Appendix B
Current Estimates of Remaining Emissions, Documentation and Methodology

Appendix B includes additional documentation and data supporting this proposed SIP Revision. It includes additional detail regarding the emissions accounting methodology and information on how ARB staff accounted for the impacts of the recession. This methodology is consistent with the methodology described in Appendix A and Appendix E of the ARB staff report "Progress Report on Implementation of PM2.5 State Implementation Plans (SIP) for the South Coast and San Joaquin Valley Air Basins and Proposed SIP Revisions" which was released to the public on March 29, 2011.

Current Estimates of Remaining Emissions

South Coast Air Basin
Remaining NOx Emissions
(Summer Season, tpd)

Category	2002	2008	2011	2014	2017	2020	2023
Stationary & Areawide	89	82	73	71	68	68	68
On-road Mobile	652	422	327	276	224	185	140
Off-road Mobile	283	225	191	185	187	176	170
Total Inventory	1024	728	591	532	479	428	378

South Coast Air Basin
Remaining ROG Emissions
(Summer Season, tpd)

Category	2002	2008	2011	2014	2017	2020	2023
Stationary & Areawide	318	247	252	254	260	267	273
On-road Mobile	361	211	171	135	119	107	98
Off-road Mobile	202	174	156	146	141	140	142
Total Inventory	881	632	580	535	520	514	513

Current Estimates of Remaining Emissions

San Joaquin Valley
Remaining NOx Emissions
(Summer Season, tpd)

Category	2002	2008	2011	2014	2017	2020	2023
Stationary & Areawide	101	76	68	57	55	53	53
On-road Mobile	312	229	183	153	115	91	69
Off-road Mobile	152	120	108	98	89	80	73
Total Inventory	565	425	359	307	259	225	195

San Joaquin Valley
Remaining ROG Emissions
(Summer Season, tpd)

Category	2002	2008	2011	2014	2017	2020	2023
Stationary & Areawide	276	263	226	223	229	235	244
On-road Mobile	110	78	66	50	43	39	37
Off-road Mobile	71	67	62	59	57	57	57
Total Inventory	457	408	354	331	329	331	339

SIP Accounting

The Clean Air Act requires the use of air quality modeling to determine the “carrying capacity” or “SIP emissions target”; that is, the maximum allowable emission levels that the nonattainment area can accommodate while attaining the standard.

While the adopted SIP contains a list of category-specific measures with regulatory timelines and expected reductions, ARB’s enforceable commitment is to meet the emission levels needed for attainment with sufficient aggregate emission reductions, including any from actual changes in emissions.

To track progress toward the emissions target, this report uses a simple emissions accounting approach that explicitly shows the impact of the recession and the benefit of the regulations ARB and the local air districts have approved since the ozone SIPs were adopted. The approach looks like:

(Emissions Inventory) – (Emission Reductions Achieved) = (Remaining Emissions)

Where:

Emissions Inventory	=	Amount of ozone precursor emissions in the SIP baseline
Emission Reductions Achieved	=	Amount of emissions that have been reduced either through adopted regulations or actual emission decreases due to the recession
Remaining Emissions	=	The ozone precursor emissions level that is forecast to be remaining in the attainment year with the impacts of both regulations and the recession.

This approach keeps the focus on meeting the ultimate goal of the emissions target derived from air quality modeling. This approach also has the advantage of explicitly showing the impacts of both the regulatory actions and the recession.

Assessing the Impacts of the Recession on Goods Movement Related Emissions

This section documents the methodologies used to account for the impacts of the economic recession on the emission inventories for trucks, in-use off-road equipment, ocean-going vessels, and cargo handling equipment. Links to more detailed information are provided.

General Methodology

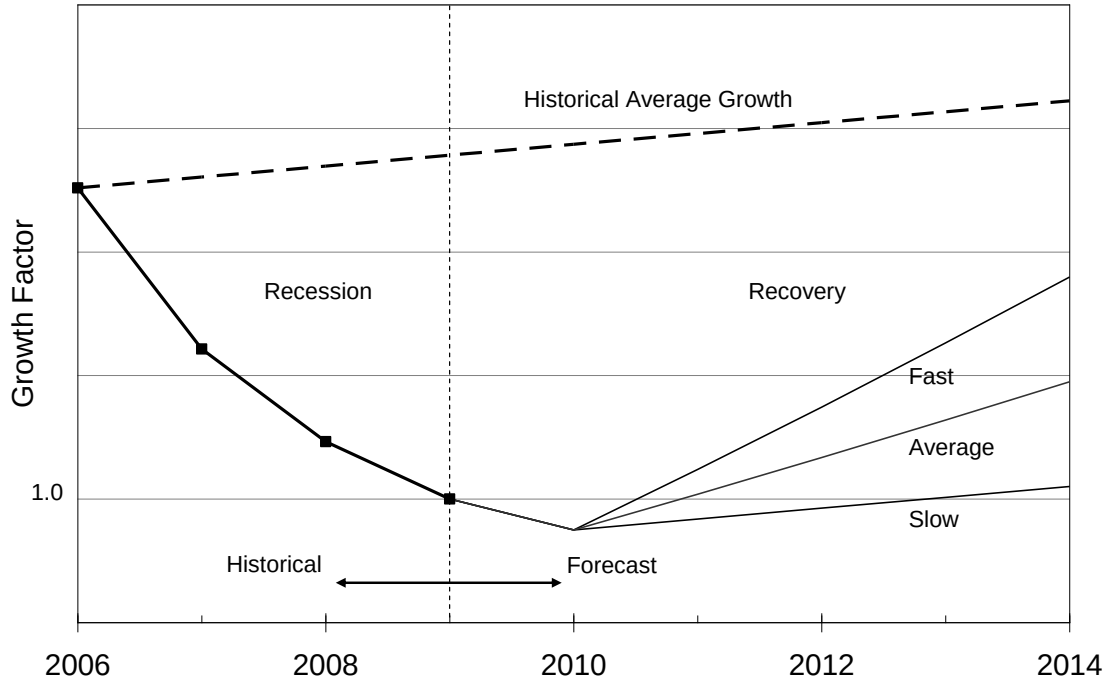
The economic recession officially started in December of 2007 and ended in June 2009. It was the most severe since the Great Depression and had a substantial impact on California industries. The emission inventories for trucks, in-use off-road equipment, ocean-going vessels, and cargo handling equipment have all been adjusted to reflect the recession's impact.

To adequately understand the impact of reduced activity on future emissions, staff developed both fast and slow recovery scenarios.

The fast recovery scenario assumes that total activity would return to projected historically average levels in 2017 and then grow at the historical average rate after that. This scenario is based on the Congressional Budget Office forecast which indicated that real gross domestic product at a nationwide level will converge with potential gross domestic product trends no later than 2015. Coupling this forecast with the assumption that California's recovery will lag the nation's by several years yielded the 2017 recovery date assumed for the fast recovery scenario.

In the slow recovery scenario, staff assumed that activity would be permanently depressed relative to historical levels, but continue to grow at the average historical growth rate beginning in 2011.

While the fast and slow scenarios provide reasonable bounds of possible recoveries, for rulemaking purposes and for this SIP update, a single forecast is needed. For that forecast, staff assumed an average recovery midway between the fast and slow recoveries. The chart below illustrates the two bounding scenarios and the assumed average used in this report. This is the same approach developed to provide economic relief through last year's regulatory amendments to the diesel trucks, buses, and off-road equipment rules.



In-Use On-Road Trucks & Buses

Staff updated the inventory for diesel trucks and buses to support ARB consideration of regulatory amendments to provide economic relief last December 2010. The update was comprehensive and included revised population estimates, new regional allocation factors, lifetime odometer assumptions, revised growth rates, forecasted vehicle age distributions to reflect the impact of the economic recession, and updated out-of-state vehicle activity. These changes are described in detail at:

http://www.arb.ca.gov/regact/2010/truckbus10/truckbus10.htm

This report required emission estimates for years and pollutants (ROG) that were not needed

for the 2010 rulemaking staff report. Staff used the same methodologies and principles used for the December 2010 regulatory inventory to develop estimates for the other years and pollutants in this report.

In-Use Off-Road Equipment

Just as for trucks and buses, staff completed a comprehensive revision to the inventory for off-road equipment to support ARB consideration in December 2010 of regulatory amendments to provide economic relief. Updates were made to the population of equipment, annual activity, load, and future equipment sales. These changes are described in detail at:

http://www.arb.ca.gov/regact/2010/offroadlsi10/offroadlsi10.htm

This report required emission estimates for years and pollutants (ROG) that were not needed for the 2010 rulemaking staff report. Staff used the same methodologies and principles used for the December 2010 regulatory inventory to develop estimates for the other years and pollutants in this report.

Ocean-Going Vessels (OGV)

The OGV inventory in the ozone SIP included vessel-specific data, an improved vessel traffic network, vessel-specific hoteling and anchorage times, and improved vessel speeds. Staff has refined that inventory since then to support rulemaking in 2008 on the sulfur content in fuel. Staff has further updated that 2008 inventory in anticipation of amendments to the same fuel rule later this year. That information is used in this report. In general, the updates include improved algorithms for vessel speed reduction (VSR), auxiliary engine power, and estimating low load adjustment factors. Recession impacts are based on container throughput statistics for the Ports of Los Angeles, Long Beach and Oakland. OGV activity was down about 25% for the combined Ports of Los Angeles and Long Beach and about 15% for the Port of Oakland between 2006 and 2009. More information is available at:

http://www.arb.ca.gov/ports/marinevess/ogv.htm

Cargo Handling Equipment (CHE)

An update to the cargo handling equipment (CHE) inventory is currently underway using new information about the population, equipment usage, impacts of the recession and fleet turnover. The new model is still under development and not available for use in this report; therefore, staff scaled the existing ozone SIP CHE emissions inventory to account for the new data.

The inventory used for the ozone SIP was based on population and activity values from a 2001 to 2004 survey. As part of the adopted regulation, equipment owners were required to report the population of their equipment to ARB. Additionally, between 2005 and 2009 the ports and rail yards have conducted their own emission inventories. This new information

indicates that the total State population is slightly higher than originally assumed. These same data sources include updates to activity and load factor. However, changes in activity and load factors offset these increases in the population.

To account for these changes, staff compared baseline 2006 emissions from the original inventory to the draft updated inventory baseline. As discussed in a recent February 2011 workshop, emissions for NOx are approximately 27 percent lower. For this report, staff assumed 2006 emissions were 27 percent lower than in the SIP. To forecast emissions forward from 2006, staff compared the original growth assumptions for CHE to the growth in port truck activity in the 2010 Truck and Bus Rule inventory model. Assuming that the CHE activity relates chiefly to the movement of shipping containers, staff reduced growth by approximately 20 percent. More information is available at:

http://www.arb.ca.gov/ports/cargo/cargo.htm

Commercial Harbor Craft

In 2007, ARB adopted a commercial harbor craft regulation and adopted amendments to the original rule in 2010. Updates were made to the population of equipment, annual activity, and regional allocation. These changes are described in detail at:

http://www.arb.ca.gov/ports/marinevess/harborcraft/hcdocuments.htm#regulatory

Emission Inventory Improvements for the San Joaquin Valley

Nature of Emissions Update

The San Joaquin Valley Air Pollution Control District (Valley Air District) initially adopted the 2007 8-hour ozone SIP in April 2007. At that time, the SIP reflected the best available emissions inventory estimates, technical calculations, and air quality modeling used to meet federal air quality planning requirements.

Since the San Joaquin Valley 2007 8-hour ozone SIP was adopted, both ARB and the Valley Air District have continued to evaluate and update emission inventory categories under their respective authority. As described earlier in this Appendix, ARB has identified emissions inventory improvements through the recent rulemaking process for trucks, in-use off-road equipment, ocean-going vessels, and cargo handling equipment. These ARB emission inventory improvements were submitted to U.S. EPA on May 18, 2011 as an update to the PM2.5 SIPs for the San Joaquin Valley and South Coast. The Valley Air District also identified emissions inventory and forecasting method improvements subsequent to the adoption of the 2007 8-hour ozone SIP that were incorporated into the San Joaquin Valley 2008 PM2.5 SIP. ARB staff briefed the Board on the improvements in November 2007, when staff presented the Board with the report entitled “ARB Staff Report to the Air Resources Board: Accelerating San Joaquin Valley Air Quality Progress.”

The San Joaquin Valley Air District improvements included using the most recent transportation activity data provided by Valley Metropolitan Planning Organizations and updates to several categories subject to recent District rulemaking (including agricultural burning and residential wood combustion). Revisions were also made to an emissions inventory methodology from the early 1990's for a category identified as "unspecified" natural gas sources. This emissions inventory category labeled was "unspecified" because it was designed to estimate small emission sources potentially not identified in other emissions categories. A review of the methodology used to estimate and forecast this emission category showed that emissions were incorrectly calculated in the base year and a growth surrogate was applied which further increased the future year forecast. In the 2008 PM2.5 SIP, the San Joaquin Valley District revised this methodology to correct the inventory error. The 2008 methodology is also being used in this ozone SIP update.

In aggregate, the emission estimates based on ARB and San Joaquin Valley Air District improvements show a 12 percent reduction in baseline NOx emissions for 2002. The change in 2023 is relatively greater primarily because the "unspecified" natural gas emissions estimate was greater in 2023 than in 2002. The revised emission estimates are shown in Table B-1.

Relationship to SIP Emissions Target

The SIP attainment demonstration shows how the 2023 emissions target will be met through a combination of adopted measures, new SIP measures, and 182(e)(5) emission reductions. The SIP emissions target represents the maximum allowable emissions level that the nonattainment area can accommodate while attaining the standard. The attainment demonstration in the San Joaquin Valley 8-hour ozone SIP was based on air quality modeling which used procedures set by U.S. EPA. To assess whether the emissions inventory improvements would affect the 2007 attainment demonstration, a qualitative review of the SIP modeling results was conducted. This review relied on the previous modeling results because in the near term it is not feasible to conduct new SIP modeling. Developing new SIP modeling and revisiting the adopted attainment demonstration would be a multi-year process. However, as part of the planning effort to address the expected revision to the federal 8-hour ozone standard, ARB will include 2023 attainment modeling for the current standard along with the attainment demonstration for the revised standard. If new modeling for 2023 shows that the emissions target has changed to require additional reductions, ARB will submit a revised commitment to provide the reductions needed to meet the emission target.

Review of SIP Modeling Results

In accordance with U.S. EPA procedures, air quality models are used to predict the relative response to reductions in ozone-forming emissions for each site in the region. Two model runs are conducted. The first model run is for the reference year (in this case 2002) using a corresponding estimate of ozone-forming emissions in that year. The second model run is for a future year (in this case 2023) using forecasted emissions, including adopted controls, but no new SIP measures. This provides modeled ozone concentrations for 2002 and 2023. The

ratio of these two concentrations is termed a relative reduction factor (RRF). The RRF reflects the modeled decrease in ozone levels between 2002 and 2023. The RRF is then applied to an observed baseline ozone level calculated according to U.S. EPA guidance to project the expected ozone level in the attainment year. In the San Joaquin Valley this projected ozone level was above the federal 8-hour ozone standard, indicating additional emission reductions were needed.

To determine how many additional reductions were needed an ozone response diagram was developed. The modeling analyses showed that Arvin was the most restrictive site in the San Joaquin Valley for attainment of the federal 8-hour ozone standard. The ozone response diagram for Arvin is shown in Figure B-1. To develop this diagram, further modeling simulations were conducted, each using incremental reductions of 20, 40, and 60 percent from the 2023 emissions forecast. From this information, the diagram provides the percent reduction needed to achieve an ozone concentration that meets the standard. This procedure established the SIP emissions target for the 2007 San Joaquin Valley ozone SIP. It is also apparent from Figure B-1 that the response to the NOx emission reductions is not linear. For example as you move down the diagram to greater NOx reductions, the rate of ozone improvement gets larger.

Determining an emission target based on revised emissions would require extensive new SIP modeling, following the process described above. However, to qualitatively assess the viability of the current attainment target, two pieces of information were key. First, as shown in Table B-1 the greater percent emission reductions resulting from the revised inventory would likely result in lower future ozone levels (a more responsive RRF). The diagram shows also that NOx reductions are the most effective precursor to control. Therefore, increasing amounts of NOx reductions result in a greater rate of air quality improvement. Taken together, these two pieces of information suggest that the existing emission targets are appropriate. The commitment to revisit the ozone modeling in the next San Joaquin Valley ozone SIP process will provide a timely review of the 2023 emissions target.

Table B-1
Comparison of Original and Revised NOx Emission Estimates
in the San Joaquin Valley

	2007 SIP NOx Emissions (tpd)	**2011 NOx Emissions (tpd)**
2002 Baseline	642	565
2023 Forecasted without SIP	295	225
Percent Change Between 2002 and 2023	54%	60%

Figure B-1
Arvin 2023 Ozone Response Diagram