**SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT**

**DRAFT STATUS REPORT FOR WORKSHOP**

**Ozone Attainment Demonstration Plan**
**For the San Joaquin Valley Air Basin**

**January 6-7, 2004**

## BACKGROUND:

Ozone air quality in the San Joaquin Valley Air Basin (SJVAB) has improved dramatically over the past two decades. The number of days in the SJVAB with measured ozone levels above the one-hour ozone national ambient air quality standard (NAAQS) of 0.12 parts per million (ppm) has dropped from 74 in 1988 (the highest level in the 1980 to 2003 time frame) to 37 in 2003. Emissions of ozone precursors (volatile organic compounds [VOCs] and nitrogen oxides [NOx]) have decreased at rates specified in the Federal Clean Air Act, as documented in rate of progress (ROP) plans issued by the San Joaquin Valley Unified Air Pollution Control District (District). In spite of these improvements, however, much progress needs to be made to bring the SJVAB into compliance with the federal one-hour ozone standard.[1]

The U.S. Environmental Protection Agency (EPA) has classified the San Joaquin Valley Air Basin (SJVAB) as severe nonattainment[2] for the national ambient air quality standards (NAAQS) for one-hour ozone. This classification requires that the SJVAB attain the ozone air quality standard by November 15, 2005. To move the SJVAB on a path towards meeting this goal, EPA has required a plan for reaching attainment by the November 15, 2005 deadline. This plan was to have been prepared and submitted to EPA by May 31, 2002.

Photochemical atmospheric modeling conducted by the San Joaquin Valley Unified Air Pollution Control District (District) and the California Air Resources Board (ARB) in 2001 identified reductions in ozone precursor emissions in the range of 300 to 400 tons/day (beyond measures that the District had committed to adopt by 2005) that were needed to meet the one-hour ozone NAAQS. Emission reductions under the authority of the District to implement are not of this magnitude; consequently, emission reductions under EPA's and ARB's authorities are also needed to attain the ozone standard. Most of the EPA and ARB reductions, and some of the necessary District reductions, will not

[1] An area is in compliance with the primary and secondary ozone NAAQS when measured ozone levels at any given station do not exceed on average 0.12 parts per million by volume more than one day per year over any three year period (40 CFR 50.9). Thus an area with four or more exceedances at a given monitor over a three-year period has not attained the standard.

[2] The 1990 Federal Clean Air Act Amendments identify five classes of nonattainment areas ranging from "marginal" to "extreme." (Section 181[a]). A classification of "severe" reflects the second worst ozone air quality, and "extreme" represents the worst ozone air quality.

be implemented in time to attain the standard by 2005. Many of the EPA and ARB adopted emission reductions for NOx achieve most of their effect after 2005, as fleets are turned over with new vehicles and equipment[3]. Other very substantial state and federal measures affecting diesel emissions (new diesel engine and diesel fuel requirements) will go into effect after 2005. Because the full suite of emissions reductions projected to be needed to meet the one-hour ozone NAAQS won't be available until after 2005, the District could not develop a plan that demonstrates attainment by November 15, 2005.

EPA is responsible for control measures establishing federal motor vehicle emission standards, and for reducing emissions from locomotives, aircraft, heavy duty vehicles, and other sources such as off-road engines that are either preempted from state control or best regulated at the national level. Due to the severity of California's air quality problems, the state was given the authority to establish more stringent emission standards for on-road motor vehicles and for some off-road sources, and to establish fuel specifications. The ARB regulates those mobile sources where it is not pre-empted from doing so by federal law, and develops "consumer product" standards for meeting air quality goals in California.

Effective September 18, 2002, EPA started sanction clocks and a Federal Implementation Plan (FIP) clock because the District had not yet submitted a number of State Implementation Plan (SIP) revisions, most notably the attainment demonstration for the severe classification for the one-hour ozone NAAQS[4]. Thus, emissions offsets sanctions are scheduled to go into effect on March 18, 2004, and federal highway fund sanctions and a FIP are scheduled to go into effect on September 18, 2004. This means that unless the District provides an attainment demonstration by March 18, 2004, EPA will impose the offset sanction. If no attainment demonstration is provided within six months following this sanction, then EPA would impose the federal highway funding sanction and promulgate the FIP.

The offset sanction applies to major stationary sources. In a severe non-attainment area, a major source is defined as any source that emits, or has the potential to emit, 25 tons per year or more of VOC or NOx. Under the FCAA [Title I, Part D, Section 173(a)], the owner/operator of a major source must obtain construction and operation permits from the District for constructing a new major source or for making a major modification to an existing source. To obtain these permits, the source must reduce emissions within the District by more than the emissions created by the new or modified source on a 1.3 to 1 ratio. If the mandatory offset sanction is imposed, the offset ratio

[3] For example, in the period 2004-2010, ARB will implement Low Emission Vehicle (LEV) regulations (LEV II) that will significantly reduce ozone precursor emissions from passenger vehicles, light trucks and sport utility vehicles, as compared to LEV standards in effect from 1994 through 2003.

[4] The District, through ARB, provided EPA with all required items except the attainment demonstration as part of the *Amended 2002 and 2005 Rate of Progress Plan for San Joaquin Valley Ozone* (December 2002). EPA declared this plan complete on September 4, 2003, and is now reviewing it for approvability.

will become 2 to 1, which means that for every one ton of emissions produced, two tons must be reduced from an applicable source in the SJVAB.

The highway construction sanction prohibits the federal Secretary of Transportation from approving or awarding transportation projects or grants, except for projects designed to improve a demonstrated safety problem or intended to minimize air pollution. Air quality exceptions to this sanction include the following types of programs: (1) programs for public transit, (2) bus and high-occupancy lanes, (3) employer trip reduction programs, (4) ramp metering and signalization, (5) parking facilities for multiple occupancy vehicles, (6) road use charges, (7) programs for breakdown and accident scene management, and (8) other programs improving air quality. Under this sanction, federal funds that would have gone to SJVAB projects affected by the sanction would be withheld and used elsewhere in California until such time as the sanctions are lifted or the funds expended outside of the SJVAB are exhausted.

To avoid these sanctions, and to continue to move the SJVAB towards attainment of the federal 1-hour ozone standards, District staff identified the option of requesting EPA to classify the SJVAB as extreme nonattainment for the 1-hour ozone NAAQS. This reclassification would move the attainment date to November 15, 2010, eliminate the severe area sanctions and FIP requirements, and would allow time for additional emission control measures to come into effect, thereby creating the opportunity to demonstrate attainment by the deadline mandated in the Federal Clean Air Act (November 15, 2010). On December 18, 2003 the District Governing Board unanimously decided to request EPA to classify the SJVAB as extreme nonattainment for the federal one-hour ozone standard. EPA is expected to issue a final notice on the request in the March—May 2004 time frame.

In June 2002, recognizing the likelihood of eventually requesting classification to extreme nonattainment, the District Governing Board directed staff to begin preparation of a plan that demonstrates attainment of the federal one-hour ozone standard by November 2010. The current schedule calls for the District to adopt this ozone attainment demonstration plan (OADP) in May 2004. The District would then forward the OADP to ARB for approval and transmittal to EPA. EPA is expected to issue a schedule for delivery of the OADP when they issue a final ruling on the request for classification as extreme nonattainment. Consequently, at present the District plans to have the OADP to EPA ahead of schedule.

Work on the Extreme OADP has been ongoing since June 2002; most of the initial effort was directed at preparing the *Amended 2002 and 2005 Ozone Rate of Progress Plan.* Emissions inventories, control measures, and planning requirements were developed for this plan and also for use in the Extreme OADP. In addition, analysis of meteorological data and atmospheric chemistry data continued under the Central California Ozone Study (CCOS) for use in selecting episodes and simulating ozone levels for the episodes as part of the Extreme OADP. Analysis of the CCOS data is thus on the critical path for developing the Extreme OADP.

The January 6-7, 2004 extreme OADP workshop organized by District staff was originally intended to share the Draft Extreme OADP with stakeholders. Delays in completion of the modeling have prevented development of the Extreme OADP. Consequently, District staff developed this Draft Status Report to inform stakeholders about the overall content and direction of the OADP and to share specific preliminary details about the emissions, control measures, and modeling associated with the OADP. Updates on each of these are presented in the following sections.

## PLAN STATUS:

### Plan Outline

Appendix A presents a proposed draft outline for the Extreme OADP. Major sections include Introduction, San Joaquin Valley Air Quality, Emission Inventory, Control Strategies, Future Ozone Air Quality, Outreach, and Rate of Progress Demonstration. In addition, because this plan is designed to meet state and federal requirements, another major section represents the Triennial Progress Report required by the California Clean Air Act. A "snapshot" of the content of each of these sections is presented below. The outline presented in Appendix A should be viewed as draft and is subject to change as the Plan evolves.

### Emissions Inventory

Two basic types of emissions inventories used in air quality planning are modeling inventories and planning inventories. The modeling inventory typically represents emissions that occurred on specific days in a given episode of high ozone levels and provides the basis to estimate emissions controls needed to attain the standard. The modeling inventory is described in more detail below in the section entitled "Modeling." The planning inventory represents a "typical" day during ozone season (i.e., emissions usually expressed as tons/day). The planning inventory is used for estimating emissions controls needed for standard attainment as well as for documenting compliance with federal Clean Air Act requirements for annual emissions reductions of ozone precursors.

Emissions inventories change over time as control measures are implemented, compliance is improved, or as source categories grow or decline. Thus, the most current inventory is generally believed to be the most accurate, even for years that have already passed. At the workshop, a snapshot of the current planning inventory will be given based on the most recent available planning inventory available from the ARB web site. The planning inventory in the Draft Extreme OADP scheduled for release in Spring 2004 may differ from that presented at the workshop due to the dynamic nature of planning inventories.

## Control Measures

This section of the report discusses the District's rulemaking schedule, outlines emission control measures to be implemented by ARB and EPA, and summarizes the control measure development process conducted by the Valley Regional Transportation Planning Agencies (RTPAs).

District Measures

The District must continue to reduce emissions by three percent per year on average and must continue to make progress toward attainment of the federal 1-hour ozone standard in order to comply with federal Clean Air Act requirements. To meet these requirements, the District implements rules, provides incentives, and encourages voluntary actions on the part of businesses and residents in the SJVAB. This draft status report emphasizes the development of rules addressing stationary source issues of general consideration, including Reasonably Available Control Technology (RACT) on newly-defined major sources and New Source Review (NSR) adjustments required to satisfy federal Clean Air Act requirements for extreme ozone nonattainment areas.

During 2004 through 2007, the District's rulemaking schedule will encompass rules as shown in Tables 1 and 2. The rulemaking schedule includes new rules and rule amendments that are necessary to satisfy various federal requirements. These include RACT, NSR, and sanction clocks, as well as making reasonable further progress toward attaining the one-hour ozone standard.

Table 1 indicates the rule activity planned for 2004 and 2005 as well as the projected adoption dates. Table 2 indicates the rulemaking activity tentatively planned for 2006 and 2007. Most of the measures in the second table are or will soon be under review to determine emission inventories and possible control measures for the indicated sources. The control measure requirements will be more fully described in the Draft Extreme OADP. Control measures must be adopted as rules and implemented by Spring 2008, in order for the measures to affect the 2010 ozone attainment deadline.

The control measures indicated in the following tables are those under consideration at this time. Projects may be added or removed based on information received during the development of the Plan; detailed examination of the emission inventories and feasible control measures; or future local, state and federal requirements.

State and Federal Measures

Motor vehicles and equipment under State and federal jurisdiction, while responsible for about 55 percent of ozone-forming gases in the Valley in 2004, are also contributing the majority of the emission reductions needed for attainment. Adopted State and federal regulations for cleaner engines and fuels are driving Valley oxides of nitrogen (NOx) emissions down by over 140 tons per day (tpd) or over 35 percent between 1999 and 2010. Emissions of reactive organic gases (ROG) from these sources will drop by well over 45 percent in the same timeframe.

**Table 1. Control Measure Schedule (2004 - 2005)**

| Rule Number | Name | Adopt | | Pollutant |
|---|---|---|---|---|
| 4604 | Can and Coil Coatings | 2003 | 4Q | VOC |
| 4409 | Oil and Gas Fugitives | 2004 | 1Q | VOC |
| 4455 | Refinery & Chemical Fugitives | 2004 | 1Q | VOC |
| 9310 – New | Fleet Rule - Group 1 (School Buses) | 2004 | 2Q | NOx, PM10 |
| 9510, 3180 - New | Indirect Source Mitigation Program | 2004 | 3Q | NOx, PM10 |
| New | Small Boilers, Heaters, Steam Generators, 2.0 - 5.0 MMBtu/hr | 2004 | 4Q | NOx |
| New | Water Heaters, 0.075 - 2.0 MMBtu/hr | 2004 | 4Q | NOx |
| 4903 | Residential Space Heating | 2004 | 3Q | NOx |
| 4694 | Wineries - Fermentation process | 2004 | 4Q | VOC |
| 4702 | Agriculture IC Engines | 2005 | 2Q | NOx |
| 4352 | Solid-Fuel Boilers, Steam Generators, Process Heaters | 2005 | 2Q | NOx, CO |
| 4401 | Steam-Enhanced Oil Well Vents | 2005 | 1Q | VOC |
| 4101 | Visible Emissions - Agricultural Equipment Exemption/Limited Approval | 2005 | July | Visible Emissions |
| 4106 | Agricultural Burning - Open Burning Restrictions | 2005 | July | NOx, VOC |
| New | Commercial Dryers – BACM | 2005 | 2Q | NOx |
| 4602 | Automotive Coating | 2005 | 3Q | VOC |
| 4682 | Polymeric Foam Manufacturing | 2005 | 4Q | VOC |

| **Table 2. Control Measures Under Consideration for Rulemaking in 2006- 2007** | | |
|---|---|---|
| **Rule Number** | **Name** | **Pollutant** |
| 2280 | Portable Equipment - NOx | NOx |
| 4354 | Glass Furnaces - NOx | NOx |
| 4402, 4625 | Sumps, Pits, and Wastewater Processing Equipment | VOC |
| 4607 | Paper, Fabric, and Film Coating | VOC |
| 4607 | Screen Printing | VOC |
| 4621 | Storage & Transfer of Gasoline - Bulk Plants | VOC |
| 4624 | Organic Liquid Loading and Transfer | VOC |
| 4641 | Cutback Asphalt Application | VOC |
| 4651 | Soil Decontamination - Air Stripping | VOC |
| 4653 | Adhesives and Sealants | VOC |
| 4692 | Restaurants - Under-fired Charbroilers | VOC |
| 4703 | Small Turbines < 10 MW, distributed generation | NOx |
| 4902 | Residential Water Heaters | NOx, VOC |
| New | Brandy Distilling | VOC |
| New | Wine and Alcohol Storage | VOC |
| New | Concentrated Animal Feeding Operations | VOC |
| New | Aircraft Fuel Transfer - Phase I | VOC |
| New | Composting/biosolids Operations | VOC |
| New | Fugitive Emissions - Heavy Oil Stream | VOC |
| New | Asphalt Plant Dryers/Heaters | NOx, VOC |
| New | Dryers and Dehydrators | NOx, VOC |
| New | Furnaces | NOx, |
| New | Off-road IC - Low Sulfur Fuel | NOx |
| Reg 9 | Fleet Rule - Ride Sharing | NOx |
| Reg 9 | Fleet Rule - Low Sulfur Diesel | NOx |
| Reg 9 | Fleet Rule - Idling Limits | NOx |

To provide additional emission reductions needed in California's ozone nonattainment areas, the Air Resources Board (ARB) in October 2003 adopted a Statewide Strategy that includes new statewide measures for California's mobile source, motor vehicle fuels, and consumer products programs. These measures will cut emissions of ROG, NOx, and particulate matter statewide. The Board directed ARB staff to quantify the emission reduction benefits from these measures, and to include these measures and their associated emission reductions, as appropriate, in upcoming state implementation plans (SIPs) for ozone nonattainment areas.

Emission reductions from defined new statewide measures listed in this document will help attain the federal 1-hour ozone standard in the San Joaquin Valley by 2010. ARB has already committed to the NOx emission reductions from five of these measures in the 2003 San Joaquin Valley PM10 SIP. Since NOx is a precursor of both PM10 and ozone, ARB staff plans to include those five NOx measures, along with other new defined statewide measures for the control of ROG, in the San Joaquin Valley Ozone SIP. This document also describes ARB's latest efforts to define additional measures to generate yet more emission reductions needed to attain the federal 1-hour ozone standard.

*Defined Near-Term State Measures:* The Statewide Strategy includes defined measures that ARB staff will develop, plus the Bureau of Automotive Repair's planned improvements to the Smog Check program. A measure for emission reductions in the San Joaquin Valley from pesticides, which falls under the authority of the California Department of Pesticide Regulation, is under development and is expected to be available for the draft Ozone SIP.

The ARB measures cover on-road vehicles, off-road equipment, marine vessels/ports, fuels and refueling, and consumer products. Lower emission standards for new engines and consumer products are complemented by measures to clean up the existing fleet of mobile sources. Other measures will reduce gasoline vapor emissions from storage tanks, service stations, and fuel tanker trucks. Tighter limits on fuel properties will also be set.

New defined State measures from the Statewide Strategy ARB staff anticipates including in the San Joaquin Valley 2010 Ozone SIP, and the expected range of emission reductions, are shown in the Table 3. As part of the Statewide Strategy, ARB staff is committed to develop and propose the listed measures to the Board for its consideration by the dates in the table. ARB may meet the emission reduction commitment by adopting one or more of the control measures in the following table, by adopting one or more alternative measures, or by implementing incentive program(s), as long as the total minimum new emission reductions are achieved.

*Process for Developing Measures into Regulations:* Each defined measure would go through the full public, regulatory development process; steps typically include:

- Meetings with the affected industry to better understand the source, its uses, and its emissions;

## Table 3. New State Near-Term Measures for San Joaquin Valley, 2010 Ozone SIP (Reductions in tons per day, based on 2010 summer planning inventories)

| Strategy (Agency) | Name | Final Action Date | Measure Committed to in SJV PM10 SIP? | Expected Reductions (San Joaquin Valley 2010) | |
|---|---|---|---|---|---|
| | | | | VOC | NOx |
| **DEFINED STATE MEASURES TO BE DEVELOPED AND PROPOSED** | | | | | |
| LT/MED-DUTY-1 (ARB) | Replace or Upgrade Emission Control Systems on Existing Passenger Vehicles – Pilot Program | 2005 | Yes | 0-5.6 | 0-5.9 |
| LT/MED-DUTY-2 (BAR) | Improve Smog Check to Reduce Emissions from Existing Passenger and Cargo Vehicles | 2002-2005 | Yes | 1.6 | 2.3-2.5 |
| ON-RD HVY-DUTY-1 (ARB) | Augment Truck and Bus Highway Inspections with Community-Based Inspections | 2003 | No | 0-0.1 | 0 |
| ON-RD HVY-DUTY-2 (ARB) | Capture and Control Vapors from Gasoline Cargo Tankers | 2005 | No | 1.4-1.8 | 0 |
| ON-RD HVY-DUTY-3 (ARB) | Pursue Approaches to Clean Up the Existing and New Truck/Bus Fleet | 2003-2006 | Yes | 0.6-2.2 | 5.8-7.6 |
| OFF-RD CI-1 (ARB) | Pursue Approaches to Clean Up the Existing Heavy-Duty Off-Road Equipment Fleet (Compression Ignition Engines) – Retrofit Controls | 2004-2008 | Yes | 1.7-5.8 | 5.8-7.3 |
| OFF-RD CI-2 (ARB) | Implement Registration and Inspection Program for Existing Heavy-Duty Off-Road Equipment to Detect Excess Emissions (Compression Ignition Engines) | 2006-2009 | No | Not Quantified | Not Quantified |
| OFF-RD LSI-1 (ARB) | Set Lower Emission Standards for New Off-Road Gas Engines (Spark Ignited Engines 25 hp and Greater) | 2004-2005 | No | 0 | 0.1 |
| OFF-RD LSI-2 (ARB) | Clean Up Off-Road Gas Equipment Through Retrofit Controls and New Emission Standards (Spark-Ignition Engines 25 hp and Greater) | 2004 | Yes | 0.2-0.6 | 0.4-0.8 |

| Strategy (Agency) | Name | Final Action Date | Measure Committed to in SJV PM10 SIP? | Expected Reductions (San Joaquin Valley 2010) | |
|---|---|---|---|---|---|
| | | | | VOC | NOx |
| SMALL OFF-RD-1 and SMALL OFF-RD-2 (ARB) | Lower Emission Standards for New Lawn and Garden Equipment | 2003 | No | 0.5 | 0-0.1 |
| FUEL-1 (ARB) | Set Additives Standards for Diesel Fuel to Control Engine Deposits | 2006-2009 | No | Not Quantified | Not Quantified |
| FUEL-2 (ARB) | Set Low-Sulfur Standards for Diesel Fuel for Trucks/Buses, Off-Road Equipment, and Stationary Engines | 2003 | No | Enabling | Enabling |
| CONS-1 (ARB) | Set New Consumer Products Limits for 2006 | 2003-2004 | No | 0.5 | 0 |
| CONS-2 (ARB) | Set New Consumer Products Limits for 2008-2010 | 2006-2008 | No | 2.1-3.7 | 0 |
| FVR-1 (ARB) | Increase Recovery of Fuel Vapors from Aboveground Storage Tanks | 2003 | No | 0-0.1 | 0 |
| FVR-2 (ARB) | Recover Fuel Vapors from Gasoline Dispensing at Marinas | 2006-2009 | No | 0-0.1 | 0 |
| FVR-3 (ARB) | Reduce Fuel Permeation Through Gasoline Dispenser Hoses | 2004 | No | 0-0.2 | 0 |
| PEST-1 (DPR) | Implement Existing Pesticide Strategy | --- | No | Baseline | N/A |
| **Potential Range for Defined Near-Term State Measures** | | | | **8.6-22.8** | **14.4-24.3** |
| **Proposed Minimum Commitment Via Adoption through 2006** | | | | **TBD** | **TBD** |

- A rigorous technical evaluation to determine the potential technologies and techniques to reduce emissions, including the feasibility, effectiveness, cost, and impacts;
- Public workshops to discuss the technical evaluation and staff's ideas for regulatory concepts, as well as participants' suggestions;
- Release of a staff report with the formal regulatory proposal, including an assessment of the potential environmental and economic impacts for a 45-day public comment period; and
- Consideration by the Board at a public hearing.

*Further Emission Reductions:* When adopting the Statewide Strategy, the Board directed ARB staff to continue to identify opportunities for further emission reductions from emission sources under ARB authority. As part of this process, ARB staff will conduct, during each of the next three years, an annual Summit on the State Implementation Plan with participation from technical experts, academia, consultants, and other interested stakeholders. ARB staff will hold the first Summit on January 13-14, 2004 in Sacramento. Additional information on the Summit is accessible at http://www.arb.ca.gov/planning/sip/sipsummit/2004/2004sipsummit.pdf.

Local Agency Measures

The Clean Air Act requires nonattainment plans to implement all reasonably available control measures (RACM) as expeditiously as practicable. Approximately two years ago, the Regional Transportation Planning Agencies (RTPAs) and their member jurisdictions began a RACM process for the Severe Area Ozone Plan. Subsequently, the "Regional Transportation Planning Agency Commitments for Implementation" Document was completed and submitted to the District in April 2002. The document included resolutions from each RTPA and their member jurisdictions, which included commitments to implement measures, as well as reasoned justification for measures that were found not to be feasible.

In cooperation with the District and the ARB, the eight RTPAs are coordinating the local government control measure process with their member agencies to adopt commitments to implement measures for the Draft Extreme OADP. In October and November 2003, a model resolution package was transmitted to each jurisdiction (eight RTPAs and 67 city and county agencies) along with their existing RACM commitments requesting adoption of RACM resolutions for the Draft Extreme OADP.

In general, the adopted resolution package will be reviewed to determine if existing commitments can be strengthened. Examples of strengthening include extending the implementation schedule for the measure through 2010 or including additional financial resources. If the existing commitment is not ongoing (e.g., implementation expires in 2005) and/or cannot be strengthened, then reasoned justification would be developed. In addition, the adopted resolution package will be reviewed to determine if any measures that were previously found not feasible are now feasible for implementation. If so, a new commitment for implementation will be developed; if not, the reasoned justification will be updated accordingly.

The RTPAs and member jurisdictions are scheduled to adopt resolutions by the end of February 2004. It is anticipated the Commitment document will be submitted to the District in March 2004.

## Modeling

Application of Photochemical Modeling in the SJVAB Draft Extreme OADP

Photochemical models are used to simulate the complex atmospheric and chemical processes that form ozone. These models estimate the amount of reduction of air pollutant emissions needed to achieve health standards. The models contain algorithms that synthesize the knowledge of meteorology, emission rates, chemical transformations, transport, dispersion, and removal of pollutants from the atmosphere. These models can be used to project air quality in future years given various emissions growth and control scenarios. The following describes the modeling system that was selected for the Draft Extreme OADP to simulate ozone formation in the San Joaquin Valley and project ozone levels in future years.

The Basis and History of Photochemical Modeling Work in the San Joaquin Valley

Current ozone modeling done for the San Joaquin Valley has its roots in an extensive field program that was done in the summer and fall of 1990. This field program, the San Joaquin Valley Air Quality Study (SJVAQS), provided data for the first extensive photochemical modeling of the San Joaquin Valley and was later incorporated in the 1994 Ozone Attainment Plan. The SJVAQS/AUSPEX Regional Model Adaptation Project (SARMAP) Air Quality Model (SAQM) was developed specifically for addressing ozone air quality issues in the SJV. SAQM incorporated lessons learned from approximately 20 years of modeling and field study experience in California and the United States. The SAQM model was used extensively through the mid- and late 1990's.

In 1998, the San Joaquin Valleywide Study Agency recognized the need for a more robust suite of photochemical models. To drive these models, the Study Agency Technical Committee developed a state of the art meteorological and ozone air pollutant measurement program called the Central California Ozone Study (CCOS), which was funded and implemented in summer 2000. During the last few years, data from CCOS has been used to simulate three ozone episodes from the summer of 2000 (June, July/August, and September). Several models have been used to simulate the CCOS episodes, including those episodes that occurred in June, July/August, and September 2000. In addition, one episode outside the CCOS measurement program (July 1999) has been simulated. A consortium of agencies including EPA, ARB, the Sacramento Metropolitan Air Quality Management District (SMAQMD), the Bay Area Air Quality Management District (BAAQMD), the District, the University of California at Riverside, the National Oceanic and Atmospheric Administration (NOAA), and expert modeling consultants evaluated these episodes. To date, the consensus opinion of these experts is that the July/August 2000 episode is the most valuable for the assessment of emission controls in the San Joaquin Valley. The Study Agency Technical Committee also is looking at the September 2000 episode for possible use in the SJVAB attainment demonstration.

As part of the technical support work for ozone air quality plans being developed by the District, BAAQMD, and the SMAQMD, the Study Agency Technical Committee reviewed various photochemical models and their performance in predicting ozone levels. These models include the Community Multi-Scale Air Quality Model (CMAQ), the SAQM model mentioned above, and the Comprehensive Air Quality Model with Extensions (CAMx). In addition, meteorological models have also been tested, including Mesoscale Model Version 5 (MM5) and the Regional Atmospheric Meteorological System (RAMS). Two chemistry modules, Carbon Bond-Four (CB4) and the State Air Pollution Research Center (SAPRC), have also been evaluated. To date, the consensus among the Technical Committee members of the Study Agency is that the best modeling system to apply to the current SJVAB Draft Extreme OADP consists of CAMx, MM5 hybridized with observations (see "Meteorological Inputs" below), and SAPRC chemistry.

The District and others have identified some issues associated with using the July/August 2000 episode as part of the SJVAB Draft Extreme OADP. One issue is that the model for this episode under-predicts actual measured ozone levels in the southern part of the San Joaquin Valley. A second issue is that wildfires also influence the southern SJV ozone in the base year, but simulations of future year ozone levels assume no wildfires present. In spite of these uncertainties, plan development is proceeding with this episode because to date no other computer simulation is working better than the CAMx and MM5/Hybrid for this episode, and its remaining issues are expected to be overcome.

The District is currently investigating another CCOS episode that occurred in September 2000 for use in the attainment demonstration. To better understand model performance, the Study Agency, working with the ARB, has contracted an expert consultant to investigate model runs for this episode. This episode is promising because ozone levels were closer to desirable planning levels, and no significant wildfires were present in the region during the base case. If the Study Agency Technical Committee deems the performance of this episode to be satisfactory, it may be used in plan development. At present, however, only the July/August 2000 episode is being developed for the Draft Extreme OADP, as described below.

## **II.** Selected Episode

During the CCOS, a high ozone event was forecast to occur and was intensively monitored during July 29 through August 2, 2000. Although Federal 1-hour ozone violations occurred in the San Joaquin Valley during the episode, the measured peak ozone concentrations were lower than typically observed peak concentrations. Table 4 below summarizes observed 1-hour peak ozone concentrations during the episode and typical peak values.

As summarized below in the emissions section, substantial wildfire activity occurred during this episode, and at least one of the wildfires is suspected of contributing to the peak observed ozone levels at the Edison site.

**Table 4. CCOS Ozone Levels vs. Typical Peak Ozone Levels, SJVAB**

| Date | Peak Central & Northern San Joaquin Valley | Site | Typical 2000-2002 Design Value | Peak Southern San Joaquin Valley | Site | Typical 2000-2002 Design Value |
|---|---|---|---|---|---|---|
| 7/30/2000 | 129 ppb | Parlier | 151 ppb | 128 ppb | Edison | 141 ppb |
| 7/31/2000 | 118 ppb | Clovis | 137 ppb | 115 ppb | Edison | 141 ppb |
| 8/1/2000 | 118 ppb | Fresno | 144 ppb | 116 ppb | Arvin | 142 ppb |
| 8/2/2000 | 131 ppb | Modesto | 123 ppb | 151 ppb | Edison | 141 ppb |

Meteorological Inputs

Air quality models require emission inputs (summarized below) and meteorological inputs. A significant number of meteorological stations monitored meteorology during the episode, both at the surface and aloft. However, even with this intensive monitoring effort, large areas of the modeling domain did not have meteorological observations. In addition to the meteorological observations, a state-of-the-science prognostic meteorological model (MM5) was exercised for the modeling domain. To best utilize the available meteorological measurements and to take advantage of the physics capability in MM5, ARB developed a hybrid approach that matches measured meteorological parameters where measurements were made, and relies on the physics within MM5 to estimate meteorological parameters where measurements were not available. This hybrid approach was used to generate the meteorological inputs for the current air quality modeling.

Modeling Domain

The modeling region, or domain, is shown at right. It covers the entire central California region, including the San Joaquin and Sacramento Valleys, and the San Francisco Bay Area. In addition, the domain extends out over the Pacific Ocean to minimize the influence of any air pollution entering the boundary of the modeling domain. The modeling approach subdivides the area into horizontal grid cells of 4 x 4 $km^2$, and into 16 vertical layers up to an altitude of 5 km above the surface. Approximately 550,000 grid cells comprise the modeling domain.

Emission Inventory

ARB and the local air districts in the modeling region have estimated emissions to represent as closely as possible the actual emissions that occurred during the episode. Emissions are distributed into each 4-km grid cell. Emissions are broadly categorized into major stationary or point sources, area sources (which include off-road mobile sources), on-road mobile sources, and biogenic sources (biologic sources of air pollutant emissions, [e.g., VOC emissions from trees and shrubs]). Local air districts estimate emissions from point sources. Estimating emissions from area sources is a cooperative effort between ARB and air districts' staffs. The off-road mobile sources

are an estimate of the population, activity, and emissions estimate of the varied types of off-road equipment. ARB's OFFROAD model estimates emissions from these sources. Where available, day-specific information was used, including 70 large point sources, agricultural burning and 15 wildfires in California and Nevada. Two of these wildfires were large: the Manter fire in eastern Tulare County (about 73,000 acres burned) and the Plaskett2 fire in Monterey County (about 6,000 acres burned).

For on-road mobile sources, ARB's EMFAC2002 v2.2 model was used to calculate emissions for each county using episode-specific hourly temperature and relative humidity. DTIM4, the latest version of the Direct Travel Impact Model (DTIM), was used to spatially and temporally distribute the on-road motor vehicle emissions for each episode day. DTIM4 output, using an Integrated Transportation Network (ITN) activity as inputs, was used to create hourly emission *ratios* for each grid cell in a county. These ratios were used to distribute county-specific, daily EMFAC motor vehicle emissions to each hour and grid cell. The ITN is a seamless on-road transportation network that covers all of California. Using as much local data as possible, the ITN was developed from many local Metropolitan Planning Organizations (MPOs), RTPAs, as well as the California Department of Transportation (Caltrans) Statewide Model.

For biogenic sources, ARB has developed a Geographic Information System (GIS)-based model for estimating biogenic volatile organic compound emissions. This model is called BEIGIS, and uses California-specific input databases with a minimum spatial resolution of 1 square kilometer and an hourly temporal resolution.

Air Quality Model

ARB ran the CAMx model, using the SAPRC99 chemical mechanism, on the July/August 2000 episode. The choice of air quality model was based on a preliminary results from a model comparison study directed at evaluating three state-of-science models: CAMx, SAQM, and CMAQ. It is widely accepted that SAPRC-99 is a scientifically superior chemical mechanism to the chemical mechanism (Carbon Bond IV) used in previous ozone SIP modeling. In addition, the Reactivity Research Advisory Committee of the California Air Resources Board has recommended the SAPRC chemical mechanism for regulatory modeling activities.

Base Case (Historical Modeling)

Before the air quality model is applied to estimate future year emission targets, it must first undergo a performance evaluation ("evaluation"). In this evaluation, the model is used to simulate an historical ozone episode, and is then judged on its ability to replicate observed conditions during the episode. A series of statistical metrics, combined with visual inspection of the model outputs, are used to judge the model. In addition, a series of sensitivity and diagnostic simulations with the model are done to ensure that it is behaving properly. Although work is ongoing to improve the modeling simulations and inputs, the use of CAMx on the July/August 2000 episode meets State and Federal model acceptance criteria, and reproduces the historical episode satisfactorily.

Future Year Modeling

Once the performance evaluation is complete and the air quality model is judged to be acceptable, it is applied with projected future year emission inventories to estimate the necessary reductions in ozone precursor emissions (oxides of nitrogen and hydrocarbons) that would be necessary to achieve attainment of the relevant ozone standard. The first step in this process is to exercise the model in a series of runs with varying levels of precursor emission reductions, and to use the results to construct an ozone isopleth diagram. This diagram provides information on the relative efficacy of controlling each precursor, and can be used to estimate an emission inventory target for attainment. Wildfires were excluded as an emissions source in the future year modeling, since it is impossible to know where they will occur.

Because the observed ozone concentrations during the episode were lower than typical high ozone events in the San Joaquin Valley, a preliminary decision was made to scale the modeling results to better reflect expected high ozone events. In this approach, the air quality model was applied for the historical year (2000) and a future year (2005 and 2010), and was used to derive a relative air quality change at each monitoring site. This relative change was then used to scale 1-hour ozone design values for year 2000 at each site, and to thus develop an expected future year design value. An initial set of ozone isopleths has been generated for this episode for both 2005 and 2010 using this approach; it suggests that additional precursor emission reductions (beyond those reflected in Table 1) will be necessary to attain the federal 1-hour ozone standard in the SJVAB. These reductions will be addressed through the measures shown in Table 2, state and federal measures, and additional long-term measures that will be identified.

**Rate of Progress**

The Federal Clean Air Act specifies that ozone nonattainment areas must submit to EPA State Implementation Plan (SIP) revisions documenting that emissions of volatile organic compounds (an ozone precursor) are declining at rates that meet or exceed levels specified in the Act. These SIP revisions are termed Rate of Progress (ROP) Plans. The FCAA identifies two types of ROP requirements: (i) a 15% VOC emission reduction to be achieved from 1990 to 1996 (termed the “15 percent Rate of Progress Plan” and (ii) an actual VOC emission reduction of at least three percent per year averaged over each consecutive 3-year period beginning November 15, 1996 until the area’s attainment date (termed the “Post-1996 Rate of Progress Plan”). EPA guidance allows substitution of NOx emissions (the other significant ozone precursor) for VOC emissions in the Post-1996 Rate of Progress Plan, provided certain conditions are met. The three percent per year requirement should be viewed as a minimum annual emission reduction; the underlying requirement for a nonattainment area’s SIP is to achieve attainment by the requisite date, even if the emission reductions necessary to achieve attainment exceed three percent per year (EPA, 1994). The SJVAB has met all ROP Plan requirements through 2005 (SJVAPCD 1994; SJVUAPCD, 1995; SJVUAPCD, 2000). The SJVAB’s most recent ROP Plan is the *Amended 2002 and 2005 Rate of Progress Plan for San Joaquin Valley Ozone* (December 31, 2002). EPA

found this *Amended ROP Plan* to be complete in September 2003, and is now reviewing it in detail in order to take final action.

The Draft Extreme OADP will fulfill the remaining ROP Plan requirements for the SJVAB out to its projected attainment date of November 15, 2010 for the federal 1-hour ozone standard. Before doing that, however, it will show that prior ROP Plan calculations are still valid given the most recent emissions inventory information. As discussed above, emissions inventories change over time to reflect implementation of control measures, adjustments to improve accuracy, and other factors. Consequently, the most recent inventories are generally believed to be more accurate, even for past years. Therefore, the Draft Extreme OADP will re-examine the ROP calculations in the most recent SJVAB ROP Plan (*Amended 2002 and 2005 Rate of Progress Plan for San Joaquin Valley Ozone*, December 31, 2002) in light of then-current (Spring 2004) planning emissions inventories for the SJVAB to demonstrate that the ROP requirements are still met. Data in the most recent planning inventory at the time of this Draft Status Report shows that the rate of progress in the December 2002 *Amended ROP Plan* is still being met; in fact, emissions have decreased more quickly than shown in the December 2002 *Amended ROP Plan*.

**California Clean Air Act**

The California Clean Air Act (CCAA) requires the District to report its progress in meeting state mandates for air quality improvements and to revise its Air Quality Attainment Plan at specified times to reflect changing conditions. More specifically, California Health and Safety Code (H&SC) section 40924, requires the District to assess the extent of air quality improvement achieved during the preceding three years based on: 1) ambient pollutant measurements; 2) best available modeling techniques; and 3) air quality indicators identified by the State Board for that purpose. Based on the ARB guidance document, Guidance for Using Air Quality-Related Indicators in Reporting Progress in Attaining the State Ambient Air Quality Standards, the District's assessment of improvement is based on air quality indicators and confirmed by ambient measurements and modeling.

The next update of this plan is due to ARB by December 31, 2003 for the period 2000--2002. Districts preparing updated SIPs in late 2003 and early 2004 (as is the case in the SJVAB) may delay the submittal of the California plans until such time as the adopted updated SIP is submitted to ARB for approval. The Draft Extreme OADP will contain a section meeting the California Clean Air Act requirements for a triennial update.

The California Clean Air Act (Section 40914 of the Health and Safety Code) also requires that districts achieve a five- percent annual emission reduction in ozone precursors. If a district cannot achieve this five-percent reduction, it must commit instead to adopt all feasible measures. No district, including the San Joaquin Valley, has been able to achieve the five-percent annual emission reduction, and all have pursued an “all feasible measures” strategy.

ARB also recently strengthened its air pollution transport regulations requiring expeditious adoption of all feasible measures in upwind air districts. As part of its triennial update, each district must review its rules to determine if it is meeting the “all feasible” requirement. If a district finds that it does not currently meet the requirement, the plan revision needs to include a list of new rules or amendments to existing rules needed to do so.

Ambient pollutant measurements are collected from monitoring stations within the SJVAB and are incorporated into the ARB's annually published Air Quality Data. ARB provided the current data set to districts statewide in July 2003. Due to the "lag time" inherent in preparing that publication, the most recent issue includes data only through 2002. The data used to prepare the annual statistics shown in that document are reflected in the air quality indicators to be discussed in the Draft Extreme OADP.

The ARB has identified three air quality indicators for districts to use in the triennial updates to ozone attainment demonstration plans: the Expected Peak Day Concentration (EPDC), the population-weighted exposure (PWE) and the area-weighted exposure (AWE). The EPDC represents the maximum ozone concentration expected to occur once per year on average at a given monitoring site. Preliminary analysis of the data provided by ARB shows that the EPDC has declined at most sites in the SJVAB since the mid-1980’s, but that levels at most of the sites either increased or showed no change from 2001 to 2002. The PWE is intended to characterize the potential average outdoor exposure per person to concentrations above the level of the state ozone standard. In contrast, the purpose of the AWE is to characterize the potential average annual outdoor exposure per unit area. For the SJVAB, the PWE has declined from 3.220 ppm-hrs in 1988 to 1.717 ppm-hrs in 2002; however, the 2002 value represents an increase from the 2001 value of 1.316 ppm ppm-hrs and reversed what had been a general downward trend in PWE values begun in the late 1990s. The AWE for the SJVAB has declined from 3.243 ppm-hrs in 1988 to 1.872 ppm-hrs in 2002; the 2002 value represents a significant jump over the 2001 value of 1.026 ppm-hrs, and also reversed a general downward trend begun in the late 1990s. However, fluctuations of comparable magnitudes in both PWE and AWE have occurred in the past for the SJVAB. Also, a single year’s data is not appropriate for identifying trends, since variations may be related to meteorological conditions. The Draft Extreme OADP will provide more details on these air quality indicators and the meaning of the values and trends in the values.

**ACRONYMS:**

| | |
|---|---|
| ARB | Air Resources Board |
| AWE | Area Weighted Exposure |
| AUSPEX | Atmosphere Utility Signatures, Predictions, and Experiments |
| BAAQMD | Bay Area Air Quality Management District |
| BEIGIS | Biogenic Emissions Inventory Geographic Information System |
| Caltrans | California Department of Transportation |
| CAMx | Comprehensive Air Quality Model with Extensions |
| CB-4 | Carbon Bond, Version Four |
| CCOS | Central California Ozone Study |
| CMAQ | Community Multiscale Air Quality Model |
| DTIM | Direct Travel Impact Model |
| EMFAC | Emissions Factors |
| EPA | Environmental Protection Agency |
| EPDC | Expected Peak Day Concentration |
| GIS | Geographic Information System |
| ITN | Integrated Transportation Network |
| MM5 | Mesoscale Model, Version 5 |
| MPOs | Metropolitan Planning Organizations |
| NAAQS | National Ambient Air Quality Standards |
| NOAA | National Oceanic and Atmospheric Administration |
| NOx | Nitrogen Oxides |
| NSR | New Source Review |
| ppb | parts per billion |
| ppm | parts per million |
| PWE | Population-Weighted Exposure |
| RACT | Reasonably Available Control Technology |
| ROP | Rate of Progress |
| RTPA | Regional Transportation Planning Agency |
| SAPRC | State Air Pollution Research Center |
| SAQM | SARMAP Air Quality Model |
| SARMAP | SJVAQS/AUSPEX Regional Model Adaptation Project |
| SIP | State Implementation Plan |
| SJVAB | San Joaquin Valley Air Basin |
| SJVAQS | San Joaquin Valley Air Quality Study |
| SMAQMD | Sacramento Metropolitan Air Quality Management District |
| tpd | tons per day |
| VOC | Volatile Organic Compounds |

# Appendix A

## Suggested Draft Table of Contents

**DRAFT**
**Extreme Ozone Attainment Demonstration Plan**
**for the San Joaquin Valley Air Basin**

## 9 FUTURE ACTIVITIES

## ACRONYMS AND GLOSSARY

## APPENDICES

**A.** County Emissions Inventories

**B.** Control Measures for No Further Consideration

**C.** Valley Transportation Planning Agencies RACM Process Summary

**D.** Regional Transportation Planning Agency Commitments For Implementation

**E.** Modeling and Attainment Demonstrations

**F.** Descriptions of State and Federal Control Measures

**G.** Ozone Health Effects Bibliography