Appendix N is being submitted to the SIP as a public comment. The contents of this appendix do not reflect SIP commitments. For the District's analysis of this document, please refer to Appendix P.

Appendix N

ISSRC "Clearing The Air"
February 2007, 1st Version

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Clearing the Air:

HOW CLEAN AIR IS POSSIBLE AND AFFORDABLE BY 2013

An Alternative State Implementation Plan for the San Joaquin Valley

EXECUTIVE SUMMARY

PREPARED BY INTERNATIONAL SUSTAINABLE SYSTEMS RESEARCH CENTER | FEBRUARY, 2007

I. Warning: San Joaquin Valley Air is Hazardous to Your Health

The San Joaquin Valley has some of the most dangerous air quality levels in the nation. It has the third highest fine particulate matter levels in the United States. One out of every three days in the Valley exceeds healthy levels of ozone (smog). The health and economic impacts of living with these pollution levels are staggering. Breathing the air in the Valley is estimated to contribute to 460 deaths per year and 192,000 missed school and workdays annually. It racks up $3.2 billion a year of taxpayer dollars in community health costs.

The unhealthy levels of air pollution in the Valley have been a known problem for more than two decades. In 1970, the Federal government first required each region to develop plans for cleaning up the air. Since then, the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD or District) has submitted several plans for cleaning up the air. Yet to date, none of these plans has been successful: Over the past 15 years, ozone decreased a modest 4 percent. Particulate matter levels have only been measured since 1999, however, the emissions of PM2.5 in the Valley have only decreased about 7 percent over the last 15 years (ARB Almanac, 2006). Other districts with similar non-attainment status have made double this progress in similar time periods.

The Alternative State Implementation Plan (SIP) presented in this report shows that clean air in San Joaquin Valley is possible by 2013. This SIP considers the best practices from these non-attainment districts that are making better progress than the San Joaquin Valley Unified Air Pollution Control District. Furthermore, all of the recommendations in this Alternative SIP use proven, available technologies and strategies within the District's power to implement today.

WHY THE SLOW PROGRESS?

There are several reasons for the slow progress.

First, we don't have a full understanding of the Valley's emissions sources and meteorology. For example, there is significant uncertainty around the impact of emissions from several important air pollution sources, including mobile sources, agricultural sources, off gassing, and farming and dairy operations. When emissions are underestimated, these sources are not adequately targeted for large potential emission reductions, and control strategies that can greatly enhance air quality are often overlooked.

In addition, some researchers have concluded that the Valley has a lower capacity for emissions than previously thought (SJVUAPCD: Discussion Paper 2006). In other words, it requires fewer emissions to create the same levels of air pollution than previous model estimates have calculated. This means emissions will have to be reduced more, and each ton of emission is more harmful than previously believed.

Second, emission reduction strategies implemented in the Valley may not have been as aggressive as they could have been. Emission reduction rules have often stopped short of feasible stringency levels; some rules have failed to reduce emissions at all. Also, until very recently, whole industrial sectors in the Valley were either exempt from direct air quality regulation (e.g., agriculture) or have simply not been addressed (new residential development).

Third, rapid population growth combined with a statewide industry boom in the transportation of goods have resulted in a rapid increase in the number of vehicles in the Valley and the amount of travel — and the pollution generated — by cars, trucks, buses, construction equipment, trains, planes and other sources.

CLEAN AIR TARGETS FOR SAN JOAQUIN VALLEY

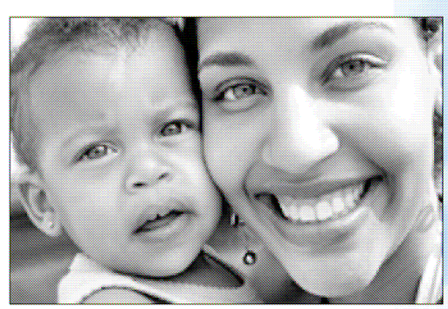
The next deadline for the District to meet ozone attainment is now set at the year 2013. Taking the above factors into account, the District estimates that emissions in the Valley must be cut by roughly 60 percent from 2006 levels to meet federal ozone standards (SJVUAPCD: Discussion Paper 2006) and for San Joaquin Valley residents to breath healthy air. If the district fails to find a reasonable method for reaching the attainment level by this date, it may ask the EPA to be reclassified as extreme non-attainment, which will trigger an extension of the deadline to 2024 for meeting the federal ozone standards.

Table EX0-1 shows the amount of reductions proposed by the District in 2006 that can be achieved by 2013. It also shows the estimated remaining amount needed to reach ozone attainment. This calculation indicates that approximately 286 tons per day of NOx + VOC (the two pollutants that create ozone pollution) must be reduced. While the District has produced a draft State Implementation Plan (SIP) to address the issue, the plan falls short of identifying specifically how emission reductions will or could be accomplished, therefore indicating the District seems increasingly on a path of delaying clean air attainment. **The purpose of this report is to offer an alternative plan that identifies practical, short-term strategies to reach this attainment goal so that the District need not delay and the people in the San Joaquin Valley can start breathing clean air by 2013.**

TABLE EX0-1
Emissions Reductions Required for Achieving Acceptable Ozone Levels in the Valley

	TONS/DAY NOX + VOC
Baseline Emissions, 2013	780
Estimated Reductions Needed for Clean Air	480
Estimated Reductions From Federal, State and District Proposed and Approved Rules	194
Remaining Reductions Required	286

II. Clean Air is Achievable by 2013



Our research and analysis indicate that it is entirely possible to reach the federal eight-hour ozone standard Valley-wide by 2013 and to make significant progress to reach the particulate matter attainment as well. The alternative clean air plan proposed here capitalizes on policy and technological solutions that can move the region significantly closer to safe air as well as improved regulations and control strategies, described in greater detail below.

CLEANING UP THE AIR: A REASONABLE PRICE TAG

We put the upper estimate of the cost for funding this alternative plan at $2.3 billion in public funding over a five-year period. By comparison, the estimated health costs to the Valley attributed to the current state of poor air quality are $3.2 billion each year. **This cost comparison shows taxpayers will *save* $4.5 billion over five years if the District implements this alternative SIP.**

The political and cost challenges of achieving this progress are real. But the alternative of not cleaning up the air, or settling for less than full attainment of federal standards by 2013, is simply unacceptable when the impacts to human health and the economy are considered and there is a real possibility that the region can reach the goal.

TESTED — AND PROVEN — STRATEGIES FOR SUCCESS

The clean air reduction strategies proposed in this plan have been identified through the review of recent studies, past and current actions taken by air pollution regulatory agencies in various parts of the United States, and successful technology demonstrations. When implemented together, these strategies can achieve air standards in the Valley by 2013.

Since many of the proposed strategies are being implemented in other areas of California or the United States, the Valley is not forced to venture into control strategies that have not been tested elsewhere. Nevertheless, these strategies will require the cooperation and substantial efforts of the pollution control board, the community, local leadership and industries to adopt and enforce.

SOLUTIONS ARE WITHIN LOCAL DISTRICT POWER AND CONTROL

Local agencies must continue working together with state and federal agencies to develop improved regulations and maximize funding for the Valley. However, the strategies outlined in this plan are *not* dependent upon State or Federal action. ***That is to say, all of these strategies can be adopted by the local air pollution control district board without approval or cooperation from other agencies.***

This is an important issue because many of the Valley's emissions sources are regulated to some extent by State and Federal agencies. State and Federal regulations can take longer to implement and are typically compromised to balance economic and environmental requirements over the whole United States or the whole state of California. However, fast action is needed to ensure the Valley's residents achieve healthy air soon. Valley authorities have cited jurisdictional constraints as limiting their ability to set emission standards for some new sources, including airplanes, trains, autos and trucks. While this is true, this report makes clear that there are local authority options to reduce emissions enough to meet clean air attainment in tandem with State and Federal actions to accelerate air pollution reductions in the Valley.

A TALE OF TWO STATE IMPLEMENTATION PLANS: KEY DIFFERENCES

In pursuit of achieving clean air attainment by 2013, several key differences emerged between this proposed Alternative State Implementation Plan and the Distict's SIP:

1. **District Plan:** Recommends achieving one-third of the 480 tons per day emissions reductions needed to reach attainment by the year 2013.

   Alternative Plan: Recommends achieving 100 percent of the emissions needed to reach attainment by the year 2013 (286 tons per day NOx + VOC more than the District's plan).

2. **District Plan:** Proposes changes or additions for 17 various stationary and area rules. The district estimates these rule amendments will reduce emissions by 40 tons per day NOx + VOC by the year 2013.

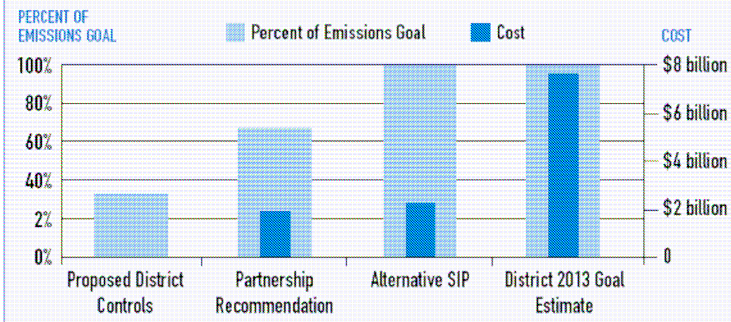
   Alternative Plan: Estimates that there are reasonable changes to these rules that can reduce emissions by an ***additional*** 83 tons per day NOx + VOC. These amendments to the District's rules do not require any additional public funds and keep affected business costs to an acceptable level and can be achieved by 2013.

3. **District Plan:** Estimates that $8 billion in financial incentives would be required to expedite reaching attainment by 2013.

   Alternative Plan: Suggests that the amount of emissions reductions needed through incentive funding can be dramatically reduced to an estimated $2.3 billion, in part by using other options available to the District, such as increasing rule stringency on agriculture, industry and new growth.

FIGURE EX-1

Comparison of Various Plans to Reach Ozone Attainment by 2013



ACHIEVING REDUCTIONS AT A REASONABLE COST

Figure EX-1 compares how different strategies help bridge the 460 ton per day gap, as well as the estimated cost for these strategies. This cost is in addition to the current $50 million per year in incentive funds at the district.

- The first strategy on the left indicates the current proposed district controls in the Draft Ozone Plan. There are no additional incentive costs assumed in this plan.
- The second option shows the recommended approach of another analysis, the California Partnership for the San Joaquin Valley's Air Quality Working Group (Partnership Plan), which was created by Governor Schwarzenegger to provide recommendations for the economic well-being of the Valley (see Appendix J of the Draft Ozone Plan). The Partnership Plan proposes to reach 66 percent of the attainment goal by 2013 at a cost of $1.9 billion.
- The third is the option outline in this plan, which achieves the total emissions reductions required at an estimated cost of $2.3 billion.
- The last option shows a calculation by the district of their estimated costs of completing the necessary reductions by 2013 for approximately $8 billion, or almost four times this alternative SIP's estimate.

One of the major differences in the plans is that the district and partnership plans assume more reductions in the areas that require incentive funding, whereas this alternative plan assumes more emissions reductions from areas that do not require incentives, such as increased rule stringencies and operational policies.

III. Policy and Regulatory Recommendations

Considering the dangerous levels of air pollution in the San Joaquin Valley, the region must proactively and aggressively pursue new technologies and innovative approaches to achieve additional pollution reductions. The strategies recommended in this report fall within the federal and state definitions for appropriate control strategies. These strategies, combined with numerous opportunities to strengthen some of the Valley's current and proposed measures, are an alternative approach for the District to meet clean air attainment by 2013.

The pollution reduction strategies outlined in this alternative SIP are:

RECOMMENDATION **1:**

Take proven technologies and apply them to the Valley

STRATEGY: Take proven technology and rules from other areas and apply them to the Valley.

DISTRICT'S STRATEGY: None of these recommendations are currently applied in the District's near-term plans.

COST & HEALTH IMPACTS: These recommendations would bring us 30 percent closer to achieving attainment and require no public funding.

TABLE EX-2
Potential Emissions Reductions from Taking Proven Technology and Applying Them to the Valley

	TONS/DAY NOx	TONS/DAY VOC
Composting Green Waste		21
Confined Animal Facilities		20
Composting and Biosolids		12
Fuel Processes & Storage		7.8
Wine Fermentation		4.5
Flaring		0.24
Graphic Arts		0.2
Solid Waste Disposal		0.1
Agricultural Irrigation Pumps	9	
Glass Furnaces	3.4	
IC Engines (excluding Irrigation Pumps)	1.7	
IC Turbines	1.2	
Boilers, Steam Generators and Process Heaters	1	
Residential Water Heaters	0.1	
District's Recommendations	4.2	35.7
Achievable Additional Rule Reductions	16.4	65.8
Percent of Needed Reductions	30%	

RECOMMENDATION **2:**

Reduce Vehicles and Equipment Pollution

STRATEGY: Regulate the operation of vehicles and equipment during certain times and types of operation, provide non-financial benefits to operators of clean vehicles and equipment, and provide public incentive funds to specifically replace or retrofit the dirtiest vehicles and equipment operations. Limit growth rates through extended Indirect Source Review techniques that include land-based ports.

DISTRICT'S STRATEGY: Use mostly incentive funding to slowly reduce these sources' emissions, with unclear methodology and targets. Use Indirect Source Review programs to reduce future growth.

COST & HEALTH IMPACTS: These recommendations would bring the Valley 70 percent closer to attainment by 2013 than the District's plan, at an estimated cost of $2.3 billion in public funding.

1. TAKE PROVEN TECHNOLOGIES AND APPLY THEM TO THE VALLEY

In recent years, the District has increased the regulation of a number of stationary and area sources in an effort to reduce emissions from these sources. However, the stringency, timeline, and, in some instances, the entities exempted or excluded in the District's rulemaking have resulted in fewer emissions reductions than are reasonably achievable.

This alternative SIP recommends specific modifications to the following District-proposed and existing rules to make them more effective in reducing emissions. (Table EX-2). Four of the most beneficial recommendations include:

- Require controls to be placed on **Composting Green Waste** facilities.
- Increase the number of regulated **Confined Animal Facilities** and require more stringent control technologies.
- Require enclosure and emissions reductions from **Composting and Biosolid** facilities.
- Require more stringent inspection and repair processes for **Fuel Processes and Storage** and implement improved technology.

Together, by increasing the stringency and applicability of these rules the Valley could achieve additional reductions of 83 tons per day of NOx and VOC than is currently proposed in the District's Draft 2007 Ozone plan. These additional reductions would achieve 30 percent of the overall reduction gap required for attaining the ozone standard.

2. REDUCE VEHICLES AND EQUIPMENT POLLUTION

The regulatory setup of federal- and state-regulated sources means that some controls that would be useful in one region with worse air quality may not be warranted in most of the nation or state. This poses a problem for local agencies seeking to further reduce emissions from federally regulated sources to meet their clean air requirements. This is the case with the San Joaquin Valley, particularly with its need to dramatically reduce emissions from state and federally controlled sources — namely, on- and off-road vehicles.

In spite of being "federally" or "state" controlled, the local district agency has available to it several very useful methods for reducing the emissions from these sources, including implementing operational restrictions and offering incentives for clean operation. An example of an operational restriction would be to prohibit operation of certain high-pollution equipment on days when air quality is expected to exceed a certain level. An example of incentives could include prioritizing the hiring of companies who use clean vehicles and equipment, exemption from some fees, special recognition in the community, or monetary incentives for switching to cleaner equipment. Under this alternative plan, the District would implement the following:

- Adopt Operational & Incentive Policies on:
  - On-Road Heavy-Duty Diesel Vehicles
  - On-Road Light-Duty Vehicles
  - Off-road Equipment and Vehicles
  - Locomotives and Aircraft
- Enhance the Indirect Source Rule (ISR) program
- Enhance the Spare the Air Program to minimize emissions on high-pollution days

Multi-Faceted Strategy: Tackling Old Technology

One of the largest emissions sources of NOx and PM2.5 in the Valley and throughout California is from diesel-fueled engines, including heavy-duty trucks, buses, trains, construction equipment, agricultural equipment, generators and other specialty equipment. Gasoline vehicles contribute a vast amount of the VOC emissions as well.

New federal regulations will greatly reduce the emissions from on- and off-road vehicles and engines, but these rules apply only to the manufacture of new vehicles. Both Caterpillar and John Deere are making products, which can reduce emissions by over 90 percent, using a combination of readily available cleaner fuels, more efficient engines and after-control technologies.

However, the turnover of the on-road fleet is extremely slow and the off-road fleet even slower. This means that although the technology is now available, it will be over a decade before the Valley begins to see significant emissions reductions. Meanwhile, the California Air Resources Board has been developing rules to require clean-up of existing heavy-duty diesel vehicles, but that process is already many years behind schedule and will take more than two decades to reach clean air goals at its current pace.

The challenge now is to accelerate fleet turnover of the legacy fleet and quickly introduce the dramatically cleaner new technologies. Accelerated turnover of the existing fleet is the most important control strategy for reducing NOx and PM emissions in the near term. Turnover of the existing fleet can be done using a combination of approaches available to the district, not exclusively through incentive funding.

Table EX-3 lists the effect that implementing an operational and incentive program for the vehicle and equipment fleet could have on the Valley. There are also recommendations for limits on emissions growth

TABLE EX-3
Potential Emissions Reductions from Reducing Vehicles & Equipment Pollution

	TONS/DAY NOx	TONS/DAY VOC	TONS/DAY PM2.5	PUBLIC FUNDING REQUIRED (in millions of $)
On-Road Heavy Duty Diesel Vehicles	74.8	5.5	2.4	$1,500
On-Road light duty vehicles	4.4	6.4	0.3	$24
Off Road Mobile Equipment and Vehicles	55.2	24.6	4.4	$238
Railroad & Aircraft	9.8	1.3	0.3	$500
Additional Measures ISR and Spare the Air	11	11		
Total Possible Vehicle and Equipment Reductions	155	49	7.1	$2,262
Percent of Needed Reductions	71%			

RECOMMENDATION **3:**

Provide transparency in rules

STRATEGY: By clearly identifying the emissions and air quality effect the proposed rule will have, negative and no-progress rules will be easily noticed and discouraged.

DISTRICT'S STRATEGY: None planned.

COST & HEALTH IMPACTS: Cost savings and reduced health impacts could be achieved from improved rulemaking.

RECOMMENDATION **4:**

Increase PM2.5 monitoring

STRATEGY: Employ more particulate monitors to increase understanding of exposure to fine and ultrafine particulates. In particular, add stations to monitor PM2.5 levels in Arvin and Parlier.

DISTRICT'S STRATEGY: None planned.

COST & HEALTH IMPACTS: Understanding the health impacts of PM2.5 in rural areas near transportation corridors is critical for ensuring public health.

RECOMMENDATION **5:**

Take a leading role in reducing state and federal source emissions

STRATEGY: Take local actions to reduce emissions of federal and state sources (see Recommendation 2). Pressure state and federal governments to provide funding and appropriate legislation to address air quality.

DISTRICT'S STRATEGY: Ask federal and state government for assistance and stricter rules.

COST & HEALTH IMPACTS: Long-term cost savings could be significant. Actions will achieve clean air years sooner.

and other port areas through extended Indirect Source Review programs. This comprehensive program could reduce emissions by up to 155 tons per day of NOx and 49 tons per day of VOC. An estimated incentive funding of $2.2 billion may be required to implement such a strategy by the year 2013. This is equivalent to about $440 million per year from 2008 to 2013. Together, these strategies could reasonably achieve 70 percent of the additional needed emissions reductions to achieve ozone attainment The following three recommendations will help provide needed information for more informed choices for the regulators and public and help to accelerate the achievement of our clean air goals:

3. ENSURE ALL NEW RULES WILL ACTUALLY REDUCE AIR POLLUTION

Many rules and rule amendments passed in the last five years have been administrative or exemptions, resulting in no emissions reduction or other air quality benefit. Yet this is not immediately clear without thorough inspection of the entire rule. It is recommended that for every measure the District develops and implements, it should report, and the rule itself should explicitly state the expected air quality and health benefits (or absence of benefits) to provide the kind of transparency and accountability taxpayers expect from a public agency.

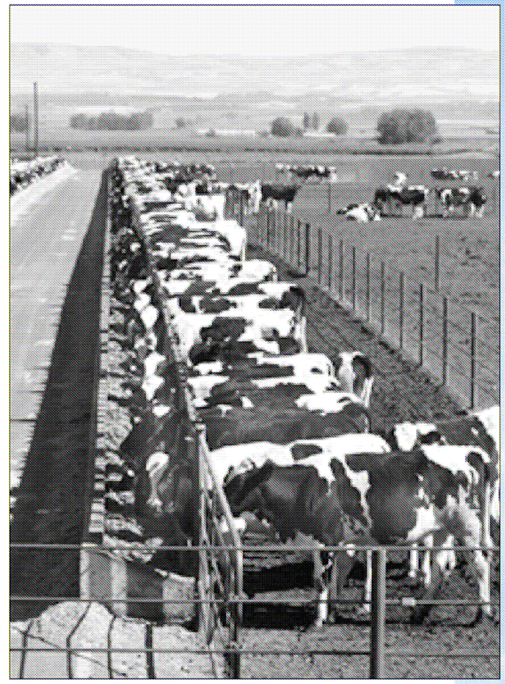
4. PROVIDE INCREASED PM2.5 MONITORS

The District should employ more particulate monitors to better measure ultrafine particulates and increase understanding of exposure to find these dangerous pollutants throughout the Valley. The South Coast Air Quality Management District is beginning to measure and address the presence and health impacts of ultrafine PM, which could be as or more significant than fine PM.

5. TAKE A LEADING ROLE IN REDUCING STATE AND FEDERAL SOURCE EMISSIONS.

The San Joaquin Valley should take local actions to reduce emissions of federal and state sources. It should also actively pressure state and federal governments to provide funding and appropriate legislation to address air quality. The District should play a more proactive role in pressuring the state and federal government agencies responsible for regulating federal and state sources by presenting information on the extent of the source emissions and the necessary reductions and rules needed in these areas.

The South Coast Air Quality Management District (SCAQMD) has faced a similar situation and has found creative ways to work around the jurisdictional limitations. For instance, in developing its 2007 Air Quality Management Plan, the SCAQMD has developed some innovative solutions that rely on voluntary and incentive programs, ISR rules, operational policies and city and local government mandates. The Valley should aggressively follow this approach. A positive byproduct of this activity by other air districts is that it can prompt affected industries to persuade state and Federal governments to encourage widespread regulations to level the playing field. The SCAQMD also has aggressively pressured state and federal governments to provide both funding and increased legislation in response to the air quality crisis facing southern California.



SHORT-TERM RESULTS NOW, LONG-TERM RESULTS FOR THE FUTURE

The focus of this analysis is how best to achieve clean air in the near term. However, if enforcement is properly maintained, these strategies will continue to help maintain clean air for decades to come.

Table EX-4 summarizes the overall emissions achievable in the near term using each of the strategies outlined above. In total, these strategies available for the SJVUAPCD to implement immediately could reduce pollution in the Valley by as much as 286 tons per day of NOx and VOC emissions. With the reductions already proposed by the district in the Draft 2007 Ozone SIP of 194 tons per day, this totals the necessary 480 tons per day reductions required to meet the ozone attainment by 2013. Achieving these additional reductions will require the district to collect approximately $2.3 billion over a five-year period to distribute as incentive funding — a $4.5 billion savings to taxpayers when compared to the health costs of District's failure to act on these recommendations.

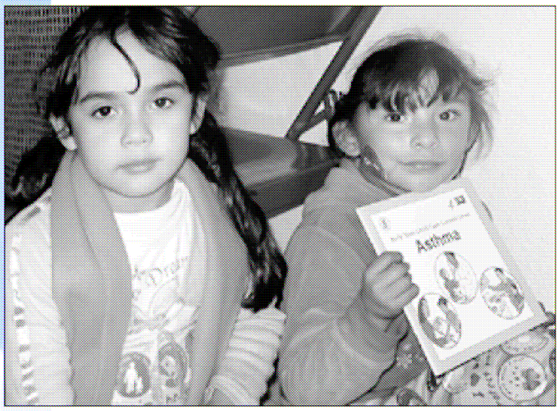
TABLE EX-4
Summary of the Alternative Plan to Reach Clean Air by 2013

	TONS/DAY NOx	TONS/DAY VOC
Increasing Stringency of Current Proposed Rules	17	66
Operational Controls & Incentive Programs	155	49
Total Achievable District Reductions	172	115
Percent of Target	100%	

IV. Conclusion

For too long San Joaquin Valley residents have breathed some of the dirtiest air in the country, contributing to hundreds of deaths each year, a loss of $2.3 million annually in missed school and workdays and an annual cost of $3.2 billion a year of taxpayer dollars in community health costs. Meanwhile, the San Joaquin Valley Unified Air Pollution Control District has not identified a reasonable path for achieving its clean air deadline by 2013, and therefore may delay reaching our clean air goals by another decade or more.

The District has acknowledged an almost 300-ton-per-day gap to reach attainment levels, concluding that it will take $8 billion to close that gap by 2013. The District estimates that if it delays clean air for over a decade, it will cost only $2.1 billion. ***However, this alternative State Implementation Plan shows the District can, without additional assistance from other agencies, reach its clean air goals by 2013 for the same amount of money by relying heavily on a combination of increasing the stringency of rules and using operational approaches.*** These approaches effectively reduce the necessary incentive monies to achieve the same reduction in emissions.



Results won't happen overnight, but together, the Valley can get to its clean air goals. Achieving clean air Valley-wide will require participation by virtually every significant pollution source. These strategies will require innovative planning, behavioral changes and better practices by the business community and the public. Additionally, new funds are needed to put some of these strategies into place. Some of this new funding would be locally obtained through fees, caps and fines. However, more funding should also be solicited from federal and other grant programs.

However, the consequences of failing to act now far outweigh these initial costs. Today, one in three families in the Valley has a member with a respiratory ailment. According to the American Lung Association, as of 2005 the Valley is home to four of the top five worst ozone-polluted cities in the United States. If we continue with the status quo, we can expect to see more children with asthma, more emergency room visits, more health care costs and more premature deaths as the Valley becomes more congested and polluted. The good news is, we now have a road map for avoiding this grim scenario. The next step is to put this plan into action, so every Valley resident can breathe clean air in as little as six years from today — by 2013.

Glossary of Terms

Ammonia: Ammonia is a pollutant that can be harmful in large concentrations as ammonia but also contributes to forming particulate matter, which is another harmful air pollutant. The largest source of ammonia emissions comes from livestock operations.

BACT: Best Available Control Technology. This is the maximum level of emissions control that has been demonstrated by a device. Many regulations require new facilities to regulate to BACT or equivalent. This control is more effective at reducing emissions than RACT (reasonably available control technology) requirements.

BARCT: Best Available Retrofit Technology. Similar to the BACT but applies to retrofits (modifications) of existing technology to lower emissions of already existing facilities or industries.

Clean Air Act (CAA): This Act was originally established in 1965 but has undergone much change due to amendments occurring all the way up through 1990. The primary function of the Clean Air Act is to allow the federal EPA to set limits on how much of any pollutant can be in the air anywhere in the United States. This act also gave EPA the power to fine violators of the Act and increase penalties. Finally, every version of the Clean Air Act specified mandatory dates for achieving attainment of air quality standards.

Control Measures: Control measures are suggested regulations to be placed on different pollution sources. If the EPA accepts them then they are adopted and implemented.

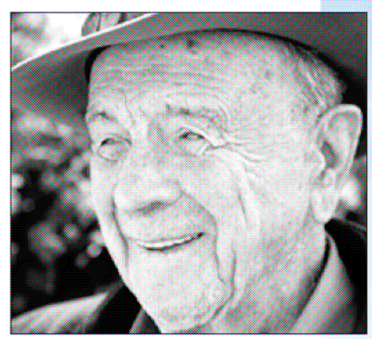
NOx: Oxides of Nitrogen. NOx are combinations of the oxygen atom(s) with nitrogen. They are typically released from combustion processes and contribute to forming ozone (smog) and particulate matter.

Ozone (O3): Ozone is a form of pollution made up of volatile organic compounds and nitrogen oxides. In the presence of sunlight, especially on hot summer days, ozone is formed.

Particulate Matter (PM): Particulate matter is made up of a combination of solid particles and liquid molecules. It can be released directly into the atmosphere or made within the atmosphere through chemical aggregate reactions. PM has a wide range of sizes that vary from particles visible to the naked eye like ash and soot, to molecules that can fit inside the nucleus of a cell. Fine particles (PM2.5) are directly emitted from combustion sources and are also formed secondarily from gaseous precursors such as sulfur dioxide, nitrogen oxides or organic compounds. Coarse particles (PM10) are formed through activities such as agricultural operations, industrial processes, combustion of wood and fossil fuels, construction and demolition activities, and entrainment of road dust into the air. Natural (nonanthropogenic or biogenic) sources also contribute to the overall PM10 problem. These include windblown dust and wildfires.

Pollutant Precursor: This is an emission that contributes to making one or more hazardous pollutants in the atmosphere. For example, NOx and VOC emissions are precursors to Ozone pollution. Ammonia and NOx are precursors to PM pollution. In order to reduce ozone levels, it is necessary to reduce the precursors (NOx & VOC).

San Joaquin Valley Air Pollution Control District (SJVUAPCD): It is the job of the SJVUAPCD to regulate stationary and area sources within the San Joaquin Valley Air Basin. The District distributes permits, makes regulations, devises public outreach programs and helps to monitor the air quality of the areas within its jurisdiction. The counties that fall within the SJVUAPCD jurisdiction are: San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare and part of Kern.



SOx: Oxides of Sulfur are combinations of oxygen atom(s) with sulfur. Since almost all petroleum-based fuels contain sulfur as well as coal, oxides of sulfur are emitted from combustion processes using liquid petroleum-based fuels or coal. Examples are diesel engines, oil and coal fired power plants, and liquid petroleum-based boilers. Natural gas and propane also contain small amounts of sulfur, and their combustion produces slight amounts of oxides of sulfur as well.

State Implementation Plan (SIP): A State Implementation Plan is a plan written by the local air district to suggest control measures for the local air district's area. The SIP is then submitted to the Environmental Protection Agency where it may approve the plan, reject the plan or require adjustments to certain portions. This plan is written with the goal of suggesting and implementing strong enough control measures to allow the district to reach its goal of attainment. Different SIP's must be written for different pollutants, i.e. ozone and particulate matter must have separate plans.

VOC: Volatile organic compounds are chemical compounds that have the ability to easily vaporize into the atmosphere and bond with NOx or other chemicals to form pollutants. Sources of volatile organic compounds include paint thinners, cleaning solvents and gasoline. Trees also emit VOCs.

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PREPARED BY INTERNATIONAL SUSTAINABLE SYSTEMS RESEARCH CENTER | FEBRUARY, 2007

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Researcher's Note

This report was developed based on the latest information publicly available as of January 1, 2007. Therefore, the information used to develop the emissions inventory for the San Joaquin Valley includes the most up-to-date information as of this point, using the baseline emissions from the November 2006 draft of the 2007 Ozone Plan, and then modifying this inventory with updates to the on-road inventory using the improved data from the November release of the ARB on road model. Thus, the emissions inventory used in this alternative ozone plan is very similar to the emissions inventory used in the January 2007 Draft of the 2007 Ozone Plan. The 'added reductions' from the control measures in this report are calculated by subtracting the control measures and reductions proposed in the November 2006 draft of the 2007 Ozone Plan. Some of the recommended measures in this alternative SIP are in part now contained in the newest January 2007 Draft of the 2007 Ozone Plan. However, this does not alter the effectiveness or validity of the values of this report.

In addition, the January 2007 Draft of the 2007 Ozone Plan contains new information on restrictions for attainment. In particular, this newest SIP estimates the carrying capacity of the basin in terms of NOx is 160 tons/day. While the Alternative SIP was developed on the strategy of targeting combined NOx and VOC reductions to reach a combined carrying capacity, the combination of emissions reductions from state, federal and already approved district rules along with the recommendations in this report will come extremely close to, if not meet the January 2007 Draft of the 2007 Ozone Plan's NOx carrying capacity of NOx by 2013.

1. Air Quality in the San Joaquin Valley

1.1. What is Air Pollution?

1.1.1. Overview

Air pollution can be any material that remains suspended in the air and has direct or indirect adverse impacts on human health or the environment. Today, air pollution is typically divided into three broad categories. The first category is called *criteria pollution.* There are six criteria pollutants defined by EPA (Table 1-1). Criteria pollutants are the pollutants found most commonly around the United States [see CAA section 108(a)(1)]. Each of these criteria pollutants are linked to adverse human health impacts. As a result, the Clean Air Act mandates the EPA to set maximum levels of these pollutants that should be allowed to protect public health. These health-based standards are called National Ambient Air Quality Standards.

The second category is *toxic* air contaminates. Toxic pollutants are grouped separately because they are more of a concern at a localized as opposed to regional level. These pollutants come from specific sources and are not ubiquitous like criteria pollutants. Both toxic and criteria pollutants are harmful to human health and can result in the death of even healthy individuals. There are thousands of chemicals that fall into the category of toxics, but the actual toxics from location to location will vary considerably. Diesel soot is one of the most common toxic air pollutants.

The third category of pollution is related to *global warming*. Global warming pollutants trap the earth's heat causing a build up in atmospheric temperatures to potentially dangerous levels. Carbon dioxide is the most abundant global warming pollutant.

Table 1-1 lists the air pollutants of each category that are most prevalent.

Table 1-1 Important Air Pollutants

Criteria Pollutants	Toxic Pollutants	Global Warming Pollutants
Particulate Matter (PM)	Benzene	Carbon Dioxide
Lead	Butadiene	Nitrous Oxide
Ozone	Formaldehyde	Methane
Carbon Monoxide	Acetaldehyde	
Nitrogen Dioxide	Chrome	
Sulfur Dioxide	Ammonia	
	Diesel Particulates	

Air pollution has harmful effects on human health, materials, and crops, costing residents and businesses considerable economic loss. Citizens living in the San Joaquin Valley are afflicted at one time and location or another with most of the air pollutants listed in Table 1-1. However, two of the pollutants, ozone and particulate matter, are found in extremely high concentrations consistently throughout the Valley.

A recent report on the economic value of reducing air pollution in the San Joaquin Valley concluded that air pollution levels that exceed the National Ambient Air Quality Standards costs residents and businesses $3.2 billion dollars each year (Hall, 2006). This figure does not include unquantifiable harm, such as the harm imposed on an asthmatic child who cannot play outdoors on bad air days or other similar harms that lack price tags. In addition to these severe consequences, air pollution results in the loss of beautiful vistas, pollutes streams and lakes making them unable to support significant fish and amphibian populations, and damages trees, including our majestic sequoia groves.

Ozone is a colorless, odorless reactive gas comprised of three oxygen atoms (O_3). Because of its reactivity, ozone in high concentrations is considered an air pollutant and can damage lung tissues, increase asthma attacks, cause chest pain, and worsen heart disease, bronchitis, and emphysema. Ozone is also linked with eye irritation, coughing, nausea, and headaches, and damage to crops and materials, such as rubber.

Ozone close to the earth - called low-level ozone - forms through a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of heat and sunlight. The amount of ozone that forms depends on the amount of NOx and VOC in the air, the temperature of the air, and the amount of sunlight. A variety of sources emit VOC, including motor vehicles, chemical plants, refineries, pesticides, dairies, and other industrial sources. There are also natural sources of VOC's such as vegetation. NOx emissions result from fuel combustion emitted primarily by on and off road vehicles, heavy-duty equipment and power plants. Many urban areas tend to have high levels of ozone, but even rural areas can be subject to increased ozone levels because of the prevalence of agricultural sources of ozone-causing pollutants. Ozone pollution typically occurs in the summertime because of increased heat and sunlight that accelerates the reaction between NOx and VOC.

While high levels of ozone near ground level is dangerous to human health and is predominately created from the emissions of human activity, it should not be confused with the ozone that naturally occurs in the upper layers of the earth's atmosphere called the stratosphere. Ozone in the stratosphere is made naturally and shields the earth from harmful ultraviolet rays from the sun. This report discusses only lower atmospheric (troposheric) ozone - low-level ozone - which plagues the San Joaquin Valley.

1.1.2. Particulate Matter

Particulate matter (PM) is made up of a combination of solid particles and liquid molecules. They can be released directly into the atmosphere or made within the atmosphere through chemical reactions. Directly emitted particles are called *primary* particulates and particles that form in the atmosphere are called *secondary* particulates. The formation of secondary particles through the reaction of ammonia and oxides of nitrogen and sulfur form very small particles called ammonium nitrate and ammonium sulfate. PM, thus, has a wide range of sizes that vary from particles visible to the naked eye like ash and soot, to molecules that can fit inside the nucleus of a cell. The difference in size is very important when studying the effects of PM. Larger particulate matter will fall to the ground and be of little consequence; however, PM that is less than 10 microns in diameter has the ability to remain suspended in the air for extended periods of time and become a health threat when inhaled. A micron is one millionth of a meter; for perspective, a human hair is 100 microns in diameter.

In the US, PM is conventionally grouped into four size ranges. *Total suspended particulate matter* (TSP) includes all particles that remain suspended in the atmosphere and ranges from 0.1 to 50 microns in size. *Coarse PM* are particles that have an effective diameter of between 10 and 2.5 microns and consist primarily of particles made through mechanical processes like grinding and resuspension on roadways and in fields. Most coarse particles typically deposit to the earth within minutes to hours and within tens of kilometers from the emission source. *Fine PM* are particles less than 2.5 microns in diameter. Fine particles are typically directly emitted from combustion sources and are also formed secondarily from gaseous precursors such as sulfur dioxide, nitrogen oxides, ammonia or organic compounds, although it is possible to mechanically form some fine particulates in resuspension and grinding processes. Fine particles are generally composed of sulfate, nitrate, chloride and ammonium compounds, organic and elemental carbon, and metals. Combustion of coal, oil, diesel, gasoline, and wood, as well as agriculture, high temperature process sources such as smelters and steel mills, produce emissions that contribute to fine particle formation. Fine particles can remain in the atmosphere for days to weeks and travel through the atmosphere hundreds to thousands of kilometers. When inhaled, fine particles can infiltrate the lung and become lodged in the deep recesses of the lung tissues or enter the bloodstream.

As measurement processes have improved, an even smaller category of particles called *ultrafine PM* has been documented. Like fine particles, ultrafine particles are also primarily a result of the combustion of fuels. They can be primary particles or also formed in the atmosphere. These particles are so extremely small that they can travel deep into the body and inside the cells to the mitochondria and nucleus of cells. This discovery has compelled health researchers to redouble their efforts to understand the mechanism and health impacts of these tiny particles. The main hypothesis is that these particles within cells are not membrane bound and can interact with intracellular proteins, organelles, and DNA, which may greatly enhance their toxic potential (Froines 2006).

This report focuses on emissions of PM2.5 since that is the most pressing particulate matter concern in the Valley at the present time. However, it is known that reducing PM2.5 also reduces levels of ultrafine PM and PM10.

Significant Primary and Secondary PM2.5 Sources

Human and natural activities emit primary PM2.5. A significant portion of PM is generated from a variety of human (anthropogenic) activity. These types of activities are primarily a result of combustion processes: of wood, fossil fuels, agricultural and other waste. Also, construction and demolition activities contribute to PM2.5 levels. Natural (nonanthropogenic or biogenic) sources also contribute to the overall PM problem. These include windblown dust and wildfires.

Secondary PM sources emit air contaminants that form or help form PM in the atmosphere. Hence, these pollutants are considered precursors to PM formation. These secondary pollutants include SOx, NOx, VOCs, and ammonia. Depending on the amount of the secondary pollutants, control measures that reduce PM precursor emissions may lower ambient PM levels.

Of special concern in the Valley is ammonia. Ammonia is typically the result of decomposing livestock waste - manure - produced by the Valley's large confined dairy, poultry, and hog industry, which account for more than 80% of all ammonia emissions. Ammonia from these operations mixes with NOx and forms ammonium nitrate, a form of PM2.5. Unfortunately, currently there are no specific regulations regarding ammonia in the San Joaquin Valley. Some air quality districts have regulations specifically to control ammonia from animal facilities, but the San Joaquin Valley does not have any specific ammonia regulations for animal facilities at this time. Later in this paper, control measures that could be used to help with ammonia emissions will be discussed.

1.2. The Relationship between Air Quality and Health

The negative effects of PM and ozone on human health and the environment have been known for decades. Epidemiological, toxicological, and laboratory studies have shown how ozone and PM damage lung and other tissue and lead to an increased risk in asthma, heart conditions, and cancer. This prompted Federal and State governments to develop air quality standards that ensure the public's health. However, as scientists continue to gather information on air pollution and health, research has found that there are health impacts even at levels of ozone and PM that meet the federal and state standards. In spite of all the knowledge of the damaging air pollution effects, air monitoring shows that over 90 percent of Californians still breathe unhealthy levels of one or more air pollutants during some part of the year. (ARB Fact Sheet: Air Pollution and Health 2005).

Air pollution negatively effects the entire population, but sensitive groups, such as children, asthmatics, and healthy adults who are active outdoors, suffer more.. Infants exposed to high particulate levels may have a greater chance of death from sudden infant death syndrome (SIDS), when the particles stick to the airway walls causing blockage. In children, their need for more oxygen per pound of body weight than adults, as well as their active nature, lead to enhanced damage from air pollution. Long-term studies now show that exposure to particle pollution may significantly reduce lung function growth in healthy children. Children who participate in three or more outdoor sports and live in high ozone environments have a risk 3.3 times greater of developing asthma than those who do not play sports (SJVAPCD 2004, 2 - 10). Fine particles, alone or in combination with ozone, can aggravate asthma, increasing the use of medication necessitating more medical treatment. Children only make up 25 percent of the population, but they comprise 40 percent of asthma patients. Fresno County currently leads the state in childhood asthma, with one in six children having lung disease, with the number the number of asthmatic children increasing every year. Fourteen Americans die every day from asthma. (EPA: Health and Environmental Effects of Ozone 1997).

Individuals with diseases such as cardio-vascular disease, bronchitis, emphysema, and pneumonia may also find their symptoms worsened by air pollution. Ozone has the ability to damage lung tissue in everyone over time, similar to receiving a sunburn on the lungs, and as people age this damage can cause a lower quality of life. Studies have found that very fine particles can penetrate the lungs and may even cause the heart to beat irregularly or become inflamed, which has the potential to cause a heart attack. It is estimated that tens of thousands of elderly people die prematurely each year from exposure to air pollution. In addition to the physical health effects, air pollution causes school absences, work absences, high medical costs, and a lower quality of life.

A final note of concern: particle and ozone pollution are not distributed evenly throughout the region. Higher levels of particle pollution in Fresno increase the risk of childhood asthma in Fresno. This knowledge should make air pollution of particular concern to all residents living in a nonattainment area. Residential proximity (within 75 m) to a major road or freeway increases the health risks of asthma. Individuals with occupational exposure to diesel exhaust (i.e. railroad workers) also have greater risk. In more than 35 studies of workers with occupational exposure to diesel exhaust, excess risk of lung cancer is consistently elevated by 20-50%. (Garcshick 2004). These results indicate that the association between diesel exhaust exposure and lung cancer is real.

Achievement of the National Ambient Air Quality Standards for ozone and PM2.5 would improve overall air quality, there is significant data providing reason to push for more stringent standards. This research indicates that air pollution in the form of particulate matter at concentrations currently allowed by EPA's standards is linked to thousands of excess deaths and widespread health problems. (EPA: Health and Environmental Effects of Ozone 1997). This data prompted the California Air Resources Board to develop more stringent particulate matter standards for California than EPA's national standards. The ARB estimates that by attaining the California PM standards, it would prevent about 6,500 premature deaths annually in California, or reduce the overall death rate by 3%. (ARB and ALA Health Effects of PM and Ozone 2004).

1.2.1. PM2.5 and Health

Exposure to particulate matter has both short and long term health impacts. Short-term exposure can result in lung irritation, lung restriction and shortness of breath, coughing, and immune responses. Long-term exposure has much more severe consequences including an increased risk of developing asthma and lung cancer. People who live in an area that is severely polluted by particulate matter develop lung cancer at a rate comparable to non-smokers exposed to second-hand smoke.

Although all airborne PM is toxic to some degree the potency and toxicity is greatly affected by the particle's physical and chemical characteristics. Fine PM (PM2.5 and less) is of special concern to health because it is easily inhaled deeply into the lungs, where it is either absorbed into the bloodstream or remains embedded for long periods of time in the lungs themselves. Ultrafine PM (PM0.1 and less) has the unique capability of infiltrating inside cells and interacting with the nucleus, mitochondria and DNA. Research has linked fine and ultrafine PM with a series of significant health problems including:

- Low birth weight/preterm birth
- Increase in asthma and other respiratory disease in children
- Decrease in lung development in children and lung function in all ages
- Cardiovascular disease including atherosclerosis in adults
- Work and school absences
- Respiratory related hospital admissions and emergency room visits
- Chronic bronchitis
- Cancer
- Premature death

1.2.2. Ozone and Health

Health effects attributed to short-term exposure to ozone include significant decreases in lung function and increased respiratory symptoms such as chest pain, cough, wheeze, and breathing difficulties. These typically occur during moderate to heavy exertion. Long-term exposures to ozone result in the possibility of irreversible changes in the lungs, which could lead to premature aging of the lungs and/or chronic respiratory illness. Even at very low levels, ozone can:

- Cause acute respiratory problems;
- Aggravate asthma;
- Cause significant temporary decrease in lung capacity of 15 to over 20 percent in some healthy adults;
- Cause inflammation of lung tissue;
- Lead to hospital admissions and emergency room visits;
- Impair the body's immune system defenses, making people more susceptible to respiratory illness, including bronchitis and pneumonia; and
- Lead to premature death.

1.3. The Process of Attaining Clean Air

1.3.1. Overview

Concern about air pollution began in the early half of the 20th Century but became pervasive after World War II due to severe smog episodes in London, England and Donora, Pennsylvania. Agencies were formed to attack the problem at the local, state, and federal levels of government. Concern reached an apex in 1970 when Congress adopted the Clean Air Act. Congress amended the Act 1977 and 1990 to address state's and EPA's inability to solve the air pollution problem in the United States. California adopted its own Clean Air Act in 1988. Basically, these laws require the Air Resources Board and the San Joaquin Valley Unified Air Pollution Control District to adopt plans and regulations that reduce emissions of air pollution so that Californians breathe healthy air by specific dates. The collection of rules and plans are called the "State Implementation Plan" or "SIP" for short.

In California the authority for air pollution control is divided between the United States Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and locally established single- or multi-county organizations. In the case of the San Joaquin Valley, a multi-county agency, the San Joaquin Valley Air Pollution Control District (SJVUAPCD), was formed to address problems in the Valley.

Each of these agencies has a specific job to do in cleaning up the air. The federal government, through the Environmental Protection Agency, sets national air quality standards, oversees state and local actions, and implements programs for toxic air pollutants, heavy-duty trucks, locomotives, ships, aircraft, off-road diesel equipment, and some types of industrial equipment. The EPA's ultimate job is to ensure that states meet the minimum federal requirements. If a state violates the Clean Air Act, then EPA must sanction the state or take-over the state's regulation of air pollution. Most of the time, the threat of this heavy-handed authority is enough to keep states in line.

State government, through the Air Resources Board (overseen by Cal/EPA), must achieve EPA's health-based National Ambient Air Quality Standards. The agency has authority to set more stringent state standards, it oversees local actions, and implements programs for motor vehicle emissions, fuels, and smog checks. Local air pollution control districts, such as the San Joaquin Valley Unified Air Pollution Control District, develop plans and implement control measures that primarily affect stationary sources such as factories and plants, but also area sources like construction sites or cultivated land. Local air districts also conduct public education and outreach efforts such as the District's *Spare the Air*, *Wood Burning*, and *Smoking Vehicle* voluntary programs. Local agencies have been able to reduce emissions from the full range of sources through the use of innovative approaches such as financial incentives and pollution fees to influence positive behavior. .

1.3.2. Federal Government Role

In 1990, Congress adopted major amendments to the Clean Air Act, which gave EPA new responsibilities and more power to enforce the Act. The Clean Air Act allowed EPA to set limits on how much of a pollutant can be in the air anywhere in the United States. This ensures that all Americans have the same basic health and environmental protections. The law allows individual states to go beyond the minimum requirements of the Act to adopt stronger pollution standards and limitations. Over time EPA has established the following ambient air quality standards (Table 1-2). These standards must be set at a level to protect public health - including a margin of safety - without regard to the cost of achieving the standard. .

Table 1-2 Federal Air Quality Standards

Pollutant	Averaging Time	Federal Standards
Ozone (O_3)	1 Hour	0.12 parts per million
Ozone (O_3)	8 Hour	0.08 parts per million
Respirable Particulate Matter (PM_{10})	24 Hour	150 micrograms per cubic meter
Respirable Particulate Matter (PM_{10})	Annual Arithmetic Mean	50 micrograms per cubic meter
Fine Particulate Matter ($PM_{2.5}$)	24 Hour	65 micrograms per cubic meter
Fine Particulate Matter	Annual Arithmetic Mean	15 micrograms per cubic meter
Carbon Monoxide (CO)	8 Hour	9 parts per million
Carbon Monoxide (CO)	1 Hour	35 parts per million
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.053 parts per million
Nitrogen Dioxide (NO_2)	1 Hour	---
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	0.030 parts per million
Sulfur Dioxide (SO_2)	24 Hour	0.14 parts per million

EPA has adopted regulations that specify how EPA will determine whether or not an area meets, or "attains" these standards. These so-called 'averaging' requirements ensure adequate health protections while taking into consideration meteorological abnormalities that may cause an occasional exceedence of the standard. For example, an area attains the ozone standard when the fourth highest concentration in a year, averaged over three years is equal to or less than the standard. For PM10, an area attains the 24 hour standard when the area does not have more than one 24-hour period that exceeds the standard averaged over three years,. For PM2.5, an area attains the 24 hour standard when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. (Part 50 of Title 40 of the Code of Federal Regulations).

1.3.3. State Government Role

The Clean Air Act mandates that each state meet the requirements of the Act.. In California, the California Air Resources Board (ARB) has primary responsibility for gathering air quality data for the state, ensuring the quality of this data, and designing and implementing emission models. In addition to monitoring the progress towards meeting federal guidelines, ARB also researches the health effects of poor air quality and sets even more stringent ambient air quality standards based on this research (Table 1-3). These state standards have been shown to be the maximum levels of air contaminants that will not be harmful to human health. However, because California law lacks deadlines for achieving these state air quality standards, with no consequences for failure to meet them, many air districts made little to no effort to meet ARB's more stringent standards.

Table 1-3 California Air Quality Standards

Pollutant	Averaging Time	State Standards
Ozone (O_3)	1 Hour	0.09 parts per million
Ozone (O_3)	8 Hour	0.070 parts per million
Respirable Particulate Matter (PM10)	24 Hour	50 micrograms per cubic meter
Respirable Particulate Matter (PM10)	Annual Arithmetic Mean	20 micrograms per cubic meter
Fine Particulate Matter (PM2.5)	24 Hour	65 micrograms per cubic meter (same as federal)
Fine Particulate Matter	Annual Arithmetic Mean	12 micrograms per cubic meter
Carbon Monoxide (CO)	8 Hour	9.0 parts per million
Carbon Monoxide (CO)	1 Hour	20 parts per million
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	---
Nitrogen Dioxide (NO_2)	1 Hour	0.25 parts per million
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	---
Sulfur Dioxide (SO_2)	24 Hour	0.04 parts per million

In addition to these duties, CARB has the ability to set restrictions and limit emissions from motor vehicles, fuels, and consumer products. California has generally been a leader in implementing the most stringent standards worldwide.

1.3.4. Local Air District's Role

The role of the local air district is to design the air quality management plan for their area and to implement, monitor, and enforce the state and federal standards. The local air district is empowered to implement new rules and regulations on stationary and area sources to implement their air quality plan. In the San Joaquin Valley, the San Joaquin Valley Air Pollution Control Board (SJVUAPCD or District), is given this task. The District is required to develop an air quality management plan to meet both federal and state requirements. Their Plan is required to outline the current state of the air quality in their district, the amount of emissions reductions needed to achieve the standards, steps to be taken to achieve the needed emission reductions, and enforcement of the reductions within their jurisdiction. Together with the state government, the District submits their air quality management plan to the federal government for approval. If the EPA rejects the submission, the state has two years to correct the deficiency or EPA must withhold federal highway funding and adopt and implement substitute federal regulations that meet the requirements of the Clean Air Act. If EPA approves the plan as part of the "State Implementation Plan," then the plan becomes enforceable like a contract between the state and the federal government. Should the District fail to implement the required controls or fail to make reasonable progress towards those goals, the EPA can restrict highway construction funds, require more stringent permits for new sources, and implement its own clean up programs all in order to compel the District's compliance

1.4. The Economic Costs of Achieving Clean Air

In March 2006, researchers from California State University Fullerton released a report on the economic benefits of attaining the federal health-based National Ambient Air Quality Standards in the San Joaquin Valley (Hall 2006). In addition to the greater quality of life cleaner air would provide, which is priceless, this report documents how economically advantageous cleaner air would be for the San Joaquin Valley Air Basin. Their results show that, "valley-wide, the economic benefits for meeting the federal PM2.5 and ozone standards average nearly *$1,000 per person per year, or a total of more than $3 billion.*" The economic benefits come from:

- 460 fewer premature deaths among those age 30 and older
- 325 fewer new cases of chronic bronchitis
- 188,400 fewer days of reduced activity in adults
- 260 fewer hospital admissions
- 23,300 fewer asthma attacks
- 188,000 fewer days of school absence
- 3,230 fewer cases of acute bronchitis in children
- 3,000 fewer lost work days
- More than 17,000 fewer days of respiratory symptoms in children

To place the reduction in premature deaths in perspective, attaining the federal PM2.5 standard would be the equivalent of reducing motor vehicle deaths by over 60% Valley-wide, and by more than 70% in Fresno and Kern Counties. Currently the main focus of the San Joaquin Valley Air District is to attain the less stringent federal standards, but Hall has shown that *attaining the California air quality standards, which are more protective of health, would double the health benefits listed above.* (Hall 2006). The effects of air pollution are not evenly distributed throughout the Valley. Those individuals living in Fresno and Kern counties experience worse air pollution than individuals in other areas of the San Joaquin Valley, and minority populations such as Hispanics and non-Hispanic blacks are exposed to more days when the health-based standards are violated.

1.5. Air Pollution Monitoring in the San Joaquin Valley

In order to determine the levels of pollution in the air, each District must set-up and maintain monitoring stations that measure pollutant levels. The statistics gathered over time from these monitors determine whether or not the District is making progress and eventually whether the Valley attains the standards. In order to ensure monitors realistically reflect local air quality, the EPA developed guidelines for locating air-monitoring equipment. First, the monitors must measure the highest concentration of a pollutant. Second, the monitoring equipment must be located in areas with high populations. Third, these monitors must measure the impact of criteria pollutants (such as PM and ozone). Finally, they must monitor background concentrations (SJVUAPCD 2004, 2 - 16). The EPA requirements are designed to ensure that the monitors measure air pollution levels that are representative of public exposure. The EPA guidelines are not designed to look at potential hotspot problems.

1.5.1. Ozone

All ozone monitoring in the Valley is directed toward measuring representative population exposures and maximum concentrations. As a result, most ozone monitors in the Valley are scaled for either neighborhood or urban measurements. (SJVUAPCD 2004, 2 - 17). The San Joaquin Valley Air Basin has a total of 23 ozone monitoring stations with eleven operated by the District, three by the National Park service, and nine by CARB. All of these monitors operate continuously using the principle of ultraviolet absorption.

Most monitors are placed in their particular location for a specific purpose. The four major metropolitan areas within the San Joaquin Valley Air Basin, (Stockton, Modesto, Fresno, and Bakersfield), each have ozone monitors to better characterize the ozone distribution in the metropolitan area. The Fresno and Bakersfield areas each have ozone monitors to measure upwind transport (Madera-Pump Yard and Shafter-Walker Street), middle-city conditions (Fresno-First, Bakersfield-California, and Bakersfield-Golden State), downwind city-edge concentrations (Fresno-Drummond and Edison-Johnson Ranch), and downwind maximum concentrations (Parlier and Arvin)The Clovis-Villa and Oildale-Manor ozone monitors, located in the northeast quadrant of the Fresno and Bakersfield metropolitan areas, respectively, are sited for maximum concentrations. The remaining ozone monitors are located in smaller urban areas and several remote locations. The Madera and Fresno areas are the two areas that will be the last regions to have clean air, according to the District's analysis (SJVUAPCD 2007). The ozone monitoring system operated by the San Joaquin Valley air quality management program appears to be appropriately designed and has been approved by CARB and by the U.S. EPA.

1.5.2. Fine Particulate Matter

The San Joaquin Valley Air District has 14 fine particulate monitors. Thirteen of the 14 are located in areas of high population to establish population exposure. The other monitoring site is located to measure PM within half a kilometer of local sources. (SJVUAPCD 2006, 2 - 1).

In order to illustrate how the SJVUAPCD compares to other districts in monitoring PM, a comparison of the number of monitors with the both the geographical area and population of several air basins in California is shown in Table 1-4. The density of monitors on a per capita basis indicate that the Valley has adequate monitoring, while the density of monitors per land area indicate the Valley is highly lacking in monitors.

However, it is not a completely adequate comparison between these districts because the Valley has a higher percentage of rural population than the South Coast and Bay Area. Because the population of the Valley is spread out throughout the entire region, it is necessary to monitor adequately the entire region. This illustrates the need to have additional PM monitors throughout the Valley. In addition, due to the placement of monitors, the real health effects attributable to fine PM remain uncertain in the Valley and may well be underestimated, especially since there are two main trade corridors running through the region (I-5 and 99). This illustrates the need for 'hotspot' monitoring.

Table 1-4 Comparison of Number of PM Monitoring Stations in Several Air Basins

District	Square Miles	Population (millions)	Number of PM Monitors	Monitors per person	Monitors per square mile
San Joaquin Valley	25,000	3.6	15	1 per 240,000	1 per 1,667
South Coast	15,000	16	37	1 per 432,432	1 per 405
Bay Area	5,340	6.8 (as of 2000)	29	1 per 234,483	1 per 184

1.6. Current Attainment Status of the San Joaquin Valley

Based on the monitoring network described above, the Valley is fails to meet several federal and state standards. Areas that don't meet a standard are called "nonattainment areas." Based on the monitoring data, the EPA has classified the Valley as a serious nonattainment area for the federal 8 hour ground-level ozone standard and a nonattainment area for the 24-hour and annual average PM2.5 (particulate matter less than 2.5 microns in diameter) standards.

In the fall of 2006, the EPA found that the Valley attained the PM10 (particulate matter less than 10 microns in diameter) standards five years past the deadline. That decision, in light of recent monitoring data showing more than the allowed number of daily violations, has been challenged by air quality advocates in the United States Court of Appeal for the Ninth Circuit.

The Valley would still be a nonattainment area for the 1-hour ozone standard, but EPA revoked the 1-hour standard when it implemented requirements to meet the 8-hour standard. Even though EPA revoked the 1-hour standard, all pollution control requirements applicable to that standard must remain in place. This apparent inconsistency prevents "backsliding" while states now focus on meeting the 8-hour standard.

In addition to the federal standards, the Valley is classified as a severe nonattainment area for the California ozone standard and a non-attainment area for the state's

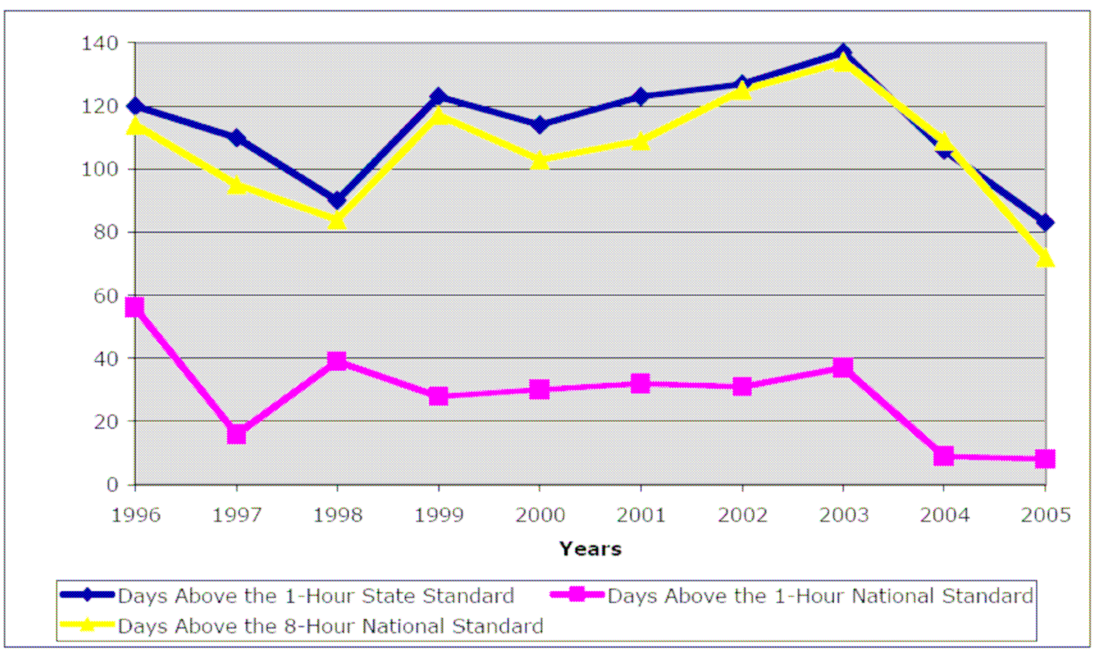
PM10 standard. (SJVUAPCD: FAQ 2006). As discussed earlier, these state standards are effectively meaningless, since air districts neither have deadlines to meet, nor face penalties for not meeting, these state air quality standards.

1.6.1. Ozone Trends

Ozone standards are measured on two different time frames–1 hour and 8 hour. For the national 1 hour standard, measurements averaged over each hour are not to exceed 0.12 parts per million (ppm) more than one time each year in a three-year period. If the district has more than one day over 0.12 ppm per year averaged over the three years, the district is considered to be in non-attainment for the national 1-Hour ozone standard. For the state standard, the limit is a more stringent 0.09 ppm. The state standard cannot be exceeded at any time and if it is the district is not in attainment.

Because ozone exposure over a longer time period is presents greater health impacts compared to short-term exposure, EPA and CARB adopted a standard that measures ozone over an 8-hour period. The federal 8-hour ozone standard is attained when the 3-year average of the 4th highest daily concentrations is 0.08 ppm or less. The state 8-hour ozone standard must not exceed 0.07 ppm in an 8 hour period. Figure 1-1 shows that during 2005, the Valley the federal 8-hour standard on more than 70 days, the state1-hour standard on more than 80 days, and the federal 1-hour standard on 8 days.

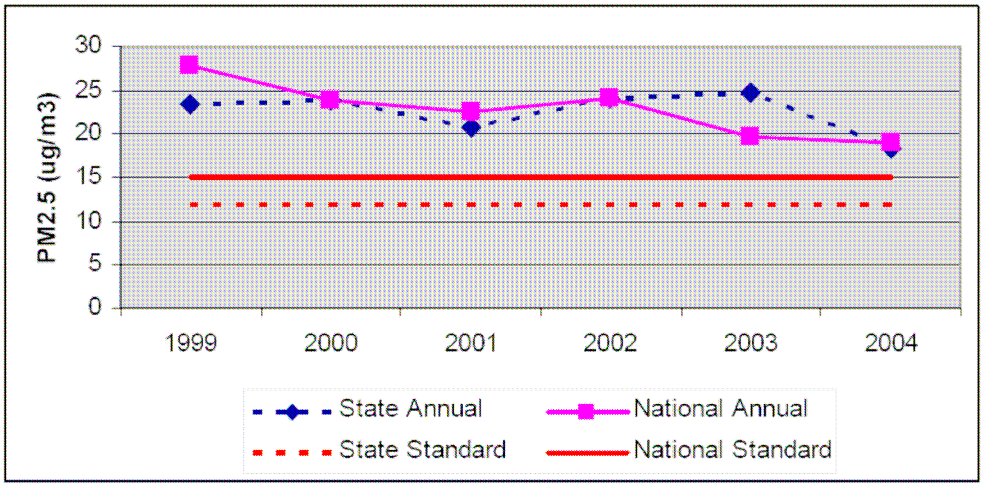
Figure 1-1 Number of Days Exceeding the 1-Hour and 8-Hour Ozone Standard in the San Joaquin Valley



1.6.2. Particulate Matter Trends

Fine particulate matter (PM2.5) also has national and state standards. EPA recently lowered the federal 24-hour standard from 65 micrograms per cubic meter to 35 micrograms per cubic meter (averaged from midnight to midnight). EPA kept the annual average standard at 15 µg/m3. California has set the state annual average standard at a more stringent level of 12 µg/m3. Figure 1-2 shows the ambient annual average PM2.5 levels since 1999. The red solid and dotted lines indicate the national and state annual average standard, and the pink and blue points represent the measured concentrations using the national and state technique for annual averages. There has been modest decrease in the ambient levels, however, there is still a significant decrease before the federal and state standards are achieved.

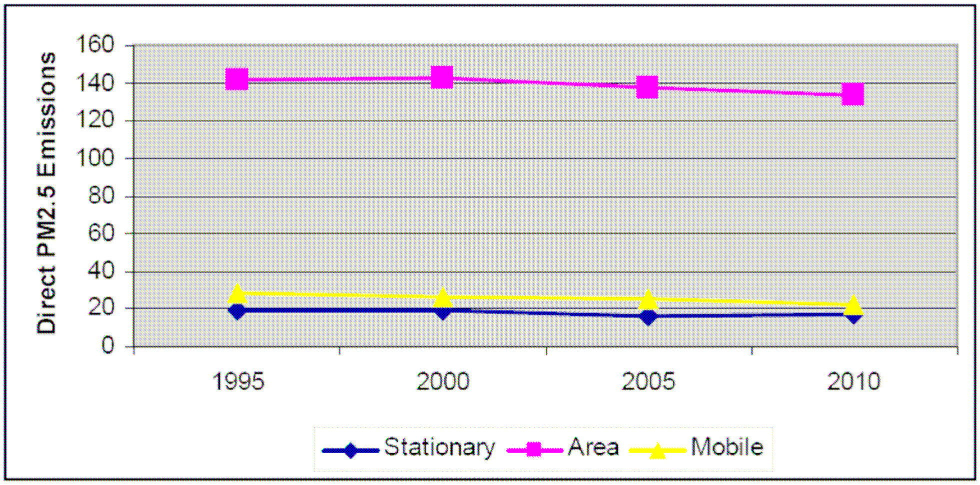
Figure 1-2 PM2.5 Trends for the Annual Average



The levels of PM2.5 in the atmosphere have only been measured for about 6 years. Therefore, for trend analysis it is useful to look at the emissions of direct pm2.5, which has been inventoried for many years.

Figure 1-3 shows the trends in the PM2.5 emissions from 1995 to 2010. As can be seen, the emissions have declined overall less than 5% over a 20 year span. The largest percent decrease is in mobile sources, followed by area sources, and virtually no decrease in the stationary sources of PM2.5.

Figure 1-3 PM2.5 Emissions Trend for the San Joaquin Valley (Tons/day)



2. Air Pollution Sources in the San Joaquin Valley

2.1. Current Major Sources of Air Pollution in the San Joaquin Valley

2.1.1. Overview

Emissions inventories are an important part of identifying the sources of air pollution in a region. An emissions inventory is simply the amount of pollutant and pollutant precursor emissions that are emitted by various activities and equipment. Each district is required to complete an inventory to help estimate the levels of air pollution and then, using computer models, to help determine where and how much pollutants need to be reduced to achieve healthy air.

Emissions inventories are always evolving and improving as new measurement methods and techniques for estimating emissions are developed. The most current inventory available at the time this plan was developed is from the SJVAPCD's 2007 Draft Ozone plan, which was released in November 2006. Some updates to this inventory have been used, such as the mobile source on road emissions using the newest EMFAC 2007 model, which was released in November 2006. Therefore, the emissions inventory used in this SIP preparation are very similar to the emissions inventory used in the District's final draft Ozone SIP that was released January 29th, 2007.

Stationary sources are significant sources at a fixed geographic location and emit pollutants from a specific point, usually a smokestack. Power plants, dairies, and large industries are examples of a typical stationary source. Emissions from stationary sources are usually significant and are usually measured directly using equipment affixed to the stack or point of emission release. Therefore, the emissions estimated from stationary sources are usually very accurate.

Area sources are from emissions of non-point sources, such as from roads, fields, and evaporation from buildings. Emissions from very small and numerous point sources such as residential housing can also be included in area sources. Regulators typically calculate the emissions from area wide sources by understanding two variables, the number of sources (for example, the number of wood-burning fireplaces in the Valley, or the lengths of unpaved roadways), and the emissions released from the source (the amount of PM emitted from a wood burning fireplace, or the amount of dust generated from a mile of roadway). Both of these values are estimated by conducting inventories of the number of sources and conducting emissions tests on a subset of the sources. However, this methodology is never perfect since it requires some extrapolation.

Mobile sources are vehicles operating on and off the roadway, mobile equipment (such as tractors), and other forms of transportation, such as trains, ships, and aircraft. Like area sources, regulators estimate the quantity of sources and the emission rate to calculate total emissions from mobile sources. For on-road sources, there are complicated travel demand models and mobile emissions models that estimate the amount of emissions from cars and trucks. Although much effort is spent estimating emissions from these vehicles, source apportionment studies show that there may be significant errors in these estimation processes.

Table 2-1 shows the top ten sources of each individual pollutant (and the top 8 for ammonia). Farming operations are the area source emissions from land cultivation and related activities, but do not include emissions from mobile agricultural equipment. These top 10 sources contribute to 67% of the VOC, 83% of the NOx, 88% of the SOx, 80% of the primary PM2.5 (directly emitted PM2.5) and 100% of the ammonia emissions from the entire Valley.

Table 2-1 Top 10 Sources of Each Pollutant with Associated Emissions (tons/year)*

	Ozone Precursors					
		PM and PM Precursors				
#	VOC	NOx	SOx	PM2.5	Ammonia
1	Farming Operations (confined animal facilities like dairies) *71*	Heavy Heavy Duty Trucks *214*	Manufacturing and Industrial *7*	Farming Operations *19*	Farming Operations *316.4*
2	Consumer Products *28*	Farm Equipment *45*	Glass and Related Products *4*	Residential Fuel Combustion *9.4*	Other Waste Disposal *16.6*
3	Oil and Gas Production *27*	Off-road Equipment *35*	Trains *2.8*	Paved Road Dust *9.1*	Fertilizers *14.9*
4	Pesticides *23*	Manufacturing and Industrial *35*	Food and Agricultural Processing *1.9*	Fugitive Windblown Dust *9.1*	On-Road Motor Vehicles *12.3*
5	Light Duty Passenger Vehicles *18*	Service and Commercial *32*	Mineral Processes *1.6*	Unpaved Road Dust *8.5*	Landfills *8.5*
6	Heavy Heavy Duty Trucks *16*	Trains *21*	Oil and Gas Production (combustion) *1.6*	Heavy Heavy Duty Trucks *8.4*	Other Miscellaneous Processes *5.0*
7	Coatings and Related Process Solvents *14*	Medium Duty Trucks *19*	Food and Agricultural *1.1*	Food and Agriculture *4.5*	Waste Burning and Disposal *0.8*
8	Food and Agricultural *12*	Food and Agricultural Processing *16*	Chemical *1.0*	Construction and Demolition *2.8*	Residential Fuel Combustion *0.6*
9	Petroleum Marketing *11*	Light Duty Passenger Trucks *15*	Service and Commercial *1.0*	Farm Equipment *2.8*	
10	Off Road Equipment *11*	Light Light Duty Passenger Trucks & SUVs *14*	Cogeneration *0.9*	Industrial Chemical Processes *2.3*	
Top 10	67% of all VOC emissions	83% of all NOx emissions	88% of all SOx emissions	80% of all PM2.5 emissions	100% of all ammonia emissions

*Numbers in italics are tons/day of the specified pollutant

2.1.2. Stationary Sources

Stationary source emissions are significant sources at a fixed geographic location that emit pollutants from a specific point, usually a stack. Examples of stationary sources are a stack from a power plant, stationary engine, or boiler. Typical processes in the Valley that produce air pollution in this category are fuel combustion; industrial processes; petroleum production and marketing; waste disposal and cleaning and surface coatings. Within the category of stationary sources the SJVAPCD breaks emissions into two subcategories called point sources and aggregated sources. Point sources are sources that emit over 10 tons per year of pollutants, and they are typically monitored individually to keep track of their emissions. Point sources include the larger processing, manufacturing, and industrial operations. The second subcategory is aggregated-point sources. These sources emit less than 10 tons per year each of any one pollutant and are not tracked individually. However, it is important to keep track of aggregated-point sources as a whole because combined they produce a significant amount of air pollution. Aggregated-point sources typically include gas stations, water heaters, and space heating. Overall stationary sources in the SJVAB emit 95 tons per day (tpd) of VOC, 124 tpd of NOx, 22 tpd of SOx and 17 tpd of PM2.5 in 2010.

Table 2-2 Major Contributors within Stationary Sources

	VOC	NOX	SOX	PM2.5
Fuel Combustion	16%	82%	62%	39%
Waste Disposal	3%	0%	0%	0%
Cleaning and Surface Coatings	23%	0%	0%	0%
Petroleum Production and Marketing	41%	1%	2%	0%
Industrial Processes	17%	17%	36%	60%

In looking at Table 2-2 it becomes clear that fuel combustion is primarily responsible for pollution from the stationary sources category. Fuel combustion occurs often in plants such as electric power plants, paper processing and other types of production plants. Thus, it is straightforward to assume more stringent regulations on plants using high levels of fuel combustion would decrease emissions significantly.

2.1.3. Area-Wide Sources

Area sources are either groups of very small point sources that are too small and too numerous to measure individually, such as a fireplaces, or emissions from a broad area, such as a field. Area-wide sources dominate the PM2.5 inventory. In addition, painting, cooking, construction, and use of consumer products are also considered area-wide sources. Area-wide sources are broken down even further into the categories of *solvent use* and *miscellaneous processes*. The solvent use category consists of evaporative emissions from consumer products, architectural coatings, pesticides, and asphalt paving. The miscellaneous processes category includes all other area-wide sources that do not involve the use of solvents such as farming operations, road dust, construction, etc. In 2010, area-wide sources will produce 139 tpd of VOC, 6 tpd of NOx, .3 tpd of SOx and 60 tpd of PM2.5.

Table 2-3 Major Contributors within Area-Wide Sources

	VOC	NOX	SOX	PM2.5
Solvent - Consumer Products	20%	0%	0%	0%
Solvent - Other	25%	0%	0%	0%
Residential Fuel Combustion and Cooking	4%	99%	100%	18%
Road Dust	0%	0%	0%	30%
Farming Operations	51%	0%	0%	32%
Windblown Dust and Other	0%	1%	0%	20%

2.1.4. Mobile Sources

Mobile sources are broken down into two categories: on-road motor vehicles and off-road mobile sources. The category of on-road motor vehicles includes all vehicles ranging from light duty passenger vehicles (typical passenger cars) to heavy-duty diesel trucks (the trucks seen transporting goods across country) to school buses. In short, this is all vehicles that travel on paved roadways. Off-road mobile sources include vehicles such as tractors, construction equipment, and lawn and garden equipment that do not typically operate on roads. Mobile sources will produce 111 tpd of VOC, 406 tpd of NOx, 4.6 tpd of SOx and 16.8 tpd of PM2.5 in 2010.

Table 2-4 Major Contributors within Mobile Sources

	VOC	NOX	SOX	PM2.5
On-Road - Light Duty Vehicles & Motorcycles	42%	11%	10%	10%
On-Road - Heavy Duty Trucks & Vehicles	21%	60%	7%	48%
On-Road - Buses	1%	2%	0%	1%
Recreational Boats and Vehicles	10%	1%	1%	4%
Off-Road Equipment	10%	9%	2%	14%
Farm Equipment	5%	11%	1%	17%
Aircraft, Trains, and Ships and Commercial Boats & Other	11%	6%	79%	7%

2.2. Projected Growth Rates in the Near Future in the San Joaquin Valley

Considering population growth is an important part of determining future air quality. New residents to the SJVAB potentially represent more pollution. This pollution comes from the increase in motor vehicles, construction, consumer products, and so on. Air pollution control measures need to be sufficient enough not only to reduce current pollution levels, but to compensate for future growth in air pollution due to business and residential growth.

Currently the San Joaquin Valley has 3.6 million people, and by 2010 that number is expected to grow to 3.9 million, and by 2020 the population is expected to hit 4.9

million (SJVUAPCD 2004, 2 - 1). With the increase in population, there will also be a significant increase in transportation growth. According to the ARB website, in 2006 residents of the San Joaquin Valley are driving 96,749 thousand miles annually. In 2010 that number will increase to 107,741 for the year and in 2020 residents will drive 135,618 miles. Naturally, this large increase in vehicle miles traveled will significantly increase total mobile source emissions if control strategies fail to account for growth in vehicle miles traveled (VMT).

3. Estimated Emissions Reductions Needed to Attain Clean Air in the San Joaquin Valley

As part of the Attainment Plan, the District must identify the amount of emission reductions necessary to meet the Federal standards. This is done using the emissions inventory discussed in the previous chapter and state-of-the-art computer modeling. The modeling combines the meteorology of the area with the amount of emissions that enter the atmosphere to make projections of air pollution levels in the future. Using these tools, the models can estimate the amount of emissions that can be emitted without exceeding the federal or state standards. This "safe" level of emissions is often called the "carrying capacity."

Both the emissions estimates and the chemistry of air modeling are complex and uncertain. The chemistry of the atmosphere is also not linear. This means that reducing X tons of VOC may reduce ozone but reducing VOC by 2X will not necessarily double the amount of ozone eliminated. In the San Joaquin Valley, the unique weather, geographic conditions, and extreme pollution problems has resulted in research costing more than $60 million dollars. This research has investigated the sources, complex atmospheric chemistry, and health effects in the region. Two major scientific studies funded in this effort have just been completed.

The District's most recent computer modeling has indicated that the most difficult area to reach attainment is in Arvin. This site is more sensitive to NOx emissions reductions than other areas. These diagrams indicate that to meet the NOx needs to be reduced roughly 75% from 2005 levels and 65% from base case 2013 emissions to reach Federal standards (SJVUAPCD Draft Final O3 Plan) at the most NOx limited regime. Based on the District's modeling, NOx emissions need to be reduced about 49% from 2020 baseline emissions with no VOC control. It is estimated from the District's diagram at Arvin, that by reducing emissions of VOCs by 40%, this will reduce the needed reductions of NOx to 42%. This is about 181 tons/day by viewing the District's carrying capacity diagram. VOC reductions in other areas have a more pronounced impact on the effect of ozone production. While there are still uncertainties in the science, these models provide us our best estimate of the amount of pollution that needs to be removed, and can offer a tangible and finite emissions reductions goal.

Based on this information, the recommended approach in this document target a combination of VOC and NOx reductions, with an over all goal of reducing emissions by an additional 286 tons/day combined in 2013 for a combined carrying capacity of 300 tons/day. The overall allowable level of NOx emissions have now been identified as between 160 and 181 tons/day specifically based on the recent District carrying capacity analysis. Based on the values provided by the district, 118 tons/day of the 194 tons/day reductions identified to come in the state, federal, and already adopted rules are NOx reductions, so that leaves approximately 160 tons/day of NOx emissions to be further reduced from the baseline 2013 NOx level. The next section outlines the recommended approaches for achieving the combined 286 tons/day and the 160 tons/day NOx emissions by 2013.

4. Recommended Approaches for Reducing Emissions

4.1. Overview

The District has recently developed attainment plans to meet the federal 1 hour ozone and PM10 standards. Now, the District is currently developing plans to meet the federal 8 hour ozone standard and the PM2.5 standard. These two new plans will describe how the District will achieve the federal standards, and specify the pollution control measures that will be used to harmful levels of ozone and PM2.5. The recommendations provided in this chapter are in addition to the current and proposed rules adopted by the SJVUAPCD as of July 2006, and the approaches relied upon in the 1-hour ozone and PM10 attainment plans. These additional measures can and should be included in the 8-hour ozone plan and the PM2.5 plans in order to meet the goal of having healthy air in all regions of the San Joaquin Valley as soon as possible. In general, these recommendations are a combination of two critical elements:

- Increasing the Stringency and Applicability of Stationary and Area Rules
- Implementation of Operational and Incentive Strategies to Reduce Non-District Regulated Sources

Each of these strategies is discussed in detail below.

4.2. Increasing the Stringency and Applicability of Stationary and Area Source Rules

There are existing rules in the District that are designed to limit emissions. In the 2007 Draft Ozone SIP released by the district on October 2, 2006, the district provided its draft plan for reducing emissions from additional or updating existing rules. There are a total of 17 new rules recommended by the district, and these cumulatively would decrease emissions by 42 tons/day of NOx and VOC by 2013. Upon review of these existing and proposed rules, several areas have been identified that could be realistically accelerated and broadened in this timeframe. Some of these concepts for increasing stringency originated from recommended rule improvements in Federal documents (a draft 1994 Federal Implementation Plan), comments previously submitted to the District, a review of similar rules from other districts, and available technology demonstrations. The total emissions reductions achievable in addition to the 42 tons/day proposed by the district October Draft Plan is 83 tons/day by 2013. The details of these emissions reductions are described in detail in this section. Because the emissions reductions are from rules, these rules require no incentive funds or public tax.

4.2.1. Agricultural Irrigation Pumps

Agricultural Irrigation pumps are used throughout the Valley and contribute over 16 tons of NOx per day on average or 28 tons/day on a summer day (irrigation season). The District has a program to replace existing stationary agricultural irrigation pumps to lower emitting diesel or electric replacements. (SJV Incentive Program Website, 2006). Approximately half of these engines have been replaced to either Tier 1 or Tier 2 standards through the taxpayer-funded Carl Moyer program (SJVAQMD Attachment 3, 2003). There are several alternatives to clean up the remaining fleet of engines. The option with the highest reduction potential is to replace existing engines with electric motors (many locations already have hookup for electric motors). Other strategies would include replacing old engines with newer cleaner engines, retrofit older engines with add-on exhaust control devices, or converting existing engines to a cleaner-burning fuel or alternate fuels.

Recommendations for Agricultural Irrigation Pumps

- Adopt regulations to accelerate replacement of Agricultural Irrigation Pumps to meet Tier 2 requirements or to be electrically operated. The deadline should be no later than the end of 2007.

Emissions Reductions Achievable from Agricultural Irrigation Pumps.

If the remaining non-Tier 1 and 2 engines were replaced to meet Tier 2 standards, roughly 7 tons/day of NOx would be avoided during the summer months (Table 4-1). If some engines (10% or 450 engines) were replaced by electric pumps, this would increase the reduction to 8.5 tons/day.

Table 4-1 Emissions Reductions Achievable from Agricultural Irrigation Pumps

	% Reductions	Tons/day NOx	Tons/day VOC
Agricultural Irrigation Pumps Baseline	n/a	22.6	2.4

Achievable Emissions Reductions	31%	9	0

4.2.2. Residential Water Heaters and Furnaces

The District currently has rule 4902 which regulates emissions from residential water heaters to no more than 40 nanograms of nitrogen oxides per Joule of heat output. However, other districts require residential water heaters to meet a 10 nanograms per Joule NOx standard in 2005 (SCAQMD Rule 1121). That standard would only apply to new or replacement water heaters so units installed prior to the effective date of the new standard remain in operation for the remainder of their useful life. If the District adopted these new standards, emissions from new water heaters could be reduced by 75%. Additionally, the emissions limit for the fan-type central furnaces using natural gas could be tightened to 20 ppm as indicated in the South Coast's 2006 Air Quality Management Plan.

Recommendations for Residential Water Heaters

- Adopt ordinances that require a percentage of solar water heaters in new construction. Examples of such communities include the Gold River Area Housing Development in Sacramento, the City of La Verne in Los Angeles County, and the cities of Thousand Oaks and Del Mar.

- Require new residential water heaters to meet a 10 nanograms per Joule NOx level instead of the 40 nanogram current level.

Emissions Reductions Achievable From Residential Water Heaters

The district has incorporated the more stringent SCAQMD NOx level into the most recent 2007 Draft SIP. Therefore, no additional benefits are assumed for achieving the lower NOx limit. Assuming the housing population growth is proportional to the population growth (10% growth over the next 4 years), and assuming 10% of the new housing requires solar water heaters, a modest 0.1 tons NOx per day could be avoided over the near term (Table 4-2).

Table 4-2 Emissions Reductions Achievable from Residential Water Heaters

	% Reductions	Tons/day NOx
Baseline:	n/a	1.4
District Emissions Reductions:		0.3
Additional Achievable		0.1

Emissions Reductions		

4.2.3. Internal Combustion Turbines and Reciprocating Engines

nternal combustion (IC) turbine and reciprocating engines using natural gas account for over 16 tons of NOx per day (this is not including agricultural irrigation pumps). There are three generic control techniques available for controlling NOx emissions from gas turbines: (1) Injection of water or steam into the combustor; (2) add-on post combustion controls (e.g., selective catalytic reduction); and (3) modification to combustor designs. SCAQMD has a rule for stationary gas turbines with a rated heat output capacity equal to or greater than 0.3 megawatt (MW). All stationary gas turbines rated equal to or greater than 0.3 but less than 2.9 MW shall meet a compliance limit based on 25 ppm NOx times a demonstrated percent efficiency. Stationary gas turbines rated equal to or greater than 2.9 MW shall meet a compliance limit based on 9 ppm NOx times a demonstrated percent efficiency. The SJVUAPCD's current rules have less stringent standards for units that are operated less than 2.5 hours per day (877 hrs/year).

Recommendations for IC Turbines and Engines

- Increase rule stringency to require all stationary gas turbines rated equal to or greater than 0.3 and less than 2.9 MW meet a compliance of 25 ppm NOx times a demonstrated percent efficiency, and units greater than 2.9 MW meet a compliance of 9 ppm NOx times a demonstrated percent efficiency.

- Remove the exemption from units operated less than 2.5 hours/day.

- Electrify 20% of turbines and engines.

Emissions Reductions Achievable From IC Turbines and Engines
By lowering the emissions requirements for smaller units and applying the rules to all units regardless of how much they are operated, the NOx emissions from turbines can be reduced by less than 4%. It is assumed that by altering the emissions limits to the ones recommended above for smaller units and applying the same emissions limits for all units regardless of how much they operate, emissions could be reduced by a modest 0.24 tons/day for NOx. If engines were electrified, more emissions could be offset. An assumption of 20% of turbines and engines are assumed to be converted to electric motors in Table 4-3.

Table 4-3 Emissions Reductions Achievable from IC Turbines and Engines

	% Reductions	Tons/day NOx
Baseline: Turbines		8.04
Baseline: Engines		8.58
Emissions Reductions: Turbines	20%	1.2
Emissions Reductions: Engines	20%	1.7

4.2.4. Flares

A flare is a combustion device designed to burn waste gases in a high-temperature flame. Flares are used to burn waste gases from refineries, power plants, oil wells, landfills, blast furnaces, chemical industries, sewage digesters, coal gasification, and ammonia fertilizer plants. Flares act as safety devices to remove the potentially flammable and explosive gases. As with all combustion, flares generate air pollutants including nitrogen oxides, sulfur dioxide, carbon monoxide, and particulate matter, hydrocarbons, and toxic emissions.
In 2006, the District amended Rule 4311, the flares. The District does state that , "The proposed amendments to Rule 4311 are not intended to reduce emissions. The amendments are necessary to comply with federal RACT requirements." (Rule 4311 Staff Report, 2006 SJVUAPCD). However, there are several steps that could be taken to reduce emissions from flaring operations that the District has not implemented with the recent amendment. These are listed below.

The current district inventory does not account for emissions from emergency flaring events, which could account for a significant amount of emissions.

Flare Emissions Reductions Recommendations:

- Require a Flare Minimization Plan for All Flare Types. Both the BAAQMD and the SCAQMD currently have a similar minimization plan. While this will not call for specific reductions, it will have the purpose of reducing *all* emissions from flaring by requiring the documentation of when, how much, and why flaring is occurring and require implementing all feasible prevention measures for reducing the amounts of flaring. If the plan is not adhered to, fines will be issued. A reasonable timeframe for implementing this type of measure is on the order of 1 year. Not only will this requirement reduce emissions of criteria and toxic pollutants, but also it will improve the inventory by accurately documenting emissions from these sources. This rule should apply to all flare types, not just ground level. When the Bay Area district did an analysis of its emissions from the flaring operations, it found it had significantly underestimated the emissions by 70%, which was due solely to the fact that more flaring activity was occurring than was originally thought. (BAAQMD, 2002) This type of regulation would eliminate these uncertainties and provide a better estimate of the emissions from flaring activities.

- Adopt the NOx and CO emissions limits on landfill gases similar to the ones required in the San Luis Ospisbo landfill gas flare rule and also make the requirement the same for all landfill gas flare units (SLO Rule 426 1995). Currently, the regulations only regulate VOC emissions and allow the devices constructed before 1995 to operate at a destruction efficiency of 90% instead of the achievable efficiency of 98%. (SJV Rule 4642 1998)

- Accelerate the deadlines in the proposed changes in Rule 4311, although this acceleration may not directly reduce emissions. Some of the regulations have a compliance deadline of 2008, when the end of 2007 is feasible.

Emissions Reductions Achievable From Flaring

It is difficult to estimate an exact emission reduction achievable from the first proposed measure. The minimization plan is designed to give a better understanding of the emissions from flaring operations, which may well be much greater than the current inventory estimates. It is likely that a significant emissions reduction could result from this plan, but since it is immeasurable at this time, it will not be included in the table below. Only benefits from the more stringent limits of the second measure are listed below (Table 4-4). Going from a 90% effective efficiency to a 98% efficiency will reduce current emissions for these flaring activities by 80%.

Table 4-4 Emissions Reductions Achievable from Flaring Operations

	% Reductions	Tons/day NOx
Baseline: Flaring (Estimate)	n/a	0.3
Emissions Reductions	80%	0.24

4.2.5. Glass Furnaces

Glass furnaces are used to make glass. There are two main types of glass production using glass furnaces: Flat Glass and Container Glass. Flat glass is any glass produced by the float, sheet, rolled, or plate glass process which is used in windows, windshields, tabletops, or similar products. Container Glass is any glass manufactured by pressing, blowing in molds, drawing, rolling, or casting which is used as a container.

The District is currently proposing increasing the stringency of rule 4354 to include RACT provisions for glass melting furnaces located at stationary sources that have a potential to emit at least 10 tons per year of either NOx or VOC starting in March 2008. The rule currently applies to units emitting 25 tons per year. The rule also has SOx reduction requirements to help reduce PM emissions. Currently, no new compliance costs are expected from the proposed District rule. The flat glass proposed rule is 9.2 lb/ton NOx and 0.1 lb/ton VOC of glass pulled on a block 24-hour average. The container glass proposed rule is 4.0 lb/ton NOx and 0.25 lb/ton VOC of glass pulled on a block 24-hour average.

Glass Furnace Emissions Reductions Recommendations

- Set a NOx limit of 3.0 lbs/ NOx per ton of glass pulled for container glass and 5.0 lbs NOx per ton of glass pulled for flat glass for all size facilities. This rule could be applied to all furnaces regardless of size and should have a compliance date no later than 2007. This rule would require some facilities to schedule a temporary shut down of the furnace to install new equipment. This is the same recommendation provided by the ARB to the District in the comments for the updated rulemaking and is being used by other districts.

- Change the required averaging period to continuous (CEMS) or no more than every 3 hours. This will ensure that the emissions limits are being achieved.

- Set start-up limits to be on the order of several days. Currently, the proposed rule allows up to 104 days to start-up. During this timeframe, the emissions are not regulated. The District's reasoning for this excessive start up time frame is due to the fact that the operator may be altering the firing configuration to optimize production during the first months of operation. However, to ensure emissions reductions there still needs to be emissions regulations during the first months of start-up. The rule should have the emissions limits set as stated during this timeframe, and if there is an operational change that causes emissions to exceed the limit, the operator should apply for an exemption under those certain conditions. This will ensure optimum emissions reductions while allowing for the necessary operational changes during start up.

Additional Emissions Reductions Achievable From Glass Furnaces

If the 3 and 5 lb/ton NOx per glass pulled regulation were applied, this would result in reducing NOx emissions by 25% for container glass production and 55% for flat glass production beyond what is currently recommended by the district. A total of 3.4 tons/day NOx emissions could be avoided (

Table 4-5).

Table 4-5 Emissions Reductions Achievable from Glass Furnaces

	% Reductions	Tons/day NOx
Baseline: Glass Furnaces	n/a	8.8
Emissions Reductions	55%	3.4

4.2.6. Augmenting Controls on Confined Animal Facilities

The District adopted Rule 4570 in June 2006. This rule applies to facilities that house large numbers of animals and is designed to reduce VOC emissions from CAF's by 28%, or 21 tons/day. (SJVUAPCD: CAF 2006). However, in terms of size of facilities, a significant number of CAFs would be below the proposed Rule 4570 applicability thresholds. Based on industry comments, staff believes that the majority of poultry facilities in the SJVAB already implement BARCT for VOC emissions.

Confined Animal Facility Recommendations:

- Increase the number of regulated Confined Animal Facilities (CAFs). A significant contribution of emissions comes from the CAFs below the defined 'large' CAF (Somewhere between 30-40%). The District should redefine the term 'large' to include most CAFs, or implement a regulation for 'medium' CAF to ensure most (>90%) of the emissions from CAFs are controlled. For example, the South Coast district regulates all facilities with more than 50 cows of any kind. The SJV district only regulates facilities with more than 1,000 lactating cows, 3,500 beef cattle, or 7,500 heifer, calves or other cattle.
- Increase the stringency of BARCT. There are many demonstrated controls available for reducing emissions from animal facilities that will not be implemented with the current proposed district regulations. For example, the district's rule, over half of the 'large' CAFs will not need to implement any changes to their current activities, and none of the poultry facilities will need to apply any changes. However, a vast number of reasonably available retrofit control technologies as defined by the District are available to employ at these CAFs. The proposed district rule is a plan where only a certain number of mitigation measures are necessary to employ, and many of these are already in-use. Because they are already in use, the "reductions" from the rule exist only on paper. In addition, there are additional control technologies that are not being used by the district that could be considered and can reduce emissions by more than 80%. The district has determined not to use many of these measures mostly because of their costs. The limits of 'cost

effectiveness' determined by the district for reducing emissions from large animal facilities are:

CAF type	Cost Effectiveness limit ($/ton VOC reduced)
Dairies	4,815
Beef feedlots	4,505
Other cattle facilities	10,088
Swine	3
Poultry	0

Valley air advocates have challenged Rule 4570 in court, arguing that the existing rule does not comply with state law applicable directly to air pollution from CAFs, Senate Bill 700.

A few of the items listed below are considered viable control options that have greater than 80% reduction in emissions but are either less cost effective than the values listed above or are not currently widely commercially applied. However, all have been demonstrated and all are not cost-prohibitive if the costs of the pollution reduced are considered with the benefits from energy production and increased milk output.

- Covering silage and venting it to a VOC control device
- Collecting and treating leachate and liquid manure through available techniques such as an anerobic digester (This measure is considered one of the preferred and cost effective measured by the South Coast (SCAQMD 2003, Appendix IV-A, IV-81)
- Use a gas absorber or bioscrubber to oxidized waste microbially
- enclose the animal housing (where not enclosed already) and vent the exhausted air to a secondary control device such as a biofilter

Based on the available information, it is estimated that approximately 70-80% of emissions of both VOC and ammonia could be reduced using already existing technologies and practices.

Emissions Reductions Achievable from Confined Animal Facilities

Using a combination of some of the recommended control strategies listed above, increasing the number of CAFs that need to mitigate their emissions, and increasing the number of requirements for reducing emissions, it is possible to reduce emissions from animal facilities upward of 75% of their current levels (

Table 4-6). Moreover, most of these controls would also reduce ammonia by the same percentage rates.

Table 4-6 Emissions Reductions Achievable from Confined Animal Facilities

	% Reductions	Tons/day VOC
Baseline CAF	n/a	74.5
Baseline CAF subject to District rules	n/a	57
Baseline With District's Proposed rule	28%	53
Reductions Recommended by the District		14
Reductions Achievable	75%	34
Additional Reductions Achievable		20

4.2.7. Ammonia reductions

Ammonia and NOx combine in the atmosphere to create ammonium nitrate, a particulate that contributes to approximately 30% of the PM in the Valley. However, the District and ARB have concluded that at this time, reducing ammonia emissions will not noticeably reduce particulate matter in the Valley. Therefore, they are not proposing to limit emissions from ammonia and they plan on reducing ammonium nitrate only by reducing NOx emissions. The District and ARB have based their conclusions on the atmospheric chemistry in the basin. Although all the research has not been completed, scientific research to date indicates that there is so much ammonia in the atmosphere that reducing ammonia will not reduce the amount of particulate matter produced. Since one part ammonia and one part NOx turn into one part PM, once all the NOx is used up, the excess ammonia cannot react anymore to create PM. At this stage, reducing ammonia will have virtually no effect on the amount of PM being created. This situation is called a "NOx limited regime", where controlling NOx is much more effective than ammonia. It is this research, and the mindset that resources and funds for emissions controls are limited, that the District and ARB have used to determine that reducing ammonia emissions is not very useful at this time.

However, there is emerging scientific information indicating that another reaction involving ammonia may be occurring in the Valley. The abundance of ammonia may cause it to deposit on the soil surface where it can react to ***create NOx*** emissions. If this is the case, then reducing ammonia emissions will have a very significant effect at reducing both NOx and PM emissions. This science is based on satellite observations of the NOx production over agricultural areas. (ref)

Therefore, in spite of the NOx limited scientific evidence, *there may be other reasons to reduce ammonia emissions for improving public health.* Consider the following:

- Abundance of ammonia over agricultural soil may react to create NOx (and therefore PM in the winter and ozone in the summer).
- Atmospheric chemistry is extremely complicated and the NOx limited regime is not necessarily universal for the entire valley, downwind of the valley, and in the future years and all meteorological conditions.
- Research is still underway that could have different conclusions to the NOx limited conclusions arrived at thus far. Certain preliminary studies indicate parts of the valley may be ammonia limited during the spring and fall months (meaning ammonia reductions will reduce particulate matter effectively).
- At a certain point, when ammonia emissions are reduced dramatically, further reductions of ammonia emissions will become highly effective at reducing PM (meaning the regime will become ammonia limited).
- The sources of ammonia in the valley are well understood and approximately 80% of the emissions are from a single source: Livestock Operations.
- Several viable controls of reducing ammonia emissions from livestock operations are available.
- Considering that the PM levels in the valley are roughly 300% more than the state standard, and that ammonia does contribute to more than 30% of the particulate matter, it seems prudent to consider all reductions to precursor emissions.

With those points in mind, it is recommended that ammonia reductions should be controlled. When one pollutant is being controlled at a facility, it is usually much more cost effective to include all pollutants of concern when designing requirements, rather than revisiting the rule several years later and requiring new controls. The following recommendations are geared toward reducing ammonia emissions:

Ammonia Reduction Recommendations

- <u>Adopt specific ammonia reduction requirements for Confined Animal Facilities.</u> Currently the San Joaquin Valley requires permits to be obtained in order to run a confined animal facility; however, this rule is designed only to limit VOC. In spite of the lack of regulation on ammonia, just due to the VOC controls, there are expected to be emissions reductions of 100 tons/day of ammonia as well. (SJVUAPCD: CAF 2006) However, much more ammonia reductions could be achieved if they were specifically regulated. The South Coast has a similar proposed rule (Rule 223) that requires permits for Large Confined Animal Facilities (LCAF) which targets not only VOCs but also ammonia. In order for an operator of a LCAF to obtain a permit in the South Coast Air Basin they must submit an emissions mitigation plan. This plan must demonstrate that the facility will use BARCT to reduce emissions of pollutants that contribute to the non-attainment of any ambient air quality standard, and that are within the District's regulatory authority. By requiring emissions mitigation plans to include ammonia controls, ammonia levels from LCAFs could be reduced. Refer to the discussion of Confined Animal Facilities for a description of the available control technologies and strategies for reducing emissions from these facilities.

- Adopt ammonia requirements for composting operations similar to South Coast's proposed rule. The South Coast Air Basin has a control measure designed to look only at composting operations (CM#2003WST-02). This measure would require operators of co-composting operations to achieve VOC and ammonia emission reduction targets using any combination of composting methods and control technologies. Some suggested methods include enclosures, aeration systems, best management practices, process controls, as well as add-on control devices, such as biofilters. The San Joaquin Valley has proposed Rule 4565 that will investigate the options for controlling VOC emissions only from composting, however, this rule does not reduce any emissions of VOC or ammonia.

4.2.8. Volatile Emissions from Fuel Processes & Storage

There are several areas where fugitive emissions from fuel storage and loading could be improved. The district outlines the feasibility of increasing stringency of fugitive emissions from heavy oil stream and from Aviation fuel transfer (SJVUAPCD 2004, 4 - 27 & 31). These and other fuel processes such as breathing losses can be further controlled through the use of increased inspection programs, decreased time allowance to repairing leaks, and better technologies for controlling leaks such as pressure-vacuum relief valves on storage tanks. By placing a cap on the amount of reductions to achieve (similar to the RECLAIM program (SCAQMD: RECLAIM 2006) a set amount of reductions can be achieved from this category.

Fuel Processes & Storage Emissions Reduction Recommendations

- Require increased inspection programs, decreased time allowance to repairing leaks, and better technologies for controlling leaks such as pressure-vacuum relief valves on storage tanks.

- Develop a cap for reducing emissions by 20% from this category from the techniques described above.

Emissions Reductions Achievable from Confined Animal Facilities
A reasonable amount to require is a 20% reduction in emissions overall through the use of the described techniques above (

Table 4-7). In contrast, the district's new proposed controls in the Draft 2007 SIP indicate a possible reduction of 3 tons/day (or 7% reduction) in emissions for these processes.

Table 4-7 Emissions Reductions Achievable from Fuel Processes & Storage

	% Reductions	Tons/day VOC
Baseline: Fugitive Emissions	n/a	39
District Recommended controls on Fugitive Emissions (All Petroleum Categories)		3.0
Reductions Achievable	20	7.8

4.2.9. Volatile Emissions from Wine Fermentation And Aging Processes

A significant amount of volatile emissions result from the wine fermenting process. Annual average emissions from fermentation operations are about 2 tons VOC per day, however, during the peak ozone season, they are around 8 tons/day. EPA recommended that the District put controls on these processes as they are a significant contributor to the inventory. Therefore, the district in December 2005 passed Rule 4694 which requires any winery of over 10 tons VOC per year to reduce emissions by 35% of their baseline. This rule can be met through alternative compliance options as well.

As part of the rule development, the District researched the available and achievable emissions controls for the wineries (SJVUAPCD: Rule 4694 2005). Using a fermentation-wet scrubber, 99.5% of captured emissions can be destroyed. It is possible to achieve 90% capture efficiency, so the overall efficiency of this system would be 89%. A capture efficiency of 100% may be achieved by using a closed capture system that has not yet been demonstrated. An alternative to the scrubber control technology would be to use a thermal oxidizer with a 98% control efficiency.

There are currently no regulations on the aging processes of wine and brandy, although they account for somewhere between about 3 and 20 tons/day VOC emissions (Draft ozone plan, S-IND-14, App I). For the aging process, it is possible to capture and destroy the VOCs with at least an 80% efficiency using regenerative thermal oxidizers or biofilters or going through a boiler. Some facilities have already installed such devices to reduce emissions for meeting the requirements of the alternative compliance plan in lieu of reducing fermentation emissions. This indicates the high cost effectiveness for some facilities for this control device. A baseline emissions and RACT estimate on the aging processes could be completed within 4 months, and controls could realistically be applied within 1 year.

Wine Fermentation Emissions Reduction Recommendations

- Require the 18 largest wineries to install the best available control devices to reduce emissions by at least 89%.

- Requiring facilities to reduce both fermentation and aging emissions of brandy by installing 80% efficient control devices.

Emissions Reductions Achievable from Wine Fermentation and Aging

The district estimates that 95% of the District's wine fermentation emissions come from 18 of the largest wineries, of more than 100 in the Valley. In addition to requiring all wineries above 10 tons per year to meet on average a 35% reduction in emissions, by requiring the 18 largest wineries to install the best available control devices to reduce emissions by at least 89%, this would reduce emissions an additional 2.7 tons/day of VOC can be avoided during peak ozone season (Table 4-8).

By eliminating the alternative compliance plan and requiring facilities to reduce both fermentation and aging emissions, reductions in this category could be reduced significantly. This estimate is a lower conservative estimate. If indeed the emissions from aging facilities are on the higher end of the range of emissions estimate, much more emissions reductions than the values assumed here could be achieved from installing these devices.

Table 4-8 Additional Emissions Reductions Achievable from Wineries

	% Reductions	Tons/ day VOC during Ozone Season
Baseline: Wine Fermentation	n/a	8
Baseline: Wine Fermentation with new District Rules	35%	3.9
Additional Reductions		2.7
Baseline: Wine & Brandy Aging	n/a	2.5
Baseline: Wine & Brandy Aging with new District Rules		2.5
Additional Reductions		1.8
Reductions Achievable		4.5

4.2.10. Boilers, Steam Generators, and Process Heaters

Currently, the District has a rule limiting the NOx emissions from commercial and industrial boilers, steam generators, and process heaters (Rule 4307). However, this rule does not cover solid fueled fired units, and certain other units such as units located at schools and biomass or waste-fired units.

Boilers, Steam Generators, and Process Heaters Emissions Reduction Recommendations

- <u>The district should remove these exempt boilers and generators and apply the rule to all units regardless of location and fuel type</u>. The above changes would change the District's rule to be comparable to the current recommended levels as documented by ARB, and adopted by Sacramento (Rule 411) and the South Coast (Rule 1146).

Emissions Reductions Achievable from Boilers, Steam Generators, and Process Heaters

The District has discussed including school boilers and has estimated that this will reduce emissions by 1 ton/day of NOx. (App I Draft O3 Plan). To date, the district has not addressed solid fuel boilers or given an estimate of the emissions from this category, so it is unclear of the magnitude of emissions reduced would come about from this category.

4.2.11. Composting and Biosolids

The District has proposed their first rule in this area in the Draft Ozone Plan (S-Gov-1, App I). However, the district recommends that no rule adoption should occur before 2020 due to current on-going research. While it is true that the emissions from this category are highly uncertain, the district has a baseline estimate of about 17 tons/day of VOC from this source. It is very likely that these emissions are not overestimated, and may well be underestimated. The South Coast in 2003 passed rule 1133 that requires new and existing facilities to fully enclose their facility and to reduce emissions by 70-80% of baseline emissions or to demonstrate an alternate equivalent compliance plan. A similar plan should be implemented in the District as soon as possible, and compliance could begin within 24 months of adoption for all facilities.

Composting and Biosolids Emissions Reductions Recommendations

- <u>Require new and existing facilities to fully enclose their facility and reduce emissions by 70-80% of baseline or demonstrate an alternate equivalent compliance plan.</u> Compliance should begin 24 months from date of adoption.

Emissions Reductions Achievable from Composting and Biosolids

The estimated reduction from this measure is 12 tons/day VOC. In reality, this reduction could be far greater due to possible underestimations of emissions from this source.

4.2.12. Solid Waste Disposal Sites

The district currently has rule 4642 to limit emissions from solid waste disposal sites. However, there are many exemptions for active landfills, hazardous waste sites, and sites with no VOC control devices that account for 82% of the emissions from this source category. The district has recognized that the current limit of 1000 ppmv of VOC could be applied to all of the exempt facilities (Draft Ozone Plan, S-Gov-3, App I). The plan recommends holding off on removing the rule exemptions until 2017. However, it is feasible to pass the rule immediately removing these exemptions and reduce emissions by a minimum of 0.1 tons/day by 2011.

Solid Waste Disposal Emissions Reductions Recommendations

- Remove Exemptions of active landfills, hazardous waste sites, and sites with no VOC control devices, and have this rule be in effect by 2011.

Emissions Reductions Achievable from Solid Waste Disposal Sites

Emissions from this change will reduce emissions by a minimum of 0.1 tons VOC per day.

4.2.13. Composting Green Waste

There are on the order of 60 tons/day of VOC emissions from green waste operations in the Valley. This estimate is an approximation and needs further refinement, however, it is likely that this number is underestimated. There are currently no regulations on green waste operations, however there are available VOC control devices and mitigation strategies that could reduce emissions by approximately 80% or more. The district is currently looking at a rule to reduce 11 tons/day through 2024 through a variety of VOC control devices. They note that the current available VOC devices could control up to 40 tons/day of emissions from this source (Draft Ozone Plan, S-Gov-5, App I). It is recommended that recognizing the crude state of emissions inventory, the emissions from this category are significant and therefore it is prudent to implement these known and available controls immediately.

Composting Green Waste Emissions Reductions Recommendations

- Require composting and green waste operations to install VOC control devices that overall reduce emissions by 50% by 2011.

Emissions Reductions Achievable from Composting Green Waste

Implementing these controls could reasonably reduce emissions by 30 tons/day by 2013. This is an additional 21 tons/day than the district recommends in their draft ozone plan.

4.2.14. Graphic Arts

The Valley has an estimated .55 tons/day of VOC from these sources. The district is proposing to increase the stringency level of the solvents to be equivalent to other districts. However, even more stringent standards are proposed in Yolo-Solano county's proposed rule. This would set all solvents used in graphic arts processes at 72 g/l. The district currently exempts certain facilities and facilities emitting less than 400 pounds per month of VOC. Emissions could be reduced further by requiring all facilities emitting more than 60 pounds per month of VOC to participate.

Graphic Arts Emissions Reductions Recommendations

- Require all solvents used in graphic arts processes to meet 72 g/l requirements, and lower the exemption rate from facilities using 400 pounds per month VOC to 60 pounds per month of VOC.

Emissions Reductions Achievable from Graphic Arts

An estimated additional 0.2 tons/day could be reduced by increasing the applicability of this rule, the majority of reductions results from increasing the facilities required to participate.

4.3. Implementation of Operational and Incentive Strategies

In order for the Valley to achieve clean air, it is necessary for additional emissions restrictions to be put not only on locally regulated sources, but state and federally controlled sources as well. Namely, these sources include on and off-road mobile vehicles and equipment, including automobiles, trucks, tractors, construction equipment, agricultural equipment, recreational vehicles, boats, planes, and trains. These vehicles and equipment are one of the largest emissions sources of NOx and PM not only in the Valley but throughout California. To date, the District has not imposed restrictions on these sources, because it is illegal for the District to put specific emissions regulations on the state and federally regulated sources. On the other hand, it will be impossible for the District to show attainment without reducing these emissions.

The SJVUAPCD is not the only local agency to face this dilemma. The South Coast Air Quality Management District (SCAQMD) has a similar problem and has found some creative alternatives to reducing emissions in these source categories without violating the regulatory system while pushing the EPA and the State to require more stringent controls.

Two techniques available to Districts for controlling Federal and State regulated sources are incentive strategies and operational policies. Using incentives, the local agency does not require emissions reductions, but gives certain benefits to the entities with lower emissions. These benefits may be in the form of monetary rewards, discounts, preferential treatment, or publicity of the 'clean status of the entity' or some combination. In the operational strategy, the local agency restricts the operation of high-polluting activities or equipment as it sees fit. The railroad idling restriction is an example of an operational control that is in the district's regulatory authority, but effectively reduces emissions from a Federally-regulated source. The two techniques may also be combined, for example, the operational policies on idling will apply unless you voluntarily install BACT. In this example, waiver of the operational restriction is the incentive for using clean technology. These types of techniques allow the district to reduce emissions from these sources without many times raising incentive funding.

A recent successful example of local government promoting incentive and operational control measures is the case of the Maersk Shipping company working with the City and Port of Long Beach to switch to cleaner fuels in the ships, cleaner transfer and loading operations, and employ cold ironing at the docks (Press: Maersk, 2006). In this approach, the SCAQMD did not have the authority to regulate these off-and on-road mobile sources, however, the local governments do have the authority to act as 'landlords' and negotiate terms of use of the ports and accessories, tariffs for entering the ports, and other incentives in exchange for Maersk's voluntary adoption of cleaner alternatives.

The same theory of operational policies can be applied to other on and off road mobile sources. A restriction on the amount of idling for trucks has been used in Southern California. Another is incentives for the operation of certain types of clean vehicles and equipment. Incentives can be in the form of monetary rewards or other forms.

All of these types of voluntary and operational control strategies are available for the District to employ on virtually any source. Specific recommendations for each source that needs to be controlled are described below. However, the control strategies here only touch on the many possibilities for reducing emissions that should not be overlooked.

4.3.1. Recommendations for Designing an Effective Retrofit Program

Even with the operational controls described above, incentive funding will be needed to fuel a retrofit program to achieve the necessary reductions in a timely manner. The technology, mechanism, and fuels are now in place to allow for a very effective program of this type. CARB has adopted regulations requiring new diesel on-road trucks sold in California to meet lower emissions standards starting in 2007, and dramatically lower in 2010. Both Caterpillar and John Deere are making products that now meet and exceed both of these standards. They are using a combination of cleaner fuels, which as of September 2006 will be available everywhere in California, along with more efficient engines, and after control technologies. The most commonly used after control technology is urea injected Selective Catalytic Reduction (SCR) for reducing NOx emission by 98% and particulate filters to reduce particulate matter by 90%. These technologies are already in use in other areas in California, and extensively in Europe. Also, it is possible to diversify the fuel source and use natural gas or LPG and meet these low emissions levels as well.

The new ultra-low-sulfur diesel fuel now being sold for on- and off-road use in California is essential for ensuring the emissions controls technology operates efficiently for the NOx and PM controls, and the new fuel also reduces SOx emissions over 95%.These new fuels allow the successful low emissions operation of the newest technology engines. However, the turnover of the on-road fleet is extremely slow and the off-road fleet even slower, therefore it will take decades to reach our clean air goals if business continues as usual. ***The challenge is now to accelerate fleet turnover of the legacy fleet. Accelerated turnover of the existing fleet is the most important control strategy for reducing NOx and PM emissions in the near term.***

Using retrofit programs, the district can provide funds and the mechanism to retrofit or replace old technology with new cleaner alternatives. Reducing such emissions through retrofitting and turnover of the existing diesel fleet has proven to be cost effective and every reasonable measure to fund this should be employed. (CAAC 2006). EPA estimates the EPA 2007 Diesel Rule impacting new engines and requiring cleaner diesel fuel will have returned $17 to society in health benefits for every dollar spent. The Nonroad Diesel Rule that was finalized in 2004 will deliver $40. (CAAC 2006). However, the overall capital amounts of funding needed to implement these measures are significant and exceed the San Joaquin's current budget. The District and community will need to be proactive at identifying and augmenting current funding opportunities. It is possible. To put in perspective on the amount of funding needed for this recommended retrofit program, it is equivalent to $121 per Valley resident per year for 5 years.

As the largest source of NOx in the Valley and a very significant source of PM, combined with the proven availability of 90% effective retrofit control technologies, this single strategy is essential for achieving clean air in the Valley. There are several key items that need to be incorporated into a retrofit and replacement program in order for it to be successfully implemented and the emissions reductions realized. These are:

- The program needs to be widespread and affect the majority of the diesel fleet in the near term. Pilot programs to date have proven successful but in order to effectively clean up the air, most if not all of the older high polluting engines should be updated.

- The program should jointly combat NOx and PM emissions, for both the maximum emissions control and the practicality and cost-effectiveness of a retrofit and replacement program. In contrast, the School Bus program targeted PM emissions but not NOx. For existing vehicles, PM and NOx reductions of over 85% can be achieved for almost all engines through the addition of after-treatment technology or the replacement of existing engines with new technology or alternatively fueled engines. These are the targets that ARB is setting for their proposed diesel engine rule.

- The program should identify the engines that could be easily retrofitted with a newer engine and exhaust controls, and those that should be scrapped and replaced with new equipment. Some older trucks and equipment (mostly pre-1977 vintage engines) are not designed to have the spatial requirements to fit newer engines and the sizable control technologies and therefore will need to be replaced. The capability of various engines to be overhauled or replaced is well-documented in the literature. In addition, many of the oldest engines and vehicles are not used enough to contribute significantly to the inventory. This should be taken into account when distributing incentive funds.

- The incentives need to be enough to elicit participation of the private fleet. The incentive structure may need to be based on the income level of the owner operators, or the number of equipment pieces, to ensure that the dirtiest of the fleet is updated.

- A component of the program may be to identify the dirtiest technologies through remote sensing and offer the owners fair market value and perhaps an incentive for new purchase or leasing opportunity for new technology. This has been shown to be a highly cost effective method for emissions reductions if done in a manner that ensures the real retirement and replacement of the dirty vehicles.

- To ensure permanent emissions reductions, the fleet must be properly maintained once the retrofit and replacements takes place. This will require education of the owners, operators, mechanics, and possibly additional funding for maintenance.

- The program should have checks to ensure success, such as performing roadside remote sensing to identify the high polluters and ensure retrofits are being maintained.

- The program should emphasize cost effective techniques and efficiency improvements and educate potential applicants of this program. A program could be set up in 1 year timeframe.

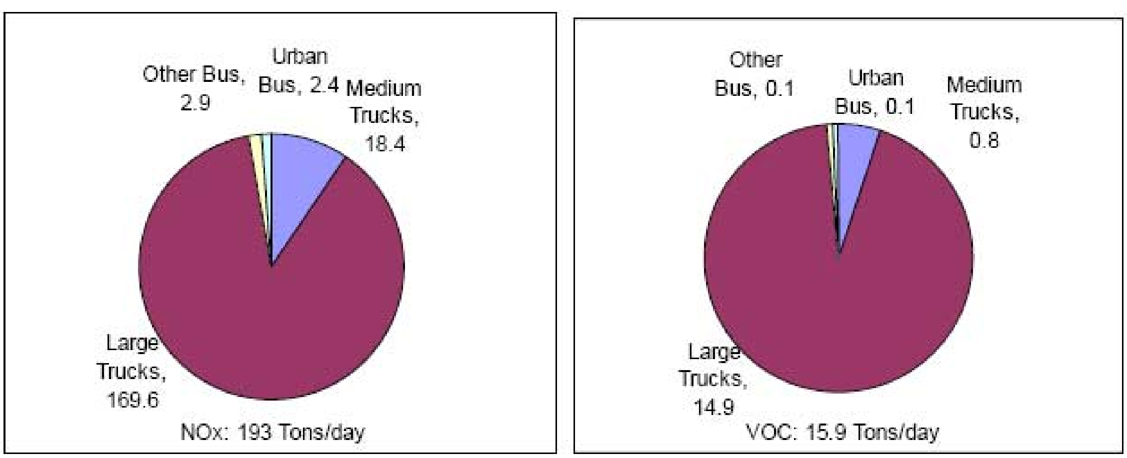
- Although incentive funding is an important aspect of the program, operational incentives and regulations should also be used to the greatest extent practical to advance the retrofit and replacement program.

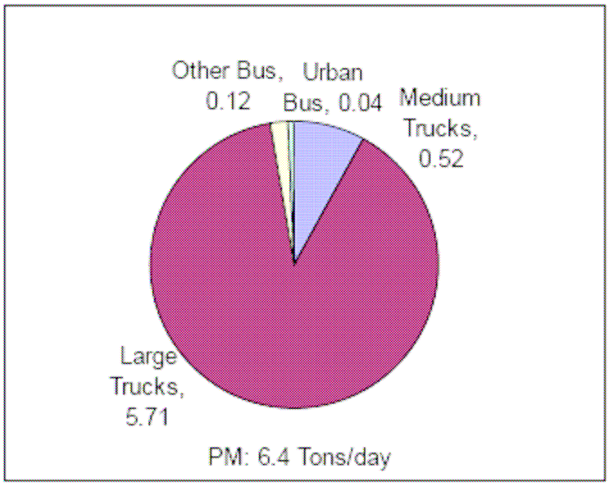
- The program should specifically target and have a program for each major source of diesel NOx and PM emissions, including:
    - On-road Heavy Duty Diesel Trucks
    - On-road Light Duty Vehicles
    - School & Urban Buses
    - Construction Equipment
    - Agricultural Equipment
    - Rail Yard Equipment

4.3.2. Emissions Reductions Achievable from On-Road Diesel Vehicles

On-Road diesel trucks and buses contribute about 190 tons/day NOx emissions to the Valley, or about 20% of all NOx emissions. Emissions from the on-road diesel fleet are primarily a result of small and medium heavy trucks (between 8,500-33,000 Gross vehicle weight rating (GVWR)]), large line haul trucks (>33,000 pounds GVWR), and school and urban buses (Figure 4-1). Improved engines and aftercontrol technologies to reduce these emissions by 90% exist and are being used in other areas throughout the world. Thus, this group of vehicles represents an enormous opportunity to help in reaching the desired emissions reductions of the Valley.

Figure 4-1 2013 Baseline Emissions from On-Road Diesel Vehicles





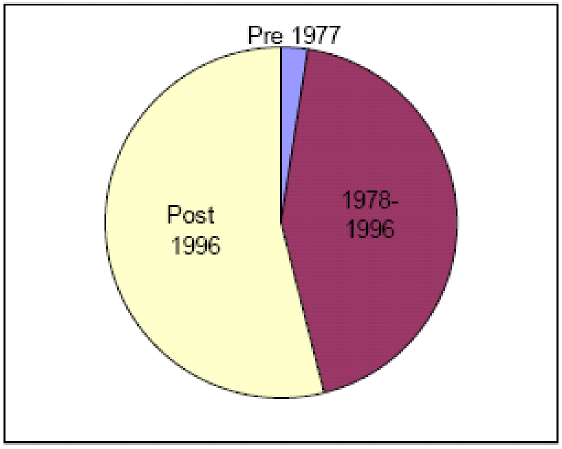
RECOMMENDATIONS

- Develop an aggressive retrofit program as outlined in Section 4.3.1 for heavy duty diesel trucks.
- Encourage transit agencies to use smaller, less polluting vans and buses on low-ridership routes.
- Work with the COGs, other municipal and county government agencies, and the state legislature to develop urban growth boundaries in the region to encourage planning and land use that reduces VMT for the buses and urban trucks.
- Expand the Spare the Air Program to help reduce travel on high pollution days

EMISSIONS REDUCTIONS ACHIEVABLE

Although the dirtiest engines are the pre-1978 trucks and buses, due to the small numbers of these vehicles, they do not contribute greatly to the emissions from these vehicles. Only about 1% of the emissions are from the pre-1978 trucks and buses in 2013 (Figure 4-2). This is an important point because the retrofit control strategies will not work on most pre 1978 vehicles.

Figure 4-2 Approximate Contributions of emissions by Model Year Groups for On-Road Diesel Vehicles



The most recent version of California's mobile source emissions model (EMFAC 2007) was used to estimate the emissions reductions of 22,000 retrofitted vehicles, which represents approximately 30% of the heavy duty diesel fleet in the Valley in 2013. Since there are more than 53,000 of the largest heavy duty diesel vehicles with model years between 1980 and 2008 on the road in the Valley, it is assumed that all of the 22,000 vehicles that are found can be retrofitted (instead of needing engine replacement) and the vehicles retrofitted operate mostly within the valley. This is the most cost effective use of the funds, and would reduce approximately 65 tons NOx/day from the Valley. This change would also reduce VOC by roughly 5 tons/day VOC, and 2 tons/day of PM. The emissions benefits can be seen in

Table 4-9.

The Strategic Action Plan for the San Joaquin Valley estimates that replacing 7500 vehicles would cost a total of 300 million dollars of incentive funding per year for 5 years to replace these vehicles (App J, 2007 Ozone report). It appears that the report assumes that the total cost of replacing each vehicle is $500,000, with $200,000 of this (40%) needed to provide through incentive funding. Since the retrofitting of a heavy duty vehicle is much less costly, it is assumed that this same amount of funding can retrofit the 22,000 vehicles instead. This, approximately $70,000 per vehicle, is considered a conservative estimate of retrofitting the fleet.

In addition to the retrofitting of the fleet, implementation of operational policies can further reduce emissions. From 2008 to 2013, the miles traveled by heavy duty diesel trucks in the Valley is expected to increase 11%, or more than 1.2 million miles a day. For diesel buses, the expected increase is 23%, or 37,000 more miles per day. If methods for developing alternative routes to reduce traffic were developed and implemented by 2013 to reduce half of the expected increase in growth from 2008 to 2013, this would reduce emissions by an additional 10.4 tons/day of NOx from diesel trucks in the valley.

Table 4-9 Emissions Reductions Achievable from On-Road Diesel Vehicles

	Tons/day NOx	Tons/day VOC	Tons/day PM	Incentive funds required (millions of dollars)
Baseline Emissions: On-road Diesel Trucks & Bus	193	15.9	6.4	n/a
Reductions from 22000 Heavy Duty Trucks	64.4	4.6	2.0	1,500
Reductions from Operational Policies	10.4	0.9	0.4	
Total On Road Diesel Reductions	74.8	5.5	2.4	1,500

4.3.3. Emissions Reductions Achievable from On-Road Light Duty Vehicle Replacement & Policies

In addition to the heavy duty truck fleet, light duty vehicles (consisting of passenger cars, sport utility vehicles and small trucks) are a significant contributor of emissions in the Valley, contributing 33 tons/day of NOx, and 50 tons/day of VOC to the Valley daily. While the newest automobiles emit virtually no emissions, this is not true for the older vehicles and some of the larger sport utility vehicles. This situation has technological opportunity for the reduction of emissions.

RECOMMENDATIONS

- Implement a replacement program for the highest polluting automobiles.
- Implement no drive days with free public transportation on high pollution days, similar to the BAAQMD program.
- Develop transportation alternatives to limit light duty passenger travel through urban growth boundaries in the region to encourage planning and land use that reduces VMT.

EMISSIONS REDUCTIONS ACHIEVABLE

Approximately 28,000 vehicles in 2013 in the Valley will be 35 years or older. These vehicles contribute a disproportionate amount of emissions, and could be replaced at a relatively low cost. The Strategic Action Plan recommends replacing 6,000 vehicles per year for 5 years with an incentive funding to the vehicle owner of $4000. The emissions benefit is estimated to be 2.5 tons/day of NOx and 5.3 tons/day of VOC in 2013 from removing the oldest 30,000 vehicles. In addition to the replacement program, there is significant growth anticipated from vehicles in the Valley. Between 2008 and 2013, it is expected that light duty vehicle travel will grow from 67 million miles a day to 77 million miles, a 15% increase in travel. If the operational policies described above could be implemented to reduce the increase in travel by half to total 73 million miles per day, this would eliminate almost 2 tons NOx per day and 1 ton VOC per day. This reduction is in addition to the retrofit emissions.

Table 4-10 Emissions Reductions Achievable from On-Road Light Duty Vehicles

	Incentive funds required (millions of dollars)	Tons/day NOx	Tons/day VOC	Tons/day PM	Estimated Public Funding ($ millions)
Baseline Emissions: Light Duty Vehicles	n/a	33	50	2.0	
Reductions from 30,000 Old Light Duty Vehicles[1]	120	2.5	5.3	0.2	24
Reductions from Operational Policies		1.9	1.1	0.1	
Total On-Road light duty vehicles Reductions		4.4	6.4	0.3	24

1. This Data is from the latest version, EMFAC 2007 released in November 2006. these values differ from other recent reports.

4.3.4. Emissions Reductions Achievable from Off-Road Sources

Off-road equipment and recreational vehicles contribute almost 100 tons/day NOx to the Valley, or about 20% of the entire NOx inventory. More than two thirds of the NOx and PM emissions from off-road mobile sources are from three specific categories: diesel construction and mining equipment, diesel oil drilling equipment, and diesel farm equipment. The top three sources of VOC are from pleasure craft, recreational off-road equipment and farm equipment (ARB OFFROAD 2007 model). The focus on reducing emissions from off-road mobile sources, then, is dedicated primarily to these six categories of off road equipment.

Table 4-11 Baseline Emissions from Top Six Off-Road Equipment and Recreational Vehicles

	Emissions (tons/day)		
Category	NOx	VOC	PM
Pleasure Craft	5.53	10.46	1.76
Recreational Equipment	0.24	6.20	0.09
Oil Drilling	14.27	1.58	0.58
Agricultural Equipment	41.34	6.69	2.40
Construction and Mining Equipment	25.38	3.39	1.34
Lawn and Garden	0.9	3.6	0.1
Total	86.75	28.33	6.18

RECOMMENDATIONS:

- Set Operational Policies and Incentives for Off-Road Equipment & Agricultural Operations The District should develop a set of operational policies for various types of off-road and agricultural operations. For example, a tractor operator would like to operate their tractor on any given day of the year. Offer that opportunity to only the tractors that have BACT technologies. Other equipment operators must not operate on days that are predicted to be in exceedence for ozone or particulate matter or when the AQI index is over 100. In addition, the air district should work with the legislature to increase the district's authority to require that public agencies operating within the air district adopt green contracting practices.

- Set Operational Policies for Off Road Recreational Vehicles and Boats - Prohibit use of off-road recreational vehicles that don't meet ARB's new emission limits on days that AQI is forecasted to be above 100; prohibit all Off-Road Recreational Vehicle use on days that AQI is forecasted to be above 150. Also, establish anti-idling rules for recreational boating and prohibit 2-stroke recreational boat use on days that AQI is forecasted to be above 100; prohibit all recreational boat use on days that AQI is forecasted to be above 150.

- Set Operational Policies and Increase Incentives for Off-road Lawn & Garden Equipment. The District and ARB has a voluntary program for replacing existing lawn and garden equipment with electrically operated devices, which reduces these emissions by virtually 100%. The district entitles its program, "Clean Green Yard Machine" and offers a discount while supplies last for trading in the gasoline lawnmower with an electric one (CGYM 2006). Approximately 800 yard machines were exchanged in the 2006 campaign SJVUAPCD: Presto 2006). This is considered an excellent program and an excellent use of incentive funding and it is recommended that this program be continued and accelerated. In addition to this type of incentive funding, an operational restriction can be put on the operators of two-stroke lawn and garden equipment during days of expected ozone exceedences. It is recommended that the district establish a policy to prohibit use of 2-stroke small off-road engines, including lawn mowers and tractors, weed whips, leaf blowers, and generators on days that AQI is forecasted to be above 100 (orange alert); and to prohibit the use of all small off road engines on days that AQI is forecasted to be above 150 (red alert). This type of a program would reduce the emissions on high ozone days as well as further incentivize the replacement program.

EMISSIONS REDUCTIONS ACHIEVABLE:

By implementing the above guidelines, it is possible to reduce emissions significantly through these operational and incentive policies by targeting the most dominant emissions sources. The emissions reductions, number of necessary retrofits, and estimated public funding required, where applicable, are shown in

Table 4-12. The funding levels listed here are approximate and should be considered to be a rough but should be reasonable estimates for the needed funding for the amount of retrofits listed. The levels of incentives are given on average, but the recommendations listed above for allocating incentives should be followed where the funds should be allocated on as needed basis. For oil drilling, 60% of the emissions come from one category, diesel fueled mobile workover rigs. Approximately 70% of these emissions are from 260 of the 611 units. Installing aftertreatment in these units can reduce NOx and PM by 90%. It is assumed that $30,000 for each unit is needed to incentivize these retrofits. Similarly, for agricultural operations, over 90% of the emissions are from diesel agricultural tractors. By installing aftercontrols or retrofitting half of the most used of the 73,000 tractors in the basin, over 30 tons/day of NOx emission could be eliminated. It is assumed that an average of $5000 dollars per unit are offered as incentives in addition to the operational restrictions. In construction and mining equipment, the vast majority of emissions are from excavators and off-road trucks. Again, retrofits and aftercontrols to reduce emissions significantly from these vehicles. By switching from 2-stroke to electric lawn and garden equipment, virtually all emissions are eliminated. It is assumed that 80% of the gasoline lawn and garden equipment can be replaced with an electric version with an incentive funding of $500,000. The remaining cost is born by the consumer and incentivized through the operational restrictions. By selecting the top polluters from the industrial and light commercial off-road equipment categories, most of which could be converted to electric or equipped with after-controls, another 5 tons per day of NOx and VOC could be eliminated. The operational restrictions on the recreational boats and equipment are assumed to reduce emissions by 25%.

Table 4-12 Emissions Reductions Achievable from Off-Road Mobile Equipment

Category	Type of Control (# of Incentivized Retrofits)	NOx (Tons/ day)	VOC (Tons/ day)	PM (Tons/ day)	Estimated Public Funding Required ($ millions)
Pleasure Craft Reductions	Operational Controls	4.1	7.8	1.3	0.0
Recreational Equipment Reductions	Operational Controls	0.1	1.6	0.0	0.0
Oil Drilling Reductions	Operational and Incentive (611)	7.54	.94	0.35	18.3
Agricultural Equipment Reductions	Operational and Incentive (37,000)	31.8	4.6	1.8	183.3
Construction and Mining Equipment Retrofit	Operational and Incentive (1,400)	4.9	0.6	0.2	10.7
Lawn and Garden Retrofits	Operational Controls	0.8	2.9	0.1	0.1
Light Commercial Equipment	Operational and Incentive (2108)	1.2	0.2	0.1	10.5
Industrial Equipment	Operational and Incentive (3097)	1.9	0.2	0.1	15.5
Total Reductions Achievable from Off Road Mobile Equipment		56.0	24.8	4.4	238.4

4.3.5. Emissions Reductions Achievable from Locomotives and Aircraft

RECOMMENDATIONS

- Require the installation of an anti-idling device or impose more stringent limits on idling locomotives unless equivalent reductions are demonstrated in other methods of operating within the district. The SCAQMD has recently passed a similar rule prohibiting the excessive (greater than 30 minute) idling by shutting off the engine, installing an anti-idling device that automatically turns off the engine, or demonstrating that the locomotive will achieve equivalent reductions in emissions over a calendar year using other methods (SCAQMD: Locomotive Idling 2006). This rule is more stringent than the statewide rule. A similar rule is recommended to be employed in the San Joaquin Valley for the reduction of NOx and PM. This rule could be realistically in effect 6 months after rule adoption.

- Set Operational Restrictions on the idle time for Aircrafts. The idle times for aircraft are typically between 13-35 minutes and many times are longer. By imposing a monthly average limit on carriers, a reasonable idle time can be met.

EMISSIONS REDUCTIONS ACHIEVABLE

Several studies have been conducted that indicate the current diesel locomotive fleet can be cost effectively retrofitted to dramatically reduce emissions of PM and NOx. One of the most feasible of these technologies is to install a selective catalytic reduction (SCR). (EEFE, 1995). In 2005, the railroad company BNSF was awarded clean-air grants in July 2004 by the Texas Emissions Reduction Program (TERP) for implementation of the hybrid technology. Remanufactured from existing switcher locomotives, they cut oxides of nitrogen (NOx) and particulates 80-90 percent, while reducing greenhouse gases and diesel fuel consumption 40-70 percent when compared to conventional yard switchers in the 1,000 to 2,000 horsepower range. (BNSF 2005) Other options that some railroad companies are doing to increase performance, efficiency, and reduce emissions to the existing fleet include reducing drag through low torque bearings, wheel/rail lubrication to reduce friction and reduced aerodynamic drag. (BNSF). This clean technology exists and is economically feasible. By replacing locomotives with the newest currently available technology, it is possible to reduce emissions from railroad operations from 7 to 18 tons/day NOx, 0.2 to .6 tons/day VOC and PM2.5 in the Valley (Table 4-13). An estimated 500 million dollars of public funding is assumed to be required to reduce emissions for retrofitting the fleet.

For aircraft operating in the Valley, emissions from aircraft are 5 tons/day of NOx and 10 tons/day of VOC in 2013. By imposing restriction on idle time, it is anticipated to reduce emissions at least by 1.5 ton/day combined NOx and VOC.

Table 4-13 Emissions Reductions Achievable from Locomotives and Aircraft

	% Reductions	Tons/day NOx	Tons/day VOC	Tons/day SOx	Tons/day PM	Estimated Public Funding (millions $)
Railroad Baseline	n/a	21.3	1.2	2.7	0.7	
Aircraft Baseline		4.6	9.7			
Operational Restrictions on Railroad	10%	2.1	0.1	0.3	0.1	0
Retrofit -	34%	7.2	0.2	0.5	0.2	500

Railroad 40% fleet						
Operational Restrictions on Aircraft	10%	0.5	1.0			
Total Available Reductions	44%	9.8	1.3	.8	.3	500

4.3.6. Recommendations for expanding ISR and Spare the Air Days

It is anticipated the measures described thus far will eliminate much of the pollution, but about 22 tons/day of NOX and VOC still need to be reduced to reach the ozone clean air goals by 2013. In addition to the operational and incentive policies and increased stringency of stationary and area rules discussed in the previous sections, there are some additional measures that the District can employ to reduce emissions further. These include:

- Expand the ISR program currently used by the District. Much of the reductions described above, especially the VMT reductions, may be handled using an ISR program. However, there are areas where further ISR reductions are available that have not been discussed in the recommendations above. For example, an ISR program could be employed specifically for the Port of Stockton. There are many land-based port equipment that could be retrofitted. The South Coast Air Quality Management district has a similar measure in their draft ozone air quality management plan. Other techniques, should be employed to ensure that indirect source emissions from new developments are fully reduced or mitigated, such as giving priority to the most energy efficient and low-polluting builders and limiting development rates.

- Expanded Spare the Air Programs - In addition to the operational restrictions on specific agricultural and off-road equipment described in the above recommendations, there are additional areas to include in a Spare the Air Program which will reduce emissions further. A program to allow benefits and recognitions to industries willing to curtail operations on high pollution days would not necessarily reduce the overall tonnage/ average day but would reduce the tons/day on the high pollution days, by reducing the number of days over the ambient air quality standards.

EMISSIONS REDUCTIONS ACHIEVABLE

It is estimated that using these additional ISR and Spare the air programs, a minimum of 11 tons/day of VOC and NOx each could be eliminated (in addition to the benefits described in previous sections) during the summer seasons high air pollution days.

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Glossary of Terms

Ammonia: Ammonia is a pollutant that can be harmful in large concentrations as ammonia, but also contributes to forming particulate matter which is another harmful air pollutant. The largest source of ammonia emissions comes from livestock operations.

BACT: Best Available Control Technology. This is the maximum level of emissions control that has been demonstrated by a device. Many regulations require new facilities to regulate to BACT or equivalent. This control is more effective at reducing emissions than RACT (reasonably available control technology) requirements.

BARCT: Best Available Retrofit Technology. Similar to the BACT but applies to retrofits (modifications) of existing technology to lower emissions of already existing facilities or industries.

Clean Air Act (CAA): This Act was originally established in 1965, but has undergone much change due to amendments occurring all the way up through 1990. The primary function of the Clean Air Act is to allow the federal EPA to set limits on how much of any pollutant can be in the air anywhere in the United States. This act also gave EPA the power to fine violators of the Act and increase penalties. Finally, every version of the Clean Air Act specified mandatory dates for achieving attainment of air quality standards.

Control Measures: Control measures are suggested regulations to be placed on different pollution sources. If the EPA accepts them then they are adopted and implemented.

NOx: Oxides of Nitrogen. NOx are combinations of the oxygen atom(s) with nitrogen. They are typically released from combustion processes and contribute to forming ozone (smog) and particulate matter.

Ozone (O3): Ozone is a form of pollution made up of volatile organic compounds and nitrogen oxides. In the presence of sunlight, especially on hot summer days, ozone is formed.

Particulate Matter (PM): Particulate matter is made up of a combination of solid particles and liquid molecules. They can be released directly into the atmosphere or made within the atmosphere through chemical aggregate reactions. PM has a wide range of sizes that vary from particles visible to the naked eye like ash and soot, to molecules that can fit inside the nucleus of a cell. Fine particles (PM2.5) are directly emitted from combustion sources and are also formed secondarily from gaseous precursors such as sulfur dioxide, nitrogen oxides, or organic compounds. Coarse particles (PM10) are formed through activities such as agricultural operations, industrial processes, combustion of wood and fossil fuels, construction and demolition activities, and entrainment of road dust into the air. Natural (nonanthropogenic or biogenic) sources also contribute to the overall PM10 problem. These include windblown dust and wildfires.

Pollutant Precursor: This is an emission that contributes to making one or more hazardous pollutants in the atmosphere. For example, NOx and VOC emissions are precursors to Ozone pollution. Ammonia and NOx are precursors to PM pollution. In order to reduce ozone levels, it is necessary to reduce the precursors (NOx & VOC).

San Joaquin Valley Air Pollution Control District (SJVUAPCD): It is the job of the SJVUAPCD to regulate stationary and area sources within the San Joaquin Valley Air Basin. The District distributes permits, makes regulations, devises public outreach programs, and helps to monitor the air quality of the areas within their jurisdiction. The counties that fall within the SJVUAPCD jurisdiction are: San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and part of Kern.

SOx: Oxides of Sulfur are combinations of oxygen atom(s) with sulfur. Since almost all petroleum-based fuels contain sulfur as well as coal, oxides of sulfur are emitted from combustion processes using liquid petroleum based fuels or coal. Examples are diesel engines, oil and coal fired power plants, and liquid petroleum based boilers. Natural gas and propane also contain small amounts of sulfur and their combustion produces slight amounts of oxides of sulfur as well.

State Implementation Plan (SIP): A State Implementation Plan is a plan written by the local air district to suggest control measures for the local air district's area. The SIP is then submitted to the Environmental Protection Agency where they may approve the plan, reject the plan, or require adjustments to certain portions. This plan is written with the goal of suggesting and implementing strong enough control measures to allow the district to reach their goal of attainment. Different SIP's must be written for different pollutants, i.e. ozone and particulate matter must have separate plans.

VOC: Volatile organic compounds are chemical compounds that have the ability to easily vaporize into the atmosphere and bond with NOx or other chemicals to form pollutants. Sources of volatile organic compounds include paint thinners, cleaning solvents, and gasoline. Trees also emit VOCs.

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