# 1 INTRODUCTION AND AIR QUALITY

## 1.1 INTRODUCTION

This *Guide to Air Quality Assessment in Sacramento County* (Guide) provides methods for the analysis and review of air quality impacts from land use development projects being considered within the boundaries of the Sacramento Metropolitan Air Quality Management District (District).

The primary purpose of the Guide is to provide useful tools to quickly identify proposed development projects that may have a significant adverse effect on air quality. This document includes screening approaches and specific methods for calculating emissions, with references to applicable models. This document also provides mitigation strategies developers can integrate into their projects to reduce air quality impacts.

The District invites CEQA practitioners and land use developers to contact District planning staff for consultation on the use of this document or for early review of a proposed project to ensure air quality impacts are mitigated early in the process and at the least possible cost.

## 1.2 AIR QUALITY IN SACRAMENTO

### 1.2.1 AIR QUALITY MANAGEMENT

Various local, regional, state and federal agencies share the responsibility for air quality management in Sacramento County. The District operates at the local level with primary responsibility for attaining and maintaining the federal and state ambient air quality standards in Sacramento County. The District works jointly with the U.S. Environmental Protection Agency (USEPA), California Air Resources Board (ARB), Sacramento Area Council of Governments (SACOG), other air districts in the Sacramento region, county and city transportation and planning departments, and various non-governmental organizations to improve air quality through a variety of programs. These programs include the adoption of regulations, policies and guidance, extensive education and public outreach programs, as well as emission reducing incentive programs.

### 1.2.2 ATTAINMENT EFFORTS, POLLUTANTS, AND HEALTH EFFECTS

An ambient air quality standard establishes a concentration above which an air pollutant is known to cause adverse health effects to sensitive groups within the population, such as children and the elderly. The USEPA and ARB have established federal and state ambient air quality standards for pollutants generally known as "criteria pollutants." These pollutants include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter ($PM_{10}$ and $PM_{2.5}$) and lead. For some of these pollutants, notably ozone and particulate matter, the state standards are more stringent than the federal standards. The different health effects studies

considered during the standard-setting process and the interpretation of the studies generally explain the differences in the standards. In addition to the federally listed pollutants, ARB has established standards for sulfates, hydrogen sulfide, vinyl chloride and visibility reducing particles. In general, the air quality standards are expressed as a measure of the amount of pollutant per unit of air over a period of time (e.g., the state $PM_{10}$ standard is 50 $\mu g/m^3$ over 24-hours).

Sacramento County does not attain the following state and federal ambient air quality standards (AAQS)(as of 7/22/19):

1-hour state ozone standard
8-hour federal and state ozone standards
24-hour federal particulate matter $PM_{2.5}$ standard
24-hour and annual state particulate matter $PM_{10}$ standards

Updates to attainment status can be found at the District's website (http://www.airquality.org/air-quality-health/air-quality-pollutants-and-standards). Maps showing attainment boundaries can be found at EPA's website (http://www.epa.gov/region09/air/maps/index.html).

An "attainment" designation for an area signifies that pollutant concentrations did not exceed the established standard. In most cases, areas once out of attainment then re-designated as attainment must develop and implement maintenance plans which are designed to assure continued compliance with the standard.

In contrast to attainment, a "nonattainment" designation indicates that a pollutant concentration has exceeded the established standard. Some pollutants are further classified based on severity. To identify the severity of the problem and the extent of planning and actions required to meet the standard, nonattainment areas are assigned a classification that is commensurate with the severity of their air quality problem (e.g., moderate, serious, severe, extreme).

Finally, an unclassified designation indicates that there is insufficient data for determining attainment or nonattainment.

Because Sacramento County does not meet the air quality standards for ozone, Sacramento County as part of the larger Sacramento Federal Ozone Nonattainment Area (SFNA) is designated a "severe" nonattainment area for the *federal eight hour ozone standard*, and is designated a "serious" nonattainment area for the *state one hour ozone standard*.

Sacramento County is designated nonattainment for the state 24 hour and annual $PM_{10}$ standards and the federal 24 hour $PM_{2.5}$ standard. On July 15, 2013, EPA recognized that Sacramento County attained the federal 24 hour $PM_{2.5}$ standard, but EPA has not yet redesignated the area to attainment (http://www.gpo.gov/fdsys/pkg/FR-2013-07-15/pdf/2013-16785.pdf). On October 28, 2013, Sacramento County was designated attainment for the federal 24 hour

$PM_{10}$ standard. The District website provides additional information on the current attainment and maintenance plans.

The District has developed regulations and programs to minimize emissions of all air pollutants – particularly those that exceed state and federal standards. Due in part to the implementation of these regulations and programs, the Sacramento region's air quality continues to improve (http://www.airquality.org/air-quality-health/air-quality-plans/air-quality-trends).

The next sections focus on each air pollutant, with more detail provided on those pollutants for which Sacramento exceeds state and federal standards. Health effects information was obtained from ARB on the California Ambient Air Quality Standards and the District's Spare the Air Health Effects.

### OZONE

The concentration of ground level ozone, commonly referred to as smog, is greatest on hot, windless, sunny, summer days. Ozone is not emitted directly into the air, but forms through a complex series of chemical reactions between two directly emitted ozone precursors: reactive organic gases (ROG) and nitrogen oxides ($NO_x$). These reactions occur over time in the presence of sunlight. Ground level ozone formation can occur in a matter of hours under ideal conditions. The time required for ozone formation allows the reacting compounds to spread over a large area, producing a regional pollution concern.

The principal sources of ROG and NOx are the combustion of fuels and the evaporation of solvents, paints, and fuels. Mobile sources emit over 65% of the combined ROG and NOx emissions in Sacramento County, according to the 2012 edition of ARB's Emissions Inventory (published in 2013).

Ozone is a public health concern because it is a respiratory irritant that increases susceptibility to respiratory infections and diseases, and because it can harm lung tissue at high concentrations. Ozone can cause constriction of the airways, forcing the respiratory system to work harder in order to provide oxygen. It can also lead to other health problems:

- Aggravated respiratory disease such as emphysema, bronchitis and asthma;
- Damage to deep portions of the lungs, even after symptoms such as coughing or a sore throat disappear;
- Wheezing, chest pain, dry throat, headache or nausea;
- Reduced resistance to infection;
- Increased fatigue;
- Weakened athletic performance; and
- Cardiovascular disease.

In addition, ozone can cause substantial damage to leaf tissues of crops and natural vegetation and can damage many natural and manmade materials such as rubber, fabric and plastics.

## PARTICULATE MATTER

Particulate matter (PM) is a complex mixture of solids and liquids that may contain soot, smoke, metals, nitrates, sulfates, dust, water and tire rubber. It can be directly emitted, as in smoke from a fire, or it can form in the atmosphere from reactions of gases such as nitrogen oxides. PM can remain in the atmosphere for many days before it is removed by rainout, washout, and gravitational settling.

There are many sources of PM emissions, including combustion, industrial and agricultural processes, grading and construction, and motor vehicle use. The PM emissions associated with motor vehicle use include tail pipe, brake and tire wear emissions, as well as road dust. PM emissions also result from wood burning in fireplaces and stoves, and agricultural burning.

The level of PM that is less than 10 microns in size in the air is a public health concern because PM can bypass the body's natural filtration system more easily than larger PM, and can lodge deep in the lungs. The size of particles is directly linked to their potential for causing health impacts. Fine particles less than 2.5 microns in size pose the greatest threat. They can block the flow of oxygen from the lungs to the bloodstream and can also pass from the lungs to the bloodstream and heart. Scientific studies have linked long-term PM pollution, especially fine particles, with significant health problems including:

- Increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing;
- Decreased lung function;
- Aggravated asthma;
- Development of chronic respiratory disease in children;
- Development of chronic bronchitis or chronic obstructive lung disease;
- Irregular heartbeat;
- Heart attacks;
- Premature death in people with heart or lung disease, including death from lung cancer;
- Increased blood pressure;
- Stroke;
- Thrombosis (blood clots leading to obstruction);
- Arthritis;
- Reduced cognitive ability in children; and
- Preterm births.

## OTHER CRITERIA POLLUTANTS

The following discussion provides information on the other criteria pollutants for which the USEPA and ARB have set ambient air quality standards, but Sacramento County currently attains. Most of these pollutants are generated by motor vehicles, although industry and other stationary sources also emit varying levels of the pollutants.

*Carbon Monoxide*

Carbon Monoxide (CO) is an odorless, colorless gas that is formed by incomplete combustion and is primarily a winter pollution problem due to cold stagnant weather conditions. Motor vehicle emissions are the dominant source of CO in Sacramento County.

At high concentrations, CO reduces the oxygen-carrying capacity of the blood and can cause dizziness, headaches, unconsciousness, and even death. Relatively low concentrations of CO can significantly affect the amount of oxygen in the bloodstream because CO binds to red blood cells more readily than oxygen. According to ARB, exposure to CO is especially harmful to those with heart disease because the heart has to pump harder to get enough oxygen to the body. CO exposure has been associated with aggravation of angina pectoris and other aspects of coronary heart disease, decreased exercise tolerance in people with peripheral vascular disease and lung disease, impairment of central nervous system functions, and possible increased risk to fetuses.

Emissions and ambient concentrations of CO decreased dramatically in Sacramento County with the introduction of the catalytic converter emission control technology for on-road motor vehicles in 1975 and reformulated vehicle fuels required by the 1990 Clean Air Act amendments. No exceedances of the state or federal standards for CO have been recorded at a monitoring station in Sacramento County since 1993. Both CARB and EPA have redesignated Sacramento County as an attainment area for CO, for the CAAQS in 1997 and the NAAQS on June 1, 1998, respectively. As of June 1, 2018, the US EPA documented that transportation conformity requirements no longer apply for CO in the Sacramento region. Sacramento has demonstrated 20 years of maintenance of the federal 8-hour CO standard.

*Nitrogen Dioxide ($NO_2$)*

$NO_2$ is a reddish brown gas that is a by-product of fuel combustion, mostly from motor vehicle and industrial sources. Aside from its contribution to ozone and particulate matter formation, nitrogen dioxide can increase the risk of acute and chronic respiratory disease. $NO_2$ can reduce visibility and can be seen as the active coloring agent in a brown cloud on high pollution days, especially when both $NO_2$ and high ozone levels are present.

*Lead (Pb)*

As a result of regulatory efforts to reduce the content of lead in gasoline, the contribution of lead from the transportation sector has been substantially reduced. Industrial activities and general aviation activities are the major sources of lead emissions. ARB reports the effects from inhalation of lead include impaired blood formation and nerve conduction. Lead can adversely affect the nervous, reproductive, digestive, immune, and blood-forming systems. Symptoms can include fatigue, anxiety, short-term memory loss, depression, weakness in the extremities, and learning disabilities in children. Lead also causes cancer.

*Sulfur Dioxide (SO2)*

Sulfur dioxide is produced by the combustion of sulfur-containing fuels, such as oil, coal and diesel. $SO_2$ is a colorless gas with a strong odor. Like nitrogen dioxide, sulfur dioxide can irritate lung tissue and increase the risk of acute and chronic respiratory disease. Sulfur oxides also contribute to particulate matter formation.

ADDITIONAL HEALTH ANALYSIS

In December 2018 the California Supreme Court issued a decision in the Sierra Club v. County of Fresno (2018) 6 Cal. 5th 502 case regarding the Friant Ranch project. The Court determined that air quality analysis should include a reasonable effort to connect a project's air quality impacts to likely health consequences or explain in meaningful detail why it is not feasible to do so. The District provides such guidance in Chapter 4.

TOXIC AIR CONTAMINANTS

Toxic air contaminants (TACs) are airborne pollutants that may be expected to result in an increase in mortality or serious illness or which may pose a present or potential hazard to human health. Chapter 5, TAC Emissions provides a description of health effects, risk management and emission trends for TACs.

GREENHOUSE GASES

The warming trend of the earth's atmosphere, also known as climate change, is related to the release of greenhouse gases (GHG) into the atmosphere. The GHGs of main concern are carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). Changes in climate may lead to sea level rise and changes to agriculture production, water supply, ecosystem sustainability and weather patterns. Increases in wildland fires and more extreme heat days leading to ozone formation have direct impacts to air quality in Sacramento County. Elevated GHG concentrations will not be likely to cause direct health impacts. However, severe heat waves, increased ozone and PM levels, and expanded ranges and transmission of some diseases may lead to serious health effects. Chapter 6, Greenhouse Gas Emissions provides more information regarding regulatory efforts and managing GHG emissions.

### 1.2.3 AIR QUALITY FACTORS

Air quality is monitored by the District and ARB at various locations in Sacramento County to determine which air quality standards are being violated and to direct the District's emission reduction efforts, such as developing attainment plans, rules, incentive programs, etc. Air quality data for most monitoring stations and pollutants being monitored can be obtained (via queries) from ARB's Aerometric Data Analysis and Management System and USEPA's Air Data Now website. The air quality in Sacramento County is largely influenced by the following factors: emissions, geography, and meteorology (wind, atmospheric stability and sunlight).

## EMISSIONS

The emission inventory in Sacramento County is comprised of both man-made (anthropogenic) and natural sources. Natural emission sources include biogenic (vegetation) hydrocarbons, natural wind-blown dust and wildfires. Anthropogenic sources include emissions from stationary, area and mobile sources.

Stationary sources consist of a single emission source with an identified emission point, such as a stack, at a facility. Facilities can have multiple emission point sources located onsite. Stationary sources are usually part of manufacturing and industrial processes. Examples of these sources include boilers, electric power plants, and other types of combustion and processing equipment.

Area sources are small emission sources that are widely distributed, but are cumulatively substantial because there are many. Examples include residential gas-fired water heaters, painting operations, gas-powered lawn mowers, agricultural fields, and consumer products such as barbecue lighter fluid and aerosol sprays.

Mobile sources include on-road and off-road motorized vehicles. On-road mobile sources typically include automobiles and trucks that operate on public roadways. Off-road mobile sources include aircraft, ships, trains, and self-propelled construction equipment that operate in areas other than a public roadway. Emissions from mobile sources are either "direct," or "indirect." Direct emissions are tailpipe emissions. "Indirect" refers to emissions that result because a facility, building, structure, installation, real property, road, or highway attracts a mobile source and resulting emissions.

Trends in emissions for Sacramento County are reported in the California Almanac of Emissions and Air Quality and http://www.airquality.org/air-quality-health/air-quality-plans/air-quality-trends . Historical levels of criteria and toxic air contaminants are documented in multiple tables in the Almanac, which is published periodically.

In 2009 the first inventory of greenhouse gas emissions (GHG) for unincorporated Sacramento County and the incorporated cities was prepared and published. Since that time, many local agencies have conducted emission inventory updates and projections in their climate action planning and GHG reduction efforts. The District tracks local agency climate action planning on its website: http://www.airquality.org/air-quality-health/climate-change/local-regional-efforts.

## GEOGRAPHY

Sacramento County is located within the boundaries of the Sacramento Valley Air Basin. The Sacramento Valley Air Basin is bounded by the North Coast Ranges on the west and the Northern Sierra Nevada Mountains on the east. The intervening terrain is flat. Sacramento is often described as a bowl shaped valley. The

relationship between geography and air quality is described in the following section on meteorology.

## METEOROLOGY

The Sacramento Valley has a Mediterranean climate, characterized by hot dry summers and mild rainy winters. During the year the temperature may range from 20 to 115 degrees Fahrenheit with summer highs usually in the 90s and winter lows occasionally below freezing. Average annual rainfall is about 20 inches with snowfall being very rare. The prevailing winds are moderate in strength and vary from moist breezes from the south to dry land flows from the north.

The mountains surrounding the Sacramento Valley create a barrier to airflow, which can trap air pollutants in the valley when meteorological conditions are right and a temperature inversion exists. Air stagnation in the autumn and early winter occurs when large high-pressure cells lie over the valley. The lack of surface wind during these periods and the reduced vertical flow caused by less surface heating reduces the influx of outside air and allows pollutants to become concentrated in the air. The surface concentrations of pollutants are highest when these conditions are combined with increased levels of smoke or when temperature inversions trap cool air, fog and pollutants near the ground.

The ozone season (May through October) in the Sacramento Valley is characterized by stagnant morning air or light winds with the Delta sea breeze arriving in the afternoon out of the southwest. Usually the evening breeze transports the airborne pollutants to the north out of the Sacramento Valley. During about half of the days from July to September, however, a phenomenon called the "Schultz Eddy" prevents this from occurring. Instead of allowing for the prevailing wind patterns to move north carrying the pollutants out of the valley, the Schultz Eddy causes the wind pattern and pollutants to circle back southward. This phenomenon's effect exacerbates the pollution levels in the area and increases the likelihood of violating the federal and state air quality standards.