHHA, to account for additional exposures through noninhalation pathways. To ensure a conservative conclusion, receptor hazards represent the sum of hazard quotients from all on-road mobile processes.

The modeled screening values are partially site specific for 2019 because much of the link-specific activity data were incorporated into the modeling. In most cases, the values are upper-bound estimates for assessing whether a site-specific HRA is warranted. The screening approach relies on numerous county defaults that are not necessarily location specific, and project sponsors are encouraged to perform their own roadway analysis depending on the availability of site-specific data. (The recommended methodology is provided in Section 6.)

9.3 RAIL LINES FOR PASSENGER, COMMUTER, AND FREIGHT

The Air District has developed a new rail source screening map that predicts the cancer risks, hazards, and PM_{2.5} concentrations from diesel locomotives³⁶ used to transport freight along Class I rail lines and to transport people along commuter/passenger rail lines. The rail source map also incorporates the health impacts from select railyards in West Oakland and Richmond-North Richmond-San Pablo, analyzed as part of AB617 (see Section 9.4 for more information). A bottom-up emissions inventory of PM_{2.5} and diesel PM was developed based on the arrival/departure schedule for commuter/passenger trains and fuel consumption rates for the two major freight rail lines operating in the Bay Area. The emissions were then processed through the air dispersion model, AERMOD, using WRF wind field data. The project sponsor may refine the screening estimates further based on changes in the commuter/passenger schedule, increases/decreases in freight traffic, updated emission factors, or evaluation of Class III or short rail lines.

The network railroad map was initially based on a shapefile from the Topographically Integrated Geographic Encoding and Referencing (TIGER) Line spatial database.³⁷ The rail line features were then realigned as necessary to match the satellite imagery in Google Earth. In the shapefile, each rail line consists of smaller segments (or links) that span short distances along each track. In the Bay Area, passenger and freight services may run along a single track (i.e., the track is shared by both services) or along parallel tracks. For modeling purposes, parallel rail tracks were consolidated onto a single track, and emissions from freight and commuter lines were aggregated. For freight activities, emissions from locomotives that perform switching operations (referred to as "switchers," which assemble or disassemble rail cars from trains) were evenly distributed along their assigned subdivision line.

³⁶ Rail service using locomotives powered by electric power or fuel cells, such as the Bay Area Rapid Transit (BART), are not included in this analysis.

³⁷ Available at <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html>.

The following sections describe the approach used to estimate the emissions for freight and commuter rail that formed the basis of the rail source screening map.

Freight Haul Lines. The rail screening map presents risks along Class I line-haul rail lines that are serviced by two freight rail providers: Burlington Northern Santa Fe Corporation (BNSF) and Union Pacific (UP). Although the map focuses on risks along Class I rail lines, the Air District recommends that project sponsors consider Class III rail lines or short lines in the cumulative analysis if the lines are close to the project site.

BNSF and UP transport goods to and from the Bay Area to the San Joaquin Valley (east), Sacramento (north), and the Peninsula (south). They provided the Air District with the average diesel fuel consumption and miles traveled in 2020 along each county subdivision line (Table 24) in the Bay Area, as well as EPA fuel-based emission factors (g/gal) for converting fuel consumption to emissions. Emissions from switchers were included in the fuel-based emissions estimates and distributed uniformly across specific subdivision lines.

Table 24 Freight Subdivision Lines Operating in the Bay Area

County	Subdivision	Start Location	End Location
Alameda	Coastal	San Leandro	Alameda County line
	Martinez	10th Street, Oakland	Alameda County line
	Niles	10th Street, Oakland	Newark
	Oakland	San Leandro	Alameda County line
	Tracy	Contra Costa County line	Alameda County line
	Warm Springs	Niles Boulevard, Fremont	Alameda County line
Contra Costa	Martinez	Alameda County line	Contra Costa County line
	Tracy	Martinez	Contra Costa County line
San Francisco	San Francisco	King Street, San Francisco	San Francisco County line
San Mateo	San Francisco	San Francisco County line	San Mateo County line
Santa Clara	Coast	Alameda County line	Santa Clara County line
	San Francisco	Santa Clara County line	San Jose
	Warm Springs	Alameda County line	San Jose
Solano	Martinez	Contra Costa County line	Davis

Passenger Rail Lines. Amtrak offers several intercity passenger rail services along the Capital Corridor, California Zephyr, Coastal Starlight, and San Joaquin routes. Emissions by link were estimated using the available schedule for fall 2021 because many of the service providers resumed normal service after 1.5 years of curtailed hours and reduced service forced by the COVID-19 pandemic. For each link, emissions were estimated as the sum of running exhaust emissions from the locomotive during transit, and idling emissions while loading (unloading) passengers at stations.

To estimate the emissions, the number of locomotives per day that run along each link, as well as information on the activity along each rail line, is required. The activity along each Amtrak route is a function of the estimated average speed of the train and the frequency of the stops. To determine the number of stops, the Air District used the posted timetable and schedule by Amtrak.³⁸ The timetables identify the number of train stops at each station and the times and frequency of the train stops. These timetables were used to determine the following information:

- ▶ The daily number of trains was calculated as the number of weekday and weekend trains weighted by 5/7 and 2/7, respectively.
- ▶ The idling times varied from 2 to 10 minutes at certain stations to accommodate timed connections to other public transportation; the average idling time (to pick up and drop off passengers) was approximately 90 seconds at most stations. Trains can also spend up to 20 minutes idling to power up (or power down) the engine at the beginning (or end) of a route.

³⁸ The most recent timetable, posted in fall 2021, was used. Timetables were obtained from <http://www.amtrak.com/train-schedules-timetables> (accessed October 2021).

Based on the timetable, the number of daily trips along each route is presented in Table 25. The level of service and number of trains were assumed to remain constant.

Table 25 Amtrak Activity by Route

Routes	Destinations	Number of Weekday Trains per Day	Number of Weekend Trains per Day
Capital Corridor	Fairfield–Oakland	22	18
	Oakland–Coliseum	14	14
	Coliseum–San Jose	14	14
California Zephyr	Emeryville–Fairfield	2	2
Coastal Starlight	Gilroy–Fairfield	2	2
San Joaquin	Antioch–Oakland	10	10

Locomotives operate under a series of load modes (notches) that, combined with idling, determine the operating mode and the corresponding emission factors. The throttle notch is based on the load expected at each station, as well as the average speed. Emission factors and speeds used for each passenger line are presented in Table 26. The average speed was estimated as the distance traveled by the train on a route (or a portion thereof) divided by the elapsed travel time (based on the scheduled departure and arrival times) of the train between stations. An average throttle notch of three was used for the Capital Corridor because of the frequent stops, whereas for all remaining routes (which have fewer stops), a throttle notch of four was used.

Table 26 Diesel PM Emission Factor (EF) and Average Speeds by Amtrak Service/Route

Train Service	Mode/Throttle Notch	EF (g/h)	Average Speed (mph)
All passenger service	Idling	47.9	0.0
Capitol Corridor	3	71.35*	35.0
California Zephyr	4	226.4	36.8
Coastal Starlight	4	226.4	40.0
San Joaquin	4	76.59*	44.4

Notes: EF = emission factor; g/h = grams per hour; mph = miles per hour; * emission factors adjusted to account for replacing/upgrading locomotive engines by Tier 4 and 2 engines.

Diesel PM emission factors were derived from the Port of Oakland 2005 Seaport Air Emissions Inventory (Environ 2008), adjusted for fuel sulfur content of 15 parts per million by weight in compliance with CARB's Marine and Locomotive Diesel Fuel regulation (adopted November 2004 and compliant with regulations passed by EPA^{39,40}). All passenger rail services were assumed to have a fleet mix based on GP4x and Dash 9 locomotives with respective certification levels being pre-controlled and achieving Tier 1 emissions. The 23 locomotives servicing the Capital Corridor and San Joaquin routes are the only exception where the engines have been replaced/upgraded to Tier 4 or 2 engines resulting in an almost 50% reduction of PM_{2.5} and diesel emissions along these routes.

³⁹ EPA's regulations for emissions from locomotives are available at <https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-emissions-locomotives>.

⁴⁰ EPA's domestic regulations for emissions from marine compression-ignition (diesel) engines are available at <https://www.epa.gov/regulations-emissions-vehicles-and-engines/domestic-regulations-emissions-marine-compression>.

Emissions were estimated for locomotives based on idling at stations or turnarounds and running exhaust between stations. Daily running exhaust emissions of diesel PM on each link were estimated as:

$$E_{RUN} = \frac{1}{S} (EF_{RUN} \cdot N)$$

where:

- E_{DPM} = emissions of diesel PM per rail link per day (g/mile-d)
- S = average speed (mph) (Table 25)
- EF_{DPM} = emission factor by rail link (g/h) (Table 25)
- N = number of locomotives that travel on the rail link per day (1/day)

Running exhaust emissions were assumed to occur along each link, excluding a 1,000-foot buffer around each station. Idling emissions estimated 500 feet before and after a station were estimated by multiplying the idling emission factor by the number of train stops on each link, which varied by rail service and link:

$$E_{IDLE} = EF_{IDLE} \sum_i N_i \cdot T_i$$

where:

- E_{DPM} = emissions of diesel PM per rail link per day (g/day)
- EF_{DPM} = emission factor for diesel PM by rail link (g/h) (Table 25)
- N = number of locomotives that travel on the rail link i per day (1/day)
- T = idling time for each stop or turnaround on rail link i per day (h)

The daily emissions along each rail link are the summation of the running and idling emissions:

$$E_{DPM} = (E_{IDLE} + E_{RUN}(L - S \cdot 0.189 \text{ miles}))$$

where:

- E_{DPM} = emissions of diesel PM per rail link per day (g/d)
- S = number of stations along the link (unitless)
- E_{IDLE} = idling emissions by rail link (g/day)
- E_{RUN} = running emissions by rail link (g/mile-day)
- L = length of rail link (miles)
- 0.189 = length of link (500 feet before and after a station) where engines are idling (miles)

Even though activity levels varied per hour for each train route, the diurnal profile (fraction of total daily emissions that are produced per hour) for emissions from passenger rail was assumed to be evenly distributed over a 24-hour period.

Commuter Rail Lines. In the Bay Area, commuter rail services offer public transportation from residential areas to major metropolitan centers. The following major commuter rail services are included in the screening map:

- ▶ ACE Rail stops at major cities between San Jose and Stockton.
- ▶ SMART Rail is a rail service along U.S. Highway 101 in the North Bay that currently services 12 stations from northern Santa Rosa to the ferry terminal in Larkspur, Marin County. The long-term plan is to expand the line by constructing four additional stations to provide service through Cloverdale in Sonoma County.

- ▶ Caltrain provides commuter rail service from San Francisco through San Mateo and Santa Clara Counties for terminus in San Jose Diridon, Tamien, and Gilroy.
- ▶ eBART is a BART extension in east Contra Costa County that uses diesel multiple-unit trains to travel along the median of State Route 4 to connect Hillcrest Avenue and Railroad Avenue in Antioch to the Pittsburg/Bay Point BART station.

Commuter locomotives in the Bay Area operate under different levels of service depending on the ridership. Caltrain has the highest demand with more than 50,000 weekday riders and three levels of daily service available: Baby Bullet (highest average train speed and minimum stops), limited service (slower average train speed and more selective stops compared to the Baby Bullet), and local service (slowest average speed and frequent stops). Service on SMART, eBART lines, and ACE lines continue to offer a single level of service.

Similar to passenger rail analysis, running and idling emissions were estimated along each link by rail service. Emissions were estimated based on the daily number of locomotives that run along each link, the number of stations located on the link, the average speed of each locomotive, and the number of stations within each link. Online timetables from fall 2021 were used to assess the number of stations along each line and the scheduled arrival and departure times and frequency in which locomotives stopped at each station. Locomotives were assumed to idle for 90 seconds at each station except for terminus stations, where the idling time increases to 20 minutes to account for powering up or down the locomotive engine. To determine the daily number of trains, the number of weekday and weekend trains were weighted by 5/7 and 2/7, respectively.

The number of daily trips along each route is presented in Table 27 for all commuter service as of fall 2021. For years beyond 2021, the level of service and number of trains were assumed to remain constant; however, commuter train schedules change from year to year to meet ridership demands, so project sponsors are encouraged to ensure that the assumptions used to develop the screening tables remain valid for their project analysis.

Table 27 Summary of Activity Level for Each Commuter Service

Routes	Destinations or Level of Service	Number of Weekday Trains per Day	Number of Weekend Trains per Day
Caltrain	Local	0 (Gilroy–Capitol)	0 (Gilroy–Capitol)
		37 (Tamien)	40 (Tamien)
		46 (Diridon–San Francisco)	32 (Diridon–San Francisco)
	Limited	6 (Gilroy–Capitol)	0
		12 (Tamien)	0
		46 (Diridon–San Francisco)	0
	Baby Bullet	0 (Gilroy–Capitol)	0
		0 (Tamien)	0
		12 (Diridon–San Francisco)	0
ACE	San Jose–Livermore	8	0
eBART	Pittsburg–Antioch	139	132
SMART	Windsor–Larkspur	26	12

Emissions for commuter locomotives follow the same methodology and locomotive fleet mix used for passenger rail line, described in "Passenger Rail Lines." The throttle notch for each commuter service was estimated based on the load expected at each station and the average speed. Table 28 presents a summary of the emission factors and speeds that were used for ACE, eBART, and SMART commuter rail. Caltrain operates at variable speeds and throttle notches based on the frequency of stops in each county. The Caltrain Baby Bullet operates on average at throttle notch five because stops are infrequent, whereas the local and limited locomotives operate at slower speeds, at throttle notch three. Table 29 summarizes the emission factors and speeds for Caltrain by station. The average speed was estimated using the distance traveled by the train for a portion of or the entire route divided by the scheduled departure and arrival times of the train at the corresponding stations.

Table 28 Diesel PM Emission Factor (EF) and Average Speeds by Commuter Service

Train service	Mode	EF (g/h)	Average Speed (mph)
ACE	Idling	47.9	0
	Running	210.9	35
eBART	Idling	6	0
	Running	18	35
SMART	Idling	6	0
	Running	18	35

Notes: ACE = Altamont Corridor Express; eBART = BART extension in east Contra Costa County; emission factor; g/h = grams per hour; mph = miles per hour; SMART = Sonoma-Marín Area Rail Transit.

Table 29 Diesel PM Emission Factor (EF) and Average Speeds for Caltrain

Train service	Mode	EF (g/h)	Average Speed (mph)
All stations	Idling – Local/Limited	47.9	0
	Idling – Bullet	16.9	0
San Francisco stations	Running – Local	210.9	36.7
	Running – Limited	210.9	38.2
	Running – Bullet	377.2	53.6
San Mateo to Tamien station	Running – Local	210.9	31.8
	Running – Limited	226.4	45.2
	Running – Bullet	437.9	60.8
Tamien station to Gilroy	Running – Local/Limited	226.4	40.7

Notes: EF = emission factor; g/h = grams per hour; mph = miles per hour.

Emissions were estimated under two modes of operations: idling at stations and running between stations. Emissions are a function of the emission factor, the number of daily locomotives that travel on each rail link, average speed, the number of stations, and the time spent idling. The data are then entered into the equations presented in "Passenger Rail Lines" to estimate emissions along each commuter line by link. Running emissions were distributed equally along the rail line except within 1,000 feet of a station (500 feet before and after a station), where idling emissions were applied. Emissions were assumed to be evenly distributed throughout a 24-hour period and remain constant for 30 years. No reduction in emissions related to future electrification of the Caltrain line was accounted for in the analysis. Caltrain is expected to

partially electrify its route in the future after financial support is secured (latest date is 2024). It is expected that 25 percent of service would continue to rely on diesel locomotives after partial electrification.

Modeling Methodology. Emissions from locomotives on consolidated rail lines⁴¹ in the Bay Area were modeled as volume sources using a downloaded shapefile from the TIGER Line spatial database. Volume source locations were modeled with a width of 11 meters (width of locomotives plus 6 meters for wake effects) and source release height of 4.06 meters based on average heights for freight and passenger locomotives.⁴² Initial lateral dimension (*Syinit*) and initial vertical dimension (*Szinit*) were determined based on the equations used for volume sources: *Syinit* = 5.12 meters and *Szinit* = 3.78 meters. Emissions were assumed to be constant in time. Meteorological data were based on wind field data generated using the WRF model for 2018. (See “Emission Factors” for additional information.)

Risk Estimates. Cancer risks were estimated by combining the exposure concentration at each receptor location with the residential exposure factors and chemical-specific potency factors, as described in Section 10. The chronic noncancer hazards were calculated by dividing the long-term exposure levels and intake by the chronic reference exposure levels. The intake methodology recommended by OEHHA includes consideration of the health impacts on children related to their greater sensitivity from early exposure to carcinogenic compounds. Multipathway toxicity factors and reference exposure levels were used, when available from OEHHA, to account for additional exposures through noninhalation pathways. Annual PM_{2.5} concentrations were also estimated for comparison to the thresholds.

The modeled screening values are refined estimates reflective of fall 2021 passenger train schedules and 2020 fuel use for freight. In most cases, further modeling from the rail sources will not be necessary unless the train schedule changes, the emission factors/fuel use/fuel blends are updated, new routes/services are added, or changes are made to freight transport. The project sponsor may rerun the modeling analysis using meteorology or other factors to ensure consistency with the project analysis. As previously noted, the screening map quantified impacts related only to Class I line-haul and commuter/passenger rail service. Health impacts from Class III line-hauls, short rail lines, and railyards are not incorporated in the screening map; therefore, project sponsors are encouraged to quantify these emissions if these sources are located close to their project sites. Section 7 provides methods for refining the estimates from locomotive engines operating along passenger/commuter rail.

9.4 SELECT RAILYARDS

The rail source screening maps include health impacts from select railyard located in communities where the Air District has conducted a detailed community-scale modeling assessment under California AB 617. The Air District implemented the AB 617 program in 2018 by partnering with local communities to address long-standing disparities in air quality and related health outcomes. The Community Action Plan (CAP) for West Oakland was adopted by the Air District’s Board of Directors in 2019 while the CAP for Richmond/San Pablo is scheduled to be completed in 2023. Both communities have major railyards that serve as

⁴¹ For simplicity, emissions from all rail services (passenger and freight) were consolidated into single rail lines, which were then modeled in AERMOD.

⁴² Average locomotive heights for Amtrak, Caltrains, and UP locomotives are 15.42 feet, 16.17 feet, and 15.67 feet, respectively, based on results of a Google search on February 8, 2022.

gateways for ferrying goods into the Bay Area and across the country. Figure 11 presents the locations of the railyards included in the rail sources screening map.

Figure 11 Railyards in West Oakland and Richmond



Three railyards operate in West Oakland within the boundaries of the Port of Oakland (Port) area. The Port has two railyards on its property: Oakland International Gateway (OIG) railyard, which is leased by BNSF, and Outer Harbor Intermodal Terminal, which is operated by Oakland Global Rail Enterprise (OGRE), on the former Oakland Army Base. BNSF is a Class I interstate railroad that serves as a transfer point for Port cargo containers. OGRE is a small regional Class III railroad serving portions of the former Oakland Army Base. A UP railyard is also located within the Port area, but it is privately owned and operated. It serves as an intermodal yard for freight movements through the Port, as well as a yard for handling domestic non-Port freight.

BNSF operates two railyards in Richmond located near each other: (1) Richmond Proper Yard, located at 303 S Garrard Boulevard, and (2) Richmond Main Yard (known as Richmond Auto Yard), located at 861 Wharf Street. The Proper Yard receives all incoming trains carrying manifest cargo and intermodal cars before being diverted by rail to other BNSF yards or customer sites. The Auto Yard is used primarily as an automotive storage facility for imported cars that arrive by switcher locomotive or that are individually driven from Potrero Point Marine Terminal. The loaded rail cars are then shunted to the Proper Yard for transport. United Parcel Service (UPS) operates the third railyard in Richmond, called the North Bay Yard, located at 1601 Atlas Road. The North Yard serves as an important transportation link for shipping packages from the Bay Area to Chicago and the rest of the country. A fourth yard, located at the Potrero Point Marine Terminal, moves imported cars from the terminal to the Proper Yard for shipping across the country.

Emissions. A bottom-up inventory was developed for each of these railyards and is described in detail in the technical appendix attached to the respective Community Action Plan. A summary of the sources included in the inventory and the estimated emissions are presented in Table 29. In general, inventories were composed of emissions from arriving-departing line-haul locomotives, switching and yard locomotives used to move railcars within the yard, and heavy-heavy duty diesel trucks. For trucks, emissions were estimated for running exhaust, brake and tire wear, and resuspended entrained road dust. Additional sources, such as cargo-handling equipment and transport refrigeration units, were included for yards where activity data were available. Because these emissions are reflective of the base year, the project sponsor is cautioned to adjust the inventory and the corresponding health impacts to account for year-to-year activity changes. As noted in Table 30, not all sources associated with each railyard are included in the map as permitted sources, and some mobile sources were combined into a single inventory for ease in modeling.

Table 30 **Railyard Sources and Emissions Modeled under AB 617**

City	Railyard/Year	Sources	Diesel PM Emissions (tons per year)	PM _{2.5} Emissions (tons per year)
Oakland	BNSF OIG Yard (2017)	Line haul	0.007	0.007
		Switcher	0.175	0.161
	OGRE Army Base (2017)	Switcher	0.077	0.071
	UP Railyard (2017)	Line haul	0.049	0.049
		Switcher	0.85	0.85
		Rail operations	0.213	0.195
Richmond	BNSF Auto Yard (2019)	Switcher	0.140	0.129
		Trucks	0.0039	0.0092
	BNSF Proper Yard (2019)	Line haul	0.064	0.059
		Switcher	0.243	0.224
		Trucks	0.0039	0.0092
		TRUs	0.0055	0.005
	UPS North Bay Yard (2019)	Line haul	0.096	0.088
		Switcher	0.281	0.258
		Trucks	0.028	0.065
	Point Potrero Yard (2019)	Line haul	0.061	0.056
		Cargo-handling equipment	0.000238	0.00226

Notes: BNSF = Burlington Northern Santa Fe Corporation; OGRE = Oakland Global Rail Enterprise; OIG = Oakland International Gateway; TRU = transportation refrigeration unit; UP = Union Pacific; UPS = United Parcel Service.

Modeling. To configure sources for AERMOD, the Air District identified individual areas representing the source activities. In most cases, separate areas were delineated in the model to represent line-haul, switcher, and truck activities. When the activities could not be bound to separate areas, a single source area was used, and emissions from all activities were combined in the modeling. Emissions from each of sources were distributed uniformly throughout the area source and were assumed to be constant in time. A release height of 4.78 meters was used for line-haul locomotives and switchers operating at the railyards. *Szinit* was set to 3.78 meters, based on the equations for on-road mobile sources. Heavy-heavy duty trucks were assumed to have a release height of 5.5 meters and *Szinit* of 2.56 meters, consistent with the previous HRA performed by CARB for West Oakland.⁴³ Additional modeling details can be found in the technical appendix of each of the respective Community Action Plans.

Risk Estimates. Cancer risks were estimated by combining the exposure concentration at each receptor location with the residential exposure factors and chemical-specific potency factors, as described in Section 10. The chronic noncancer hazards were calculated by dividing the long-term exposure levels and intake by the chronic reference exposure levels. The intake methodology recommended by OEHHA includes

⁴³ For the *West Oakland Action Plan*, different release heights were used to model heavy-heavy duty trucks in railyards versus roadways to be consistent with CARB's Diesel Particulate Matter Health Risk Assessment for West Oakland. Project sponsors, however, are encouraged to use the same release heights for similar vehicle classes in their air quality analysis.

consideration of the health impacts on children related to their greater sensitivity from early exposure to carcinogenic compounds. Multipathway toxicity factors and reference exposure levels were used, when available from OEHHA, to account for additional exposures through noninhalation pathways. Annual PM_{2.5} concentrations were also estimated for comparison to the thresholds.

The modeled screening values for each railyard reflect 2017 (West Oakland) or 2019 (Richmond) conditions. The project sponsor can further refine the estimates depending on changes in activity level, updated emissions factors, inclusion of other sources, or demarcation of source areas. As previously noted, the screening map quantifies the impacts from the highest-emission sources at railyards, but minor sources should not be ignored if they are deemed significant based on their proximity to residential receptors.

9.5 DISTANCE DECAY FACTORS

The Air District developed decay factors embedded in the Health Risk Calculator that can be applied to the stationary source screening map to reflect reduced air concentrations (and associated health impacts) from atmospheric mixing after the pollutant is released. Category-specific decay factors were developed for GDFs and diesel combustion engines (generators). These decay factors are to be used only in conjunction with the screening health risk values for diesel engines and gas stations and may not be used for other source types. General decay factors were developed for application to all remaining sources. The following sections describe the methodology used to develop each category specific decay factor.

Gas Stations. The decay factors for gas stations were created by running AERMOD multiple times under multiple conservative modeling scenarios. Representative meteorological data from several cities were used in conjunction with various building configurations and release parameters. The worst-case Chi/Q (predicted air concentration based on emission of 1 gram per second) was selected based on the various modeling runs, to create decay factors at set distances away from the station (Table 31). The decay factors for GDFs are used to assess only cancer risks and hazards; gas stations do not emit fine particulate matter.

The Air District plans to discontinue use of the decay factors listed in Table 30 in future iterations of the GDF screening values. Starting in July 2022, GDF screening values will be derived following the recommended procedures for preparing gas station emission inventories and HRA outlined in CARB's Gasoline Service Station Industrywide Risk Assessment Technical Guidance. Project sponsors can use the available screening tool from CARB to estimate cancer risk, chronic hazard, and acute hazard from gas stations using permitted throughput limits.

Table 31 Gas Station Decay Factors

Distance (feet)	Decay Factor (unitless)	Distance (feet)	Decay Factor (unitless)
66	1.000	541	0.040
82	0.728	558	0.038
98	0.559	574	0.036
115	0.445	590	0.034
131	0.365	607	0.033
148	0.305	623	0.031
164	0.260	640	0.030
180	0.225	656	0.029
197	0.197	672	0.028
213	0.174	689	0.027
230	0.155	705	0.026
246	0.139	722	0.025
262	0.126	738	0.024
279	0.114	754	0.023
295	0.104	771	0.022
312	0.096	787	0.022
328	0.088	804	0.021
344	0.082	820	0.020
361	0.076	836	0.020
377	0.071	853	0.019
394	0.066	869	0.018
410	0.062	886	0.018
426	0.058	902	0.017
443	0.055	918	0.017
459	0.052	935	0.016
476	0.049	951	0.016
492	0.046	968	0.015
508	0.044	984	0.015
525	0.042		

Diesel Internal Combustion Engines. Internal combustion engines, such as those used in standby generators and fire pumps, are commonly found in most commercial buildings to provide emergency power during power outages. To develop decay factors for these internal combustion engines, 150 air dispersion scenarios were run using AERMOD. The modeling runs included assumptions for various stack release parameters, two dozen building configurations for downwash considerations, and six different meteorological data sets. The worst-case Chi/Q from the modeling analysis was selected to create the decay factors presented in Table 32. The decay factors represent the diminished exposure (and cancer risk and fine PM concentrations) based on distance from the exhaust stack related to atmospheric mixing. To

ensure that the decay factors are conservative, results from the HRA found in several permit applications were compared against the screening values and adjusted accordingly, using the decay factor for the maximum exposure residential receptor. As designed, the screening value results (adjusted with the decay factors) were above the cancer risks threshold in 85 percent of the cases. For the remaining 15 percent of the cases, the adjusted screening values were below the cancer risk threshold. Based on this assessment, the Air District concluded that the screening map, when adjusted with the appropriate decay factors, provides a conservative estimate of potential cancer risks.

Table 32 Diesel Engine Decay Factors

Distance (feet)	Decay Factor (unitless)	Distance (feet)	Decay Factor (unitless)
82	0.8500	492	0.1200
98.4	0.7300	525	0.1000
115	0.6400	590	0.0900
131	0.5800	656	0.0800
164	0.5000	722	0.0700
197	0.4100	787	0.0600
230	0.3100	853	0.0500
262	0.2800	918	0.0400
295	0.2500	984	0.0155
328	0.2200	1,050	0.0120
361	0.1800	1,115	0.0092
394	0.1600	1,181	0.0071
426	0.1500	1,246	0.0054
459	0.1400		

General Sources. For all other source types (i.e., those that are not diesel engines or gas stations), a general decay factor was developed to conservatively reduce exposure point concentrations and associated risks based on distance from the source. Various modeling analyses using both stack (point) and area source release parameters were run using EPA's SCREEN3 model. Evaluation of the results at various receptor distance found that analysis using the area source produced the most conservative and consistent decay factors compared to the stack, where peak downwind concentrations were dependent on the stack height and release strength. Area source dimensions were modeled from 5 to 50 feet in length with release heights from ground level to 20 feet. The rural land use option was selected over the urban option because it produced more gradual, conservative decay factors. Table 33 presents the decay factors that can be applied to all sources not classified as a gas station or internal combustion engine.

Table 33 Generic Decay Factors

Distance (feet)	Decay Factor (unitless)	Distance (feet)	Decay Factor (unitless)
33	0.883	525	0.330
49	0.855	541	0.319
66	0.827	558	0.309
82	0.801	574	0.299
98	0.775	591	0.290
115	0.750	607	0.280
131	0.726	623	0.271
148	0.702	640	0.262
164	0.679	656	0.254
180	0.658	673	0.246
197	0.636	689	0.238
213	0.616	705	0.230
230	0.596	722	0.223
246	0.577	738	0.216
262	0.558	755	0.209
279	0.540	771	0.202
295	0.523	787	0.195
312	0.506	804	0.189
328	0.489	820	0.183
344	0.474	837	0.177
361	0.458	853	0.171
377	0.444	869	0.166
394	0.429	886	0.160
410	0.415	902	0.155
427	0.402	919	0.150
443	0.389	935	0.145
459	0.376	951	0.141
476	0.364	968	0.136
492	0.353	984	0.132
509	0.341		



10 ESTIMATING HEALTH RISK AND HAZARD

HRA is decision-making tool used to assess whether potential emissions emanating from a facility or project may be harmful to local residents. HRA combines the annual average chemical concentrations predicted using an air dispersion model from Section 3.1 by the chemical intakes and chemical-specific toxicity values provided here. The outcome is a cancer risk and hazard index that can be used for comparisons to applicable thresholds. The cancer risk is the incremental probability that an individual will develop cancer over a lifetime as a direct result of exposures to potential carcinogens from anthropogenic sources. The estimated risk is a unitless probability, often expressed as chances in a million. A hazard index is used to assess noncancer health impacts for different exposure scenarios (chronic and acute). A hazard index is the ratio of the potential exposures to a chemical by the levels at which no adverse effects are expected.

At present, EPA has defined de minimis risks for carcinogens as being within the range of 10^{-4} to 10^{-6} excess lifetime cancer risk. The Air District uses 10^{-5} (10 in a million) excess lifetime cancer risk as a point of departure, meaning that a higher risk is deemed unacceptable on a project basis. Year 2021 amendments to Regulation 2-5 have limited the cancer risk to 6 in a million for designated communities that are overburdened by air pollution and other health disparities. At this time, the Air District is not proposing to change the cancer risk threshold to align with amendments made in Regulation 2-5. It should be noted that the risk of cancer described here is an increased probability of contracting cancer during a lifetime as a result of exposure to toxics from a project. It does not represent an actual incidence of cancer in an exposed population, nor does it equate to deaths from cancer, because not every cancer case results in death. A hazard index of 1.0 is the target threshold for assessing noncancer hazards by project, although a value greater than 1.0 does not necessarily correlate to a statistical probability of harm.

The following sections present the risk assessment methodology for estimating risks and hazards consistent with the Air District's regulation.

10.1 CANCER RISK

Cancer risks are calculated over an assumed 30-year exposure duration averaged over a 70-year lifetime combined with the annual average chemical concentrations, chemical intakes, and chemical-specific toxicity factors. The chemical concentrations are modeled using site-specific release parameters, from the point of release to the exposure point at the downwind receptor locations, as described in Section 2.1. The chemical intake or dose describing the frequency and duration of the exposure is estimated using receptor's breathing rates, exposure duration, and exposure frequency. In accordance with OEHHA's revised HRA guidelines (2015) and *Technical Support Document for Cancer Potency Factors* (OEHHA 2009), the Air District has adopted an intake methodology that addresses children's greater sensitivity and health impacts from early exposure to carcinogenic compounds. The updated calculation procedures include the use of age-specific weighting factors, breathing rates, fraction of time at home, and reduced exposure durations. Each factor is described below and presented in Table 34:

- ▶ Age sensitivity factors account for the heightened sensitivity of children to carcinogens during fetal development and early childhood. Consistent with OEHHA, the Air District uses a factor of 10 for exposures that occur from the third trimester of pregnancy to 2 years of age, 3 for exposures that occur from 2 years through 15 years of age, and 1 for all other age groups. The Air District has been incorporating age sensitivity factors into its permitting processes since 2010.
- ▶ Daily breathing rates are the age-specific daily air intake. OEHHA developed a range of rates for four age groups: last trimester to newborn, newborn to 2 years of age, 2 years to 16 years of age, and older than 16 years of age. Consistent with recommendations by CAPCOA and CARB, the Air District uses the 95th percentile breathing rates for the most sensitive age groups (less than 2 years of age) and 80th percentile for all other age groups.
- ▶ Fraction of time at home (FAH) refers to the estimated amount of time residents stay at home. In past HRAs, the Air District assumed that residents are home 24 hours a day, 7 days a week. OEHHA in its 2015 Risk Assessment Guidance recommends less than 100 percent of the time based on population and activity statistics. Consistent with OEHHA, the Air District recommends an FAH of 0.73 for 16 to 30 year olds and 1 for under 16 to address exposures at local schools close to emitting facilities.
- ▶ Exposure duration is the length of time that an individual is continuously exposed to air toxics. Previously, the Air District used a 70-year lifetime exposure duration for residents over a 70-year lifespan. Based on updated demographic data, the Air District follows OEHHA's recommendation of a 30-year exposure duration, consistent with EPA, for residents.

Table 34 presents a summary of the exposure factors for residents, off-site workers, and students.

Table 34 Exposure Factors

RESIDENTIAL RECEPTORS

Factor	Units	Age Group: Last Trimester to Newborn	Age Group: 0 to 2 Years Old	Age Group: 2 to 16 Years Old	Age Group: > 16 Years Old
Daily breathing rate	liters/kg-day	361	1,090	572	261
Age sensitivity	unitless	10	10	3	1
Fraction of time at home	unitless	1	1	1	0.73
Exposure duration	years	0.25	2	14	14
Exposure frequency	days/year	350			

OFF-SITE WORKERS

Factor	Units	Values
Daily breathing rate	liters/kg-8 hrs	230 (95% percentile 8-hour breathing rate for 16- to 70-year-olds)
Age sensitivity	unitless	1
Exposure duration	years	25
Exposure frequency	days/year	250

STUDENTS/DAYCARES

Factor	Units	Age Group: 0 to 2 Years Old	Age Group: 2 to < 16 Years Old
Daily breathing rate	liters/kg-8 hrs	1,090	520
Age sensitivity	unitless	10	3
Exposure frequency	days/year	350	180–350
Exposure duration	years	Cumulative, maximum years children will be attending school and/or daycare	Cumulative, maximum years children will be attending school and/or daycare

¹ Based on the maximum number of days children will be present at the school or daycare, including classroom instruction, summer schools/camps, afterschool programs, and athletic programs.

The factors are combined in the following equation to calculate the dose, an expression describing the chemical intake of an individual over their lifetime:

$$E_{VC,FT,Pr,Pol,L} = \sum_{h=1}^{24} VMT(h)_{VC,FT,L} \cdot EF(s(h))_{VC,FT,Pr,Pol}$$

where:

$Dose_i$ = Accumulated dose for an individual breathing carcinogen i for 30 continuous years (mg/kg-day)

CF = Conversion factor (10^{-6} mg-m³/μg-L)

- EF = Exposure frequency (350 days per year⁴⁴)
 DBR_j = Daily breathing rate during year j (L/kg-day)
 FAH_j = Fraction of time at home during year j (unitless)
 ED_j = Exposure duration of year j (years)
 $C_{i,j}$ = Annual average concentration for pollutant i during year j ($\mu\text{g}/\text{m}^3$) equal to the emission rate (g/sec) multiplied by the source type Chi/Q (dilution factor $\mu\text{g}/\text{m}^3$ per g/sec)
 ASF_j = Age sensitivity factor for year j ; the value of the factor is higher in early years of exposure (unitless)
 AT = Averaging time (25,550 days, equivalent to 70-year lifespan)

Cancer risk is estimated by multiplying the dose in units of milligrams of pollutant per kilogram of body weight per day (mg/kg-day) by the cancer potency factor [CPF: (mg/kg-day)⁻¹]:

$$\text{Cancer Risk} = \text{Dose} \cdot \text{CPF}$$

The CPF is the 95 percent upper confidence limit on the increased cancer risk from a lifetime exposure to a chemical. The potency factors that are used in an environmental clearance document must be those promulgated by OEHHA. These toxicity values can be found at <https://oehha.ca.gov/chemicals>. Some CPFs are available in Table 2-5-1 of Air District Regulation 2-5. However, amendments to the table require approval by the Air District's Board of Directors and thus may not include the most current CPFs available from OEHHA. If a substance is emitted and toxicity values have not been identified by OEHHA, other sources of data and provisional values may be used.

The dose is paired to the route-specific CPFs based on the exposure pathway describing how the individual comes into contact with the chemical. Typically, the air quality analysis addresses impacts related to exposures of volatile organic gases emitted into the air. Because these chemicals do not appreciably deposit to soil, surface waters, or plants, exposures occur mainly through inhalation. However, a small subset of compounds—semi-volatile organic and metal toxicants—are emitted partially or totally as particles subject to deposition. These chemicals can be ingested as they are deposited on soil, absorbed through the skin (dermal), or transferred to an infant through the mother's milk. For all multipathway chemicals, the exposure pathways that must be evaluated for residential, student, and worker scenarios include inhalation, soil ingestion, and dermal contact. Breast milk consumption must be evaluated for residents if polycyclic aromatic hydrocarbons (PAHs), lead, dioxin, furans, or polychlorinated biphenyls (PCBs) are emitted from the project site. Less typical exposure routes, such as ingestion of homegrown produce and fish, may be explored on a site-specific basis.

Table 35 summarizes the possible exposure routes to be considered for any project following OEHHA guidance. Consult with the lead agency to determine which pathways must be considered for the project. To account for the additional risks from exposure to most common noninhalation pathways, multipathway CPFs⁴⁵ from OEHHA are used in combination with the noninhalation dose equation. Project sponsors can also use the

⁴⁴ The screening map uses an exposure frequency of 350 days per year, consistent with OEHHA and EPA guidance. The total of 350 days per year represents the number of days individuals will reside in their home less approximately 2 weeks of vacation.

⁴⁵ Multipathway CPFs are listed in Table 2-5-1 of Regulation 2-5 under CP weighing factors. CP weighing factors can be used in combination with the inhalation dose to estimate risks from multiple pathways. Project sponsors should check the OEHHA web site to ensure that the latest CPFs are being used in the analysis.

following modules to assess multipathway exposures: the Air Dispersion Modeling and Risk Assessment Tool (ADMRT) and the Health Risk Assessment Standalone Tool (RAST) in CARB's HARP2⁴⁶ program.

Table 35 Exposure Pathways

Receptor	Mandatory Exposure Routes	Site Condition–Dependent Exposure Pathway
Resident	▶ Inhalation ▶ Soil ingestion ▶ Dermal exposure to contaminated soil ▶ Breast-milk consumption¹	▶ Homegrown produce ingestion ▶ Angler-caught fish ingestion ▶ Drinking water ingestion ▶ Home-raised animal product ingestion (e.g., cow's milk, meat, and eggs)
Worker	▶ Inhalation ▶ Soil ingestion ▶ Dermal exposure to contaminated soil	
Student	▶ Inhalation ▶ Soil ingestion ▶ Dermal exposure to contaminated soil	

¹ Consideration of the breast-milk consumption pathway is mandatory in the air quality analysis if PAHs, creosotes, lead, dioxin, furans, or PCBs are emitted from the project site.

CARB's Hot Spots Analysis and Reporting Program Version 2 (HARP2) is the recommended model for calculating and presenting HRA results because it follows the risk assessment guidance methodology and is consistent with the Air District's Regulation 2-5. HARP2 can also assess potential health impacts posed by chemicals that must be analyzed using a multipathway (e.g., inhalation and noninhalation) approach. Project sponsors can use the version of AERMOD included in the Air Dispersion Modeling and Risk Tool (ADMRT) of HARP2, or if they are using a vendor-purchased version of AERMOD, the estimated concentrations can be imported from plotfiles as "Import/Calc GLCs" into the ADMRT.

As discussed previously, HRAs performed by the Air District use toxicity values approved by the Air District's Board of Directors in Regulation 2-5. To access the table in ADMRT, select the "use Bay Area AQMD approved health table" option in "Settings" under the "File" heading. To address the health impact from multipathway pollutants, a deposition rate must be entered by the user. The Air District recommends using the conservative rate of 0.05 meter per second for risk assessments if at least one source on the project is not abated with a verifiable control. A deposition rate of 0.02 meter per second may be used if all multipathway pollutant sources have verifiable particulate matter controls and the emitted particulates are in the PM_{2.5} size fraction.

The Air District recognizes that the assumptions used in the risk methodology may be overly conservative, especially when receptors such as workers or students spend less time at a site or if the sources do not operate continuously. Project sponsors can deviate from the prescribed inputs if they provide justification regarding the actual receptor behaviors and activity patterns. Conversely, receptors such as workers may experience higher than estimated coincident exposures when the source emits only when the receptor is present. One of the methods to address the higher exposure is to apply a worker adjustment factor (WAF)

⁴⁶ Available at <https://ww2.arb.ca.gov/our-work/programs/hot-spots-analysis-reporting-program>.

in HARP2 to align the worker hours with the times when the source is emitting. (WAF can be entered under the Inhalation tab by selecting “Use adjustment factors.”) This method can be used even if the source was modeled in AERMOD with noncontinuous emissions.⁴⁷ It should be noted that this method can be applied for adjusting the cancer risk for workers or students but not for residents. The WAF is estimated using the following equation by first adjusting for the hours that a source is emitted and then making a corresponding adjustment accounting for the hours when a receptor will be present at the site:

$$WAF_{Cancer} = \frac{H_{Resident}}{H_{Source}} \cdot \frac{D_{Resident}}{D_{Source}} \cdot DF$$

where:

WAF_{Cancer}	=	Worker adjustment factor for cancer risk
$H_{Resident}$	=	Hours per day of residential exposure (24 hours)
H_{Source}	=	Number of hours per day that the source operates (hours)
$D_{Resident}$	=	Number of days per week that the resident is exposed (7 days)
DF	=	Discount factor (unitless)

The discount factor accounts for situations when the receptor is present at the site, but the source is not emitting:

$$DF = \frac{H_{Coin}}{H_{Worker}} \cdot \frac{D_{Coin}}{D_{Worker}}$$

where:

DF	=	Discount factor (unitless)
H_{Coin}	=	Hour per day that the receptor’s schedule coincides with when the source is emitting (hours)
H_{Worker}	=	Hours that the receptor is at the site per day (hours)
D_{Coin}	=	Number of days per week that receptor’s schedule coincides with when the source is emitting (days)
D_{Worker}	=	Number of days that the receptor is at the site per week (days)

A discount factor of 1 should be used in cases where the source is emitting at all times when the receptor is present at the site. For example, the WAF for the case when the source and the worker follow a standard work schedule (i.e., DF equal to 1) is $4.2 = 24 \text{ hrs}/8 \text{ hrs} \cdot 7 \text{ days}/5 \text{ days} \cdot 1$. This example emphasizes the importance of adjusting the estimated cancer risks using WAF for a noncontinuous source because the nonadjusted cancer risk would be underestimated by 420 percent. The increased cancer risk is attributed to the worker being exposed to 100 percent of the annual emissions from the source because the source operates only when workers are at the site rather than the typical 23 percent if the same source emissions were evenly distributed throughout the year. A good example is a construction site where nonfugitive emissions occur from workers operating off-road equipment and related construction activities at the job site.

Care should be taken if the WAF is used in the assessment, and justification should be provided to support the facility operating hours and the worker or student schedule. The Air District cautions that if the WAF is used to characterize the risk to students, care should be taken to ensure that the number of days and

⁴⁷ Adjustments to the source emissions for noncontinuous sources should follow the methodology outlined in Section 3.6 to ensure that a full year of emissions are modeled.

hours that students are present at the site is accurate and conservative. For example, many schools offer on-site early morning drop-offs and afterschool programs to care for students with working parents. Athletic programs may also be offered at the schools with practices and games scheduled after school or during the weekends. By restricting the hours of operation used in the modeling for noncontinuous sources, the project will be required to accept the modeled emissions schedule as a permit condition after the environmental document is certified.

For projects that operate a mixture of continuous and noncontinuous sources, the WAF cannot be applied in HARP2 because the adjustment will be applied to all sources within the modeling run, resulting in a significant overestimation of cancer risk from continuously operating sources. Another way of handling this situation is to adjust the unit emissions using the WAF on noncontinuous sources to avoid additional modeling runs. However, a separate dispersion run will be required to estimate the worker chronic hazard where the adjustment is removed because the WAF does not apply to noncancer health impacts.

The project sponsor may take other site-specific considerations into account when estimating the dose given sufficient justification. For example, the exposure duration of 30 years may be reduced to accommodate a shorter period, such as temporary housing at a shelter, hostel, or transitional home. Project sponsors may also consider reduced exposures by accounting for the time receptors spend on-site. It is recommended that the project sponsor analyzes the project's risk and hazards using the standard assumptions before making any adjustments to the exposure duration. Only in cases where the project exceeds the threshold should additional modifications be considered. The project sponsor should keep in mind that the activity patterns of the most vulnerable populations (i.e., infants and seniors) may prove to be the most conservative receptor.

It is not permissible to omit sources or pollutants from a project in an environmental clearance document unless the source has negligible health impacts. An HRA must include all sources of emissions that will emanate from a project, including all sources of potential emissions whether or not they are subject to the Air District permitting requirements. The permitting process excludes most mobile source emissions and emissions from exempt sources and focuses primarily on sources subject to the Air District regulation in the permit application. Additionally, all sources that emit for which OEHHA has identified a toxicity value must be included in the HRA. Risks are not estimated for chemicals lacking OEHHA-approved toxicity values. A challenge to the completeness of the risk assessment can be made if sources or pollutants are omitted. The total chances per million cancer risk for the project is the sum of the pollutant-specific risk values from all sources associated with the project.

10.2 CHRONIC NONCANCER HAZARD

Hazard is the potential for developing noncarcinogenic health effects as a result of exposures to chemicals over the exposure period. Unlike cancer risk, hazard is not a probability but is a measure estimated as a ratio of the magnitude of the receptor's exposure relative to a chemical-specific reference level that poses no appreciable health effect to all receptors (including sensitive populations). Two types of hazards are used in risk assessment, depending on the timeframe of the exposures: acute for short-term, 1-hour exposures and chronic for long-term exposures. This section discusses the chronic long-term hazard, and Section 10.3 discusses the acute hazard.

Hazard is based on the concept that there is a level of exposure below which no adverse effects will be observed, referred to as the reference exposure level (REL). The REL is the estimated daily exposure concentration that a person can be exposed to without any adverse effects. RELs are designed to be protective of the most sensitive individuals within the population, so it is not necessary to incorporate factors such as breathing rates, exposure frequency, or other age sensitivity values, used in the cancer dose, to determine the hazard. Only RELs available from OEHHA should be used in any risk analysis (<https://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary>), and although RELs are listed in Table 2-5-1 of the Air District's Regulation 2-5, project sponsors should ensure that they are using the most current values.

The noncancer chronic hazard is calculated by dividing the annual average concentration, estimated from the air dispersion model, by the REL for that chemical:

$$HQ_i = \frac{C_i}{REL_i}$$

where:

HQ_i = Hazard quotient for exposure to chemical i (unitless)

C_i = Annual average concentration of chemical i ($\mu\text{g}/\text{m}^3$)

REL_i = Chronic noncancer reference exposure level for chemical i ($\mu\text{g}/\text{m}^3$)

A hazard quotient is used to describe the exposure to a single chemical through a single exposure pathway (e.g., inhalation). In accordance with OEHHA's risk assessment guidelines, chronic noncancer hazards should be assessed for both inhalation and noninhalation (e.g., ingestion and dermal contact) chronic exposures. Similar to CPF, multipathway RELs⁴⁸ are available to assess health impacts on receptors from all applicable exposure pathways. Project sponsors are encouraged to use the available modules in CARB's HARP2 program to assess the noncancer hazard index from multipathway exposures. Pollutants that have OEHHA-approved toxicity values must be included in the chronic hazard estimates. A challenge to the completeness of the risk assessments can be made if these substances are omitted.

The total noncarcinogenic hazard attributable to exposure to all chemicals through a single exposure pathway is known as the hazard index (HI). Although it is common practice to sum the contribution across all HIs, the formal methodology is to sum the individual hazard quotients (HQs) for chemicals affecting the same toxic endpoint, target organ, or organ systems. For the purposes of the risk assessment, it is reasonable to estimate the receptor's total hazard as the sum of the HIs across all pathways regardless of the portal of entry associated with each exposure pathway or the unique toxic endpoint and toxicity mechanism. The resulting HI should then be compared against the threshold of 1. If the total HI exceeds the hazard threshold, then further evaluation can be taken to determine whether:

- one or more chemicals has an HQ exceeding the threshold or

⁴⁸ Multipathway RELs are listed in Table 2-5-1 of Regulation 2-5 under CREL weighing factors. CREL weighing factors can be used in combination with estimated exposure concentration to estimate the hazard from multiple pathways. Project sponsors should check the OEHHA website to ensure that the latest CPFs are being used in the analysis.

- the summation of several chemical-specific HQ by health effect or target organ, each less than the threshold, results in an exceedance.

In the first case, the presence of at least one chemical-specific hazard that is greater than the threshold indicates a potential for noncarcinogenic health effects. For the second case, a detailed analysis is required whereby the total HI is summed according to major health effects or a target organ/system being affected. Generally, health effects from exposure to multiple chemicals through multiple pathways that target different organs are not additive and thus, summing HI across all chemicals, pathways, and organs may result in an overestimation of the noncarcinogenic hazard. Each segregated HI by health effects and/or target organ should be compared against the threshold. If the segregated HI exceeds the threshold, there is a potential for noncarcinogenic health effects. However, if all the segregated HI are less than the target hazard level, then the project is not likely to cause noncarcinogenic health effects from exposure to project-related chemicals.

10.3 ACUTE NONCANCER HAZARD

The acute hazard is described as the potential noncarcinogenic effects resulting from short-term exposures—in this case, 1 hour of exposure. The potential for acute noncancer hazards is evaluated by comparing the maximum short-term exposure level to an acute REL following the same methodology for chronic hazard. The acute REL is a chemical concentration level at or below which no adverse health effects are anticipated by sensitive individuals exposed for 1 hour. Acute RELs are available from OEHHA at <https://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary> and in Table 2-5-1 of the Air District's Regulation 2-5, although project sponsors should verify that they are using the most current values.

The acute noncancer hazard is calculated by dividing the maximum 1-hour concentration, estimated from the air dispersion model, by the acute REL for that chemical:

$$HQ_{acute} = \frac{C_{one\ hr\ max}}{REL_{acute}}$$

where:

HQ_{acute}	=	Acute hazard quotient for exposure to chemical i (unitless)
$C_{one\ hr\ max}$	=	1-hour maximum concentration of chemical i ($\mu\text{g}/\text{m}^3$)
REL_{acute}	=	Acute noncancer reference exposure level for chemical i ($\mu\text{g}/\text{m}^3$)

In accordance with OEHHA's risk assessment guidelines, acute noncancer hazards should be assessed only for the inhalation exposure pathway.

As with the chronic noncancer calculation, for multiple substances that affect the same organ system, the individual substance HQs are summed to determine the HI. Project sponsors can take the reasonable step of estimating the receptor's total acute hazard as the sum of the HIs across all pathways regardless of the toxic endpoint and toxicity mechanism. Further evaluation of comparing the individual chemical HI or segregating HI based on target organ/system can be performed if the total hazard exceeds the acute threshold. If all the segregated acute HI are less than the target hazard level, then the project is not likely to cause noncarcinogenic health effects from exposure to project-related chemicals.

This page intentionally left blank.



11 CUMULATIVE ANALYSIS

Cumulative analysis is the aggregation of health impacts from multichemical and multipathway exposures from all significant sources (stationary and mobile sources) to receptors living within a geographic area of the project. The primary aim of the cumulative analysis is to inform the project sponsor and the lead agency about the public health implications associated with the project. The results of the cumulative analysis can be used in an explicit analysis to identify targeted risk mitigation strategies on sources, chemicals, or pathways that most contribute to the receptors' risk.

The Air District recommends the following step-wise process for conducting a cumulative analysis, and project sponsors are encouraged to review the referenced subsection for additional information:

- ▶ Determine the project radius for inclusion of sources in the cumulative analysis (see Section 2.2). The project radius is based on the distance from either the new source or the receptor depending on the type of project.
- ▶ Identify all present and foreseeable future sources within the project radius (see Section 2.3). The sources may include highways and high-volume roadways, truck distribution centers, ports, railyards, rail lines, refineries, airports, chrome plating facilities, crematoriums, dry cleaners using perchloroethylene, airports, standby and prime generators, and GDFs.
- ▶ Use the source-specific CEQA screening tools, described in Section 9, to estimate the cancer risk, chronic hazards, and PM_{2.5} concentrations from surrounding sources.

- ▶ Estimate the cancer risk, chronic hazard, and PM_{2.5} concentrations from significant sources where screening tools are not available. Project sponsors can use the guidance found in Sections 5–8 for additional assistance.
- ▶ Sum the individual cancer risk, chronic hazard, and PM_{2.5} concentrations from all sources and the project's contribution to nearby receptors surrounding the project site.
- ▶ Compare the project's cumulative cancer risks, chronic hazards, and PM_{2.5} concentrations against the applicable cumulative thresholds (see Section 1.2) to conclude whether a public health concern exists.

Where the project involves construction prior to operation, the Air District recommends that the exposure duration for the health risk analysis start during construction and continues through to the operations. For example, if construction is anticipated to occur for 3 years, then the residential exposure starts with an unborn child at the third trimester (when construction begins) and continues until the child is 2.75 years of age. The child is then exposed to the project operations through adulthood for another 27.25 years. The maximum impacted receptor may be at separate locations during construction versus operations as new sources are installed. In that case, the project sponsor has the option of summing the contribution to the maximum exposed individual from construction and operations regardless of the location or determining the maximum exposed individual by summing the contribution from construction and operations across multiple receptor locations surrounding the project. The project-level results from combined construction and operations can then be compared against the project-level thresholds of significance. The Air District recommends that a second air quality analysis be included for 30 years of operations from the project if emissions from operations exceed the construction impacts. Like the project-level analysis, operational and construction impacts from the project are aggregated with the risks, hazards, and PM_{2.5} concentrations associated with the surrounding sources to assess cumulative impacts. If the cumulative impacts from the combined project and surrounding sources are above the cumulative thresholds, the project is cumulatively considerable and mitigations may be warranted.



12 REFERENCES

AASHTO. See American Association of State Highway and Transportation Officials.

American Association of State Highway and Transportation Officials. 2018. *A Policy on Geometric Design of Highways and Streets*. Seventh edition. Washington, DC.

BAAQMD. See Bay Area Air Quality Management District.

Bay Area Air Quality Management District. 2006. *Permit Handbook*. Available:

<https://www.baaqmd.gov/~media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en>.

———. 2012 (November). *Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area*. Available:

https://www.baaqmd.gov/~media/Files/Planning%20and%20Research/Plans/PM%20Planning/ParticulatesMatter_Nov%207.ashx.

———. 2020 (December). *BAAQMD Health Risk Assessment Modeling Protocol*. Available:

https://www.baaqmd.gov/~media/files/ab617-community-health/facility-risk-reduction/documents/baaqmd_hra_modeling_protocol-pdf.pdf?la=en.

———. 2022. *California Environmental Quality Act (CEQA) Guidelines*. Available:

<https://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/updated-ceqa-guidelines>.

- California Air Pollution Control Officers Association. 2009. *Health Risk Assessments for Proposed Land Use Projects*. Available: http://www.capcoa.org/wp-content/uploads/2012/03/CAPCOA_HRA_LU_Guidelines_8-6-09.pdf.
- California Air Resources Board. 2021a. *Gasoline Service Station Industrywide Risk Assessment Technical Guidance*. Available: <https://ww2.arb.ca.gov/resources/documents/gasoline-service-station-industrywide-risk-assessment-guidance>.
- . 2021b. Appendix H: “2021 Update to the Emission Inventory for Commercial Harbor Craft: Methodology and Results.” Available: <https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2021/chc2021/apph.pdf>.
- . 2021c. *Miscellaneous Process Methodology 7.9: Entrained Road Travel, Paved Road Dust*. Available: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/2021_paved_roads_7_9.pdf.
- . 2021d. *EMFAC2021 Volume I – User’s Guide*. Available: <https://arb.ca.gov/emfac/>.
- . n.d. *Use of Back-Up Engines for Electricity Generation during Public Safety Power Shutoff Events*. Available: <https://ww2.arb.ca.gov/resources/documents/use-back-engines-electricity-generation-during-public-safety-power-shutoff>.
- California Department of Transportation. 2019. CT-EMFAC2017. Report CTAQ-RT-19-368.02.07. Prepared by S. Bai, A. Seagram, L. Churchman, G. Parajon, A. Ekstrand, Y. Du, and J. West. Available: <http://www.dot.ca.gov/env/air/ctemfac-license.html>.
- CAPCOA. See California Air Pollution Control Officers Association.
- Cimorelli, A. J., S. G. Perry, A. Venkatram, J. C. Weil, R. J. Paine, R. B. Wilson, R. F. Lee, W. D. Peters, R. W. Brode, and J. O. Paumier. 2002 (October 31). *AERMOD Model Formulation and Evaluation*. EPA-454/R-02-002d. U.S. Environmental Protection Agency. Available: https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/aermod_mfed.pdf.
- Environ. See Environ International Corporation.
- Environ International Corporation. 2008 (March 14). *Revised Port of Oakland 2005 Seaport Air Emissions Inventory*. Available: https://www.portofoakland.com/files/pdf/environment/airEmissions_Inventory.pdf.
- EPA. See U.S. Environmental Protection Agency.
- Office of Environmental Health Hazard Assessment. 2009 (May). *Technical Support Document for Cancer Potency Factors: Methodologies for Derivation, Listing of Available Values, and Adjustments to Allow for Early Life Stage Exposures*. Available: <https://oehha.ca.gov/media/downloads/cnr/tsdcancerpotency.pdf>.
- . 2015 (February). *Air Toxics Hot Spots Program: Risk Assessment Guidelines—Guidance Manual for the Preparation of Health Risk Assessments*. Available: <https://oehha.ca.gov/media/downloads/cnr/2015guidancemanual.pdf>.

- Paine, R. J., R. W. Brode, R. B. Wilson, A. J. Cimorelli, S. G. Perry, J. C. Weil, A. Venkatram, W. D. Peters and R. F. Lee. 2003. AERMOD: The Latest Features and Evaluation Results. Paper # 69878 presented at the Air and Waste Management Association 96th Annual Conference and Exhibition, June 22–26, 2003. Air and Waste Management Association. Pittsburgh, PA.
- U.S. Environmental Protection Agency. 1990. Stack Heights, Section 123, Clean Air Act, 40 CFR Part 51. Research Triangle Park, NC.
- . 1992 (October). *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources*. Revised. EPA-450/R-92-019. Available: https://www.epa.gov/sites/default/files/2020-09/documents/epa-454r-92-019_ocr.pdf.
- . 1995. *SCREEN3 Model User's Guide*. EPA-454/B-95-004. Office of Air Quality Planning and Standards. Research Triangle Park, NC.
- . 1998. *Revised Draft - User's Guide for the AMS/EPA Regulatory Model – AERMOD*. Office of Air Quality Planning and Standards. Research Triangle Park, NC.
- . 2001. Appendix W to Part 51 Guideline on Air Quality Models, 40 CFR Part 51. Research Triangle Park, NC.
- . 2008 (January). *AERSURFACE User's Guide*. EPA-454/B-08-001. Available: <https://nepis.epa.gov/Exe/ZyNET.exe/P1009S1K.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C06THRU10%5CTXT%5C00000024%5CP1009S1K.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1>.
- . 2011. Air Pollution (AP) report *AP-42 Compilation of Air Pollutant Emissions Factors, Volume I: Chapter 13.2.1, "Paved Roads."* Available: <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-13-miscellaneous-0>.
- . 2012 (March 2). Haul Road Workgroup Final Report Submission to EPA-OAQPS. Memorandum from Tyler Fox, Leader of the Air Quality Modeling Group, C439-01. Available: https://www.epa.gov/sites/default/files/2020-10/documents/haul_road_workgroup-final_report_package-20120302.pdf.
- . 2015a (August 3). *AERMOD Implementation Guide*. Revised. Prepared by AERMOD Implementation Workgroup, Office of Air Quality Planning and Standards, Air Quality Assessment Division. Research Triangle Park, NC. Available: https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/aermod_implementation_guide.pdf.
- . 2015b (November). *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM_{2.5} and PM₁₀ Nonattainment and Maintenance Areas*. EPA-420-B-15-084. Prepared by Transportation

and Regional Programs Division, Office of Transportation and Air Quality. Available:

<https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NMXM.pdf>.

- . 2015c (November). *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas: Appendices*. EPA-420-B-15-084. Prepared by Transportation and Regional Programs Division, Office of Transportation and Air Quality. Available: <https://nepis.epa.gov/Exe/ZyPdf.cgi?Dockey=P100NN22.pdf>.
- . 2018 (April). *User's Guide for the AERMOD Terrain Preprocessor (AERMAP)*. EPA-454/B-18-004. Available: <https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2006104821.xhtml>.



BAY AREA AIR QUALITY
MANAGEMENT DISTRICT

California Environmental Quality Act
Air Quality Guidelines
Appendix F: Glossary

These guidelines are nonbinding recommendations, intended to assist lead agencies with navigating the CEQA process. They may be updated as needed in the future, and any updates will likewise be nonbinding and advisory.



Aerosol – Particle of solid or liquid matter that typically remain suspended in the air from a few hours to several weeks depending on the particle size and weight.

Area Sources – Sources of air pollutants that individually emit relatively small quantities of air pollutants but that may emit considerable quantities of emissions when aggregated over a large area. Examples include water heaters, lawn maintenance equipment, and consumer products.

Bay Area Air Quality Management District (Air District) – A regional air pollution control agency with jurisdiction over the nine counties that surround San Francisco Bay (not including northeastern Solano County and northern Sonoma County).

Best Available Control Technology (BACT) – The most stringent requirements for new or modified emission sources. An emissions limitation based on using the most up-to-date methods, systems, techniques, and production processes available to achieve the greatest feasible emission reduction.

Best Management Practice (BMP) – A measure that reduces emissions and therefore reduces health risks from air pollution. Examples include retrofitting diesel generators to low- or zero-emitting technology, electrifying loading docks, limiting truck idling times, requiring low- to zero-emitting truck engines, and adding abatement devices to stationary sources.

California Air Resources Board (CARB) – The State of California agency responsible for air pollution control. Responsibilities include establishing state ambient air quality standards, setting allowable emission levels for motor vehicles in California, and providing oversight of local air quality management districts.

California Clean Air Act (CCAA) – Legislation enacted in 1988 that provides the basis for air quality planning and regulation independent of federal regulations. A major element of the act is the requirement that local

air districts in violation of the California ambient air quality standards prepare attainment plans that identify air quality problems, causes, trends, and actions to be taken to attain and maintain California's air quality standards by the earliest practicable date.

California Emissions Estimator Model (CalEEMod) – A statewide land use emissions computer model designed to provide a uniform platform for government agencies, land use planners, and environmental professionals to quantify potential criteria pollutant and greenhouse gas emissions associated with both construction and operations from a variety of land use projects.

California Environmental Quality Act (CEQA) – Legislation requiring state and local agencies to disclose the significant environmental impacts of a project through the preparation of an initial study, a negative declaration, or an environmental impact report and to identify actions to mitigate any significant environmental project impacts.

Carbon Dioxide (CO₂) – A colorless, odorless gas that occurs naturally in the Earth's atmosphere. Significant quantities are also emitted into the air by fossil fuel combustion.

Carbon Dioxide Equivalent (CO₂e) – The amount of carbon dioxide by weight that would produce the same global warming impact as a given weight of another greenhouse gas, based on the best available science, including from the Intergovernmental Panel on Climate Change.

Carbon Monoxide (CO) – A colorless, odorless, invisible, flammable gas that can be dangerous to human health in high concentrations, especially indoors where there is little ventilation.

Carbon Neutrality – The point at which the removal of carbon pollution from the atmosphere meets or exceeds carbon emissions. For the purposes of California's Climate Change Scoping Plan, "carbon neutrality" refers to the state achieved when carbon dioxide and other greenhouse gas emissions generated by sources such as transportation, power plants, and industrial processes are less than or equal to the amount of carbon dioxide that is stored, both in natural sinks and mechanical sequestration.

Chlorofluorocarbons (CFCs) – A family of inert, nontoxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, and insulation or as a solvent or aerosol propellant. CFCs drift into the upper atmosphere, where their chlorine components destroy stratospheric ozone.

Clean Air Act (CAA) – Long-standing federal legislation, last amended in 1990, that is the legal basis for national clean air programs.

Conformity – A requirement in federal law and administrative practice that projects will not be approved if they do not conform with the State Implementation Plan because they would cause or contribute to an increase in air pollutant emissions, violate an air pollutant standard, or increase the frequency of violations of an air pollutant standard.

Criteria Air Pollutants – Pollutants for which the National ambient air quality standards and the California ambient air quality standards have been established. Criteria air pollutants include ground-level ozone, particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), and lead.

Design Element – The features, prerequisites, and measures that must be incorporated into a land use project for the impacts from greenhouse gas emissions to be considered less than significant for California Environmental Quality Act purposes.

EMission FACtors (EMFAC) (Model) – A California Air Resources Board computer model developed to assess emissions from on-road motor vehicles, including cars, trucks, and buses in California.

Emission Factor – For stationary sources, the relationship between the amount of a pollution produced and the amount of raw material processed or burned. For mobile sources, the relationship between the amount of pollution produced and the number of vehicles miles traveled. By using the emission factor of a pollutant and specific data regarding quantities of materials used by a given source, it is possible to compute emissions for the source.

Emission Inventory – An estimate of the amount of pollutants emitted into the atmosphere from major mobile, stationary, areawide, and natural sources over a specific period, such as a day or a year.

EV – Electric vehicle.

EV Capable – According to California's Green Building Standards Code, EV-capable infrastructure includes the "raceway" (the enclosed conduit that forms the physical pathway for electrical wiring to protect it from damage) and panel capacity to support future installation of a dedicated 208/240 VAC, 40-amp branch circuit and charging station(s).

EV Ready – According to California's Green Building Standards Code, EV-ready building standards require installation of dedicated 208/240 VAC, 40-amp branch circuits, circuit breakers, and other electrical components, including a receptacle or blank cover needed to support future installation of one or more charging stations.

EVSE – Electric vehicle supply equipment (e.g., chargers).

Exposure – When a receptor comes in contact with one or more contaminants and the magnitude of the exposure is defined as the amount of contaminant(s) that is either ingested, inhaled, or absorbed during a specified time period. **Gasoline-Dispensing Facility (GDF)** – Retail service station or private facility that stores and/or dispenses gasoline into fuel tanks.

Global Warming Potential (GWP) – The ratio of radiative forcing that would result from the emission of 1 kilogram of a greenhouse gas to that from the emission of 1 kilogram of carbon dioxide over a fixed period.

Greenhouse Gas (GHG) – Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), halogenated fluorocarbons (HCFCs), ozone (O₃), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), and hydrofluorocarbons (HFCs).

Hazardous Air Pollutants – Federal terminology for air pollutants that are not covered by ambient air quality standards but may reasonably be expected to cause or contribute to serious illness or death (see "National Emissions Standards for Hazardous Air Pollutants (NESHAPs)," below).

Health Risk Assessment (HRA) – A detailed comprehensive analysis to evaluate and predict the dispersion of hazardous substances in the environment and the potential for exposure of human populations, and to assess and quantify both the individual and the population-wide health risks associated with those levels of exposure.

High Efficiency Particulate Air Filter (HEPA Filter) – An air filter capable of filtering 0.3-micron particles with 99.97-percent efficiency.

Hydrogen Sulfide (H₂S) – A gas characterized by its “rotten egg” smell, found in the vicinity of oil refineries, chemical plants, sewage treatment plants, and wetlands.

Indirect Sources – Land uses and facilities that attract or generate motor vehicle trips (e.g., shopping centers, office buildings, and airports) and thus result in air pollutant emissions.

Inversion – The phenomenon of a layer of warm air over cooler air. This atmospheric condition resists the natural dispersion and dilution of air pollutants.

Mobile Source – Any motor vehicle that produces air pollution. Cars, trucks, and motorcycles are on-road mobile sources, and airplanes, trains, and construction equipment are off-road mobile sources.

National Ambient Air Quality Standards (NAAQS) – The Clean Air Act requires the U.S. Environmental Protection Agency to set NAAQS for criteria air pollutants at levels determined to be protective of public health.

National Emissions Standards for Hazardous Air Pollutants (NESHAPs) – Emissions standards set by the U.S. Environmental Protection Agency for hazardous air pollutants that may cause an increase in deaths or in serious, irreversible, or incapacitating illness.

Nitrogen Oxides (NO_x) – Gases formed in great part from atmospheric nitrogen and oxygen when combustion takes place under conditions of high temperature and high pressure. NO_x is a precursor to the criteria air pollutant ozone.

Nonattainment Area – Defined geographic area that does not meet one or more of the ambient air quality standards for the criteria pollutants designated in the federal Clean Air Act or the California Clean Air Act.

Overburdened Communities – Effective July 1, 2022, Air District permit regulations set more stringent health risk limits and public noticing requirements for projects located in overburdened communities, defined in *Regulation 2-1-243* as census tracts that score at or above the 70th percentile in CalEnviroScreen 4.0, and areas within 1,000 feet of the boundaries of those census tracts.¹

Ozone (O₃) – A pungent, colorless, toxic gas. A product of complex photochemical processes in the presence of sunlight. Tropospheric (lower atmosphere) ozone is a criteria air pollutant.

Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 2.5 micrometers (PM_{2.5}) – Individual particles of this size are small enough to be inhaled deeply into the lungs.

Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 10 micrometers (PM₁₀) – The small size of these particles allows them to make their way to the air sacs deep within the lungs, where they may be deposited and result in adverse health effects.

¹ BAAQMD. *Regulation 2 Rule 5: New Source Review of Toxic Air Contaminants - 2021 Amendment (Current)*
https://www.baaqmd.gov/rules-and-compliance/rules/reg-2-rule-5-new-source-review-of-toxic-air-contaminants?rule_version=2021%20Amendment.

Photochemical Process – The process, which involves chemical changes, brought about by the radiant energy of the sun acting upon various polluting substances. The products of this process are known as photochemical smog.

Precursor – Compounds that change chemically or physically after being emitted into the air and eventually produce air pollutants. For example, many organic compounds are precursors to ozone.

Prevention of Significant Deterioration (PSD) – A U.S. Environmental Protection Agency program in which state and/or federal permits are required that are intended to restrict emissions for new or modified sources in places where air quality is already better than required to meet primary and secondary ambient air quality standards.

Reactive Organic Gases (ROG) – Classes of organic compounds, especially olefins, substituted aromatics, and aldehydes, that react in the atmosphere to form photochemical smog or ozone.

Sensitive Receptors – Facilities or land uses that include members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses. Examples include schools, hospitals, and residential areas.

State Implementation Plan (SIP) – A plan prepared by states and submitted to the U.S. Environmental Protection Agency describing how each area will attain and maintain national ambient air quality standards.

Stationary Source of Air Pollution – A fixed, nonmobile producer of pollution, usually found at industrial or commercial facilities.

Sulfur Oxides (SO_x) – Pungent, colorless gases formed primarily by the combustion of sulfur-containing fossil fuels, especially coal and oil. Considered a criteria air pollutant, sulfur oxides may damage the respiratory tract, as well as vegetation.

Threshold of Significance – A quantitative or qualitative standard that can be used to define the level of effect above which a lead agency considers an air impact to be significant.

Toxic Air Contaminants (TACs) – TACs are air pollutants, identified by the California Air Resources Board, that may cause or contribute to an increase in deaths or in serious illness, or that may pose a present or potential health hazard. Health effects may occur at extremely low levels of TACs.

Transportation Control Measures (TCMs) – Measures to reduce vehicle use and thereby reduce traffic congestion and decrease emissions from motor vehicles.

U.S. Environmental Protection Agency (EPA) – The federal agency responsible for controlling air and water pollution, toxic substances, solid waste, and cleanup of contaminated sites.

Vehicle Miles Traveled (VMT) – A metric of the total miles traveled by vehicles in a defined area over a defined period. It is often used to estimate the environmental impacts of driving.

Zero-Emission Vehicle – Vehicle that produces no exhaust emissions from the on-board source of power (e.g., a fully electric vehicle). These vehicles still produce emissions from tire and brake wear and can contribute to re-entrained road dust.

This page intentionally left blank.