VI.

Proposed Amendments to the Aerosol Coating Products Regulation, Proposed Tables of Maximum Incremental Reactivity (MIR) Values, and Proposed Amendments to Air Resources Board Method 310

A. Introduction

In this Chapter, the Air Resources Board (ARB) staff provides a description, in plain language, of the proposed amendments to the Aerosol Coatings Regulation, the proposed Tables of Maximum Incremental Reactivity (MIR) Values, and the proposed amendments to ARB Method 310. The reasons for proposing the amendments are also explained. The description in plain language satisfies the requirements of Government Code section 11343.2, which requires that a noncontrolling, "plain English" summary of the regulation be made available to the public.

To begin with a distinction between the terms volatile organic compounds (VOC) and reactive organic compound (ROC) is necessary. The term VOC refers to the compounds regulated by the mass-based limits. Under our current mass-based regulations, the VOC definition does not include exempted compounds such as acetone. ROC is a new term we are proposing here and refers to the compounds that would be regulated by the proposed reactivity limits. ROC includes all organic compounds such as acetone. As explained in Chapter II and IV low reactive compounds that have been exempted in the VOC definition, are included as ROC. These low reactive compounds do make small amounts of ozone. Therefore, it is appropriate to include them in a reactivity-based control approach. When the term VOC is used, we are referring to the mass-based portion of the regulation, when we use the term ROC we are referring to the reactivity provisions proposed here.

The proposed amendments presented here recognize that each ROC has a different potential to form ozone once emitted into the air. This concept is known as "reactivity." By understanding the differences in ROCs' potentials to form ozone, a control approach can be established to limit the amount of ozone produced by the ROCs contained in aerosol coatings products. This type of control approach has the potential to provide more flexibility to manufacturers, at less cost than traditional mass-based VOC controls, while achieving an equivalent air quality benefit. Using the concepts of reactivity, staff is proposing to establish reactivity limits for aerosol coatings to replace the January 1, 2002, mass-based VOC limits presently contained in the regulation. As the basis for setting reactivity limits, staff is proposing to use the MIR scale. The concepts of ROC photochemical reactivity are discussed in detail in Chapter II of this report.

At present, the Aerosol Coatings Regulation requires reductions in emissions of VOCs by specifying the total amount, or mass, of VOCs (on a percent by weight basis) that can be contained in an aerosol coating product. The first reductions in VOC content became effective in January 1996. Further reductions in total VOC content are required beginning in January 1, 2002. The amendments proposed here would replace 2002 VOC content limits with reactivity limits that provide an equivalent air quality benefit. Reactivity limits for the general coatings categories would become effective on June 1, 2002, and limits for the specialty coatings categories would become effective on January 1, 2003. To establish equivalent limits, staff has quantified the ozone reductions associated with the mass-based VOC limits and calculated a reactivity limit that ensures an equal air quality benefit. The new Subchapter containing the MIR values is proposed to serve as the basis for implementing the reactivity provisions.

Staff is also proposing amendments to Method 310 to specify its use for determining compliance with the proposed reactivity limits. These changes would allow Method 310 to be used with manufacturers' formulation data to determine the amount and type of each ROC ingredient in an aerosol coating product.

B. Proposed Amendments to the Aerosol Coatings Regulation

1. Introduction

Air Resources Board staff is proposing amendments to the Regulation for Reducing Volatile Organic Compound Emissions from Aerosol Coatings Products (Aerosol Coatings Regulation), contained in Title 17, California Code of Regulations (CCR), sections 94520-94528. As mentioned above, the major change being proposed is to replace the existing January 1, 2002, mass-based VOC content limits with reactivity limits that provide an equivalent air quality benefit. However, the current (1996) mass-based limits will continue to be in effect. Hence, we are proposing that the structure of the regulation be changed to continue to include all of the requirements necessary to comply with the January 1996 VOC content limits, and we are adding additional provisions that would be necessary for compliance after the effective date of the reactivity limits. To do this, as proposed, many provisions contained in the regulation would be bifurcated into parts one and two. Part one would contain the mass-based requirements, and be labeled as products subject to the limits in section 94522(a)(2). Part two would contain the reactivity-based requirements, and be labeled as products subject to the limits in section 94522(a)(3).

As described in more detail below, staff is proposing amendments to sections 94521-94524, and section 94526 of the Aerosol Coatings Regulation, Title 17, CCR, sections 94520-94528. The proposed amendments to the Aerosol Coatings Regulation are shown in Appendix A of this Technical Support Document. We are also proposing to change the title of the regulation to the "Regulation for Reducing the Ozone Formed from Aerosol Coatings Product Emissions." This title change reflects the change to a reactivity-based control approach.

2. Proposed Amendments to Definitions, section 94521

In section 94521 definitions are provided for terms used in the regulation which are not self-explanatory. We are proposing to amend section 94521(a) to add a number of reactivity-related terms. Each definition proposed for addition follows:

Base Reactive Organic Gas (Base ROG):

The "base reactive organic gas (Base ROG)" is a term to describe the mixture of gases used to derive the MIR scale. It is a mixture of the gases contained in ambient air in 39 urban centers in the United States, including the California cities of Los Angeles, San Diego, San Francisco, and Sacramento.

Ingredient:

An ingredient is any component of an aerosol coating product. The weight fraction of each ingredient of an aerosol coating product, including reactive organic gases and solids must be known to accurately determine the weighted reactivity of a product.

Maximum Incremental Reactivity (MIR):

"Maximum Incremental Reactivity (MIR)" is a numerical value that describes the change in the weight of ozone formed by adding a specific amount of a ROC ingredient to the base ROG mixture. The units associated with a MIR value are grams of ozone formed per gram of ROC.

Ozone:

Ozone is a toxic pollutant formed in the troposphere by reactions of nitrogen oxides and ROCs in the presence of sunlight. It is a molecule consisting of three oxygen atoms.

Product-Weighted MIR (PWMIR):

The "Product-Weighted MIR (PWMIR)" is the total reactivity of a product expressed as grams of ozone per gram of product. The PWMIR is the sum of each MIR value multiplied by the weight fraction of each ingredient in the product. For compliance, the PWMIR must be less than or equal to the reactivity limit for that product category.

Reactivity Limit:

The "reactivity limit" is the maximum reactivity allowed for an aerosol coating product, expressed as grams ozone per gram product. The reactivity limit is calculated to achieve the same ozone reduction as was estimated to be achieved from the previously adopted mass-based VOC limit. A complete description of the method used to calculate the reactivity limits is found in Chapter IV.

Reactive Organic Compound (ROC):

A reactive organic compound is a compound that has the potential to contribute to ozone

formation in the troposphere once emitted. In general, all VOCs [as defined in section 94521] are ROCs. The definition is proposed to clarify that all VOCs, including compounds defined as low reactive, contribute to ozone formation and are considered in determining the total reactivity of aerosol coating products. Under a reactivity-based control strategy we are proposing that VOC compounds such as acetone and methyl acetate would no longer qualify as exempt compounds after the effective date of the reactivity limits.

Upper Limit Kinetic Reactivity (ULKR):

The "Upper Limit Kinetic Reactivity (ULKR)" refers to maximum percentage of an emitted ROC ingredient that has reacted in the atmosphere. The ULKR used is one hundred percent and is used to compute an upper limit MIR (ULMIR) value. A further description of kinetic reactivity is included in Chapter IV.

Upper Limit Mechanistic Reactivity (ULMR):

The "Upper Limit Mechanistic Reactivity (ULMR)" means the maximum gram of ozone formed per gram of ROC ingredient reacting. The MR value is used to compute a upper limit MIR (ULMIR) value. A further description of mechanistic reactivity is included in Chapter IV.

Upper Limit MIR (ULMIR):

The "Upper Limit MIR (ULMIR)" is a numerical value calculated by ARB staff that estimates the maximum reactivity for ROCs that do not have a published MIR value. The method to calculate an ULMIR was developed by Dr. Carter (Carter, 2000). The ULMIR value is calculated by multiplying the upper limit kinetic reactivity by the upper limit mechanistic reactivity. ULMIR values are expressed in units of grams of ozone per gram of ROC. The proposed approach to calculate ULMIRs is described in Appendix E. ULMIRs were only calculated for ROCs reported in the aerosol coating survey that do not have a published MIR value.

Weight Fraction:

The weight fraction is the weight of an ingredient divided by the total weight of the product expressed to thousandths. The weight fraction of an ingredient is multiplied by its MIR value to obtain the weighted reactivity of an ingredient in a product. The reactivity of all ingredients is summed to get the total product-weighted reactivity.

3. Proposed Amendments to Standards and Requirements for Aerosol Coating Products, section 94522

We are proposing a number of amendments to sections 94522. First of all, we are proposing to delay the effective date to comply with the reactivity limits. This is necessary to allow manufactures adequate time to reformulate their products. Our proposal is to amend the effective date for the "general coating" aerosol coatings categories from January 1, 2002, to June 1, 2002. The general coating categories are: Clear Coatings, Flat Paint Products, Fluorescent Coatings, Metallic Coatings, Nonflat Paint Products, and Primers.

We are also proposing to delay the compliance date for the remaining "specialty categories" from January 1, 2002, to January 1, 2003. This additional extension would allow manufacturers to focus first on reformulation efforts for the "general coating" categories, which will provide the greatest air quality benefit.

However, delaying the effective date will result in a short term ozone shortfall of 9.6 tons per day (tpd). However, by requiring compliance from the general coating categories by June 1, 2002, 7.9 tpd, or 82 percent of the ozone reductions will be achieved concurrent with the 2002 ozone season (based on VOC reduction commitment of 2.53 tpd). For an additional seven months there will be a shortfall of 1.7 tpd of ozone (based on a VOC reduction commitment of 0.6 tpd).

We believe the delay of the effective date is necessary to prevent disruptions in the aerosol coating market place and to minimize the possibility of an economic hardship for aerosol coating manufacturers. This proposal also ensures that efficacious products will continue to be available to the consumer in all 35 categories. We believe that these considerations override the short-term air quality disbenefit. Because 82 percent of the required reduction will be achieved as the ozone season begins in 2002, we believe the overall proposal will have a minimal impact on air quality.

a. Compliance with Limits, section 94522(a)(1)

We are proposing to add new subsection 94522(a)(1) to ensure that manufacturers who comply with the reactivity limits prior to the effective dates would not be found to be out of compliance. At present aerosol coatings manufacturers are required to include information on the applicable product category, the applicable limit, and the date of manufacture.

As proposed in new section 94522(a)(1), if products are labeled with the reactivity limit rather than the VOC limit, then the product would meet all the requirements for products manufactured to meet the reactivity limit, and would no longer be subject to the requirements for the mass-based VOC limits contained in section 94522(a)(2).

b. Limits for Aerosol Coatings Products, sections 94522(a)(2) and 94522(a)(3)

Section 94522(a)(2) contains standards that limit the VOC content of 35 categories of aerosol coatings and the dates when the standards take effect. We are proposing to delete the mass-based VOC standards that become effective on January 1, 2002, and replace them with new reactivity limits that are contained in the Table of Limits in proposed new section 94522(a)(3). The January 8, 1996, VOC limits found in section 94522(a)(1), would continue to be effective, however. The proposed reactivity limits are shown in Table VI-1.

TABLE VI-1
PROPOSED TABLE OF REACTIVITY LIMITS

	Weighted Product Reactivity g O_3 / g product
General Coatings	**06/01/02**
Clear Coatings	1.54
Flat Paint Products	1.21
Fluorescent Coatings	1.77
Metallic Coatings	1.93
Nonflat Paint Products	1.40
Primers	1.11
Specialty Coatings	**01/01/03**
Art Fixatives or Sealants	1.80
Auto Body Primers	1.57
Automotive Bumper and Trim Products	1.75
Aviation or Marine Primers	1.98
Aviation Propeller Coatings	2.47
Corrosion Resistant Brass, Bronze or Copper Coatings	1.78
Exact Match Finishes	
Engine Enamel	1.72
Automotive	1.77
Industrial	2.07
Floral Sprays	1.68
Glass Coatings	1.42
Ground Traffic/Marking Coatings	1.18
High Temperature Coatings	1.83
Hobby/Model/Craft Coatings	
Enamel	1.47
Lacquer	2.70
Clear or Metallic	1.60
Marine Spar Varnishes	0.87
Photograph Coatings	0.99
Pleasure Craft Finish Primers, Surfacers or Undercoaters	1.05
Pleasure Craft Topcoats	0.59
Shellac Sealers	
Clear	0.98
Pigmented	0.94
Slip-Resistant Coatings	2.41
Spatter/Multicolor Coatings	1.07
Vinyl/Fabric/Leather/Polycarbonate Coatings	1.54
Webbing/Veil Coatings	0.83
Weld-Through Primers	0.98
Wood Stains	1.38
Wood Touch-Up, Repair or Restoration Coatings	1.49

It should also be noted that when the reactivity limits become effective, products would no longer be able to participate in the Alternative Control Plan or the Hairspray Credit Program. Neither of these programs is presently designed to include products complying with reactivity limits. The provision clarifying that the Alternative Control Plan can no longer be used is specified in new subsection 94522(a)(6).

c. Sell-Through of Products, subsection 94522(b)

We are proposing to modify subsection 94522(b), to specify that products would have a three-year sell through period if the products were manufactured prior to the effective dates of the reactivity limits and contain a date or a code indicating the date the product was manufactured. Of course, these products would still be required to be in compliance with the January 8, 1996, VOC limits.

d. Products Containing Methylene Chloride, subsection 94522(c)(2)

Proposed new subsection 94522(c)(2) would limit the use of methylene chloride in aerosol coatings because methylene chloride has been identified as a toxic air contaminant (TAC). In the existing Aerosol Coatings Regulation, methylene chloride use is restricted by requiring that the percent by weight of methylene chloride in an aerosol coating be added to the total VOC content to determine compliance. However, when calculating the total reactivity of a product this type of provision does not provide the same restriction because methylene chloride is negligibly-reactive, and has a low MIR value. Therefore, to limit methylene chloride use we are proposing a "no new use" provision. As proposed, if an existing product already uses methylene chloride, no additional methylene chloride could be added when the product is reformulated. The baseline would be established based on the 1997 survey data. Any product that does not currently contain methylene chloride, could not reformulate using methylene chloride.

Our complete analysis and health risk assessment which serve as our justification for this provision is in included in Appendix G. The provision is also discussed in Chapter X, section E, Emission Reductions and Other Potential Environmental Impacts.

e. Products Containing Perchloroethylene or Ozone Depleting Substances, subsection 94522(d)(2)

Proposed new subsection 94522(d)(2) would restrict the use of perchloroethylene and ozone depleting substances in products meeting the reactivity limits, in the same way ("no new use") their use is restricted for products manufactured to meet the mass-based VOC limits in section 94522(a)(2). However, products could only continue to use, but not increase use of perchloroethylene or an ozone depleting substance, if the product contained perchloroethylene or an ozone depleting substance in calendar year 1997.

f. Multicomponent Kits, section 94522(e)(2)

In proposed new subsection (e)(2) we are proposing a method to calculate the reactivity of "multicomponent kits," to determine compliance with the reactivity limits. A multicomponent

kit is a system in which two or more aerosol coatings are sold together in one package, and both coatings are necessary to produce the finished coating. We are proposing that the total reactivity of multicomponent kits must be less than or equal to the total of all the reactivity limits had each product individually met the reactivity limits. This means that the products in the kit can be "averaged" with a product above the reactivity limit being offset with a product below the reactivity limit. An equation is provided to aid in determining compliance with this provision. This is similar to the provision for products complying with the mass-based VOC limits.

g. Products Assembled by Adding Bulk Paint to Aerosol Containers of Propellant, section 94522(f)

In section 94222(f) we are proposing language to clarify that aerosol coating products assembled by adding bulk paint to aerosol cans of propellants must meet either the mass limits or the reactivity limits, whichever are currently effective.

h. Requirements for Lacquer Aerosol Coatings Products Subject to the VOC Limits Specified in 94522(a)(2), section 94522(g)

We are proposing that the provisions currently in place for lacquer aerosol coatings apply only to the mass-based VOC limits contained in section 94522(a)(2). This provision allowed lacquer aerosol coatings to continue to be sold until January 1, 1998, that had a combined VOC and methylene chloride content of up to 80 percent by weight. Although this provision has expired, products that were manufactured prior to January 1, 1998, can continue to sold, supplied, offered for sale, or applied until January 1, 2001, due to sell-through provisions. However, once the reactivity limits become effective, this provision would no longer be needed.

i. Assignment of Maximum Incremental Reactivity (MIR) Values, Proposed New subsection 94522(h)

In new proposed subsection 94522(h) the procedures for assigning MIR values for aerosol coatings ingredients are specified. Non-ROC ingredients such as resins, pigments, plasticizers, and fillers, as well as ingredients that do not contain carbon, would be assigned MIR values of zero. Each ROC would be assigned its respective MIR value using Tables of MIR Values and MIR Values for Hydrocarbon Solvents contained in newly proposed Subchapter 8.6, sections 94700-94701. As proposed in new subpart D, only ROCs in the tables of MIR Values can be used in aerosol coatings to comply with the reactivity limits in section 94522(a)(3).

To determine the product weighted MIR (PWMIR), the weight fraction of each ingredient in an aerosol coating is multiplied by the MIR value. The weighted reactivity of all ingredients is then summed to get the PWMIR. This value, in grams ozone per gram of product, is compared to the reactivity limit contained in section 94522(a)(3). If the calculated PWMIR of the aerosol coating product is greater than the category reactivity limit, the product does not comply and would need to be reformulated. If the PWMIR of the aerosol coating is less than or equal to the category reactivity limit, the product is in compliance.

4. Exemptions, section 94523

We are proposing to amend subsections (c) and (d) to clarify that the exemptions would apply to products meeting either the VOC content standards or the reactivity limits. Subsection (c) provides that the requirements of the Aerosol Coatings Regulation do not apply to products that are intended for sale or use outside of California. Subsection (d) provides that the requirements prohibiting the use of non-complying aerosol coatings applies only to commercial application of aerosol coating products. This means that a household consumer using a non-complying product would not be in violation of the regulatory requirements.

5. Administrative Requirements, section 94524

a. Most Restrictive Limit, subsection (a)

We are proposing to amend subsection (a), the "most restrictive limit" clause. Currently, if any representation is made that an aerosol coating could be used as a product for which a lower limit is specified, the aerosol coating product would be subject to the lower limit. The amendment would clarify that the "most restrictive limit" provision would continue to apply after the reactivity limits become effective.

b. Labeling Requirements, new subsection (b)(1)(B)

We are proposing to add a new subpart (1)(B) to clarify that manufacturers would be required to display the reactivity limit, the coating category, and the date or a code indicating when the product was manufactured after the limits become effective. At present, for products manufactured to meet the mass-based VOC limits specified in 94522(a)(2), manufacturers are required to include the VOC content limit on cans of aerosol coatings. The provisions in renumbered subparts (1)(A)(3.) and (4.), which require manufacturers to list the aerosol coating category, and the date or a code indicating when the product was manufactured on their products, would continue to apply.

c. Reporting Requirements, subsection (c)

We are proposing that all of the current reporting requirements would continue to apply once the reactivity limits become effective. An amendment is proposed to subpart (c)(2)(F) to clarify that after the reactivity limits in section 94522(a)(3) become effective, products would have to supply, within 90 days written notice, the product weighted MIR, and the weight fraction of all ingredients in the aerosol coating product. A further amendment is proposed to part (H) to clarify that the Executive Officer may ask for any information to help determine the reactivity of emissions from aerosol coatings.

d. Special Reporting Requirements for Perchloroethylene-Containing Aerosol Coatings, subsection (e)

We are proposing amendments to the perchloroethylene reporting requirements to specify that the reporting requirements will continue to apply after the reactivity limits become effective.

We are also proposing to delete subsection (e)(2)(C), which requires manufacturers to report the applicable product form of their perchloroethylene-containing aerosol coatings. This provision is unnecessary because all products subject to the rule are aerosol product forms.

6. Test Methods, section 94526

   a. Testing for Products Manufactured to Meet the Reactivity Limits in section 94522(a)(3)

All of the test methods currently used to determine compliance with the aerosol coating regulation would continue to apply. However, we are proposing to add a new subsection (b) to specify testing procedures and requirements for products meeting the reactivity limits after the proposed effective dates. In subpart (b)(1) we specify that ARB Method 310, Determination of Volatile Organic Compounds in Consumer Products, can be used to determine the ingredients and the amount of each ingredient in an aerosol coating product. Note that we are also proposing amendments to Method 310 to accommodate testing for compliance with the reactivity limits. These amendments are described below in section eight of this Chapter.

In proposed new subpart (b)(2), manufacturers would be required to supply formulation data, the product category, and any other information necessary to verify the product weighted MIR. The information would be required to be supplied within 10 working days of receiving written notification from the Executive Officer that their product(s) have been selected for compliance testing. Requiring formulation data at the time of testing will speed the analysis and enforcement processes. We are still working to determine an appropriate de minimus level for ingredient impurities and may present a proposal at the Board hearing.

Other modifications to section 94526 would reletter the remaining subsections. We are also proposing to amend relettered subsection (c) to indicate that testing for exempt compounds applies only to products manufactured to meet the mass-based VOC limits [section 94522(a)(2)]. After the effective date of the Reactivity Limits, no compounds would be considered exempt, however, it should be noted that ingredients that do not form ozone are assigned MIR values of zero.

C. Proposed New Subchapter 8.6, sections 94700-94701, Tables of MIR Values

The proposed Tables of MIR Values for compounds and hydrocarbon solvents are contained in sections 94700 and 94701, respectively, of new Subchapter 8.6. These tables are also included in Appendix A of this Technical Support Document. The MIR values are used to calculate both the reactivity limits and a product's total reactivity (PWMIR). The MIR values contained in section 94700 are also used to establish the MIR values for hydrocarbon solvents contained in section 94701. A more detailed description of the MIR scale is contained in Chapters II of this report. Section 94700 lists each ROC by name, its respective MIR value, and the effective date. This is the revised list of MIR values dated April 11, 2000, and is based upon the research of Dr. William Carter at the University of California, Riverside.

Proposed section 94701 would contain the MIR values for hydrocarbon solvents. Hydrocarbon solvents are not composed of a single chemical component, but rather many different hydrocarbon constituents. As described further in Chapter IV, they are produced from the fractionation of a broader distillation range petroleum stream. For this reason, we are proposing to group hydrocarbon solvents that have similar characteristics, such as average boiling range, alkane content, and aromatic content. The proposed groupings were based on the methodology described in Chapter IV, and using the MIR values found in the Table of Compounds.

Because we recognize that the MIR values may change as more data become available, we also believe a process needs to be put in place to allow regular updates to the Tables of MIRs and to allow for additions of compounds not currently on the list. We believe it would be appropriate to review the Table of MIRs periodically and make changes as recommended. We also believe it would be appropriate to review the reactivity limits periodically to determine if any changes to the MIRs would have a significant impact on any of the limits. If, upon review, changes to the limits were warranted, to protect air quality, we would propose the necessary changes to the Board in a regulatory rulemaking. We are still working on a process for updating MIR values and limits and may propose additional changes at the Board hearing.

D. Proposed Amendments to ARB Method 310, Determination of Volatile Organic Compounds in Consumer Products

The ARB Method 310 is designed to determine the total VOC content in consumer products. The method incorporates procedures from the American Society of Testing and Materials (ASTM), the United States Environmental Protection Agency (U.S. EPA), and the National Institute for Occupational Safety and Health (NIOSH), all of which are referenced in section 94526 of Title 17, CCR, Division 3, Chapter 1, Subchapter 8.5, Article 3, sections 94520-94528.

At present, ARB uses Method 310 for analysis of the overall VOC content of aerosol coating products. In addition to general chemical analyses, Method 310 allows the determination of specific chemical ingredients (for example, NIOSH Method 1400). If necessary, separation of a complex mixture can also be performed by the gas chromatography-mass spectrometry (GC/MS) procedures specified in Method 310 such as U. S. EPA methods 8240B and 8260B. The proposed amendments would require chemical ingredient information (in percent by weight) for determining whether the product meets the reactivity limit. Hence, amendments are proposed to allow Method 310 to be used for ROC determination. The proposed amendments are included as Appendix B of this Technical Support Document. We are also proposing to change the name of the method to Air Resource Board Method 310: Determination of Volatile Organic Compounds (VOC) in Consumer Products. This change is proposed to reflect that Method 310 can be used to verify and provide discreet results for the ingredients contained in aerosol coatings.

REFERENCES

Carter, W.P.L. (2000). The SAPRC-99 Chemical Mechanism and Updated VOC Reactivity Scales, Draft Version. Revised April, 11, 2000. Prepared for the California Air Resources Board Contracts Nos. 92-329 and 95-308. Appendix D, pp. D-1 to D-33. http://www.cert.ucr.edu/~carter/reactdat.htm