sierra research

Report No. SR2007-09-03

Assessment of the Need for Long-Term Reduction in Consumer Product Emissions in the South Coast Air Basin

prepared for:

Consumer Specialty Products Association

September 12, 2007

prepared by:

Sierra Research, Inc.
1801 J Street
Sacramento, California 95811
(916) 444-6666

Report No. SR2007-09-03

Assessment of the Need for Long-Term Reductions in Consumer Product Emissions in the South Coast Air Basin

prepared for:

Consumer Specialty Products Association

September 12, 2007

Principal author:

James M. Lyons

Sierra Research, Inc.
1801 J Street
Sacramento, CA 95811
(916) 444-6666

Assessment of the Need for Long-Term Reductions in Consumer Product Emissions in the South Coast Air Basin

Table of Contents

List of Tables

1. EXECUTIVE SUMMARY

The long-standing efforts to eliminate the air quality problems related to photochemical "smog" in Southern California's South Coast Air Basin (SCAB) are well known. These efforts have been primarily aimed at bringing the SCAB into compliance with the federal National Ambient Air Quality Standard (NAAQS) for ozone. As with all other NAAQS, the ozone standard has been set at a level designed to protect public health.

More recently, public exposure to high ambient concentrations of fine particulate matter ($PM_{2.5}$)[*] has also become a major concern, leading to the establishment of a NAAQS for that pollutant. As is the case with respect to ozone, considerable efforts have been made to reduce emissions of both $PM_{2.5}$ as well as its precursors.

The latest step in the efforts to bring the SCAB into compliance with both the ozone and $PM_{2.5}$ NAAQS has been the development of the 2007 Air Quality Management Plan (AQMP) by the South Coast Air Quality Management District (SCAQMD). Compliance with the $PM_{2.5}$ NAAQS in the SCAB is required by 2015, while compliance with the ozone NAAQS is required by 2024. The 2007 AQMP includes an air quality modeling assessment intended to establish the emissions levels of pollutants that can be tolerated in the SCAB while assuring that levels of ozone and $PM_{2.5}$ do not violate the respective NAAQS, and a suite of control measures designed to bring emissions down to those levels. This suite of control measures, which will be implemented by both the SCAQMD and the California Air Resources Board (CARB), targets virtually every source of pollutants related to ozone and $PM_{2.5}$, but focuses primarily on reductions in oxides of nitrogen (NOx) emissions as the strategy for attainment of both the ozone and $PM_{2.5}$ NAAQS.

One of the emissions sources targeted by the 2007 AQMP is consumer products, the use of which results in emissions of VOC but not NOx. Although consumer products have been subject for almost 20 years to increasingly stringent emissions regulations imposed by CARB, additional reductions in VOC emissions from this source are sought in the 2007 AQMP. The AQMP proposes additional consumer product regulations—including additional near-term CARB regulations and a long-term measure that would take effect beyond 2020.[†] The near-term consumer product regulations are expected to aid in achieving both the $PM_{2.5}$ and the ozone NAAQS. In contrast, the long-term consumer

[*] Fine particulate matter is defined as particles with a diameter of less than 2.5 microns.

[†] The near-term CARB control measure is referred to as CARB's Consumer Products Program, and the long-term measure is designated as SCLTM-03 in the 2007 AQMP. As discussed in Section 4, there are three SCAQMD near- and mid-term consumer product control measures discussed in the AQMP.

product regulation is intended to achieve the very last increment of VOC emission reductions that the air quality analysis performed for the 2007 AQMP indicates may be required for attainment of the ozone NAAQS. However, the 2007 AQMP has not examined the need for this second round of regulation in detail, and it is not clear it will actually be required to achieve compliance with the ozone NAAQS.

This report presents the results of a detailed air quality modeling analysis performed using the same data, models, and methods used in preparation of the 2007 AQMP and specifically examines the need for the second round of long-term consumer product regulations incorporated into the 2007 AQMP. The results of this analysis show that the long-term regulations seeking additional reductions in consumer product VOC emissions are not necessary for the achievement of compliance with the ozone NAAQS in the SCAB.

###

2. INTRODUCTION

Air quality problems related to photochemical "smog" have been well documented in Southern California's South Coast Air Basin (SCAB) since Professor A.J. Haagen-Smit first determined the chemical processes leading to its formation during the 1950s. The principal component of smog is ozone, which is formed in the atmosphere as the result of photochemical reactions involving oxides of nitrogen (NOx) and reactive volatile organic compounds (VOCs). Since that time, efforts to reduce ambient ozone concentrations to acceptable levels have been on-going. These efforts have been primarily aimed at bringing the SCAB into compliance with the federal National Ambient Air Quality Standard (NAAQS) for ozone. As with all other NAAQS, the ozone standard has been set at a level designed to protect public health.

More recently, public exposure to high ambient concentrations of fine particulate matter ($PM_{2.5}$)* has also become a major concern, leading to the establishment of a NAAQS for that pollutant. Fine particulate matter may be directly emitted by sources such as Diesel vehicles or, like ozone, may be formed in the atmosphere from precursors such as NOx, oxides of sulfur (SOx), and VOC. As is the case with respect to ozone, considerable efforts have made to reduce emissions of both $PM_{2.5}$ as well as its precursors.

The latest step in the efforts to bring the SCAB into compliance with both the ozone and $PM_{2.5}$ NAAQS has been the development of the 2007 Air Quality Management Plan (AQMP) by the South Coast Air Quality Management District (SCAQMD). Compliance with the $PM_{2.5}$ NAAQS in the SCAB is required by 2015, while compliance with ozone NAAQS is required by 2024. The 2007 AQMP includes an air quality modeling assessment intended to establish the emissions levels of pollutants that can be tolerated in the SCAB while assuring that levels of ozone and $PM_{2.5}$ do not violate the respective NAAQS, and a suite of control measures designed to bring emissions down to those levels. This suite of control measures, which will be implemented by both the SCAQMD and the California Air Resources Board (CARB), targets virtually every source of pollutants related to ozone and $PM_{2.5}$, but focuses primarily on reductions in NOx emissions as the strategy for attainment of both the ozone and $PM_{2.5}$ NAAQS.

One of the emissions sources targeted by the 2007 AQMP is consumer products, the use of which results in emissions of VOC but not NOx. Although consumer products have been subject for almost 20 years to increasingly stringent emissions regulations imposed by CARB, additional reductions in VOC emissions from this source are sought in the

* Fine particulate matter is defined as particles with a diameter of less than 2.5 microns.

2007 AQMP. The AQMP proposes that CARB and perhaps the SCAQMD adopt additional consumer product regulations in the near-term and that an additional long-term regulatory effort targeting consumer products take effect beyond 2020. The near-term consumer product regulations will aid in achieving both the $PM_{2.5}$ and the ozone NAAQS. The long-term consumer product regulations, however, are intended to achieve the very last increment of VOC emission reductions that the air quality analysis performed for the 2007 AQMP indicates may be required for attainment of the ozone NAAQS. The 2007 AQMP has not, however, examined the need for the long-term regulations in detail and it is not clear that it will actually be required to achieve compliance with ozone NAAQS. Given this, the purpose of this report is to investigate the need for additional long-term reductions in VOC emissions from consumer products in greater detail than was done during preparation of the 2007 AQMP.

This introduction is followed by a brief overview of consumer products and their regulation; a summary of the 2007 AQMP; and, lastly, a summary of a detailed air quality modeling analysis performed using the same data, models, and methods used in preparation of the 2007 AQMP, and that specifically examines the need for the long-term consumer product regulations incorporated into the 2007 AQMP.

###

3. CONSUMER PRODUCTS OVERVIEW

The California Air Resources Board (CARB) has a well-established regulatory program for consumer products that is intended to reduce emissions of volatile organic compounds (VOC) from these products. From the perspective of air quality, a consumer product is defined by the Section 41712 of the California Health and Safety Code as:

> *a chemically formulated product used by household and institutional consumers, including, but not limited to, detergents; cleaning compounds; polishes; floor finishes; cosmetics; personal care products; home, lawn, and garden products; disinfectants; sanitizers; aerosol paints; and automotive specialty products; but does not include other paint products, furniture coatings, or architectural coatings.*

The one common characteristic of consumer products is that their formulations contain VOCs that, to some degree, enter the atmosphere. VOC emissions from consumer products were first targeted for regulation by CARB during the late 1980s when the agency approved its first "Consumer Products Control Plan."[*] Beginning with the adoption of the Phase I Consumer Products Regulations in 1990, to date there have been 15 separate CARB rulemakings related to the regulation of VOC emissions from consumer products.[†] Control measures targeting VOC emissions from consumer products were incorporated into CARB's statewide control strategies for both the 1994 and 2003 ozone State Implementation Plans (SIPs).[‡]

As part of the most recent CARB rulemaking, the agency estimated that by 2010 its existing consumer product regulations would result in the elimination of approximately 180 tons per day of VOC emissions statewide.[§] This translates into about a 42% reduction in VOC emissions from the entire consumer products category relative to uncontrolled levels. The magnitude of this reduction is remarkable given that reformulation is the only means of reducing VOC emissions from consumer products and the presence of specific VOC compounds is, in many cases, essential to product efficacy and performance.

---

[*] Consumer Products Control Plan, State of California Air Resources Board, June 16, 1989.
[†] See *http://www.arb.ca.gov/consprod/regact/passhearings.htm*
[‡] See *http://www.arb.ca.gov/planning/sip/sip.htm*
[§] Proposed Amendments to the California Consumer Products Regulation and the Aerosol Coatings Regulation, California Air Resources Board, September 29, 2006.

Another important factor associated with VOC emissions from consumer products is that they tend to have lower photochemical reactivity or "ozone forming potential" than VOC emissions from other sources. A previous study* determined that consumer product VOC emissions are approximately 50% less photochemically reactive than the average VOC emissions from other sources. In addition, CARB staff has reported that motor vehicle exhaust VOC emissions are three times more reactive than VOC emissions from consumer products.† This means that eliminating VOC emissions from sources other than consumer products is likely to result in a considerably larger air quality benefit than would be achieved by reducing an equivalent mass of VOC emissions from consumer products.

In summary, many consumer products, by their very nature, must include VOC compounds in their formulations to ensure efficacy and proper performance. Some of these VOC compounds enter the atmosphere where they can cause adverse impacts on air quality, with increased ambient ozone concentrations being the primary effect. This fact has long been recognized by CARB, which has been regulating VOC emissions from consumer products for almost 20 years, and there have been dramatic reductions in VOC emissions from consumer products as a result of regulations implemented during that time. Finally, on a per-unit basis, VOC emissions from sources other than consumer products lead to greater increases in ambient ozone levels.

###

* Impact of Consumer Products on California's Air Quality, Sierra Research Report SR97-07-01, July 1997.

† See *http://www.arb.ca.gov/planning/sip/2007sip/2007sip.htm*

4. THE 2007 AQMP

The most recent South Coast Air Quality Management District Air Quality Management Plan has been designated as the 2007 AQMP.[*] The 2007 AQMP describes how compliance with federal NAAQS for ozone and $PM_{2.5}$[†] will be achieved in the South Coast Air Basin. As noted previously, the SCAB is currently classified as a nonattainment area with respect to the $PM_{2.5}$ NAAQS and a "severe" nonattainment area with respect to the ozone NAAQS. As part of the 2007 AQMP, however, the SCAQMD is requesting redesignation of the SCAB to an "extreme" ozone nonattainment area. Under federal law, the SCAB is required to come into attainment with the $PM_{2.5}$ NAAQS no later than 2015. Assuming that the SCAB is redesignated as an extreme ozone nonattainment area, compliance with the NAAQS is required by 2024. Attainment of the NAAQS requires that observed ambient levels of $PM_{2.5}$ and ozone demonstrate that compliance with the NAAQS has been achieved.

4.1 General AQMP Requirements

The main purpose of the 2007 AQMP is to demonstrate and document how the SCAB will achieve compliance with the $PM_{2.5}$ and ozone NAAQS by the applicable deadlines. In general terms, this required the following:

1. Development of an inventory of current emissions from all sources;
2. Development of an inventory of projected future-year emissions from all sources that accounts for all existing emission control measures;
3. Performance of an air quality modeling analysis to determine which pollutants need to be controlled and to what degree emissions of those pollutants must be reduced to achieve compliance with the NAAQS; and
4. Development of a suite of emission control measures that achieve the required emission reductions by the required compliance dates.

The results of the air quality modeling analysis are particularly important because they both demonstrate that the area can be brought into attainment with the NAAQS and establish limits on the amount of pollutants that can be emitted while maintaining

[*] The draft final version of the SCAQMD 2007 AQMP is available at *http://www.aqmd.gov/aqmp/07aqmp/07AQMP_draftfinal.html.*

[†] The fine particulate NAAQS applies to particles that are less than 2.5 microns in diameter.

compliance with the NAAQS. This limit is frequently referred to as the emissions "carrying capacity" of the area.

Subtracting the projected future-year emissions of a given pollutant at the compliance date from the carrying capacity for that pollutant yields the amount of emissions that must be eliminated by the new control measures incorporated into the AQMP by that compliance date. Federal law imposes requirements on the new control measures that include the following:

1. The emission reductions that would result from the implementation of each measure must be quantifiable;
2. The emission reductions due to each measure must be surplus (e.g., not already assumed to have occurred for purposes of attaining the NAAQs);
3. The emission reductions due to each measure must be permanent;
4. It must be demonstrated that each measure can be implemented; and
5. Each measure must be federally enforceable.

Another issue with respect to control measures is that federal and state laws have created distinct authorities with respect to the imposition of emission regulations on specific sources. For example, only the federal government has the authority to regulate certain sources, such as new locomotives and aircraft; the state has the authority to regulate ubiquitous sources such as on-road vehicles, pesticides, and consumer products; and the SCAQMD has the authority to regulate local stationary sources such as power plants and refineries, and most commercial facilities. The 2007 AQMP describes the emission control measures proposed for adoption by both the SCAMQD and the state, with the latter also being described in CARB's Proposed State Strategy.[*]

Finally, an important aspect of the redesignation of the SCAB to an "extreme" ozone nonattainment area is that it provides (in addition to a later compliance deadline) a "black box" to which some of the emission reductions required for attainment can be allocated. Emission reductions allocated to the black box are not required to be associated with defined control measures, but rather are reductions that are anticipated to be achieved as the result of "advancements" in emission control technology. Despite the fact that the black box affords time for technological development prior to the specification of the control measures that will be implemented, the SCAQMD has already defined four long-term control measures in the 2007 AQMP.

4.2 Emission Reduction Targets of the 2007 AQMP

As discussed previously, the relative importance of emissions of different pollutants differs with respect to compliance with the $PM_{2.5}$ and ozone NAAQS and there are two distinct deadlines for compliance. As a result, the 2007 AQMP has two distinct emission

[*] See *http://www.arb.ca.gov/planning/sip/2007sip/2007sip.htm*

reduction targets, which are discussed below. It is important to note, however, that, in general, there is little documentation provided in the 2007 AQMP regarding how these targets were selected, what alternatives were considered, and how sensitive the attainment demonstrations are to changes in the target emission levels.

Beginning with the $PM_{2.5}$ emission reduction targets, the pollutants of concern include direct $PM_{2.5}$ emissions as well as emissions of SOx, NOx, and VOC, which are all precursors to the formation of secondary $PM_{2.5}$. Based on the air quality modeling analysis for the 2007 AQMP, the relative reduction in ambient $PM_{2.5}$ concentrations due to the reduction of a given mass of SOx emissions is 10 times greater than that of the same mass reduction in VOC emissions. In addition, the effects of reductions in a given mass of NOx and direct $PM_{2.5}$ emissions are 5 and 3 times greater, respectively, than are reductions in VOC emissions. Using these and other data, the SCAQMD determined the carrying capacity (or the level of emissions of these pollutants that can be tolerated) for achieving the $PM_{2.5}$ NAAQS by the 2014 deadline. These data are presented in Table 4-1, along with baseline emissions data for 2005 and 2014. As shown in the table, the focus of the SCAQMD strategy for achieving the $PM_{2.5}$ NAAQS requires dramatic reductions in SOx and NOx emissions and smaller, but still substantial, reductions in emissions of direct $PM_{2.5}$ and VOC.

Turning to the carrying capacity for achievement of the ozone NAAQS, the 2007 AQMP air quality analysis indicates, as shown in Table 4-2, that dramatic reductions in NOx emissions will be required, along with significant but much more modest reductions in VOC emissions. Also, as noted above, the 2007 AQMP has allocated some of the emission reductions required for attainment to the black box; these allocations are also shown in Table 4-2.

Table 4-1
2007 AQMP $PM_{2.5}$ Control Strategy

	Pollutant Emissions (tons per day)			
	Direct $PM_{2.5}$	Sox	NOx	VOC
2005 Baseline	106	62	1029	720
2014 Baseline	102	43	654	528
2014 Carrying Capacity	87	19	454	469
Required Reductions from 2014 Baseline	15	24	200	59
Reductions as % of 2014 Baseline	15%	56%	31%	11%

Table 4-2 2007 AQMP Ozone Control Strategy		
	Pollutant Emissions (tons per day)	
	NOx	VOC
2005 Baseline	1029	720
2023 Baseline	506	536
2023 Carrying Capacity	114	420
Total Required Reductions from 2023 Baseline	392 (188)[a]	116 (28)[a]
Total Reductions as % of 2023 Baseline	78%	22%
Black Box Reductions as % of 2023 Baseline	37%	5%

[a] Values in parenthesis are reductions attributed to the advanced technology control measures of the black box.

Overall, as shown, the 2007 AQMP strategy for attainment of the ozone NAAQS relies heavily on NOx emission reductions and NOx reductions dominate the black box. The focus of the 2007 AQMP control strategy for both $PM_{2.5}$ and ozone on NOx emission reductions is significant because the relationship between NOx and VOC emissions and ozone is complicated and non-linear. As a result, it is possible that at some points along the AQMP's NOx reduction pathway, additional reductions in VOC emissions may yield little or no additional improvement in ambient ozone levels.

4.3 2007 AQMP Control Measures

As noted above, given the differences in the legal authority of CARB and the SCAQMD to adopt control measures targeting different sources, the 2007 AQMP includes a suite of measures that each agency will implement. The SCAQMD measures generally target stationary and area sources and, to a limited degree, mobile sources. In contrast, the CARB measures, which are implemented on a statewide (rather than local) basis, primarily target mobile sources as well as consumer products.

Table 4-3 summarizes the reductions in NOx and VOC emissions in the SCAB in 2023 resulting from control measures to be implemented by the SCAQMD and other local agencies and those to be implemented by CARB and other state agencies that have been incorporated into the 2007 AQMP. As shown in the table, the 2007 AQMP will result in the implementation of new control measures targeting virtually all sources of emissions and will include additional CARB regulations for consumer products. These additional CARB regulations, which are to be adopted by 2012 and implemented by 2014, are expected to yield VOC reductions of 14 tons per day in the SCAB in 2023. The reductions in VOC emissions achieved due to these near-term CARB consumer product measures are quite significant as they amount to 16% of all identified VOC reductions and 12% of the total required VOC reductions, including those allocated to the black box.

Table 4-3 **2023 SCAB Emission Reductions From 2007 AQMP Ozone Control Measures**		
	Emission Reductions (tons per day)	
Agency/Source	NOx	VOC
SCAQMD/All Short- and Mid-Term Measures	9	19
CARB/Passenger Vehicles	7	10
CARB/On-Road Trucks	18	2
CARB/Goods Movement	100	3
CARB/Other Off-Road	16	26
CARB/Consumer Products	0	14
Additional CARB Measures Proposed by SCAQMD	34	14
Local Goods Movement Measures	11	0
Total Identified	195	88
Black Box	188	28
Total	383	116

Although general authority to regulate consumer products in California rests with CARB,[*] the SCAQMD's list of short- and mid-term control measures includes the following measures targeting consumer products:

- CTS-01 – Emission Reductions from Lubricants;
- CTS-03 – Consumer Product Certification and Emission Reductions from Use of Consumer Products at Institutional and Commercial Facilities; and
- CTS-04 – Emission Reductions from the Reduction of VOC Content of Consumer Products Not Regulated by the State Board.

However, despite the fact that the AQMP associates 2023 SCAB VOC emission reductions of 2.0, 2.2 and 6.0 tons per day with CTS-01, CTS-03, and CTS-04, respectively, it also notes that these reductions are not included in the reductions claimed for all of the SCAQMD's short- and mid-term measures. The AQMP's treatment of these measures is further confused by the fact that the SCAQMD's air quality modeling analysis assumes that the consumer product emission reductions associated with CTS-03 are realized but that those associated with CTS-04 are not. Also, the SCAQMD air quality modeling analysis includes the reductions associated with CTS-01, but those reductions are assumed to come from a source category other than consumer products.

[*] See Section 41712, California Health and Safety Code.

In addition to identifying the control measures summarized above, the SCAQMD has included in the 2007 AQMP recommendations for four long-term control measures that could provide at least some of the emission reductions allocated to the black box. Despite being included in the 2007 AQMP by the SCAQMD, all four measures would target sources that only CARB has authority to regulate: mobile on- and off-road sources and consumer products. The SCAQMD's recommended measures are described in the 2007 AQMP as follows:

- SCLTM-01A – Further Reductions from On-Road Mobile Sources;
- SCLTM-01B – Further Emission Reductions from On-Road Heavy-Duty Vehicles;
- SCLTM-02 – Further Reductions from Off-Road Mobile Sources; and
- SCLTM-03 – Further Reductions from Consumer Products.

The 2023 emission reductions in the SCAB attributed to these control measures by the SCAQMD are 62 tons per day of NOx for the combination of SCLTM-01A and -01B, 116 tons per day of NOx for SCLTM-02, and 20 tons per day of VOC for SCLTM-03.

The long-term consumer product control measure, SCLTM-03, would account for two-thirds of the VOC reductions allocated to the black box. Based on the discussion of this measure in the 2007 AQMP, it appears that it was selected simply because, by 2023, consumer product emissions will be the single largest remaining source of VOC emissions. The 20 ton per day reduction assigned to SCLTM-03 is relative to an 88 ton per day total consumer product emission inventory. It is not clear that it will be technically or commercially feasible[*] to achieve the additional 23% reduction in consumer product emissions ascribed to SCLTM-03 from what will be an already highly controlled source. Further, given the lack of documentation in the 2007 AQMP regarding how the VOC carrying capacity was determined, it is not clear that the VOC emission reductions from SCLTM-03 are even necessary to demonstrate or achieve attainment with the ozone NAAQS.

###

[*] Nor is it clear that the other requirements of Health and Safety Code Section 41712 can be satisfied.

5. ASSESSMENT OF THE NEED FOR LONG-TERM REDUCTIONS IN CONSUMER PRODUCT EMISSIONS

As discussed above, there are a number of factors that call into question the need for the inclusion of SCLTM-03 in the AQMP. These factors include the following:

- The methodology used to determine the required VOC reductions attributed to the black box;
- The magnitude of the required NOx reductions attributed to the black box;
- The projected margin of compliance with the eight-hour ozone NAAQS; and
- The fact that the long-term consumer products measure will result in only limited reductions in emissions of low reactivity VOCs.

Given the above factors, an assessment of the need for the inclusion of SCLTM-03 was undertaken. This assessment involved the replication of the SCAQMD ozone air quality modeling analysis that forms the basis for the AQMP attainment demonstration with and without the inclusion of SCLTM-03. This assessment, performed by ENVIRON,[*] is documented in Appendix A.

These results are summarized in Table 5-1, which shows the eight-hour ozone design values calculated by ENVIRON without SCLTM-03 in place and the increase in design value if the measure is eliminated from the AQMP. As shown, the peak eight-hour ozone value of 84 ppb at Crestline is unchanged by the elimination of SCLTM-03 and the maximum increase in eight-hour ozone levels at any site is 1 ppb.

The results of the ENVIRON assessment indicate that if the SCLTM-03 control measure were not implemented, the eight-hour average ozone levels at all monitoring sites would remain below the NAAQS attainment level of 85 ppb. More simply stated, even if the SCLTM-03 measure were eliminated from the 2007 AQMP, the SCAB would be expected to attain the ozone NAAQS based on the air quality analysis that forms the basis for the 2007 AQMP. Therefore, measure SCLTM-03 can be eliminated from the 2007 AQMP even before an assessment is made as to whether it would conform to Health and Safety Code Section 41712.

[*] ENVIRON developed the CAMx model used by the SCAQMD; all of the models, inputs, and other data required for the assessment were provided to ENVIRON by SCAQMD staff.

Table 5-1 **Environ Ozone Air Quality Modeling Results Without Measure SCLTM-O3**		
Site	Design Value without SCLTM-03 (ppb)	Increase in Design Value Due to Elimination of SCLTM-03 (ppb)
Azusa	62	1
Banning Airport	68	1
Burbank	68	0
Crestline	84	0
Lake Elsinore	61	0
Fontana	81	1
Glendora	80	1
Indio	55	0
Pasadena	73	1
Perris	80	1
Palm Springs	58	0
Pomona	76	1
Redlands	81	0
Reseda	66	0
Rubidoux	77	1
Santa Clarita	75	1

###

APPENDIX A

ENVIRON Report on

"Need for Additional Consumer Product VOC Controls Beyond the ARB's Control Measure to Achieve Attainment of the 8-Hour Ozone Standard in Southern California"

Need for Additional Consumer Product VOC Controls Beyond the ARB's Control Measure to Achieve Attainment of the 8-Hour Ozone Standard in Southern California

Ralph Morris and Bonyoung Koo
ENVIRON International Corporation
101 Rowland Way
Novato, California 94945

September 6, 2007

BACKGROUND

The South Coast Air Quality Management District (SCAQMD) has released a 2007 Air Quality Management Plan (AQMP) that proposes control measures to achieve the 8-hour ozone NAAQS by 2024. The 8-hour ozone attainment demonstration was based on photochemical modeling using the Comprehensive Air Quality Model with extensions (CAMx). CAMx was run for a 2002 base case emissions scenario and a 2023 base case and 2023 AQMP control case and the results used to project 8-hour ozone Design Values to 2023 for comparison with the NAAQS. The projected 2023 8-hour ozone Design Values under the 2007 AQMP control plan were all below the 85 ppb NAAQS, thereby demonstrating attainment of the 8-hour ozone standard.

The 2007 AQMP attainment demonstration includes three control measures for controlling volatile organic compound (VOC) emissions from Consumer Product (CP) sources. The California Air Resources Board (ARB) has jurisdiction over Consumer Products and developed the near-term control measure ARB-CONS-01 to control VOC emissions from CP sources. On top of this, the SCAQMD developed an additional long-term CP control measure, SCLTM-03, that specifies additional VOC CP controls that go beyond the ARB CP control measure. Among the additional short-term control measures proposed by the district, only CTS-03 was applied to CP sources. CTS-01 measure was applied to non-CP district-controlled sources and CTS-04 was not used in the attainment demonstration.

The Consumer Specialty Products Association, Inc. retained ENVIRON to determine the effects of removing the SCAQMD's additional SCLTM-03 CP VOC control measure on the 2007 AQMP 8-hour ozone attainment demonstration.

APPROACH

ENVIRON acquired the CAMx modeling inputs and outputs from the SCAQMD used in the 2007 AQMP 8-hour ozone attainment demonstration modeling. The 2007 AQMP ozone modeling database was stored in an IDE hard disk and shipped to ENVIRON in

mid April 2007 by Satoru Mitsutomi at SCAQMD. The disk contained CAMx v4.40beta source code and input database for the following modeling periods:

- August 4-7, 1997
- August 4-8, 2004
- May 17-24, 2005
- July 14-19, 2005
- August 2-9, 2005
- August 25-29, 2005

The modeling input database includes:

- Initial and boundary conditions
- Photolysis rate inputs
- Albedo/haze/ozone inputs
- Landuse input
- Meteorological inputs (height/pressure/wind/temperature/water vapor/cloud/rain/vertical diffusivity)
- Merged/premerged area and point-source emissions for base (2002/2004/2005), future (2023), and intermediate (2009/2012/2014/2017/2020) years
- Emission control factor inputs

The disk also contained GEM emission model code and scripts, various emission preprocessing tools, and postprocessing tools for CAMx model outputs. The CEPA program used to prepare the emission control factors was provided to ENVIRON in late May 2007 by Susan Yan at SCAQMD via FTP transfer.

As noted earlier, three control measures were applied to VOC emissions from CP sources: ARB-CONS-01 developed by ARB, and further reductions applied by SCAQMD (SCLTM-03 and CTS-03). Emissions adjustment factors for these control measures were specified in a CEPA input file. The SCLTM-03 CP control measure was removed from the 2007 AQMP control plan by setting the adjustment factors for the SCLTM-03 in the CEPA input file to 1.0 and re-running the CEPA program. The 2023 modeling was performed without the additional SCLTM-03 CP control measure to determine whether it is needed to attain the 8-hour ozone NAAQS in southern California.

RESULTS

ENVIRON first tried to reproduce the 2023 8-hour ozone attainment demonstration published in the 2007 AQMP using the 2002 base case and 2023 control case CAMx output files provided by the SCAQMD. The calculated 2023 8-hour ozone Design Values for the 2007 AQMP control plan were close, but did not exactly match the values published in the 2007 AQMP. The differences were traced to differences in the CAMx 2002 base case ozone estimates. The SCAQMD was contacted and the district staff noted the CAMx 2002 base case emissions inputs used in generating the 2023 8-hour

ozone Design Values published in the 2007 AQMP were different than what was supplied to ENVIRON and that the emission files had been accidentally overwritten so could not be provided at the moment. According to Satoru Mitsutomi, the SCAQMD is currently in the process of reproducing the lost emissions and they will be available soon. Instead, the SCAQMD provided the 2002 base case CAMx modeling outputs that it claims were used for the 2007 AQMP. Although using the output data made it possible to reproduce the ozone Design Values published in the 2007 AQMP within rounding error (it appears that the design values published in the 2007 AQMP were rounded; ENVIRON used truncation, which is conventional for design value calculation) for most of the monitoring sites, there still was a significant difference in the design value ENVIRON calculated and that published in the 2007 AQMP for two of the sites: Azusa and Burbank.[†] For this analysis, ENVIRON proceeded using the 2002 base case modeling results provided by the SCAQMD, whose use still demonstrated that 8-hour ozone attainment would be achieved in 2023 under the 2007 AQMP control plan.

The SCLTM-03 CP control measure was then eliminated from the 2007 AQMP control plan and new 2023 modeling was performed that included all of the control measures in the 2007 AQMP with the exception of the SCLTM-03 CP control measures. In the 2023 base case, there was a total of 496 tons per day (TPD) of anthropogenic VOC emissions, 114 TPD associated with CP sources. The 114 TPD CP VOC emissions are adjusted downwind by 5 TPD for a baseline adjustment and reduced an additional 14 TPD, 2.5 TPD and 21 TPD due to the ARB-CONS-01, CTS-03, and SCLTM-03 CP control measures, respectively. Based on the adjustment factors specified for each of the control measures, the CEPA program generates the control factor inputs, which are then used by GEM emission model to prepare future year emissions inputs for CAMx.

Table 1 displays the projected 8-hour ozone Design Values in 2023 (1) as published in the 2007 AQMP; (2) as calculated by ENVIRON using the 2002 base case and 2023 AQMP control case CAMx output files as provided by the SCAQMD; and (3) as calculated by ENVIRON using the 2002 base case CAMx outputs provided by the SCAQMD and the 2023 CAMx output generated by ENVIRON that represents implementation of all control measures in the 2007 AQMP except the SCLTM-03 CP control measure. The maximum projected 8-hour ozone Design Value anywhere in the basin in all three scenarios occurs at the Crestline monitor, where an 83 ppb value was published in the 2007 AQMP; as this is less than 85 ppb, it therefore demonstrates attainment. The Crestline Design Value calculated by ENVIRON using the 2007 AQMP data provided by the SCAQMD was 84 ppb, 1 ppb higher than was published in the 2007 AQMP but still below 85 ppb, so still demonstrating attainment of the 8-hour ozone standard. The removal of the SCLTM-03 CP control measures has no effect on the

[†] Seeing different Design Values than those published even using the SCAQMD modeling outputs, it appears that the district has used a different methodology for the two sites. It is not clear in the AQMP document, however, what the methodology is. It is also noted that there exist some inconsistencies in the document: for example, multiplying the 2002 Design Value by the published RRF does not produce the published 2023 Design Value for some sites, including Azusa and Burbank. Nevertheless, it is immaterial since both sites are in attainment in either case.

projected Design Value at Crestline so attainment is still demonstrated even without the SCLTM-03 CP control measure.

CONCLUSIONS

Removal of the SCLTM-03 additional Consumer Product VOC control measure from the 2007 AQMP control plan does not affect the 2023 8-hour ozone attainment demonstration. Thus, the 2007 AQMP control plan without the SCLTM-03 measure is a viable and more cost-effective 8-hour ozone attainment plan. This result is not surprising since the SCAQMD is pursuing a NOx-heavy emissions control strategy in the 2007 AQMP; once ozone goes over the "ridge line" in the VOC/NOx isopleths, further NOx control very effectively reduces ozone concentrations. One reason for the pursuit of the NOx heavy control plan is the presence of large amounts of uncontrollable biogenic VOC emissions, which explains the little sensitivity of ozone to the CP SCLTM-03 VOC control measure.

Table 1. Projected 2023 8-hour ozone Design Values (ppb) for the 2007 AQMP control plan (1) as published in the 2007 AQMP and (2) as calculated by ENVIRON using the CAMx output data as provided by the SCAQMD and (3) as calculated by ENVIRON removing just the SCLTM-03 CP control measures fro the 2007 AQMP control plan.

Monitoring Site	Published[(1)] 2007 AQMP	Calculated[(2)] 2007 AQMP	Calculated[(3)] without SCLTM-03
Azusa	69	61	62
Banning Airport	68	67	68
Burbank	63	68	68
Crestline	83	84	84
Elsinore	62	61	61
Fontana	81	80	81
Glendora	79	79	80
Indio Jackson	56	55	55
Pasadena	73	72	73
Perris	79	79	80
Palm Springs	59	58	58
Pomona	75	75	76
Redlands	81	81	81
Reseda	66	66	66
Rubidoux	76	76	77
Santa Clarita	74	74	75