16. AIR QUALITY

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As earth's resources come under increasing strain and competition for utilization, a key natural resource often taken for granted is the air that we breathe. Because air is ubiquitously distributed and generally invisible, it is difficult to grasp the fact that it is a degradable resource. Through various activities, an expanding human population in California and elsewhere is increasing emissions to the atmosphere, taxing the air quality of California and placing a disproportionate burden on certain air basins, e.g., San Joaquin Valley, South Coast. To address the increasing importance and scope of concerns about air quality, it is important that everyone takes steps now to reduce emissions.

The winegrowing community is an important contributor to California's vibrant economy. Because agriculture constitutes only one source of the state's air emissions and the wine industry is only a portion of the agricultural component, emissions associated with each vineyard or winery may seem minimal. However, a collective commitment by the winegrowing community to limit emissions acknowledges that all efforts make a difference and moves the dialogue beyond the narrow and reactive focus on individual sources, impacts, and regulations. Through self-imposed high standards and voluntary assessment, cost-effective practices and technologies can be identified and implemented, improving air quality while maintaining the economic viability of this important business sector.

Certain emissions are categorized and regulated as criteria (or common) air pollutants – specific gases and small particles escaping to the atmosphere during crop production or processing. Through air movement, pollutants can travel great distances, potentially impacting humans, other organisms, and the environment far from the source. Growers and vintners are encouraged to identify sources and monitor amounts of criteria air pollutants as a means for developing and implementing plans for effective mitigation. Although not criteria pollutants, carbon dioxide (CO_2) and other greenhouse gases emitted during the combustion of fossil fuels and from other activities have been linked with global warming. Understanding how and which operations produce greenhouse gases can help managers develop a strategy for reducing them, including offsetting CO_2 contributions. This chapter allows an assessment of your winegrowing practices for protecting air quality by focusing on activities to limit emissions of criteria air pollutants and greenhouse gases.

Concerns about air quality likely will intensify. It is important, therefore, that the winegrowing community leads and highlights its efforts for decreasing emissions. Many vineyards and wineries across the state already are proactively implementing preventive measures. Vehicular traffic and speed have been reduced on unpaved roads. Integrated approaches to vineyard management that include cover cropping, low/no tillage, and integrated pest management (IPM) are practiced. Older diesel engines have been replaced with low-emission technology. Moreover, it is crucial to note that agriculture provides key biological filters for some emissions. For example; vines, cover crops, and other plants associated with the vineyard or winery extract CO_2 from the air and sequester the carbon in their tissues. The conservation and augmentation of flora is important for enhancing this capacity.

The purpose of this chapter is to provide you with 10 criteria to self-assess:

- The status of your air quality protection planning, monitoring, goals, and results
- Your awareness of emission sources by major operation and conservation practices to reduce emissions
- The extent of management support and employee training to improve air quality
- The opportunities in your operations to identify and prioritize options for decreasing emissions.

The desired outcome of completing this chapter is to improve your understanding of how emissions from your operations impact local, statewide, and global air quality. You also will be in a better position to promote existing or develop new goals and action plans for limiting emissions, thereby protecting human health and ensuring viable ecosystems.

List of Air Quality Criteria

16-1 Planning, Monitoring, Goals, and Results
16-2 Vineyard Floors
16-3 Unpaved Surfaces – Roadways and Traffic and Equipment Staging Areas
16-4 Irrigation
16-5 Pest Management Strategy
16-6 Pesticide Stewardship
16-7 Agricultural and Winery Chemicals and Materials
16-8 Energy Sources and Efficiency
16-9 Transportation
16-10 Agricultural Burning

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-1 Planning, Monitoring, Goals, and Results	I am knowledgeable about sources of air emissions associated with my vineyard or winery ***And*** I understand the difference between and sources of PM10 and PM2.5 particulate matter ***And*** I regularly use resources for air quality information (e.g., Air Quality Index, regional web sites) ***And*** Emission sources are identified and annual emissions calculated (where feasible) ***And*** Yearly goals and reduction targets are tracked for air and climate protection ***And*** Employees are trained in air and climate protection and training includes written material ***And*** I include air and climate protection when designing a vineyard or winery.	I am aware of sources of air emissions associated with my vineyard or winery ***And*** I understand the difference between and sources of PM10 and PM2.5 particulate matter ***And*** I am aware of resources for air quality information ***And*** Emission sources are identified and annual emissions estimated (where feasible) ***And*** Goals and reduction targets are set for air and climate protection ***And*** Employee training in air and climate protection is provided ***And*** I include air and climate protection when designing a vineyard or winery.	I am aware of some sources of air emissions associated with my vineyard or winery ***And*** I have a general idea of the difference between and sources of PM10 and PM2.5 particulate matter ***And*** I am assessing sources and impacts of emissions from my vineyard or winery ***And*** I will use results to support decisions for process and technology improvements ***And*** I plan to investigate options for air and climate protection when designing a vineyard or winery.	I have a general idea about some sources of air emissions associated with my vineyard or winery ***And*** I do not know the difference between PM10 and PM2.5 particulate matter ***And*** I do not consider air and climate protection when designing a vineyard or winery.

BOX 16-1 AIR QUALITY INDEX (AQI)

The AQI is an index for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health effects you may experience within a few hours or days after breathing polluted air. The US Environmental Protection Agency (US EPA) calculates the AQI for five of the criteria air pollutants regulated by the Clean Air Act: ground-level ozone, nitrogen dioxide, particulate matter, sulfur dioxide, and carbon monoxide. For each of these pollutants, US EPA has established national air quality standards to protect public health.

How Does the AQI Work? Think of the AQI as a yardstick that runs from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while an AQI value over 300 represents hazardous air quality. An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level that US EPA has set to protect public health. AQI values below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is considered to be unhealthy – at first for certain sensitive groups of people, then for everyone as AQI values get higher.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101-150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151-200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201-300	Health alert: everyone may experience more serious health effects.
Hazardous	> 300	Health warnings of emergency conditions. The entire population is more likely to be affected.

US EPA has assigned a specific color to each AQI category to make it easier for people to understand quickly whether air pollution is reaching unhealthy levels in their communities. For example, the color orange means that conditions are “unhealthy for sensitive groups”, while red means that conditions may be “unhealthy for everyone”, and so on.

Adapted from US EPA at http://www.airnow.gov. Go to http://www.airnow.gov/index.cfm?action=airnow.local to determine the AQI for your area and use the map of California to get real-time air quality information.

BOX 16-2 WHAT ARE AIR PARTICLES? WHERE DO THEY COME FROM?

Particles in the air are a mixture of solids and liquid droplets that vary in size and often are referred to as "particulate matter". Small particles or respirable particulate matter – particles less than or equal to 10 microns in diameter (PM10) – pose a greater health concern than larger particles because they can pass through the nose and throat and penetrate the lungs. Ten microns is about one-seventh the diameter of a human hair. Particles exceeding 10 microns usually do not reach the lungs, but can irritate the eyes, nose, and throat.

PM10 include "coarse" and "fine" particles. Coarse particles, with diameters ranging between 2.5 and 10 microns, typically are released during crushing or grinding operations and, importantly, as fugitive dust (from non-point sources) disturbed by wind, vehicles, or equipment.

Fine particles (PM2.5) have diameters less than or equal to 2.5 microns and pose the greatest health concerns. PM2.5 is directly emitted when fuels such as coal, oil, diesel, gasoline, or wood are burned. Fine particles can be emitted during combustion associated with power plants, wood stoves, and motor vehicles (e.g., cars, trucks, buses, marine engines). These particles also are produced during fuel use by construction equipment, agricultural burning, forest fires, and residential fireplaces. Moreover, a large fraction of PM2.5 is secondarily formed through the atmospheric reaction of oxides of nitrogen (NOx) or sulfur dioxide with ammonia to form ammonium nitrates and ammonium sulfates, respectively. NOx and sulfur dioxide are combustion by-products.

For more information on air particles and health impacts go to http://www.airnow.gov/index.cfm?action=jump.jump_particle.

BOX 16-3 CHARACTERIZATION AND REGULATION OF CRITERIA AIR POLLUTANTS

The Federal Clean Air Act required US EPA to set nationwide standards for air quality based on human health concerns. Federal standards have been established for the six criteria or common air pollutants: ground-level ozone, nitrogen dioxide, particulate matter (PM10 and PM2.5), sulfur dioxide, carbon monoxide, and lead. Moreover, the California Air Resources Board (CARB) generally has adopted more restrictive state standards for these pollutants pursuant to the California Clean Air Act. Standards are reviewed periodically and may be revised. Geographic areas in which the level of a criteria air pollutant exceeds federal and/or state standards are classified as non-attainment areas. There are 15 air basins within California that are designated as being in attainment or non-attainment status. Regional or county air districts associated with non-attainment areas for one or more pollutants must prepare management plans that detail means for ensuring future compliance with federal and/or state standards. Regional or county plans are incorporated into the State Implementation Plan submitted to US EPA describing how California will attain and maintain the national standards.

Criteria Air Pollutant	**Key Sources**
Ozone (ground level)	Formed by photochemical reaction involving volatile organic compounds (VOCs) and nitrogen oxides (NOx)
Volatile organic compounds (VOCs)*	Released from handling and combustion of fossil fuels (e.g., diesel, gasoline, oil, coal, natural gas); livestock; solvents, paints, glues, pesticides, and other petroleum-derived products; and respiration by plants and decomposition of organic matter
Nitrogen dioxide	Combustion of fossil fuels (especially diesel)
Particulate matter (PM10 and PM2.5)	Combustion of wood and fossil fuels (especially diesel), dust from industrial and agricultural operations and unpaved roadways, some applications of pesticides, and atmospheric conversion of gaseous pollutants
Sulfur dioxide	Combustion of coal and oil
Carbon monoxide	Combustion of fossil fuels, especially during cold temperatures
Lead	Leaded aviation gasoline, paint, smelters, and manufacture of lead storage batteries

Detailed information about the criteria air pollutants and associated human health and environmental effects is at http://www.epa.gov/oar/oaqps/peg_caa/pegcaa11.html. Glossaries of air pollution terms are at http://www.arb.ca.gov/html/gloss.htm and http//www.epa.gov/oar/oaqps/peg_caa/pegcaa10.html.

*Although not criteria pollutants, volatile organic compounds are included because they are important ozone precursors.

BOX 16-4 HOW IS OZONE BOTH GOOD AND BAD?

Ozone occurs in two layers of the atmosphere. The stratosphere, which contains the "good" ozone layer, extends from about 6 to 30 miles above earth and protects life from the sun's harmful ultraviolet rays. Ozone is produced naturally in the stratosphere. But, this "good" ozone is gradually being destroyed by man-made chemicals referred to as ozone-depleting substances, including chlorofluorocarbons, hydrochlorofluorocarbons, halons, methyl bromide, carbon tetrachloride, and methyl chloroform. The loss of stratospheric ozone allows additional ultraviolet radiation to reach earth's surface, endangering human health and damaging crops.

The layer closest to earth's surface is the troposphere, extending about six miles up. Here, ground-level or "bad" ozone is an air pollutant causing human health and other concerns. Ground-level ozone is the main component of urban smog and is formed when nitrogen oxides (NOx) react with volatile organic compounds (VOCs) in the presence of sunlight. Highest ozone concentrations occur during the spring and summer, when meteorological conditions (i.e., hot sunny days) are optimum for ozone formation. Such conditions can result in ozone peaks lasting from a few days to a week. Emissions associated with industrial facilities, electricity utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some major NOx and VOC sources.

Ground-level ozone damages vegetation and ecosystems. It can reduce the growth and yield of crops, especially for sensitive species and varieties. Moreover, ozone can increase crop susceptibility to pests and other stresses such as harsh weather. US EPA estimates that annual crop damage caused by ozone amounts to $3 billion nationwide.

Ozone is used as a sanitizer in winery operations. Because ozone has such a short half-life, it cannot be stored but must be generated on-site and used immediately. Most wineries use ozone dissolved in water and some off-gassing can occur. To protect workers, managers need to thoroughly train staff in standard operating procedures for ozone usage and safety; use only properly designed, correctly sized, and carefully maintained ozone generating equipment; and appropriately test and monitor ozone concentrations.

For more general information, visit http://www.airnow.gov/index.cfm?.action=gooduphigh.index. For information about impacts on crop productivity, go to www.ars.usda.gov/research/programs/programs.htm?np_code=203.

BOX 16-5 UNDERSTANDING AND REGULATION OF VOLATILE ORGANIC COMPOUNDS (VOCS)

Ground-level ozone, a criteria air pollutant, is produced by chemical reactions involving VOCs, nitrogen oxides (NOx), and sunlight. Although not criteria air pollutants, VOCs are important ozone precursors and considered a key target for reduction in order to achieve federal and state ozone standards. Definitive understanding of the capacity for each VOC to produce ozone is evolving. Nevertheless, State Implementation Plans must address means to reduce VOC emissions in air basins exceeding standards. Plans will be updated to reflect changes in standards resulting from improved understandings of ozone precursor capacities and health risks (e.g., more stringent federal 8-hr ozone standard established in 2004).

The reality is that VOC emissions associated with agriculture are being scrutinized. It is important for the California winegrowing community to remain alert to issues and take proactive steps to minimize emissions where feasible and collaborate with regulators about possible additional regulations. Scrutinized sources of VOCs associated with the wine industry include pesticides (see **Box 16-13** for more detail and proactive mitigative measures) and fermentation/storage processes affecting ethanol releases. The wine industry must invest its vast knowledge and experience in actively participating in dialogue and research towards improved understandings of impacts to air quality and reasonable solutions.

Updated information and links pertaining to State Implementation Plans for VOCs and the criteria air pollutants are at http://www.arb.ca.gov/planning/sip/sip.htm.

BOX 16-6 CALIFORNIA AIR RESOURCES BOARD AGRICULTURAL ACTIVITIES

Agricultural activities are becoming increasingly subject to air pollution permits and other regulations. One purpose of the Air Resources Board website is to keep the California agricultural community informed about air quality related activities that may impact their operations. It includes board meetings (past and future), actions, programs, news clips, and details about the Agriculture Advisory Committee. To explore this site, go to http://www.arb.ca.gov/ag/ag.htm.

To obtain electronic notices about significant regulatory activities and developments, register at www.arb.ca.gov/listserv/sip.htm.

BOX 16-7 CARBON SEQUESTRATION AND AIR QUALITY

Unlike criteria air pollutants, greenhouse gases are of concern primarily because of potential impacts on global warming and other subsequent climatic ramifications, such as rising sea levels. Carbon dioxide (CO_2) is the key concern but greenhouse gases also include methane, nitrous oxide, chloroflurocarbons, and others.

Carbon sequestration can be defined as the retention of carbon to prevent or delay its release to the atmosphere as CO_2. Plants are considered a "sink" for CO_2 because they uptake this gas during photosynthesis. Because plants assimilate carbon, enhancing their populations helps limit atmospheric concentrations of carbon dioxide and issues associated with global warming. Perennial plants are particularly efficient at carbon sequestration because carbon is stored in permanent structures, i.e., roots, trunks, and cordons. Grapevines in California, for example, were estimated to assimilate 251,084 tons of CO_2 into permanent structures in 1992 (Larry Williams, Department of Viticulture and Enology, UC Davis, Presentation at 1995 UC Davis Symposium – Recent Advances in Viticulture and Enology).

Carbon sequestration can be increased by maximizing and diversifying vegetation in and around the vineyard, such as utilizing cover crops (especially permanent covers), maintaining or planting hedgerows, seeding unpaved roadways and other areas, and planting trees and shrubs. Additionally, the rate of carbon storage in decomposing plant tissues and soils is enhanced with decreased tillage. The proliferation of plants and minimization of tillage also improves air quality by mitigating airborne dust and PM10.

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-2 Vineyard Floors	I am knowledgeable about soil management practices for mitigating airborne dust and PM10 ***And*** I implement a comprehensive soil conservation plan that includes a permanent or no-till cover crop, no or minimally disruptive under-the-vine tillage, and other practices (e.g., wind barriers such as trees and hedgerows, nighttime farming, under-the-vine mulches/compost, vegetated non-farmed areas, combined operations enabling reduced tractor passes).	I am knowledgeable about soil management practices for mitigating airborne dust and PM10 ***And*** I implement a soil conservation plan that includes cover cropping, reduced tillage, and one or more other practices.	I am aware of soil management practices for mitigating airborne dust and PM10 ***And*** I implement a soil conservation plan that includes cover cropping.	I do not implement soil management practices for mitigating airborne dust and PM10 ***Or*** I implement legal requirements (see **Box 16-8**).

BOX 16-8 CONSERVATION MANAGEMENT PRACTICES TO REDUCE PM10

The San Joaquin Valley Unified Air Pollution Control District requires that growers with 100 or more acres of continuous, or adjacent, farmland prepare and implement Conservation Management Practices (CMPs) that minimize PM10 emissions for each crop farmed. Affected growers must implement at least five CMPs per crop, generally one from each of five categories: land preparation and cultivation, harvest activities, unpaved roads, unpaved equipment yards, and other cultural practices. Detailed information, including the characterization of various CMPs, is available from *Agricultural Air Quality, Conservation Management Practices for San Joaquin Valley Farms* (2004) found at http://www.valleyair.org/farmpermits/updates/cmp_handbook.pdf.

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-3 Unpaved Surfaces – Roadways and Traffic and Equipment Staging Areas	I am knowledgeable about practices for mitigating airborne dust and PM10 from unpaved surfaces ***And*** I implement a conservation plan that includes effectively timed applications of water or regulatory compliant anti-dust materials* and/or layering gravel, chipping, mulching, sanding, paving, or seeding ***And*** Speeds and travel are restricted on and around the operation ***And*** Employees are trained to reduce fugitive dust from unpaved areas and training includes written material.	I am knowledgeable about practices for mitigating airborne dust and PM10 from unpaved surfaces ***And*** I implement a conservation plan that includes effectively timed applications of water or regulatory compliant anti-dust materials* and/or layering gravel, chipping, mulching, sanding, paving, or seeding ***And*** Speeds and travel are restricted on and around the operation ***And*** Employee training to reduce fugitive dust from unpaved areas is provided.	I am aware of practices for mitigating airborne dust and PM10 from unpaved surfaces ***And*** I implement a conservation plan that includes effectively timed applications of water or regulatory compliant anti-dust materials* and/or layering gravel, chipping, mulching, sanding, paving, or seeding ***Or*** Speeds and travel are restricted on and around the operation.	I do not implement practices for mitigating airborne dust and PM10 from unpaved surfaces ***Or*** I implement legal requirements (see **Box 16-8**).

*Check with local regulatory officials about regulatory compliant and environmentally sustainable anti-dust materials for your area.

BOX 16-9 ANTI-DUST MATERIALS AVAILABLE FOR CONTROLLING PM10

Chips/Mulches, Organic Materials, Polymers, "Road Oil", and Sand: Using regional or county air district approved materials to suppress dust on roads that meet the vehicle trips per day threshold.

Paving: Paving the roads greatly reduces the amount of dust released. Be advised that paving can increase runoff in certain circumstances.

Gravel: Adding gravel to a sufficient depth will reduce dust. If the road has greater than 75 trips per day, the applied gravel must be washed.

Seeding: Seeding to establish ground cover where feasible can greatly reduce roadway dust.

Detailed information and specific products recommended for the San Joaquin Valley are available from *Agricultural Air Quality, Conservation Management Practices for San Joaquin Valley Farms* (2004) found at http://www.valleyair.org/farmpermits/updates/cmp_handbook.pdf. Additional information regarding regulations for controlling PM10 from unpaved roadways and traffic areas for the San Joaquin Valley is at http://www.valleyair.org/busind/comply/PM10/compliance_PM10.htm.

For products and practices appropriate for other regions, check with your regional or county air district.

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-4 Irrigation*	I am knowledgeable about how irrigation design and practices affect air quality ***And*** I implement a cost-effective plan for reducing emissions that includes a monitored and maintained micro-irrigation system ***And*** My irrigation strategy delivers minimal amounts of water to achieve yield and quality goals ***And*** I irrigate during off-peak hours (decreases ground-level ozone formation and conserves energy) ***And/Or*** I replaced/retrofitted older diesel-powered irrigation units with cleaner-burning technology (e.g., low-emission diesel engines), converted to electric motors, or use alternative fuels (e.g., biodiesel, propane, natural gas, methane).	I am knowledgeable about how irrigation design and practices affect air quality ***And*** I implement a cost-effective plan for reducing emissions that includes a monitored and maintained micro-irrigation system ***And*** My irrigation strategy delivers minimal amounts of water to achieve yield and quality goals.	I am aware of how irrigation design and practices affect air quality ***And*** I am developing a plan to simultaneously reduce air emissions, conserve energy and cost, and meet expectations for yield and quality.	I am not aware of the relationship between irrigation operations and air quality.

*Air emissions associated with irrigation include nitrogen oxides (NOx), fine particulate matter (PM2.5), volatile organic compounds (VOCs), and greenhouse gases (e.g., CO_2).

BOX 16-10 AGRICULTURAL PUMPING EFFICIENCY PROGRAM

The Agricultural Pumping Efficiency Program (APEP) is an educational and incentive rebate program developed to improve overall pumping plant efficiency and encourage energy conservation. Eligible participants often receive rebates for costs associated with on-site efficiency tests and necessary equipment upgrades. Increases in pumping efficiency lead to less energy consumption, decreased cost, and fewer air emissions.

Who is eligible?
All owners or users of an electric or natural gas utility account that is used for production agriculture or large turf irrigation (non-residential accounts of five or more horsepower for turf irrigation) who are paying the Public Goods Charge are eligible (normally customers of PG&E, SCE, SCG, or SDG&E – SDG&E customers should contact APEP to ensure their eligibility).

For contact and detailed information on this program, visit http://www.pumpefficiency.org.

BOX 16-11 AIR QUALITY AND DIESEL ENGINES

In 1998, the California Air Resources Board (CARB) designated diesel exhaust as a toxic air contaminant after an exhaustive, 10-year scientific assessment process. Using the newly developed cancer risk assessment for diesel, CARB estimated that diesel particulate matter or soot was responsible for 70% of the state's risk of cancer from airborne toxics for the year 2000. Accordingly, in September 2000, CARB approved its Diesel Risk Reduction Plan – a comprehensive approach designed to reduce diesel particulate matter and associated potential cancer risks by 75% in 2010 and by 85% in 2010 from year 2000 levels.

Agricultural engines are not being singled out. To meet goals, all uses and categories (on road, off road, and stationary) of diesel-fueled engines are being examined and controls implemented where determined to be technically and economically feasible. Based on the statewide diesel particulate matter emissions inventory for the year 2000, emissions from agricultural operations (excluding logging) represented 14% of the total and were comparable to that from on-road heavy-duty trucks (16% of total).

For detailed information about the Diesel Risk Reduction Plan, go to http://www.arb.ca.gov/diesel/dieselrrp.htm**.**

BOX 16-12 COST-SHARE PROGRAMS TO IMPROVE AIR QUALITY

Detailed below are programs by the US Department of Agriculture Natural Resources Conservation Service (NRCS) and others which provide the winegrowing community with cost-share incentives for improving technology or practices to reduce air emissions.

NRCS Environmental Quality Incentives Program (EQIP) – California Air Quality Initiative

- A program administered by NRCS that provides cost-share incentives and technical assistance for qualified growers in PM10 serious non-attainment areas and ozone severe non-attainment areas
- Diesel Engine Replacement – to reduce pollutants from diesel irrigation engines by replacing older engines with certified cleaner-burning diesel engines, electric motors, or natural gas or propane fueled engines
- Unpaved Roads and Equipment Areas – to reduce PM10 by implementing dust control technologies
- Chipping Removed Vineyards – to reduce PM10 by chipping instead of burning removed vines
- Disposing Chemically Treated Stakes and End-Posts – to prevent toxic dust emissions by disposal at appropriate landfills instead of burning
- Detailed information is at http://www.ca.nrcs.usda.gov/programs/eqip

Carl Moyer Program

- A statewide grants program administered by local air districts to retrofit or replace diesel engines for heavy-duty vehicles and equipment (e.g., off-road heavy-duty vehicles, irrigation pumps) with lower-emission technology
- Implementation of recent legislative change should expand the scope and funding for agricultural sources of emissions (Agricultural Assistance Program) as well as for cars and light-duty trucks
- More information is at http://www.arb.ca.gov/msprog/moyer/moyer.htm and through regional or county air districts

Agricultural Diesel Conversion Incentive Program

- A program by Pacific Gas and Electric Company (PG&E) and Southern California Edison (SCE) that provides reduced electricity rates and enhanced line extension allowances for converting stationary diesel irrigation engines to electric motors
- Agricultural customers operating a stationary diesel irrigation engine in the service territories of PG&E or SCE are eligible
- More information is at http://www.arb.ca.gov/ag/diesel/diesel.htm

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-5 Pest Management Strategy	I am knowledgeable about how pest management practices affect air quality ***And*** I implement a cost-effective plan that reduces emissions from soil disturbance, fuel use, and pesticides while maintaining pests at tolerable levels ***And*** The plan first relies on biological and cultural tactics that minimize equipment passes and pesticide inputs ***And*** Decisions for pesticide applications are based on economic thresholds and/or weather model decision tools and incorporate VOC and PM10 considerations ***And*** Weed and floor management practices mitigate dust and PM10.	I am knowledgeable about how pest management practices affect air quality ***And*** I implement a cost-effective plan that reduces emissions from soil disturbance, fuel use, and pesticides while maintaining pests at tolerable levels ***And*** The plan first relies on biological and cultural tactics that minimize equipment passes and pesticide inputs ***And*** Decisions for pesticide applications are based on economic thresholds and/or weather model decision tools.	I am aware of how pest management practices affect air quality ***And*** I am developing a cost-effective plan to reduce emissions from pest management operations while maintaining pests at tolerable levels.	I am not aware of how pest management practices affect air quality.

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-6 Pesticide Stewardship	I never use fumigants* ***And*** I follow recommended practices for dust (e.g., sulfur) and liquid applications to minimize PM10 and drift** ***And*** I am familiar with and avoid use of pesticides associated with higher VOC emissions (see **Box 16-13**) ***And*** Applicators are trained about pesticide issues relevant to air quality and training includes written material.	I never use fumigants* ***And*** I follow recommended practices for dust (e.g., sulfur) and liquid applications to minimize PM10 and drift** ***And*** I have some understanding of pesticide products associated with higher VOC emissions (see **Box 16-13**).	I only use fumigants to address verified biological problems* ***And*** I follow recommended practices for dust (e.g., sulfur) and liquid applications to minimize PM10 and drift**.	I choose and apply pesticides without considering impacts to air quality other than following legal requirements.

*For more information, see **Criteria 3-11 – 3-13** and associated educational boxes in the Viticulture chapter.

Recommended practices to avoid pesticide drift and PM10 are detailed in **Criteria 6-33 and **6-34** and associated educational boxes in the Pest Management chapter. Additional sources of information about pesticide drift, spray particle size, and mitigative practices are at http://www.agdrift.com, *Best Management Practices for Sulfur in Winegrapes* at http://www.cawg.org/images/stories/pdf/ed-grower_bmps.pdf, and *Sulfur Best Application Practices: Managing Sulfur Applications Near Sensitive Areas* (Coalition for Urban/Rural Environmental Stewardship) at http://www.curesworks.org/publications/sulfur.asp.

BOX 16-13 VOLATILE ORGANIC COMPOUNDS (VOCS) AND PESTICIDES

Many pesticide active and inert ingredients are sources of VOCs, which can react with nitrogen oxides (NOx) and sunlight to form ground-level ozone. Emissions data from the San Joaquin Valley in 2004 list agricultural pesticides as the sixth highest contributor to VOCs (6.3 %), following livestock waste (9.6 %), light and medium duty trucks (9.1 %), light duty passenger cars (8.3 %), prescribed burning (7.5 %), and oil and gas production (7.4 %). Because ozone concentrations exceed federal and state standards in some air basins, State Implementation Plans include elements to reduce VOC emissions from pesticides in non-attainment areas. Voluntary efforts and education have been emphasized, but future actions may include restrictions affecting products and uses.

In cooperation with the California Air Resources Board, the California Department of Pesticide Regulation determines and maintains pesticide VOC emission inventories using estimates of product-specific emission potentials (EPs) and pesticide use report data. The EP is that fraction of the product assumed to potentially contribute to atmospheric VOCs.

Potential VOC emission (pounds) = pounds pesticide product applied x EP

Understanding the relationship of estimated laboratory EPs to field emission rates and subsequent ozone formation is evolving. However, growers should keep abreast of current understandings and consider limiting use of pesticides with higher estimated EPs, especially fumigants (also directly toxic) and emulsifiable concentrates. As a general guideline, current estimated default EPs by formulation category are listed below. This and additional information including a list of estimated EPs by product are at http://www.cdpr.ca.gov/docs/pur/vocproj/vocmenu.htm.

Formulation Category	Emission Potential (%)	Formulation Category	Emission Potential (%)
Pressurized products	100.00	Granular/flake	3.70
Emulsifiable concentrates	39.15	Oil	3.47
Solution/liquid (ready to use)	7.30	Wettable powder	1.85
Liquid concentrate	5.71	Dust/powder	1.53
Suspension	5.71	Soluble powder	1.15
Pellet/tablet/cake/briquet	5.18	Dry flowable	1.02
Flowable concentrate	4.80		

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-7 Agricultural and Winery Chemicals and Materials (excluding pesticides)	I am knowledgeable about how chemicals and materials used in the winery or vineyard affect air quality ***And*** I implement a plan for chemical acquisition and use that includes considerations of VOC potential, toxicity, and potential for ozone depletion* ***And*** The plan includes only the purchase and minimal use of materials with both low potential to emit VOCs and low toxicity ***And*** Proven or suspected ozone depleting materials are not used ***And*** Employees are trained about relevant air quality issues and safe storage, use, and cleanup procedures and training includes written material.	I am knowledgeable about how chemicals and materials used in the winery or vineyard affect air quality ***And*** I implement a plan for chemical acquisition and use that includes considerations of VOC potential, toxicity, and potential for ozone depletion* ***And*** The plan includes the preferential purchase and use of materials with both low potential to emit VOCs and low toxicity ***And*** Proven or suspected ozone depleting materials are being eliminated from use.	I am aware of how chemicals and materials used in the winery or vineyard affect air quality ***And*** I am developing a plan for chemical acquisition and use that includes VOC potential, toxicity, and potential for ozone depletion*.	I am not aware of how chemicals and materials used in the winery or vineyard affect air quality.

*See the Material Handling chapter for more details.

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-8 Energy Sources and Efficiency*	I am knowledgeable about links between energy sources and efficiency and air quality ***And*** I track amounts of fuel used and associated emissions by my vineyard or winery ***And*** I have implemented a plan for over one year to simultaneously reduce emissions, conserve energy, and reduce costs* ***And*** I replaced/retrofitted three or more gasoline- or diesel-powered machines with. . . (see category 3) ***And*** I assessed the efficiencies of all motorized equipment and am replacing inefficient ones ***And/Or*** A renewable energy system has been installed.	I am knowledgeable about links between energy sources and efficiency and air quality ***And*** I know amounts of fuel used and associated emissions by my vineyard or winery ***And*** I implement a plan to simultaneously reduce emissions, conserve energy, and reduce costs* ***And*** I replaced/retrofitted one or two gasoline- or diesel-powered machines with cleaner-burning technology (e.g., low-emission diesel engines), converted to electric motors, or use alternative fuels (e.g., biodiesel, propane, natural gas, methane) ***And*** I am assessing the efficiencies of all motorized equipment.	I am aware of links between energy sources and efficiency and air quality ***And*** I know amounts of fuel used and some associated emissions by my vineyard or winery ***And*** I am developing a plan to simultaneously reduce emissions, conserve energy, and reduce costs* ***And*** The efficiencies of major motorized equipment have been assessed.	I am not aware of links between energy sources and efficiency and air quality ***And*** I have no plan to develop an energy management program for my vineyard or winery ***And*** Motorized equipment is assumed to be operating efficiently.

*See the Energy Efficiency chapter for details about energy management planning and alternative fuels and power sources.

BOX 16-14 EDUCATION TO IMPROVE ENERGY EFFICIENCY FOR AGRICULTURE

Pacific Gas & Electric's Pacific Energy Center and the Energy Training Center in Stockton, through collaborative efforts with other organizations and cities, offer free workshops to the agriculture sector. Workshops include Pumping System Assessment, Industrial Refrigeration Efficiency, Using BEST Winery Benchmarking and Efficiency Tool to Improve Winery Performance, and Prime Movers – Engines or Motors.

To find out more about content and location for these workshops, visit http://www.pge.com/education_training/classes/energy_efficiency/index.jsp#classresults.

BOX 16-15 DEPARTMENT OF ENERGY (DOE) BEST PRACTICES SOFTWARE TOOLS

With the right know-how, you can use DOE's powerful tools to help identify and analyze opportunities for energy system savings and resultant air emission reductions. While these tools can be downloaded from DOE's web site, you are encouraged to attend a training workshop to enhance your knowledge and take full advantage of opportunities identified via the software programs. For some tools, advanced training also is available to increase your expertise.

Specific software tools are available for compressed air, motor, process heating, and pumping systems. To get more information and access these free software tools, visit http://www1.eere.energy.gov/industry/bestpractices/software.html.

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-9 Transportation	I am knowledgeable about links between miles traveled and air quality ***And*** I consider deliveries to and from the winery or vineyard and travel by visitors as contributing to our air quality impact ***And*** I track miles traveled, fuel use, and emissions by our diesel trucks each year ***And*** I have implemented a plan for over one year to minimize the miles traveled to and from our facility and to reduce engine idling time each year ***And*** Employees are trained (includes use of written material) to reduce emissions from travel and employees utilize commute alternatives.	I am knowledgeable about links between miles traveled and air quality ***And*** I consider deliveries to and from the winery or vineyard and travel by visitors as contributing to our air quality impact ***And*** I know the miles traveled, fuel use, and emissions by our diesel trucks each year ***And*** I have developed a plan to minimize the miles traveled to and from our facility and to reduce engine idling time each year ***And*** Employee training to reduce emissions from travel is provided.	I am aware of links between miles traveled and air quality ***And*** I consider deliveries to and from the winery or vineyard as contributing to our air quality impact ***And*** I have a general idea about the miles traveled by our diesel trucks each year ***And*** I am developing a plan to minimize the miles traveled to and from our facility each year.	I am not aware of links between miles traveled and air quality ***And*** I do not consider deliveries to and from the winery or vineyard as contributing to our air quality impact ***And*** I do not know the miles traveled by our diesel trucks each year.

AIR QUALITY				
Criteria	**Category 4**	**Category 3**	**Category 2**	**Category 1**
16-10 Agricultural Burning	No burning is done in the vineyard ***And*** All vineyard prunings are chipped, ground, and utilized in the vineyard or sent for biomass processing ***And*** Diseased vines are composted or chipped and utilized ***And*** Field workers are trained in beneficial uses of vineyard prunings ***And*** We lead or participate in activities to educate other growers about alternatives to burning vineyard waste.	All vineyard prunings are chipped, ground, and utilized in the vineyard or sent for biomass processing ***And*** Only diseased vines are burned ***And*** Field workers are trained in beneficial uses of vineyard prunings ***And*** All burning is done under the supervision of a trained vineyard manager ***And*** Burns are never started before sun rise or after dusk.	Only vineyard prunings, diseased vines, and/or weeds are burned ***And*** All burning is done under the supervision of a trained vineyard manager ***And*** Burns are never started before sun rise or after dusk ***And*** Alternatives to burning are being investigated and tested.	Various flammable materials are burned following legal requirements* ***And*** Field workers are allowed to supervise the burning of materials ***And*** I do not worry about what time the burn is started.

*Legal requirements for open-field burning include the need to obtain a burn permit and burn authorization from the regional or county air district. Never burn chemically treated wood (see **Box 16-16**). To address poor air quality in the Central Valley, the California Health and Safety Code requires the San Joaquin Valley Unified Air Pollution Control District to prohibit the burning of most categories of agricultural waste (including vineyard removals and prunings) by June 1, 2010. Check with your air district and agricultural commissioner's office for additional and specific requirements and restrictions.

BOX 16-16 REMOVAL AND DESTRUCTION OF CHEMICALLY TREATED WOOD

Because of the significant public health risk determined by the California Department of Toxic Substances Control, stakes and end-posts treated with the preservative chromated copper arsenate cannot be burned or chipped. Chromated copper arsenate is regulated as a toxic substance and burning or chipping releases toxic dust. Chemically treated wood must be extracted prior to waste piling and hauled to and disposed of at certified Class II or specified Class III composite-lined landfills. After inspection by regional or county air district personnel, remaining vineyard waste may be piled and burned according to legal requirements, chipped and utilized in the vineyard, or processed as an energy source.

A compliance assistance bulletin for vineyard removal for the San Joaquin Valley is at http://www.valleyair.org/BurnPrograms/Ag_burning.htm.

BOX 16-17 GLOBAL WARMING AND RISKS TO AGRICULTURE

Most scientists agree that human activities are contributing to the trend of increasing levels of atmospheric greenhouse gases and resultant global warming. However, the projection of exact environmental effects from global warming is difficult. Anticipated impacts are derived via computer modeling, with higher levels of confidence for large-scale areas. For national issues and expectations about global warming and links to international information, see http://yosemite.epa.gov/oar/globalwarming.nsf/content/index.html.

Global warming could impact California agriculture by decreasing the reliability of water supplies, changing the dynamics of pest populations, and causing variations in crop yield and quality. For winegrapes, warmer temperatures and associated climatic ramifications may advance the ripening process in many regions, reducing grape quality. A summary of the impressive modeling effort that forecasts these and other potential impacts is at http://carnegieinstitution.org/news_releases/news_040817.html.

The California Energy Commission details policies, programs, research, links, and other information relative to climate change in California at http://climatechange.ca.gov.

For your local forecast visit EPA's Web site at:
www.epa.gov/AIRNow

You Can Help Keep the Air Cleaner!

Every day tips:

. Conserve electricity. Consider setting your thermostat a little higher in the summer and lower in winter. Participate in local energy conservation programs. Look for the ENERGY STAR label when buying home or office equipment.
. Keep car, boat, and other engines properly tuned, and avoid engines that smoke.
. Car pool, use public transportation, bike, or walk when possible.
. Combine errands to reduce "cold starts" of your car and avoid extended idling.
. Consider using gas logs instead of wood. If you use a wood-burning stove or fireplace insert, make sure it meets EPA design specifications. Burn only dry, seasoned wood.
. Mulch or compost leaves and yard waste.

Tips for days when particle pollution is expected to be high:

. Reduce the number of trips you take in your car.
. Reduce or eliminate fireplace and wood stove use.
. Avoid using gas-powered lawn and garden equipment.
. Avoid burning leaves and other materials.

Office of Air and Radiation (6301A)
EPA 452/F-03-002
www.epa.gov/AIRNow