BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Air Pollutants

Acid Deposition

"Acid rain" has come to be recognized as a major environmental problem. The precipitation of acidic water as rain, snow, and dew is related to air pollution because the sulfuric and nitric acids that contaminate atmospheric moisture are generated from the combustion of fossil fuels.

Complex chemical changes take place when sulfur oxides (emitted from sources such as power plants) and nitrogen oxides are transported in the air many miles from their points of origin. Over a period of three to five days, the materials are converted to their acid forms and precipitated from the atmosphere. In Canada and Scandinavia, it has been shown that acidic rainfall has resulted in "aquatic death" for many small lakes.

Since the emission of sulfur oxides is considerably lower in California than in other parts of the world, the primary source of acid rainfall is nitric acid resulting from automobile emissions. Measurements in California have shown periods of acidic rain in the initial stages of storms, but thus far no significant long-range transport to the vulnerable mountain lakes has been observed.

Carbon Monoxide (CO)

This is an odorless, invisible gas which affects the health of people exposed to high concentrations. Carbon monoxide is especially dangerous indoors, when ventilation is inadequate.

Almost 70 percent of the Bay Area's carbon monoxide comes from motor vehicles. A substantial amount also comes from burning wood in fireplaces and woodstoves. State and federal controls on new cars and voluntary efforts to reduce wood burning have been implemented to prevent carbon monoxide from reaching adverse levels. The Bay Area has not exceeded the national or state standard for carbon monoxide for several years and is now formally recognized as an attainment area for CO.

Hydrogen Sulfide

A colorless gas with a strong "rotten egg" odor, hydrogen sulfide (H_2S) can be smelled at very low concentrations. It discolors paints and tarnishes many metals. This gas is produced largely at sewage treatment plants and at oil refineries as a by-product in refining crude oil. Concentrations of H_2S are limited by District regulations.

Nitrogen Oxides

Air is comprised of about 80 percent nitrogen. Whenever anything burns at high enough temperatures a certain amount of nitrogen in the air burns as well. Burning, also known as oxidation, occurs when material combines with oxygen in such a way as to release energy in the form of light and heat. The resulting compounds containing nitrogen are primarily nitric oxide (NO) and nitrogen dioxide (NO2). Mixtures of these two compounds are known as oxides of nitrogen and they are involved in photochemical reactions that produce ozone.

At concentrations experienced in the Bay Area nitrogen dioxide can be seen as a brown haze. On days with otherwise good visibility, the coloration effects will be noticeable. At higher concentrations, damage has been noticed in sensitive crops such as beans and tomatoes, and pulmonary changes have been observed in laboratory animals. The Environmental Protection Agency (EPA), California's Air Resources Board (CARB) and the District have all adopted measures to curtail emissions of nitrogen oxides. The District directly controls power plants, boilers, stationary turbines, and stationary engines that are sources of these pollutants, and indirectly controls vehicular sources of NOx by working to change people's driving habits.

Organic Compounds

Organic gases, or hydrocarbons, are released when fuels or organic waste materials are burned. These materials are the result of incomplete combustion and range in complexity from methane, a simple organic gas, to much more complex molecules containing carbon, hydrogen and oxygen in varying proportions. Organic compounds are also emitted by consumer products such as aerosol sprays and by paints, inks, solvents and gasoline when they evaporate. Some organic compounds are not emitted directly, but are products of other compounds that react in and are oxidized by the atmosphere.

Organic compounds are significant air pollutants because they react with oxides of nitrogen in the presence of sunlight to produce photochemical smog, or ozone. The District has adopted more than fifty rules to directly control organic compounds from numerous operations such as: petroleum production, refining and marketing; various coating operations; and semiconductor manufacturing. In addition, some organic compounds, such as benzene 1,3-butadiene, formaldehyde, and acrolein are toxic. Health risks posed by these compounds include cancer risks; chronic, non-cancer risks, such as diseases of the lungs, liver, and kidneys; and acute risks, such as eye and respiratory irritations. The District has initiated the Community Air Risk Evaluation (CARE) program to identify locations with high levels of toxic emissions and sensitive populations and is using this information to reduce toxic emissions in areas with high exposures to toxic air contaminants and sensitive populations.

Particulate Matter

Dust, mist, ash, smoke and fumes are some of the liquid or solid particles found in the atmosphere. In many parts of the world, natural particles like dust and pollens are the principal source of air pollution; in industrialized regions, particulate emissions caused by human activities predominate. Some types of particulate matter are more toxic than others.

Smoke, composed of carbon and other products of incomplete combustion, is the most obvious form of particulate pollution. Open fires, incinerators, petroleum refinery flares, and fuel burning in vehicles and aircraft all produce these highly visible particulates.

Industrial processes such as those used in refining crude oil and in manufacturing chemicals also contribute to particulate formation. Liquid aerosols and solid particles form photochemically in the atmosphere when sunlight reacts with waste gases. When metals are melted, the heated material emits fumes which may condense to form

metallic oxides in the atmosphere. Industrial dust is formed by grinding or pulverizing materials, as in cement production. Earth-moving operations, especially farming and construction, also cause large amounts of dust to enter into the air.

Studies of exposed workers have shown that particles from diesel combustion engines are highly carcinogenic, prompting regulators to focus on implementing tighter controls for diesel-powered trucks, ships, trains, and construction equipment. Communities near freeways and near ports have been identified as having high concentrations of diesel particulate matter and the emitters are the focus of regulatory efforts and grant programs to reduce diesel particulate matter.

Photochemical (Ground Level) Ozone

Commonly referred to as "smog" — results from a chemical reaction which takes place in the atmosphere among ozone precursors (reactive organic gases and oxides of nitrogen) under the photochemical influence of sunlight. Various factors affect this process, including the quantity of gases present, the volume of air available for dilution, the temperature, and the intensity of the ultraviolet light. Prime (worst case) conditions for ozone formation occur in the summer and early fall on warm, windless, sunny days. The major effects of photochemical smog are aggravation of respiratory diseases, eye irritation, visibility reduction and vegetation damage.

Motor vehicles are the greatest source of ozone precursors in the Bay Area, accounting for more than 50 percent of the reactive organic gases and oxides of nitrogen oxides in the region. California's motor vehicle control program, together with the District's regulatory controls, have greatly reduced exceedances of the national ozone standard from a high of 65 days in 1969.

For additional information, see A Day in the life of Ozone

Sulfur Dioxide/Oxides

Heating and burning "fossil fuels," like coal and oil, release the sulfur present in these materials. In areas where large quantities of fossil fuels are used, sulfur oxides can be a major air pollution problem. The largest fraction of sulfur oxides is sulfur dioxide (SO_2). This substance often further oxidizes to form sulfur trioxide (SO_3), which in the presence of moisture can form sulfuric acid mist (H_2SO_4). These contaminants can damage vegetation and affect the health of both humans and animals.

In the past, sulfur oxides were a problem in the Bay Area, especially in the vicinity of the large oil refineries and chemical plants in Contra Costa County. The Air District has been controlling emissions from these sources since 1961, however, and no state or federal excesses have been recorded at District monitoring stations since 1976.

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Bay Area Air Quality Management District
939 Ellis St. San Francisco, CA 94109
(415) 771-6000 | 1-800-HELP AIR