State of California
AIR RESOURCES BOARD

Initial Statement of Reasons for the Proposed Amendments to the Regulations for Reducing Volatile Organic Compound Emissions from Aerosol Coatings, Antiperspirants and Deodorants, and Consumer Products

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Summary

SUMMARY

State law, Health and Safety Code section 41712, requires the Air Resources Board (Board) to adopt an aerosol coatings regulation that achieves the maximum feasible reduction in volatile organic compound (VOC) emissions. State law defines the maximum feasible reduction objective as a 60 percent reduction in VOC emissions from the 1989 baseline emissions. Another requirement of State law is that the adopted aerosol coatings regulation be technologically and commercially feasible.

In March 1995, the Board adopted the aerosol coatings regulation. This regulation established VOC limits for 35 categories of aerosol coatings. The first-tier limits became effective on January 8, 1996, and the second-tier limits are scheduled to become effective on December 31, 1999. The first and second-tier limits were designed to achieve a 60 percent reduction in VOC emissions, but at the time of adoption the second-tier limits were not necessarily technologically or commercially feasible.

State law also requires the Board to hold a public hearing by December 31, 1998, on the technological and commercial feasibility of achieving compliance with the second-tier limits by December 31, 1999. At this public hearing, the Board is to consider amendments to the aerosol coatings regulation if it determines that the second-tier VOC limits are not technologically and commercially feasible.

In this summary, we provide a plain English discussion of the staff's recommendation on the technological and commercial feasibility of the second-tier limits and staff's proposed amendments to the aerosol coatings regulation. We also explain the rationale for this proposal. In addition, we provide a discussion of the staff's proposal to be consistent with the U.S. Environmental Protection Agency (U.S. EPA) by exempting methyl acetate from the VOC definition in the aerosol coatings regulation, the antiperspirant and deodorant regulation, and the consumer products regulation. This discussion chapter is intended to satisfy the requirements of Government Code section 11346.2(a)(1), which requires that a noncontrolling "plain English" summary of the regulation be made available to the public. Also, the plain English description of the proposed amendments is discussed in detail in Chapter III of the Technical Support Document.

A. SUMMARY OF PROPOSED AMENDMENTS

What amendments to the aerosol coatings regulation are being proposed?

Based on our evaluation of the second-tier VOC limits, we are recommending that the Board determine that some limits are not technologically and commercially feasible; that some of the second-tier VOC limits are not the most stringent feasible VOC limits; and that a 60 percent reduction in VOC emissions from aerosol coatings is not technologically and commercially feasible.

We are proposing less stringent VOC limits for twelve product categories. These twelve categories have existing second-tier limits that we believe are not technologically and commercially feasible. We are also proposing more stringent VOC limits for eleven product categories with existing second-tier limits that we believe are not the most stringent feasible VOC limits. We are proposing to retain the existing second-tier VOC limits for the remaining twelve categories. For all of the second-tier VOC limits, we are proposing to extend the effective date from December 31, 1999, to January 1, 2002, to provide adequate time for manufacturers to reformulate their products. We are also proposing several minor editorial changes. Table 1 shows the 35 aerosol coating categories and compares the existing December 31, 1999, VOC limits to the proposed VOC limits.

Are other amendments proposed?

Yes. We are proposing to exempt methyl acetate from the existing VOC definitions in the aerosol coatings regulation, the antiperspirant and deodorant regulation, and the consumer products regulation. On April 9, 1998, the U.S. EPA promulgated a final rule that exempted methyl acetate from the federal definition of VOC. Following the U.S. EPA's exemption of methyl acetate, the Air Resources Board was petitioned by Eastman Chemical to exempt methyl acetate from all of the VOC definitions for consumer products. We have conducted an environmental impacts analysis and have determined that exempting methyl acetate would not have an adverse environmental impact. This exemption would also provide consumer product manufacturers more flexibility in complying with the VOC limits.

TABLE 1
Proposed Changes to the VOC Content Standards for Aerosol Coating Products

Category	Allowable VOC Content (percent by weight) Existing 1/8/96	Existing 12/31/99	Proposed 1/1/2002
General Coatings			
Clear Coatings	67.0	40.0	50.0
Flat Paint Products	60.0	30.0	40.0
Fluorescent Coatings	75.0	45.0	60.0
Metallic Coatings	80.0	50.0	65.0
Nonflat Paint Products	65.0	30.0	45.0
Primers	60.0	30.0	40.0
Specialty Coatings			
Art Fixatives or Sealants	95.0	70.0	60.0
Auto Body Primers	80.0	50.0	45.0
Automotive Bumper and Trim Products	95.0	75.0	75.0*
Aviation or Marine Primers	80.0	70.0	70.0*
Aviation Propeller Coatings	84.0	75.0	70.0
Corrosion Resistant Brass, Bronze or Copper Coatings	92.0	70.0	70.0*
Exact Match Finishes			
Engine Enamel	80.0	60.0	50.0
Automotive	88.0	60.0	50.0
Industrial	88.0	60.0	70.0
Floral Sprays	95.0	85.0	70.0
Glass Coatings	95.0	80.0	65.0
Ground Traffic/Marking Coatings	66.0	40.0	45.0
High Temperature Coatings	80.0	55.0	60.0
Hobby/Model/Craft Coatings			
Enamel	80.0	70.0	70.0*
Lacquer	88.0	70.0	70.0*
Clear or Metallic	95.0	75.0	80.0
Marine Spar Varnishes	85.0	70.0	60.0
Photograph Coatings	95.0	70.0	70.0*
Pleasure Craft Finish Primers, Surfacers or Undercoaters	75.0	55.0	55.0*
Pleasure Craft Topcoats	80.0	55.0	55.0*
Shellac Sealers			
Clear	88.0	70.0	70.0*
Pigmented	75.0	60.0	60.0*
Slip-Resistant Coatings	80.0	70.0	60.0
Spatter/Multicolor Coatings	80.0	60.0	55.0
Vinyl/Fabric/Leather/Polycarbonate Coatings	95.0	70.0	70.0*
Webbing/Veil Coatings	90.0	70.0	80.0
Weld-Through Primers	75.0	60.0	50.0
Wood Stains	95.0	75.0	75.0*
Wood Touch-Up, Repair or Restoration Coatings	95.0	75.0	90.0

* VOC standards marked with an asterisk are the same as the existing December 31, 1999, standards.

B. EFFECTS OF THE PROPOSED AMENDMENTS

What products will be affected by the proposed amendments?

Thirty-five categories of aerosol coating products will be affected. These products are primarily aerosol paints, but also include aerosol clear coatings and aerosol stains.

We do not know how many products may be affected by the exclusion of methyl acetate from the definition of VOC. The most likely consumer product to be reformulated with methyl acetate is hairspray. Hairspray manufacturers may choose to use methyl acetate to comply with the 55 percent VOC limit for hairspray which will become effective on June 1, 1999.

Who would be affected by the proposed amendments?

The proposed amendments to the aerosol coatings regulation would affect any person who sells, supplies, offers for sale, applies, or manufactures for use in California any aerosol coating product subject to the VOC limits. This includes manufacturers, distributors, wholesalers, retailers, and aerosol coating users. The regulation is intended to apply to both household and industrial uses of aerosol coating. However, it should be noted that the regulation contains a specific exemption for noncommercial application of aerosol coatings. This exemption was provided to avoid enforcement actions against home use of noncomplying aerosol coatings.

The primary impact would be on manufacturers and marketers of aerosol coatings, which will have to reformulate some of their products. There would also be an impact on distributors and retailers, who must ensure that they are selling or supplying complying products. In addition, since some products will have to be reformulated, suppliers of chemicals, propellants, containers, valves, and other product components may be impacted, depending on whether there is an increased or decreased demand for their products. Finally, consumers may have to pay more for some aerosol coating products, or may have to make some adjustments in their use of the reformulated products.

The proposed exclusion of methyl acetate from the definition of VOC would affect any manufacturer who might use methyl acetate in the formulation of consumer products. The primary impact on these manufacturers would be to provide additional flexibility in complying with the VOC limits for consumer products.

Will the performance of aerosol coatings products be affected?

There will be some changes in the characteristics of the reformulated aerosol coating products since their formulations will change. However, we do not expect significant impacts on product performance. The regulation specifies different VOC standards for 35 categories of products to ensure that each type of product can be successfully reformulated. There are already complying products in nearly all of the 35 categories, and in most cases the complying products represent a significant market share. Finally, manufacturers have numerous reformulation options that will provide them with the flexibility to develop products that meet consumers needs.

C. REQUIREMENTS IN STATE LAW AND THE STATE IMPLEMENTATION PLAN (SIP)

Do the proposed amendments meet the requirements of State law?

Yes. As discussed above, State law requires the Board to conduct a public hearing on or before December 31, 1998, on the technological and commercial feasibility of achieving full compliance with the final aerosol coating limits by December 31, 1999. If the Board determines that the December 31, 1999, limits are not technologically and commercially feasible, it may extend the effective date up to five years, and must establish the most stringent interim limits. However, State law does not specify the action the Board must take if it determines that the December 31, 1999, limits that are designed to achieve a 60 percent reduction are not technologically and commercially feasible even with the maximum allowable five year extension. We believe the intent of State law is to allow the Board to establish the most stringent final limits that are technologically and commercially feasible, even if a 60 percent reduction in emissions is not achieved.

We are recommending that the Board determine that twelve of the December 31, 1999, limits are not achievable with the maximum five year extension and, we are proposing new final limits for these categories. The proposed new limits represent the most stringent feasible VOC limits that are technologically and commercially feasible. For eleven other categories we are recommending that the Board determine that the December 31, 1999, limits do not represent the most stringent feasible VOC limits. For these categories, we are proposing more stringent final limits to meet the requirements of State law. For the remaining twelve categories, we are proposing to retain the existing final limits. We are also proposing to extend the effective date to January 1, 2002 (two years), for all of the proposed limits which is allowable under State law. Overall, we believe these proposed amendments meet statutory requirements.

How were the 1989 baseline emissions calculated?

To determine the aerosol coating emissions in 1989, we relied on the 1989 ARB emissions inventory. In that year, the total emissions from all consumer products were estimated to be 250 tons per day. Based on the ARB's 1989 emissions inventory, aerosol coatings accounted for about twelve percent of the consumer products inventory or an estimated 30 tons per day. This estimate agrees well with the 1990 U.S. EPA survey (29.6 tons per day based on California's population), and the 1989 Chemical Specialties Manufacturers Association's (CSMA) Pressurized Products Survey (30 tons per day based on California's population).

Do the proposed amendments satisfy our commitments in the SIP?

On November 15, 1994, the ARB adopted the State Implementation Plan (SIP) for ozone. The SIP serves as California's overall long-term plan for attainment of the federal ambient air quality standard for ozone. In making our SIP commitment for consumer products, the emissions reductions from aerosol coatings were combined with those from the mid-term measures. When combining the emissions reductions from the mid-term measures and the proposed amendments, the emission reduction commitment for 2002 would be achieved. However, the proposed amendments to the aerosol coatings regulation do not fully meet our SIP commitment to achieve

a 60 percent reduction in aerosol coatings emissions by 2005. When we made our SIP commitment we acknowledged that we would need to revisit the aerosol coatings regulation to determine if a 60 percent reduction in emissions is technologically and commercially feasible. Because of this, we have not yet submitted the aerosol coatings regulation to the U.S. EPA as a SIP revision. We expect to obtain the necessary emission reductions from alternative measures in time to demonstrate that rate-of-progress and attainment requirements will still be met.

As discussed above, we are proposing that the final VOC limits for twelve product categories be made less stringent if the Board determines that the December 31, 1999, limits for these categories are not technologically and commercially feasible even with the maximum five year extension. This proposal would achieve a 42 percent or 12.6 tons per day reduction in aerosol coating VOC emissions instead of the 60 percent or 18 tons per day reduction specified in the SIP. We are recommending this approach because staff believes that a 42 percent reduction in aerosol coating emissions is the most stringent feasible reduction in emissions. This disparity will need to be addressed in the forthcoming update to the SIP.

As part of this effort, we believe that a complete update to the SIP inventory for consumer products is needed. In addition to conducting the 1997 Aerosol Coatings Survey, we are currently conducting the 1997 Consumer and Commercial Products Survey, which is a comprehensive survey of the overall consumer product usage and emissions in California. We plan to provide a memorandum to the Board this fall on the status of our survey efforts. We believe this effort is necessary to have an accurate and up-to-date consumer product inventory to use as a basis for addressing our consumer product SIP commitments. The updated consumer product inventory will serve as the basis for amending the official SIP inventory in the year 2000. We will also continue to evaluate emerging technologies for aerosol coatings to determine if further reductions are feasible in the future.

D. REGULATORY DEVELOPMENT PROCESS AND EVALUATION OF ALTERNATIVES

How did ARB staff develop the proposed amendments?

The proposed amendments were developed in cooperation with industry and other interested parties. One of our actions was to conduct a comprehensive survey of aerosol coating manufacturers and marketers selling products in California. The survey was to gather detailed information necessary to develop the proposed amendments.

We also conducted three public workshops (on May 19, 1998, July 23, 1998, and August 19, 1998). During the workshops, ARB staff discussed among other things statutory and SIP requirements, nonconfidential summaries of the survey data, and the proposed VOC limits.

In addition to these more formal meetings, ARB staff participated in site visits sponsored by the industry, and conducted numerous meetings and teleconferences with interested stakeholders to gather the technical information necessary to develop the proposed amendments.

What information was gathered from the ARB's 1997 Aerosol Coatings Survey?

The ARB's 1997 Aerosol Coatings Survey requested: (1) general information about the responding companies; (2) product specific formulations including VOC speciation data, sales, and cost information; and (3) information about the company's research and development efforts to achieve the December 31, 1999, VOC limits. The company information and product specific cost information were needed to perform ARB's economic impacts analysis. The product specific formulation and sales information were needed to determine the total VOC and speciated VOC emissions from aerosol coating products. Finally, the research and development reports (along with the product formulation information) were needed to develop the proposed VOC limits.

The ARB staff worked with the industry and trade associations to ensure that the response to the survey was complete. To allow the industry access to the information during the development of the proposed amendments, ARB staff also worked with the industry to develop nonconfidential summaries of the survey data.

Who has been most active in the process?

Aerosol coating manufacturers and marketers and their trade associations have been most active in the process. The trade associations include the National Paint and Coatings Association (NPCA), and the Western Aerosol Information Bureau (WAIB). ARB staff maintains a comprehensive mailing list of companies and interested parties, which received information throughout the development of the proposed amendments.

How were the proposed VOC limits developed?

The proposed VOC limits were developed in cooperation with the aerosol coatings industry and other interested parties. In developing the proposed VOC limits, ARB staff considered the survey information, research and development reports, and the input of manufacturers and other interested parties. ARB staff presented proposals at each of the three workshops for discussion, and modified the proposed VOC limits based on the technical information received. In addition, ARB staff considered information provided during numerous meetings, and telephone conversations with manufacturers.

Did ARB staff evaluate any alternatives?

In developing the proposed VOC limits, ARB staff evaluated the December 31, 1999, VOC limits and an alternative set of VOC limits proposed by several members of the aerosol coatings industry and the NPCA (the "industry proposal"). The ARB staff found that while the December 31, 1999, VOC limits achieved greater overall emission reductions than the staff's proposal, many of the limits are not technologically or commercially feasible, or do not represent the most stringent feasible VOC limits.

E. COMPLIANCE WITH THE PROPOSED AMENDMENTS

How will manufacturers comply with the proposed VOC limits?

Manufacturers reformulating their noncomplying products to meet the proposed VOC limits will need to replace some of the VOC solvents or propellants in their formulations with non-VOC ingredients. Manufacturers are expected to use primarily the following compliance options to meet the proposed VOC limits:

- increase the amount of acetone;
- increase the amount of paint solids;
- use exempt propellant hydrofluorocarbon-152a;
- use exempt solvent parachlorobenzotrifluoride; or
- use exempt solvent methyl acetate.

Are there alternative options for achieving compliance?

Manufacturers can also comply with the aerosol coatings regulation through the use of the Alternative Control Plan (ACP) regulation. The ACP allows manufacturers to average the emissions from aerosol coating products above and below the applicable VOC limits, as long as the overall emissions are less than or equal to the emissions that would have occurred had all the products complied with the VOC limits. However, manufacturers are not allowed to average the emissions from aerosol coating products with other types of consumer products. At present, the ACP is only an option for manufacturers complying with mass VOC limits. To date, three manufacturers (including one aerosol paint manufacturer) have taken advantage of the ACP.

Are the proposed VOC limits technologically and commercially feasible?

As explained in Chapter V and VI of the Technical Support Document, we believe the proposed VOC limits are technologically and commercially feasible. The proposed amendments specify standards for 35 individual categories of coating products to ensure that each type of product can be successfully reformulated. For all but two of the proposed VOC limits, there are currently complying products being sold. The two categories that do not currently have complying products are the "flat paint products," and "corrosion resistant brass, bronze, or copper coatings." In the case of the flat paint products, we believe that these products can meet the proposed 40 percent VOC limit (see Chapter VI of the Technical Support Document). In the case of the corrosion resistant brass, bronze, or copper coatings, there was only one product identified in the category, and the manufacturer stated that they can meet the proposed limit. In

addition, for all the aerosol coating categories, there are a variety of reformulation options that can be used by manufacturers to reformulate their products. Finally, the ACP provides additional compliance options.

What are the emission reduction benefits from the proposed amendments?

As shown in Table 2, the proposed limits are expected to reduce current VOC emissions by about 3.6 tons per day from the levels found in products that are currently being sold (based on the 1997 ARB Aerosol Coatings Survey). The total VOCs reduced since 1989, including reductions from the first-tier limits and the exemption of acetone as a VOC, are about 12.6 tons per day. Overall, the emission reductions achieved by the proposed limits are 5.4 tons per day less than the reductions that would have been achieved by the previously adopted December 31, 1999, limits (18 tons per day reduction). The VOC reductions from metallic paints, primers, and ground traffic or marking paints are negative because the growth in emissions since 1989 is greater than the reductions achieved from the proposed VOC limits. The seven categories shown account for about 86 percent of the emissions, with the other 28 categories accounting for the remaining 14 percent of the emissions.

F. ECONOMIC IMPACTS

What are the expected economic impacts of the proposed amendments on businesses?

Under the proposed amendments, manufacturers will have additional time to comply with VOC limits that, overall, are less stringent than the existing second-tier limits. Therefore, the proposed amendments will result in an overall cost savings to affected businesses. However, we conducted an analysis of the costs manufacturers will incur to reformulate their existing products to meet the proposed VOC limits. We did this in order to provide full disclosure of economic information that may be of interest to industry and members of the public. The following analysis presents this information.

In our economic impacts analysis, we evaluated the proposed amendments for potential impacts on profitability and other aspects of businesses subject to the proposed limits (with particular attention to California businesses), the cost-effectiveness of the limits, and the estimated cost impacts to consumers. To conduct our analysis, we relied on a combination of publicly available financial databases (Dun and Bradstreet, *Ward's Business Directory of U.S. Manufacturing Industries*), the 1997 ARB Aerosol Coatings Survey, industry journals/literature, and discussions with industry representatives.

TABLE 2
Summary of Emissions and Emission Reductions from Aerosol Coating Products

Aerosol Coating Category	1989 Baseline VOC Emissions (TPD)[1]	1997 VOC Emissions (TPD)[2]	Percent of Total Emissions	Proposed VOC Limit (%) 1/1/2002	Emission Reductions (TPD)	Emission Reductions from 1989 Baseline[3]
Clear Coatings	1.1	.95	4.5	50	0.16	0.30
Flat Paints	2.4	1.6	7.7	40	0.34	1.3
Fluorescent Paints	0.4	0.2	1.1	60	0.02	0.20
Metallic Paints	1.5	1.8	8.4	65	0.23	-0.10[4]
Nonflat Paints	15.7	8.7	41	45	1.41	8.3
Primers	1.4	2.0	10	40	0.44	-0.20[4]
Ground Traffic or Marking	0.8	2.8	13	45	0.74	-1.2[4]
Misc. Specialty Coatings	6.6	2.9	14.3	Varies	0.22	4.0
Total	30	21	100		3.60	12.6

1 Based on 1989 ARB Emissions Inventory, including acetone as a VOC

2 Based on 1997 ARB Aerosol Coatings Survey. Includes reductions from the exemption of acetone and first-tier VOC limits effective on January 8, 1996.

3 Emission reduction includes exemption of acetone as a VOC.

4 Categories with negative reductions result from growth in category since 1989.

Based on our analysis, we expect most manufacturers to be able to absorb the added costs of the proposed amendments without an adverse impact on their profitability. We also found that the proposed amendments are cost-effective relative to similar ARB regulations or measures, and the impacts to consumers based on changes to raw materials cost are consistent with existing ARB regulations.

We estimated the change in "return on owner's equity" (ROE) as an indicator of the limits' potential impacts on business profitability. The cost to comply with the proposed amendments, due to increased research and development, materials costs, equipment purchases and other investment costs, is presumed to impact a business' ROE and therefore its profitability. The cost to reformulate noncomplying products for a typical small, medium and large company was used to determine the total annual reformulation costs. Our analysis indicates the estimated change in ROE can vary from essentially no change to an eight percent change. The average change in ROE is about two percent, relative to the pre-regulatory ROE. This estimated change in ROE is well within the change in ROE estimated for ARB's existing consumer products regulations.

Our ROE analysis for the proposed amendments may overestimate the impact on business because it assumes that all of the costs of the proposed limits will be absorbed by manufacturers. In reality, we expect at least some of the investment costs to comply with the proposed limits to be passed on to consumers. The analysis also does not quantify the extent of cost mitigation from "technology-transfer" between product lines and from third-party manufacturers (i.e., contract fillers) who fill essentially equivalent products for a number of competing businesses. Finally, the analysis does not take into account cost mitigation through alternative means of compliance such as the Alternative Compliance Plan (ACP). Manufacturers will generally not comply by using a voluntary program unless there is an economic incentive to do so.

While we expect that most businesses will be able to absorb the costs of the proposed amendments without significant adverse impacts on their profitability, there is the possibility that some individual businesses will be adversely affected by this regulatory action. Therefore, it is possible that this proposal may have a significant adverse impact on some businesses that are not in a market position to invest monies to develop new low VOC products as well as other manufacturers, or to absorb the increased cost resulting from their compliance with the proposed limits.

Based on our analysis, we do not expect the proposed amendments to have a significant impact on employment, or business creation, elimination, or expansion. We also do not expect the proposed amendments to have a significant impact on the competitiveness of California businesses compared with those outside of California. This is because all companies that sell aerosol coating products in California would have to meet the proposed VOC limits, whether located in or outside of California.

The proposed VOC limits will primarily impact aerosol coating manufacturers and marketers (companies which contract out the manufacturing of their products). However, we recognize that other industries could also be impacted to a lesser amount which is difficult to quantify. These industries include distributors, retailers, and "upstream" suppliers who supply containers, valves, solvents, propellants, and other chemicals used in aerosol coatings.

Distributors and retailers could be impacted if some manufacturers decide to carry a dual inventory of products (one for California and one for the rest of the nation). Another potential cost to distributors or retailers would be the implementation of procedures to ensure that noncomplying products are not sold past the three year "sell-through period." However, based on retail sell-through data obtained during the development of ARB's existing consumer product regulations, we believe the existing three year sell-through period should provide ample time to allow for the sale of noncomplying aerosol coating products.

Upstream suppliers could be impacted because manufacturers will be purchasing some different solvents, propellants, and other materials for their reformulated products. They may also purchase different containers, valves, or other components for their reformulated products. However, we do not expect these changes to result in a major impact on the affected industries because chemical companies generally supply many different industries, and because many of the upstream suppliers also provide the alternative products which will be used in the reformulated products. In fact, we expect some upstream suppliers will benefit since the proposed limits are likely to create new or increased demand for materials to be used in compliant formulations.

Will the proposed amendments be cost-effective?

Cost-effectiveness is one measure of a regulation's efficiency in reducing a given amount of pollutant (often reported in "dollars (to be) spent per pound of VOC reduced"). The determination of cost-effectiveness is well-established and often used to compare a proposed regulation's cost-efficiency with those of other regulations. Under the proposed amendments, manufacturers will have additional time to comply with VOC limits that, overall, are less stringent than the existing second-tier limits. Therefore, the proposed amendments will result in a cost savings to affected businesses relative to the existing second-tier limits. However, we also conducted an analysis of the cost-effectiveness of reformulating existing products to meet the proposed VOC limits. To conduct our analyses, we relied on specific formulation data from the 1997 ARB Aerosol Coatings Survey, industry journals/literature, and discussions with industry representatives. Our analyses considered separately the impacts on the cost-effectiveness from nonrecurring, investment costs (as an annualized cost) and the impacts from recurring costs (primarily changes in raw material ingredients).

Based on our analyses, we estimate the cost-effectiveness of the aerosol coatings regulation to range from less than $1.00 to about $3.00 per pound of VOC reduced. The overall average cost-effectiveness is estimated to be about $1.57 per pound of VOC reduced. These estimated cost-effectiveness values are consistent with existing ARB regulations and control measures.

Will consumers have to pay more for aerosol coatings subject to the proposed amendments?

We estimate the cost per unit increase to range by category from no cost to about $0.20 per unit. We estimate the average cost per unit increase to be about $0.10. To the extent manufacturers pass these costs along to the consumer, the actual retail price changes may be higher or lower than indicated by this analysis. Chapter VIII of the Technical Support Document shows the detailed analyses resulting in our estimated range in unit cost increases.

G. ENVIRONMENTAL IMPACTS

What are the expected environmental impacts of the proposed amendments?

As explained in Section E of this Summary, the proposed VOC limits will achieve about 5.4 tons per day less emission reductions than the existing December 31, 1999, VOC limits. In addition, the effective dates of the proposed VOC limits are proposed to be extended to January 1, 2002. Therefore, we conclude that the proposed amendments will have an adverse environmental impact. However, these changes are necessary to preserve the technological and commercial feasibility of the VOC limits. The proposed amendments to the December 31, 1999, VOC limits will ensure that manufacturers can continue to manufacture consumer acceptable products that will meet the basic market demand. We believe these considerations override any adverse impacts that may occur as a result of these amendments.

It should also be noted that manufacturers will still need to reduce the VOC content of the products that they are presently selling in order to meet the proposed January 1, 2002, limits. This is because the proposed January 1, 2002, limits are lower than the currently applicable limits which became effective on January 8, 1996. We estimate that the proposed January 1, 2002, limits will achieve a 3.6 ton per day reduction in VOC emissions relative to the current emissions from aerosol coatings, which will result in a positive impact on air quality and public health.

Based on our analysis, as detailed in Chapter VII of the Technical Support Document, we do not expect any other adverse environmental impacts to result from the proposed amendments. We examined the potential effect of the proposed amendments on air quality, global warming, stratospheric ozone depletion, and the impacts on water quality and solid waste disposal.

How would the proposed amendments reduce the risk to public health?

It has long been known that exposure to ground level ozone and PM_{10} have adverse impacts on public health. Research has shown that, when inhaled, ozone and PM_{10} can cause respiratory problems, aggravate asthma, and impair the immune system. Numerous scientific studies have shown that by reducing VOC emissions, ozone and PM_{10} concentrations are reduced. Therefore, by reducing ozone and PM_{10} concentrations, the proposed amendments would reduce the health risks posed by exposure to these pollutants.

Are there any potential negative environmental impacts from the exemption of methyl acetate?

Based on our analysis, we expect that the exemption of methyl acetate from the VOC definitions in the antiperspirant and deodorant, consumer products, and aerosol coatings regulations (collectively "the consumer products regulations") would not have any significant adverse environmental impacts. We expect a positive environmental impact if methyl acetate is substituted for more reactive compounds. We conducted our analysis with consideration of potential impacts on air quality, water quality, landfill loading, and toxicity.

What future activities are planned for aerosol coatings?

We are developing a voluntary compliance alternative based on the photochemical reactivity of the VOC's in aerosol coatings. Photochemical reactivity is a measure of a VOC's potential to form ozone in the air we breathe. Of the many different VOCs released into the atmosphere, each reacts at a different rate and through a different chemical reaction mechanism. The VOCs with high reactivity have a greater potential to form ozone, while other VOCs react slowly in the atmosphere, and are less likely to form ozone. Using a reactivity scale it is possible to account for the differences in VOC reactivities, and use the differences to limit emissions from aerosol coatings. The reactivity program would be based on the maximum incremental reactivity (MIR) scale developed by Dr. William Carter of the University of California at Riverside. To ensure that the best available science is reflected in this scale, we are in the process of having Dr. Carter's work peer reviewed.

Following this review, we plan to present our proposal to the Board in 1999, for a new voluntary regulation, the California Low Emissions and Reactivity (CLEAR) Regulation for Aerosol Coatings. With the CLEAR Regulation manufacturers would be able to choose to comply with either the mass-based or the reactivity-based VOC limits, whichever are more cost-effective. The proposed reactivity limits would be designed to achieve equivalent ozone reductions to the second-tier mass limits while providing compliance flexibility.

RECOMMENDATION

We recommend that the Board adopt the proposed amendments to the aerosol coatings regulation, and the proposed amendments to the antiperspirant and deodorant and consumer products regulations. Adoption of the proposed amendments will result in the most stringent feasible reduction in aerosol coatings emissions, and provide manufacturers more flexibility in complying with the VOC limits for consumer products.

State of California
AIR RESOURCES BOARD

Initial Statement of Reasons for the
Proposed Amendments to the Regulations for
Reducing Volatile Organic Compound Emissions
from Aerosol Coatings, Antiperspirants and Deodorants, and
Consumer Products

Technical Support Document

I.

INTRODUCTION

A. OVERVIEW

In this report, we present the Initial Statement of Reasons (ISOR) for proposed amendments to the December 31, 1999, (second-tier) volatile organic compound (VOC) limits in the aerosol coatings regulation. We also present the basis for our proposal to exempt methyl acetate from the VOC definition in the aerosol coatings regulation, the antiperspirant and deodorant regulation, and the consumer products regulation. This document includes discussions of the following information related to the proposed regulatory action:

- VOC emissions from the aerosol coating categories and the overall need for emission reductions;
- the technological and commercial feasibility of the second-tier VOC limits and of the proposed amendments to them;
- the process used to develop the proposed amendments to the second-tier VOC limits;
- proposed amendments to the second-tier VOC limits for aerosol coatings;
- an analysis of the expected environmental and economic impacts from the proposed amendments to the second-tier VOC limits;
- proposed amendments to the VOC definition to exempt methyl acetate; and
- anticipated future activities related to a reactivity-based regulation for aerosol coatings and other consumer product categories.

B. LEGISLATIVE HISTORY

The Air Resources Board's (ARB) authority to regulate aerosol coatings and other consumer products is contained in Health and Safety Code section 41712. Section 41712 was originally enacted by the Legislature as part of the California Clean Air Act of 1988. In enacting section 41712, the Legislature gave the ARB new authority to control emissions from consumer products, an area that had previously been subject to very few air pollution control regulations.

Section 41712 has been amended a number of times since it was originally enacted in 1988. The current language of section 41712 requires the ARB to adopt regulations to achieve the maximum feasible reduction in VOCs emitted by consumer products. In addition, all consumer products regulations adopted by the ARB must be: (1) based on adequate data; (2) technologically and commercially feasible; (3) necessary to attain state and federal ambient air quality standards; and (4) not result in the elimination of a product form.

As originally enacted, section 41712 gave the ARB the authority to regulate VOC emissions from "consumer products." But the term "consumer products" was defined to specifically exclude "paint." Because aerosol coatings are considered to be "paint," the ARB initially did not have any authority to regulate aerosol coatings. The authority to regulate aerosol coatings was vested in the local air pollution control and air quality management districts.

All this changed in 1992 and 1993. In 1992, the Legislature enacted Assembly Bill 2783 (AB 2783, Sher; Stats. 1992, Chapter 945). Assembly Bill (AB) 2783 gave the ARB the authority to regulate aerosol paints. It did this by amending the definition of "consumer products" in section 41712 to include "aerosol paints" as a consumer product to be regulated by the ARB.

In 1993, the Legislature further amended Health and Safety Code section 41712 by enacting AB 1890 (AB 1890, Sher; Stats. 1993, Chapter 1028). The AB 1890 amendments established a prescriptive emission reduction process for aerosol paints. These amendments require the ARB to:

- adopt statewide regulations on or before January 1, 1995, that will achieve a 60 percent emission reduction from the use of aerosol paints by December 31, 1999, and to develop interim limits prior to 1999;

- conduct a public hearing on or before December 31, 1998, on the technological or commercial feasibility of achieving full compliance with the final limits by December 31, 1999;

- grant an extension of time not to exceed five years if the ARB determines the 60 percent reduction is not technologically or commercially feasible by December 31, 1999;

- adopt the most stringent interim limits if an extension of time is granted for the final limits; and

- ensure that the final limits for aerosol paints do not become federally enforceable prior to the effective date established, including any extension if granted.

The AB 1890 amendments also clarified the intent of the Legislature with respect to the regulation of aerosol paints by requiring, with one exception, that limits on the emissions of reactive organic compounds from aerosol paints be set solely by the State board to ensure uniform standards are applicable on a statewide basis. The only exception to this requirement is any regulation that has been adopted by a district pursuant to an order of a federal court. The only district regulation that meets this criterion is Rule 49 of the Bay Area Air Quality Management District, which was adopted in June 1990 in response to a federal court order.

Senate Bill 987 (SB 987, Sher; Stats. 1997, Chapter 568) is the most recent amendment to section 41712 affecting aerosol paints. Senate Bill 987 specifies that acetone be included among the VOCs in the 1989 baseline year measurement used for the calculation of the 60 percent emission reduction from the use of aerosol coating products.

C. REGULATORY BACKGROUND

1. Consumer Product Regulations Adopted to Date

To date, the ARB has taken several actions to fulfill the legislative mandate set forth in Health and Safety Code section 41712. Three regulations have been adopted that limit the VOC content of 45 consumer product categories and 35 categories of aerosol coatings. In addition, two voluntary regulations have been adopted to provide compliance flexibility to companies.

On November 8, 1989, the ARB adopted a regulation for reducing VOC emissions from antiperspirants and deodorants (the "antiperspirant and deodorant regulation;" sections 94500-94506.5, Title 17, California Code of Regulations (CCR)) (ARB, 1989a-b). The ARB then adopted a more comprehensive regulation for reducing VOC emissions from 44 additional categories of consumer products, which was adopted by the ARB in three phases (the "consumer products regulation;" sections 94507-95417, Title 17, CCR) (ARB, 1990a-b; ARB, 1991a-c; ARB, 1997a). Phase I was adopted on October 11, 1990, Phase II was adopted on January 9, 1992, and Phase III was adopted on July 24, 1997. The Phase III amendments became legally effective on August 16, 1998. These regulations reduce VOC emissions primarily through specification of maximum allowable VOC content limits (by weight percent) for individual product categories.

On September 22, 1994, the ARB adopted the first voluntary regulation, the "Alternative Control Plan Regulation for Consumer Products" (the "ACP") (ARB, 1994a). The ACP is a market-based regulation that employs the concept of an aggregate emissions cap or "bubble." This program supplements existing regulations by providing consumer products and aerosol coatings manufacturers additional flexibility when formulating consumer products. This regulation is contained in Title 17, CCR sections 94540-94555.

The ARB adopted a third regulation on March 23, 1995, the "Regulation to Reduce Volatile Organic Compound Emissions from Aerosol Coating Products" (the "aerosol coating

regulation" (ARB, 1995a-b). This regulation limits the VOC content of 35 categories of aerosol coatings. At the same time, the ACP was amended to make it possible to "bubble" aerosol coatings emissions. The aerosol coatings regulation is contained in Title 17, CCR, sections 94520-94528.

In addition, on November 13, 1997, the ARB approved the second voluntary regulation, the Hairspray Credit Program (ARB, 1997b), which allows hairspray manufacturers and marketers to generate emission reduction credits if they comply early with the second-tier VOC limit for hairspray. The Hairspray Credit Program regulation became legally effective on August 24, 1998, and is contained in Title 17, CCR, sections 94560-94574.

2. The State Implementation Plan

On November 15, 1994, the ARB adopted the State Implementation Plan (SIP) for ozone (ARB, 1994b). The SIP serves as California's overall long-term plan for attainment of the federal ambient air quality standard for ozone. Together with significant reductions from stationary industrial facilities, mobile sources (e.g. cars, trains, boats), and other area sources (e.g. architectural and industrial maintenance coatings), the emission reduction commitments in the consumer products element of the SIP are an essential part of California's effort to attain both the national and State ambient air quality standards for ozone. The VOC reductions from consumer products are also needed to help several local air pollution control districts meet rate-of-progress requirements in the federal Clean Air Act (CAA).

Our commitment in the SIP is to reduce consumer product emissions by 85 percent by the year 2010 (including the adopted regulations). This reduction is necessary for the South Coast Air Basin, among others, to attain the federal ozone standard and meet the rate-of-progress requirements under the CAA. To meet the emission reductions committed to in the SIP, we developed a multi-faceted program comprised of "near-term," "mid-term," and "long-term" control measures. The near-term SIP measures are comprised of the antiperspirant and deodorant, consumer products, and aerosol coating regulations. We partially met our mid-term measures commitment with the approval of VOC limits for 18 additional consumer product categories (the Phase III amendments) on July 24, 1997. We are continuing to evaluate additional categories to achieve further emission reductions as part of our mid-term SIP commitment. The long-term SIP measures will rely on new technologies to achieve further VOC reductions, market incentives, and consumer education.

Listed below is a breakdown of how our SIP commitment for an 85 percent reduction in emissions from consumer products will be achieved:

- 30 percent will come from the near-term measures;
- 25 percent will come from the mid-term measures; and
- 30 percent will come from the long-term measures.

The second-tier aerosol coating limits are an important component of the near-term measures goal to reduce VOC emissions from consumer products by 30 percent. The near-term measures emission reductions, in conjunction with the mid-term measures emission reductions, are necessary for the Sacramento Metropolitan Area and Ventura County Air Pollution Control District to demonstrate ozone attainment by 2005. They are also necessary for other districts to show continuing rate-of-progress.

Another SIP commitment was achieved by establishing the "Consumer Products Working Group" (CPWG) to help facilitate the development and implementation of future consumer products control measures. This working group has been in existence since April 11, 1995, and has been advisory in nature. It is comprised of representatives from the ARB, industry, environmental groups, the local districts, and the United States Environmental Protection Agency (U.S. EPA). Its role is to provide a forum for ongoing communication, cooperation, and coordination in the development of consumer product control measures.

Additionally, in the SIP, we committed to consider photochemical reactivity principles for the control of VOCs from consumer products. As part of the CPWG, on April 11, 1995, we also formed the "Reactivity Subgroup" to help in the investigation and development of reactivity-based consumer product regulations. Thus, we have been working with the Reactivity Subgroup for the past three years to develop reactivity-based regulatory control strategies. Our goal is to provide consumer product manufacturers an option for compliance flexibility. To provide this flexibility, we plan to bring a reactivity-based regulation to the Board for adoption in 1999.

On November 15, 1994, the ARB submitted the consumer products Phase I and II regulations and the antiperspirant and deodorant regulation to the U.S. EPA for approval as a SIP revision. On January 13, 1995, the U.S. EPA found the submittal complete and approved the regulations on February 14, 1995. The U. S. EPA's approval of the consumer products regulations was published in the Federal Register on August 21, 1995. The ACP was submitted to the U.S. EPA for approval as a SIP revision on August 27, 1996.

3. Comparable Federal Regulations

The U.S. EPA Administrator signed the final approval for the enactment of the National Volatile Organic Compound Emissions Standards for Consumer Products on August 14, 1998. The U.S. EPA published the final rule in the September 11, 1998, Federal Register, Volume 63, No. 176, pages 48819-48847 (U.S. EPA, 1998b). The standard effective date for all the categories in the U.S. EPA rule is November 15, 1998.

Prior to establishing VOC limits for the consumer product categories, the U.S. EPA was required to do the following: (a) determine the potential of VOC emissions from consumer products to contribute to ozone levels which violate the national ambient air quality standard for ozone; (b) identify the highly reactive species of such VOC emissions; and (c) list those consumer products that account for at least 80 percent of the VOC emissions on a reactivity-adjusted basis.

The U.S. EPA rule is similar to the ARB's consumer product regulations, although some differences do exist. Of particular importance for this rulemaking is that there is no current U.S. EPA proposal to reduce VOC emissions from aerosol coating products. The U.S. EPA's rule also differs from the ARB regulations in the following ways: (1) it does not regulate as many consumer product categories; (2) it has only one standard effective date; (3) it does not apply to retailers; (4) it has no second-tier or "future effective" VOC standards for any category; (5) it allows innovative products to demonstrate emissions that are less than or equal to representative products, whereas ARB requires emissions that are less than representative products; (6) it has no restrictions on the use of ozone-depleting products; (7) it requires that economic hardship, not extraordinary economic hardship, be demonstrated as one of the three variance findings; (8) it requires that compliance be determined solely through manufacturer records, not through product testing; (9) it has an unlimited, instead of a three-year, "sell-through" period for noncomplying products manufactured before the effective date of the standards; and (10) it has no alternative control plan option.

Whenever possible, the ARB strives to harmonize its rules with federal regulations addressing the same issues. However, our current regulations, including the aerosol coatings regulation, Phase I, Phase II, and Phase III regulations, predate the proposed U.S. EPA regulation by several years. Additionally, as discussed above, our regulations are more effective in reducing emissions from consumer products and will achieve additional emission reductions from aerosol coatings. Given the serious nature of the air pollution problem in California, the need for a regulation to reduce VOC emissions from aerosol coatings to benefit the human health and the environment is justified.

4. Definition of VOC

On April 9, 1998, the U.S. EPA published the most recent change to the federal definition of VOC (Federal Register, Volume 63, Number 68, pages 17331-17333) (U.S. EPA, 1998a). The federal definition of VOC now excludes methyl acetate, based on its low photochemical reactivity. Following the U. S. EPA action, the ARB was petitioned by Eastman Chemical

Company to exempt methyl acetate from the VOC definition in the consumer products regulations.

We conducted an analysis of the environmental impacts of exempting methyl acetate from the VOC definitions in the consumer products regulations. This analysis has shown that, due to its low reactivity in the atmosphere, the exemption of methyl acetate would not result in adverse environmental impacts. Therefore, we are proposing to exempt methyl acetate from the VOC definition in the aerosol coatings regulation, the antiperspirant and deodorant regulation, and the consumer products regulation.

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II.

EMISSIONS FROM AEROSOL COATINGS

In this chapter, we discuss the emissions from aerosol coatings in 1989, provide a summary of the volatile organic compound (VOC) emissions reported in the 1997 Aerosol Coatings Survey (survey), and estimate the VOC emissions remaining after implementation of the proposed second-tier VOC limits.

A. ESTIMATED VOC EMISSIONS FROM AEROSOL COATING PRODUCTS

The use of aerosol coating products results in VOC emissions which originate from the solvents and propellants used in these products. When aerosol coatings are used outdoors or in well ventilated areas, the VOCs are directly emitted to the ambient air. The propellants used in aerosol coatings, such as isobutane, propane, and dimethyl ether, are gases at room temperature. These gases are emitted when an aerosol coating is sprayed and are immediately available for transport to the atmosphere through air exchange. The solvents used in aerosol coatings evaporate during the application and drying processes of the coating. Typically, a solvent blend of fast evaporating and slow to medium evaporating solvents are used in the formulation to provide the correct drying time for the coating film. The evaporation of the solvents takes place in two stages, with the initial loss of solvent (up to 80 percent) being dependent on the vapor pressure of the fast evaporating solvent. After the initial loss of solvent, the polymer film is formed. The remaining solvent loss is caused by a slower diffusion-controlled process (Industrial Colloid Advisory Group). The nonvolatile portion of the coating remains in the cured coating film and, under normal use conditions, is not emitted to the atmosphere.

1. Aerosol Coatings Emissions in 1989

Based on the Air Resources Board's (ARB) 1989 emissions inventory, the total VOC emissions from all consumer products was about 250 tons per day (tpd) in 1989. In 1989, aerosol coatings accounted for about 12 percent of the consumer products VOC inventory or about 30 tpd (annual average) (ARB, 1994). As a check on this estimate, other sources of information were investigated including the United States Environmental Protection Agency's (U.S. EPA) 1990 Survey, and the Chemical Specialties Manufacturers Association's (CSMA) Pressurized Product Survey for 1989. Estimates based on these sources of information agree well with the ARB's estimate. Specifically, when the data from a 1990 survey conducted by the U.S. EPA is scaled down for California by population, the emissions are estimated to be about 29.6 tpd. Similarly, scaling down the CSMA national data by California's population, the emissions are about 30 tpd (ARB, 1995).

Health and Safety Code section 41712 requires the ARB to adopt a technologically and commercially feasible regulation to achieve a 60 percent reduction in aerosol coating emissions relative to the 1989 baseline. Applying a 60 percent reduction to the estimated 1989 baseline emissions of 30 tpd results in a VOC emission reduction target of 18 tpd, assuming no growth in aerosol coating sales.

2. ARB's 1997 Aerosol Coatings Survey

A requirement of ARB's regulation for reducing VOC emissions from aerosol coating products is the reporting of responsible party and manufacturer information to the Executive Officer of the ARB (17 CCR 94524 (c)). From this information, ARB staff developed a mailing list of 313 potential responsible parties and manufacturers of aerosol coatings.

Another requirement of the regulation is the reporting of 1997 product sales and formulation data, as well as research and development efforts to achieve the second-tier limits which would have become effective on December 31, 1999. To assist with the reporting requirements of the regulation, ARB staff, with input from industry representatives, developed an aerosol coatings survey questionnaire. The questionnaire is comprised of four sections:

Form I	Company Information Section
Form II	Product Sales Data
Form III	Product Formulation Data (listing of all ingredients)
	-A Lowest VOC Formulation
	-B Highest VOC Formulation
	-C Highest Sales Formulation
Form IV	Report on Research and Development Efforts

Consistent with the regulatory requirements, grouping of products for reporting was allowed if all products within a group were of the same coating category and were formulated with the same resin system. For grouped products, reporting of the lowest and highest VOC formulations along with the formulation of the highest sold product was required.

The survey questionnaire was sent out to the potential responsible parties and manufacturers on November 26, 1997. Responses to the survey were requested by February 26, 1998. The survey was resent in early May 1998 to 150 companies that had not responded to the first mail-out. Also in early May 1998, the survey was resent to 52 companies identified as manufacturers along with a letter clarifying their reporting requirements. As of July 30, 1998, data have been reported for 137 responsible parties and 53 manufacturers. This represents data accounting for at least 90 percent of the sales of aerosol coatings in California.

3. 1997 Product Sales and VOC Emissions from Aerosol Coatings

The ARB staff designed an ORACLE database to store the survey data. Our results reflect data received and entered into the database as of July 30, 1998. Based on our survey

results, the 1997 sales from all coating categories were 38.2 tpd, and the nonexempt VOC emissions were 21.0 tpd in California.

Table II-1 summarizes product sales and nonexempt VOC emissions calculated from the survey data. While the survey allowed for product grouping, most products were reported separately rather than as groups. The database contains 1,970 single product formulations out of a total of 2,358 entries. The emissions were calculated using the highest sales formulation when products were grouped. Using the highest sales formulation rather than the highest or lowest VOC formulation incurs little error. The variation in emissions calculated using these formulations differs by less than two percent from the highest sales emissions estimate.

Based on the information compiled from the survey, the six "general" aerosol coating categories account for about 73 percent of the total VOC emissions in 1997. The VOC emissions from the 29 "specialty" categories account for the remaining 27 percent of emissions. The nonflat ("glossy") coatings represent the largest share of emissions, at about 41 percent of the total VOC emissions from aerosol coatings.

Table II-1 also summarizes our estimates of VOC emissions reductions from the implementation of the proposed second-tier limits. These numbers were calculated by sorting out formulations which would be "noncomplying" with the proposed limits and reducing their VOC content to the limit for that category. The reduction in VOC emissions for each product is the percentage change in VOC content for the product multiplied by its sales. These reductions are summed for each product in a category to calculate the total VOC reduction from the category. As the table displays, the proposed second-tier limits would achieve reductions of 3.56 tpd from the 21.0 tpd emitted in 1997. The table also shows that the total VOC reductions from the first-tier limits, the exemption of acetone, and the proposed second-tier limits would be 12.6 tpd. Therefore, the overall VOC reduction from the aerosol coatings regulation would be a 42 percent reduction from the 1989 baseline emissions of 30 tpd.

TABLE II-1
SUMMARY OF VOC EMISSIONS AND REDUCTIONS FROM AEROSOL COATINGS

Aerosol Coating Category	California Sales (tpd)	1989 VOC Emissions (tpd)	1997 VOC Emissions (tpd)	2002 VOC Reductions (tpd)	Remaining Emissions (tpd)
General Categories					
Clear Coatings	1.60	1.1	0.95	0.16	0.79
Flat Paint Products	3.19	2.4	1.61	0.34	1.27
Fluorescent Coatings	0.33	0.4	0.22	0.02	0.20
Metallic Coatings	2.50	1.5	1.77	0.23	1.54
Nonflat Paint Products	16.57	15.7	8.73	1.41	7.32
Primers	3.93	1.4	2.00	0.44	1.56
Subtotals	28.12	22.5	15.28	2.60	12.68
Specialty Categories					
Art Fixatives or Sealants	0.33	0.04	0.20	0.03	0.17
Auto Body Primers	0.50	1.3	0.25	0.04	0.21
Auto Bumper and Trim	0.36	0.14	0.22	0.01	0.21
Exact Match Engine Enamel	0.42	0.37	0.21	0.01	0.20
Exact Match Automotive	0.73	1.2	0.38	0.03	0.35
Ground/Traffic/Marking	4.73	0.82	2.83	0.74	2.09
High Temperature Coatings	0.73	0.68	0.49	0.07	0.42
Vinyl/Fabric/Leather/Polycarb	0.35	0.15	0.22	0.00	0.22
All Other Coating Categories*	1.95	2.9	0.97	0.03	0.94
Subtotals	10.1	7.6	5.77	0.96	4.81
Totals	38.22	30.1	21.05	3.56	17.49

***Contains the following categories:** Aviation or marine primers; aviation propeller coatings; corrosion-resistant brass, bronze, or copper coatings; exact match industrial; floral sprays; glass coatings; hobby/model/craft (h/m/c) enamel; h/m/c lacquer; h/m/c clear or metallic; marine spar varnishes; photographic coatings; pleasure craft finish primers, surfacers, or undercoatings; pleasure craft topcoats; shellac sealers, clear; shellac sealers, pigmented; slip-resistant coatings; spatter/multicolor coatings; webbing/veil coatings; weld-through primers; wood stains; and wood touch-up, repair, or restoration coatings.

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III.

PROPOSED AMENDMENTS TO THE AEROSOL COATINGS REGULATION AND THE VOLATILE ORGANIC COMPOUND DEFINITIONS IN THE CONSUMER PRODUCTS REGULATIONS

A. INTRODUCTION

In this chapter, we provide a plain English discussion of the proposed amendments to the aerosol coatings regulation**,** and explain the rationale for them. The discussion is intended to satisfy the requirements of Government Code section 11346.2(a), which requires that a noncontrolling, "plain English" summary of the regulation be made available to the public. The aerosol coatings regulation is codified in Title 17 of the California Code of Regulations (CCR), sections 94520-94528.

The aerosol coatings regulation reduces volatile organic compound (VOC) emissions from the use of aerosol coatings by imposing limits on their VOC content. At present, the regulation contains VOC limits for 35 product categories that would go into effect on December 31, 1999, if not amended. The proposed amendments would change the VOC limits for 23 product categories and would extend the effective date of the VOC limits for all 35 product categories until January 1, 2002. We have also proposed additional regulatory action to correct minor errors that currently appear in the official California Code of Regulations, as prepared by Barclays Law Publishers.

We have proposed amendments to three sections of the aerosol coatings regulation. The affected sections are: section 94521, "Definitions," section 94522, "Standards and Requirements for Aerosol Coating Products," and section 94524, "Administrative Requirements."

Health and Safety Code section 41712 and section 94522(g) of the aerosol coatings regulation require the Air Resources Board (ARB) to hold a hearing on the technological and commercial feasibility of achieving full compliance with the second-tier VOC limits by December 31, 1999, and to amend the VOC limits if necessary. The proposed amendments and the regulatory hearing to consider them will meet those requirements. Additionally, some of the proposed amendments address inaccuracies in the preparation of the official version of the aerosol coatings regulation, which is prepared and published by Barclays Law Publishers.

In addition to the other proposed amendments to the aerosol coatings regulation, we are proposing to exempt methyl acetate from the VOC definition in the aerosol coatings regulation as well as the consumer products regulation, and the antiperspirant and deodorant regulation. This

amendment would maintain consistency between our regulations, and the federal consumer products regulation, and would provide consumer product manufacturers additional compliance flexibility without detrimental air quality effects. This proposed amendment is discussed in detail using plain language in Section C below.

B. PROPOSED AMENDMENTS TO THE AEROSOL COATINGS REGULATION

1. Proposed Amendments to Definitions in section 94521 to Correct Errors in Barclays Official California Code of Regulations

The proposed amendments to the aerosol coatings regulation include editorial revisions to five definitions and the re-adoption of one definition. These revisions are needed to correct clerical errors in the preparation of the official version of the CCR. We are proposing to make editorial revisions to the definitions for "enamel", "exact match finish, engine paint", "exact match finish, industrial", "executive order", and "volatile organic compound". We are proposing to re-adopt a definition for "pleasure craft finish primer/surfacer/undercoater" because Barclays Law Publishers incorrectly omitted it in the official version of the CCR. With these proposed revisions, the definitions in the official version of the aerosol coatings regulation will be made identical to those previously adopted by the Board.

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

Section 94522 contains limits on the VOC content of 35 categories of aerosol coatings, the effective date for the limits, a prohibition on the sale of noncomplying coatings, reporting requirements and other provisions.

The principal effect of the proposed amendments to the aerosol coatings regulation is to change the allowable VOC content for 23 out of 35 categories of aerosol coatings. Another major change is to extend the effective date of the limits for all aerosol coating categories from December 31, 1999, to January 1, 2002, to provide manufacturers sufficient time to comply with the regulation. We are proposing less stringent limits for 12 product categories because we believe that the December 31, 1999, VOC limits for those categories are not technologically and commercially feasible. We are proposing more stringent limits for 11 product categories because we believe that the existing limits do not represent the most stringent feasible VOC limits. We are proposing to retain the existing limits for the remaining 12 product categories. The proposed amendments are shown in Table III-1.

Additionally, we are proposing to add section 94522(a)(3), which allows certain coatings that meet the definitions of both high-temperature coatings and metallic coatings to be subject to the VOC limit for metallic coatings. This revision is needed to ensure that the proposed limit for these coatings is technologically and commercially feasible. The proposed amendments would also restore language in section 94522(d) which was omitted by Barclays in the official version of the CCR. We are proposing to delete section 94522(g) because the November 19, 1998, hearing will fulfill the hearing requirement. We then propose to renumber 94522(h) as 94522(g).

TABLE III-1
Proposed Changes to the VOC Content Standards for Aerosol Coating Products

Category	Allowable VOC Content (percent by weight) Existing 1/8/96	Existing 12/31/99	Proposed 1/1/2002
General Coatings			
Clear Coatings	67.0	40.0	50.0
Flat Paint Products	60.0	30.0	40.0
Fluorescent Coatings	75.0	45.0	60.0
Metallic Coatings	80.0	50.0	65.0
Nonflat Paint Products	65.0	30.0	45.0
Primers	60.0	30.0	40.0
Specialty Coatings			
Art Fixatives or Sealants	95.0	70.0	60.0
Auto Body Primers	80.0	50.0	45.0
Automotive Bumper and Trim Products	95.0	75.0	75.0*
Aviation or Marine Primers	80.0	70.0	70.0*
Aviation Propeller Coatings	84.0	75.0	70.0
Corrosion Resistant Brass, Bronze or Copper Coatings	92.0	70.0	70.0*
Exact Match Finishes			
Engine Enamel	80.0	60.0	50.0
Automotive	88.0	60.0	50.0
Industrial	88.0	60.0	70.0
Floral Sprays	95.0	85.0	70.0
Glass Coatings	95.0	80.0	65.0
Ground Traffic/Marking Coatings	66.0	40.0	45.0
High Temperature Coatings	80.0	55.0	60.0
Hobby/Model/Craft Coatings			
Enamel	80.0	70.0	70.0*
Lacquer	88.0	70.0	70.0*
Clear or Metallic	95.0	75.0	80.0
Marine Spar Varnishes	85.0	70.0	60.0
Photograph Coatings	95.0	70.0	70.0*
Pleasure Craft Finish Primers, Surfacers or Undercoaters	75.0	55.0	55.0*
Pleasure Craft Topcoats	80.0	55.0	55.0*
Shellac Sealers - Clear	88.0	70.0	70.0*
Shellac Sealers - Pigmented	75.0	60.0	60.0*
Slip-Resistant Coatings	80.0	70.0	60.0
Spatter/Multicolor Coatings	80.0	60.0	55.0
Vinyl/Fabric/Leather/Polycarbonate Coatings	95.0	70.0	70.0*
Webbing/Veil Coatings	90.0	70.0	80.0
Weld-Through Primers	75.0	60.0	50.0
Wood Stains	95.0	75.0	75.0*
Wood Touch-Up, Repair or Restoration Coatings	95.0	75.0	90.0

* VOC standards marked with an asterisk are the same as the existing December 31, 1999, standards.

3. Proposed Amendments to Administrative Requirements, section 94524

Proposed changes to section 94524 include deleting subdivision (c)(2) to repeal reporting requirements which have expired, and renumbering subdivisions (3) and (4) as subdivisions (2) and (3), respectively. In addition, two amendments would restore language in subdivision (d), accidentally omitted by Barclays in preparation of the official records of the CCR, and would correct an incorrect code citation in subdivision (e)(1).

C. PROPOSED AMENDMENT TO THE VOC DEFINITIONS IN THREE CONSUMER PRODUCT REGULATIONS

1. Description of the Amendment

We are proposing to modify the VOC definitions in the aerosol coatings regulation, the consumer products regulation and the antiperspirant and deodorant regulation (consumer products regulations, Title 17, CCR) to exempt methyl acetate as a low reactive VOC. The proposed amendment affects section 94501, "Definitions", in the antiperspirant and deodorant regulation, section 94508, "Definitions", in the consumer products regulation and section 94521, "Definitions", in the aerosol coatings regulation. The modification also affects the Alternative Control Plan (ACP) Regulation for consumer products and aerosol coatings because the ACP regulation incorporates the VOC definition in these regulations by reference (see Title 17, CCR, Article 4, Alternative Control Plan, sections 94540-94555).

This proposed VOC exemption does not affect the regulations implemented by the local air pollution control districts in California. Before considering exempting methyl acetate from the VOC definition in their rules, air districts would need to conduct their own environmental impacts analysis to justify such an exemption.

2. Rationale for this Amendment

The U.S. Environmental Protection Agency (U.S. EPA) exempted methyl acetate from its VOC definition in May 1998 (63 FR 17331). The exemption was based on recent studies documenting the negligible contribution to ground-level ozone formation from this compound (i.e. negligible photochemical reactivity). Subsequent to the U.S. EPA's exemption of methyl acetate, the ARB was petitioned by Eastman Chemical Company to exempt methyl acetate from the VOC definitions in the consumer products regulations. In response to this petition we began a comprehensive evaluation to determine whether any significant adverse impacts to the environment could result from exempting methyl acetate from the VOC definition in California's consumer products regulations. Given the air quality needs of California, we believe that it is important to conduct analyses that are specific to California conditions. Our environmental impacts assessment for this proposal is presented in Chapter VII. If adopted, this exemption would provide manufacturers additional flexibility in formulating complying products without increasing ground-level ozone levels.

IV.

DEVELOPMENT OF THE PROPOSED AMENDMENTS TO THE AEROSOL COATINGS REGULATION

PROCESS FOR DEVELOPING THE PROPOSED VOC LIMITS

The proposed amendments to the aerosol coatings regulation were developed over approximately a one year period during which we worked closely with the affected aerosol coatings industry and trade associations. One of our first actions was to conduct a comprehensive survey of aerosol coatings manufacturers selling products in California. The survey requested data on research and development efforts, and the formulations and sales of products sold in California in 1997. In addition to reviewing the survey data, each aerosol coatings category was investigated using technical information such as industry publications, product catalogs, and extensive discussions with aerosol coatings manufacturers.

We conducted three public workshops with interested parties while developing the proposed amendments to the regulation. The workshops were well attended with representatives from industry, trade associations, and aerosol coatings suppliers. Several manufacturers of aerosol coatings have been actively involved in the regulatory process. These manufacturers have attended all of the public workshops, have met with ARB staff on several occasions, and have arranged for informational tours at their manufacturing facilities in California.

Associations that have been involved include the National Paint and Coatings Association (NPCA), and the Western Aerosol Information Bureau (WAIB). Representatives of these associations have also attended all of the workshops, met with ARB staff on several occasions, and arranged for informational facility tours.

A chronology of the meetings held is shown below in Table IV-1.

TABLE IV-1
Summary of Meetings

Date	Meeting/Workshop	Location
August 21, 1997	Meeting with representatives of California State University regarding "Speciation Profiles" research contract	San Luis Obispo
August 26, 1997	Meeting with Diversified Brands at their California manufacturing facility	Anaheim
August 26, 1997	Meeting with U.S. Can Co. at their California manufacturing facility	Commerce
January 13, 1998	Meeting with industry representatives	Sacramento
February 9, 1998	Meeting with industry representatives	San Francisco
April 15, 1998	Meeting with Diversified Brands and NPCA at Flecto's California manufacturing facility	Oakland
May 5, 1998	Consumer Products Working Group (CPWG) meeting	Sacramento
May 19, 1998	Public Workshop	Sacramento
June 23, 1998	Meeting with industry representatives	Sacramento
July 1, 1998	Meeting with industry representatives	Conference Call
July 9, 1998	Meeting with industry representatives	Sacramento
July 23, 1998	Public Workshop	Sacramento
August 19, 1998	Public Workshop	Sacramento

V.

TECHNOLOGICAL AND COMMERCIAL FEASIBILITY OF THE PROPOSED VOLATILE ORGANIC COMPOUND (VOC) LIMITS

In this chapter, we present why we believe that the proposed VOC limits meet statutory requirements regarding technological and commercial feasibility. However, the proposed limits do not achieve the 60 percent reduction in VOC emissions specified in State law. As part of this analysis, we discuss in detail the reformulation techniques that can be used by manufacturers to reformulate their products to meet the proposed VOC limits.

A. FEASIBILITY

Health and Safety Code section 41712 requires all consumer product regulations adopted by the Board to be "technologically and commercially feasible." Section 41712 also directs the Board to achieve the "maximum feasible reduction in VOCs emitted" from the use of aerosol paints, which is defined in section 41712(a)(3) as at least a 60 percent reduction in the emissions of VOCs resulting from the use of aerosol paints. The existing December 31, 1999, limits in the aerosol coatings regulation were designed to achieve a 60 percent reduction in VOC emissions. However, we believe that many of these limits are not technologically and commercially feasible, as explained in Chapter VI. For this reason, we are proposing less stringent VOC limits for twelve categories. In other categories, the December 31, 1999, limits do not appear to represent the most stringent feasible VOC limits. For these eleven categories, we are proposing more stringent VOC limits. We are proposing to retain the December 31, 1999, limits for the remaining twelve categories. In addition, we are proposing to extend the effective dates of all the limits to January 1, 2002, to allow adequate time for reformulation and product testing.

During the development of our existing consumer product regulations, the ARB staff described its interpretation of the statutory criteria regarding technological and commercial feasibility. These statutory criteria were followed in setting the proposed VOC limits for aerosol coatings. The ARB staff's interpretation is summarized below.

1. Technological and Commercial Feasibility

Technologically Feasible

Health and Safety Code section 41712(d) requires the Board to adopt consumer product regulations that are "technologically feasible." Technological feasibility is a different concept than "commercial feasibility," and does not take into account the cost of the complying product. The staff believes that a proposed limit is technologically feasible if it meets at least one of the following criteria: (1) the limit is already being met by at least one product within the same category, or (2) the limit can reasonably be expected to be met in the time frame provided through additional development efforts. In terms of compliance with the proposed VOC limits, there are complying products in each aerosol coating category with the exception of "flat coating products" and "corrosion resistant brass, bronze, or copper coatings." In the case of "flat coating products," Chapter VI explains the available reformulation techniques that can be used to achieve compliance by the proposed effective date. In the case of "corrosion resistant brass, bronze, or copper coatings," only one product was reported and the manufacturer has indicated that the product can be reformulated to the proposed limit (Protective Coatings Unlimited). Chapter VI shows the number of complying products and complying market share at the proposed VOC limit for each aerosol coating category.

In setting the proposed VOC limits for each of the aerosol coatings categories, staff made an effort wherever possible to ensure that multiple reformulation technologies exist which would allow products to comply. Proposed limits were set at VOC levels that staff determined could be met without increased use of toxic air contaminants or ozone-depleting compounds. General reformulation options include increased use of solids, or use of exempt solvents or propellants, as explained in detail in Sections B and C of this chapter. Multiple reformulation options allow flexibility in the design of compliant products, ensuring that efficacious, cost-effective products will be brought to the marketplace.

Commercially Feasible

Health and Safety Code section 41712(d) also requires the Board to adopt consumer product regulations that are "commercially feasible." The term "commercially feasible" is not defined in State law. In interpreting this term, the staff has utilized the reasoning employed by the United States Court of Appeals for the District of Columbia in interpreting the federal Clean Air Act. In the leading case of International Harvester Company v. Ruckelshaus, (D.C. Cir. 1973) 478 F. 2d 615, the Court held that the United States Environmental Protection Agency could promulgate technology-forcing motor vehicle emission limits which might result in fewer models and a more limited choice of engine types for consumers, as long as the basic market demand for new passenger automobiles could be generally met.

Following this reasoning, the staff has concluded that a regulation is "commercially feasible" as long as the "basic market demand" for a particular aerosol coating product can be

met. "Basic market demand" is the underlying need of consumers for a product to fulfill a basic, necessary function. This must be distinguished from consumer "preference," which may be towards specific attributes of a particular product.

We believe our proposed VOC limits meet the criteria for commercial feasibility because: (1) complying products are already available in nearly all of the product categories, as stated above; (2) several compliance options are available to the industry, providing flexibility to manufacturers when reformulating their products; (3) the reformulation options are cost-effective, as explained in detail in Chapter VIII; and (4) the 35 individual VOC limits are designed to assure that each of the different types of aerosol coatings will be available to consumers.

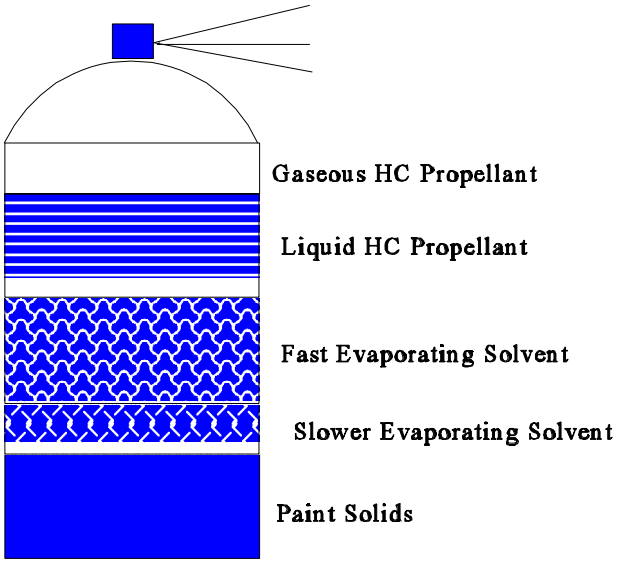
B. REFORMULATION OPTIONS

1. Reformulation Options for Solvent-based Aerosol Coatings

Product Formulation

Before explaining the reformulation options available, a quick review of current solvent-based aerosol coatings is provided below.

Figure V-1
Solvent-Based Aerosol Coating



As shown in Figure V-1, solvent-based aerosol coatings consist primarily of propellants (which exist in an equilibrium state between the gaseous and liquid forms), fast and slower evaporating solvents, and coating solids. In actuality, all of the ingredients except the gas phase

propellant are in a single homogeneous phase after the product is shaken to evenly distribute the coating solids. The hydrocarbon propellants and solvents (except acetone) account for the VOCs, while the solids and acetone account for the non-VOC ingredients. The propellants are almost without exception hydrocarbon blends including propane, n-butane, or isobutane. A wide variety of solvents are used including ketones, esters, alcohols, aliphatic and aromatic hydrocarbons. Generally, a balance of fast and slower evaporating solvents is used, with a larger proportion of fast evaporating solvent.

Reformulation Options

Several reformulation methods are available to manufacturers to reduce the VOC emissions from solvent-based aerosol coatings. Most likely, a combination of two or more of the methods described below will be employed to achieve the proposed January 1, 2002, VOC limits. We believe that the following reformulation techniques (or a combination of these) are most likely to be utilized by manufacturers in reformulating their solvent-based products:

- Replacing some of the solvents with acetone;
- Replacing some of the medium evaporating solvent with parachlorobenzotrifluoride;
- Replacing some of the hydrocarbon propellant with hydrofluorocarbon-152a; or
- Increasing the proportion of coatings solids.

Acetone

Acetone is a fast drying exempt VOC solvent that has been widely used in aerosol coatings even before VOC regulations were enacted. The ARB approved the exemption of acetone as a VOC due to its low reactivity (potential to form tropospheric ozone) on September 28, 1995. When this exemption became legally effective on February 29, 1996, most products became compliant with the first-tier limits (effective January 8, 1996) without reformulation due to the combination of acetone and solids. Acetone currently accounts for a significant proportion of aerosol coatings formulations as shown in Table V-1.

TABLE V-1: Percentage of Acetone in Selected Aerosol Coatings Categories*

Category	**Percentage Acetone**
Clear Coatings	25
Flat Coatings	27
Fluorescent Coatings	5
Metallic Coatings	9
Nonflat Coatings	26
Primers	21
Ground Traffic/Marking Coatings	3

* Based on 1997 ARB Aerosol Coatings Survey

Acetone is widely used in aerosol coatings because it is a fast drying solvent with excellent solvency. The properties of acetone are summarized in Table V-2.

TABLE V-2
Physical Properties of Acetone*

Formula	CH_7COCH_3
Molecular Weight	58.1
Boiling Point, degrees F ©	133 (56)
Vapor Pressure, mm Hg @ 20° C	185.5
Evaporation Rate, n-BuOAc=1	5.6
Density, g/cc @ 20° C	0.792
Kauri-Butanol Value	N/A
Surface Tension in Air: dynes/cm @ 20° C	22.3
Solubility parameter $(cal/cm^3)^{1/2}$	10
Flash Point, TCC degrees F ©	- 15 (-26)

* Shell Chemical Company

We expect that many manufacturers will be able to lower the VOC content of their coatings by replacing some of their solvents with acetone. Several manufacturers have reported using acetone in combination with other exempt solvents and propellants to achieve the lowest possible VOC levels in the laboratory (Chase Products, Seymour of Sycamore, Zynolyte). However, we realize that there are limitations to this option. For example, aerosol coatings must maintain a balance between fast evaporating solvents and slower evaporating solvents. Too much fast evaporating solvent such as acetone can produce defects such as bubbles, pinholes, or "blushing" (Hydrosol; Plasti-kote; Raabe; Seymour of Sycamore). One manufacturer also reported that high solids aerosol coatings can be difficult to formulate with large amounts of acetone because high solids coatings require large quantities of slower evaporating processing solvents (Plasti-kote). In addition, as explained in Chapter VI, fluorescent (including fluorescent ground traffic or marking coatings) and leafing metallic coatings cannot tolerate as much acetone as other coatings.

Parachlorobenzotrifluoride (PCBTF)

PCBTF (also known by the trade name Oxsol 100) is an exempt solvent that has the potential to be used in modest amounts in aerosol coatings to replace some of the medium evaporating solvents. The ARB approved the exemption of PCBTF as a VOC due to its low reactivity on September 28, 1995. In addition, PCBTF is not an ozone depleting substance or a

federal hazardous air pollutant. It is not currently used in aerosol coatings, but is used in nonaerosol coatings, inks, adhesives and other resin applications (Occidental Chemical). Manufacturers also reported using it in their research and development efforts to meet the December 31, 1999, VOC limits. Its properties, shown in Table V-3, are comparable to many of the solvents currently used in aerosol coatings.

TABLE V-3*
Physical Properties of PCBTF (Oxsol 100)**

Formula	$C_7H_4F_3Cl$
Molecular Weight	180.5
Boiling Point, degrees F ©	282 (139)
Vapor Pressure, mm Hg @ 20° C	5.3
Evaporation Rate, n-BuAc=1	0.9
Density, g/cc @ 20° C	1.34
Kauri-Butanol Value	64
Surface Tension in Air: dynes/cm @ 20° C	25
Solubility parameter $(cal/cm^3)^{1/2}$	8.6
Flash Point, TCC degrees F ©	109 (43)

* Occidental Chemical Corporation
** Oxsol 100 is a registered trade name of the Occidental Chemical Corporation

PCBTF has a solubility parameter similar to VM&P naphtha, and is an excellent solvent for a wide variety of resins (Hare; Nagy). It has a mid-range boiling point and vapor pressure (evaporation rate) similar to xylene, which is often used in aerosol coatings. It is also very stable in coatings formulations, nonhygroscopic, and is less flammable than many traditional coatings solvents (Hare).

PCBTF is not currently used in aerosol coatings because it is more expensive than other solvents. Specifically, it is estimated to cost $1.70/pound, depending on the amount purchased (OxyChem, 5/21/98). This is several times the cost of other solvents typically used in aerosol coatings. However, it is expected that it would be used in relatively small amounts to achieve compliance.

PCBTF also has a strong odor. Its odor threshold is reported to be 0.1 ppm (Oxychem, 5/29/98), which is lower than most other solvents typically used in aerosol coatings. However, as stated above, it is expected that PCBTF would be used in relatively small amounts to

achieve compliance. Also, masking agents are available that can be used to alter the natural aromatic odor of PCBTF (Oxychem, 7/30/98).

Hydrofluorocarbon-152a (HFC-152a)

HFC-152a (or Dymel 152a) is a non-VOC propellant that can be used to replace part of the hydrocarbon propellants currently used in aerosol coatings. Also, unlike CFC's and HCFC's, HFC-152a is not an ozone-depleting substance. HFC-152a is not currently used in aerosol coatings. However, it is used in other aerosol consumer products. Manufacturers also reported using it in their research and development efforts to meet the December 31, 1999, VOC limits.

As shown in Table V-4, HFC-152a has many properties similar to the hydrocarbon propellants currently used in aerosol coatings.

TABLE V-4* Physical Properties of HFC-152a (Dymel 152a**)	
Formula	CH_3CHF_2
Molecular Weight	66
Boiling Point, degrees F ©	-13 (-25)
Vapor Pressure, psig (bar) @ 70º F (21º C)	63 (4)
Vapor pressure, psig (bar) @ 130º F (54º C)	177 (12)
Density, g/cc @ 70º F (21º C)	0.91
Kauri-Butanol Value	11
Flammability Limits in Air, vol. %	3.9 to 16.9
Flash Point, degrees F ©	< -58 (< -50)

* E.I. du Pont de Nemours and Company (Du Pont)
** Dymel 152a is a registered trade name of E.I. du Pont de Nemours and Company

HFC-152a is not currently used in aerosol coatings because it is more expensive than other propellants. Specifically, it is estimated to cost $1.85 per pound (Du Pont, 1996), compared with approximately $0.20 per pound for the hydrocarbons depending on the blend, amount purchased, and the location of purchase (Aeropres). For this reason, manufacturers are expected to use only enough to meet the proposed VOC limits.

Manufacturers have reported that some resins, including acrylic lacquers, nitrocellulose lacquers, hydrocarbon resins, and fast-drying short-oil alkyds, are less tolerant of HFC-152a (Zynolyte; Plasti-kote). Specifically, they reported that these resins may precipitate out ("kick out") if too much HFC-152a is used. In response to these concerns, Du Pont conducted solubility tests with HFC-152a and the resins mentioned above, and did not encounter precipitation of the resins (Du Pont, 1998). Nevertheless, if a manufacturer's formulation is not compatible with HFC-152a, they can use an alternative resin, use less HFC-152a, or use the other reformulation options described in this chapter.

In addition, some manufacturers have reported that because HFC-152a is more dense, it results in a coarser spray compared with the hydrocarbon propellants (Plasti-kote). In this case, manufacturers may try a different propellant blend, or try using a different spray valve.

High-solids Formulations

Manufacturers can reduce the VOC content of their products by increasing the amount of coating solids (resins and pigments). The extent to which this is possible for the various aerosol coatings categories is well established because manufacturers primarily used higher solids formulations to meet the Bay Area Air Quality Management District's (BAAQMD's) aerosol

coatings regulation in 1991 (before acetone was exempted as a VOC). For example, a typical solvent-based nonflat aerosol coating met the 65 percent VOC limit by increasing coating solids to 35 percent of the formulation. The average aerosol coating now has approximately 20 percent solids because acetone is available to reduce the VOC content (ARB 1997 Aerosol Coatings Survey).

A potential advantage of high solids aerosol coatings, beyond a reduction in VOC content, is that the increased coating solids may allow extended use of the product. This is based on the concept that a product with more coating solids can potentially cover more surface area. Although there is some disagreement within the aerosol coatings industry about whether higher solids products result in greater coverage, some manufacturers advertise their higher solids products as premium products with greater coverage.

High solids products also have some potential disadvantages. Due to the high cost of pigments and other coating solids, high solids coatings tend to cost more than conventional lower solids formulations. However, the cost per amount of coatings delivered may be less.

In reformulating to higher solids products, the formulator may not be able to simply increase the amounts of the same solids used in a conventional formulation. This is because the viscosity of the product may increase to the point that the product will not spray out in a fine mist. Therefore, other changes to the formulation may also have to be made to reduce the viscosity as explained in detail in the previous aerosol coatings staff report (ARB, 1995).

Emerging Technologies for Solvent-Based Products

We believe that the reformulation options described above are the most likely to be utilized by manufacturers. However, new exempt compounds or emerging technologies may provide additional reformulation options in the future.

Potential New Exempt Solvents

Additional solvents may be approved by the ARB for exemption from the VOC definition. For example, methyl acetate is a fast drying solvent that has been exempted from the U.S. EPA's VOC definition, and is being proposed for exemption by the ARB in this regulatory action. Methyl acetate has a similar evaporation rate and solvency as acetone, but with differences in odor and other properties (Eastman Chemical). However, some manufacturers have reported that they do not expect methyl acetate to assist them in reformulation efforts because it is similar to acetone, but more expensive.

Tertiary-butyl acetate is another solvent that may potentially be exempted. The U.S. EPA has received a petition to exempt this compound.

Reactive Diluents

A reactive diluent is a liquid which is a VOC during application and one which, through chemical and/or physical reaction, such as polymerization, becomes an integral part of the coating (SCAQMD). Research has been conducted to determine if reactive diluents can be used to produce low VOC nonaerosol coatings (Badou). In the future, this technology may provide an additional method of reformulating aerosol coatings to the proposed VOC limits.

Compressed Gas Propellants

Compressed gas propellants such as carbon dioxide and nitrogen have been used successfully in aerosol products for many years, but have not yet been used in aerosol coatings. Manufacturers have conducted some research on these propellants, but have not yet found them to be as effective at lowering VOC content as other reformulation methods (Zynolyte; Seymour of Sycamore).

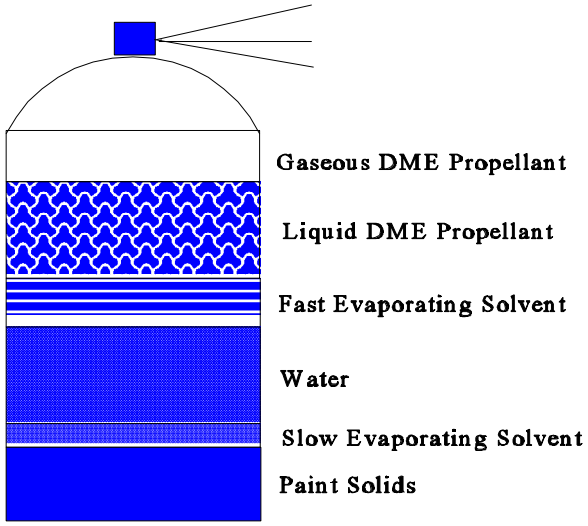
2. Reformulation Options for Water-based Aerosol Coatings

Product Reformulation

Water-based aerosol coatings account for about five percent of the aerosol coatings market. These products are formulated differently than solvent-based products, and therefore their reformulation options are different. Before explaining the reformulation options, a quick review of water-based aerosol coating formulations is provided on the following page.

As shown in Figure V-2, water-based aerosol coatings consist primarily of dimethyl ether propellant (which exists in an equilibrium state between the gaseous and liquid forms), water, fast and slower evaporating water-miscible solvents, and coating solids. Figure V-2 does not show ingredients used in small amounts such as surfactants, solvents used as carriers for resins, drying agents, wetting agents, and thickeners. The propellant in water-based products is almost always dimethyl ether (DME) because it is water-soluble, unlike the hydrocarbon propellants. The fast evaporating solvents are typically alcohols such as ethyl or propyl alcohol, while the slower evaporating (coalescing) solvents are generally glycols or glycol ethers.

Figure V-2
Water-Based Aerosol Coatings



In "water-reducible" water-based aerosol coatings, all the ingredients except the gas phase propellant are in a single homogeneous phase (after the product is shaken to evenly distribute the coating solids). In most "emulsion" or "dispersion" water-based systems, the resin and carrier solvent are dispersed in tiny "droplets" within the "continuous" phase of water, water soluble solvents, and liquid dimethyl ether propellant. The previous aerosol coatings staff report provides a detailed discussion of the different types of water-based aerosol coatings (ARB, 1995).

Reformulation Options for Water-based Aerosol Coating Products

Most water-based coatings are lower in VOC content than their solvent-based counterparts. As shown in Table V-5 below, the sales-weighted average VOC contents of water-based products are much closer to the proposed limits than the solvent-based products. In fact, in the "clear coatings" and "spatter/multicolor" coating categories, the sales-weighted average VOC (SWA VOC) content of the water-based products is below the proposed limit, and the majority of these products already comply with the proposed limits. In the other categories, there are few complying products, but many that are close to complying with the proposed limits. These products could comply with relatively minor formulation changes.

Table V-5* Comparison of Sales-Weighted Average VOC Contents of Water-Based and Solvent-Based Products			
Category	Proposed VOC Limit (%)	SWA VOC of Water-based Coatings (%)	SWA VOC of Solvent-based Coatings (%)
Clear Coatings	50	47	60
Nonflat Coatings	45	48	52
Ground Traffic or Marking Coatings	45	52	65
Spatter/Multicolor Coatings	55	48	48
* Based on 1997 ARB Aerosol Coatings Survey. Categories listed account for 94 percent of water-based coatings by weight.			

Manufacturers can reformulate their water-based products to the proposed limits by:

- Replacing some of the DME propellant and/or solvents with water or paint solids;
- Replacing some of the DME propellant with HFC-152a; or
- Replacing some of the solvent with acetone.

Replacement of DME and/or VOC solvent with water or paint solids

Water-based aerosol coatings may be able to achieve the proposed VOC limits by replacing a small amount of the DME propellant and/or VOC solvents with water or paint solids. At least one manufacturer stated that they intend to investigate various proportions of DME, solvents, water, and paint solids to achieve a complying system (Diversified Brands). Since water-based coatings are often finely balanced formulations, even small reductions in the DME or solvent content may require significant development work, including changes in the type of resins used. Manufacturers may need to investigate different types of water-based "systems" (including "water-reducible" formulations, emulsions, and dispersions) to determine the type that is best suited to achieving the proposed limits.

Acetone and HFC-152a

Water-based products cannot *readily* use significant quantities of acetone or HFC-152a to reduce their VOC content (as solvent-based products can). This is because HFC-152a is not water-soluble, and acetone may destabilize emulsions or result in resin "kickout" or "gumming" (Diversified Brands; K-G Packaging; Seymour of Sycamore). However, at least one

manufacturer is investigating ways to use acetone up to levels of 10 percent to reduce the VOC content of their products (K-G Packaging). Since many water-based products are very close to the proposed limits, a small amount of acetone would be sufficient for many products to comply. This manufacturer is also investigating using blends of HFC-152a and DME in water-based products. According to the manufacturer, this technology may potentially allow flat or nonflat water-based products to achieve a 40 percent VOC level (K-G Packaging).

3. Reactivity-based Reformulation Options

We are developing a voluntary compliance alternative based on the science of reactivity. Reactivity is a measure of a VOC's potential to form ozone in the air we breathe. Of the many different VOCs released into the atmosphere, each reacts at a different rate and through a different chemical reaction mechanism. The VOCs with high reactivity have a greater potential to form ozone, while other VOCs react slowly in the atmosphere, and are less likely to form ozone. Using a reactivity scale we can account for the differences in VOC reactivities, and use the differences to control emissions from aerosol coatings. Our reactivity program would be based on the maximum incremental reactivity (MIR) scale developed by Dr. William Carter of the University of California at Riverside. To ensure that the best available science is reflected in this scale, we are in the process of having Dr. Carter's work peer reviewed. Following this review, we plan to present our proposal to the Board in 1999.

We intend to propose a new voluntary regulation, the California Low Emissions and Reactivity (CLEAR) Regulation for Aerosol Coatings. With the CLEAR Regulation manufacturers would be able to choose to comply with either the mass-based or the reactivity-based VOC limits, which ever are more cost-effective. The proposed reactivity limits would be designed to achieve equivalent ozone reductions while providing compliance flexibility.

C. ISSUES

1. *Issue: HFC-152a and PCBTF are unproven for use in aerosol coatings and are more expensive than currently used compounds.*

Response: Although HFC-152a and PCBTF are not currently used in aerosol coatings, we believe they can be used to reformulate products to meet the proposed limits. As explained in this chapter, these compounds have properties that make them viable alternatives to the existing solvents and propellants used in aerosol coatings. Manufacturers have used these compounds in their research and development efforts to meet the December 31, 1999, VOC limits for the general coating categories, and have been able to successfully lower the VOC content of their products. The primary reason that these compounds are not used in currently marketed products is that they are more expensive. However, as explained in Chapter VI, they could be used in relatively small amounts to formulate complying products.

2. ***Issue: Parachlorobenzotrifluoride (PCBTF) has a strong odor that customers will not accept.***

Response: While PCBTF does have a strong odor, manufacturers will generally be able to add small amounts to their formulations to achieve compliance (as explained in Chapter VI). In addition, many of the other solvents already used in aerosol coatings have strong odors. Finally, as explained in this chapter, masking agents are available that can be used to hide the odor.

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VI.

DESCRIPTION OF PROPOSED VOC LIMITS FOR AEROSOL COATING PRODUCT CATEGORIES

A. LEGAL REQUIREMENTS

In this chapter, we summarize the proposed VOC limits for each of the 35 categories (six general and 29 specialty) of aerosol coating products, and the possible methods of achieving compliance with these limits. State law requires that we review the commercial and technological feasibility of the December 31, 1999, VOC limits by December 31, 1998. State law allows an extension of up to five years if the December 31, 1999, VOC limits are not technologically and commercially feasible. State law also requires that we propose the most stringent interim limits during any such extension. Our review shows that for twelve of the aerosol coating categories, the December 31, 1999, VOC limits are not technologically and commercially feasible. Therefore, we are proposing less stringent VOC limits for these categories. For eleven other categories, we have found that the December 31, 1999, limits do not represent the most stringent feasible VOC limits. We are proposing more stringent limits for these categories. We are proposing to retain the existing limits for the remaining twelve categories. For all of the proposed limits, we are proposing to extend the effective date to January 1, 2002, to allow manufacturers sufficient time to develop complying formulations. We are also proposing that all of the proposed VOC limits replace the December 31, 1999, limits as the final limits. Based on our review of current and emerging technology in Chapter V, many of the December 31, 1999, limits are not expected to be technologically and commercially feasible even with the maximum five-year extension. However, we will continue to evaluate emerging technologies for aerosol coatings to determine if further reductions are feasible in the future.

B. DESCRIPTION OF SEVEN MAJOR CATEGORIES

In this section, we provide a brief description of the seven categories which account for the majority of emissions (86 percent) from aerosol coating products. For these categories, the ARB is proposing less stringent VOC limits than the existing December 31, 1999, limits. This is the case because we have determined that the December 31, 1999, limits are not

technologically and commercially feasible even with a five year extension. The basis for this proposal is discussed below.

The data presented in this section reflect information reported in the 1997 ARB Aerosol Coatings Survey as of July 30, 1998. The data presented on complying market share and the number of complying products reflect data received as of June 30, 1998. Although the data received as of June 30, 1998, do not reflect a few late survey submittals, it is substantially complete and was reviewed by the industry (in nonconfidential summary form) to correct erroneous complying products.

1. Clear Coatings:

Product Category Description:

Aerosol clear coatings are general use coatings that are colorless and contain resins, but no pigments or fillers other than flatting agents. Flatting agents (also called flatting pigments), may be included in the formulation to decrease the gloss of a clear coating without adding color to the film (for example to produce a flat, or "satin" clear finish).

Clear coating products are formulated as both solvent-based and water-based formulations. However, solvent-based formulations account for the majority of sales (92.5 percent). A variety of resin types are used, including alkyds, polyurethanes, acrylic and nitrocellulose lacquers. Although coating properties vary with individual formulations, certain resin types generally yield particular coating characteristics. For instance, polyurethane resins generally yield coatings that are hard and resistant to scratches and abrasion, while acrylic lacquers are known for their resistance to "yellowing."

There are several "specialty" coating categories defined in the regulation that may also include clear coating products. However, these clear coatings, which perform specialized functions, are not included in the general clear coating category. Examples of specialty categories that include clear coatings are the "art fixative or sealant" category, the "corrosion resistant brass, bronze, or copper coating" category, and the "photograph coatings" category, among others. Clear coating products with specialized uses unlike those defined for the specialty categories would be categorized in the general clear coating category.

The aerosol clear coatings category is the sixth largest aerosol coating category in terms of sales and emissions according to the 1997 ARB Aerosol Coatings Survey. As shown in Table VI-1, clear coatings had estimated sales of 1.6 tons per day in 1997, or about four percent of the aerosol coatings market. The VOC emissions from this category account for an estimated 0.95 tons per day, or about five percent of the emissions from aerosol coatings.

TABLE VI-1
Clear Coatings*

Number of Products	Category Sales (tons/day)	VOC Emissions (tons/day)
128	1.6	0.95

* Based on ARB 1997 Aerosol Coatings Survey.

Proposed VOC Limit and Compliance:

As shown in Table VI-2 below, the proposed VOC limit for clear coatings is 50 percent by weight, effective January 1, 2002. This limit is higher than the December 31, 1999, limit of 40 percent. After review of the 1997 ARB Aerosol Coatings Survey data, research and development reports, and conversations with individual manufacturers (Chase; Deft; Flecto; Hydrosol; K-G Packaging; Rudd), ARB staff determined that the existing 40 percent limit is not technologically and commercially feasible. Specifically, in addition to the reformulation constraints on general coatings (as explained in the discussion of flat, nonflat, and primer coatings), clear coatings generally have less total solids and higher VOC contents because resins increase viscosity more than other coating solids. According to the 1997 ARB Aerosol Coatings Survey, clear aerosol coatings have a sales-weighted average VOC content of 59 percent, which is higher than the sales-weighted average VOC content of 51 percent for flats and primers, and 53 percent for nonflats.

As shown in Table VI-2 below, there are currently 22 complying products at the ARB proposed limit of 50 percent. These products represent 19 percent of the market, and include both solvent-based formulations that comply with the use of acetone, and water-based formulations.

TABLE VI-2
Clear Coatings*

12/31/99 VOC Limit (wt.%)	1/1/2002 Proposed VOC Limit (wt.%)	Sales-Weighted Average VOC (%)	Complying Market Share (%)	Number of Complying Products	Emission Reductions (tons/day)
40	50	59	19	22	0.16

* Based on ARB 1997 Aerosol Coatings Survey.

Noncomplying solvent-based products can be reformulated using the following options explained in more detail in Chapter V: (1) increasing the amount of acetone in the formulation; (2) increasing the amount of solids (in this case resins) in the formulation; (3) using the exempt propellant hydrofluorocarbon 152a (HFC-152a); or (4) using the exempt solvent parachlorobenzotrifluoride (PCBTF).

Solvent-based products that are within a few percent of the proposed 50 percent limit will most likely slightly increase their acetone and/or resin content to achieve compliance. For products further from the proposed limit, manufacturers can switch to a resin system that is:

(1) lower in viscosity, which will allow a higher resin content; or (2) compatible with a higher acetone content. Another option would be to utilize a combination of approaches including the use of HFC-152a or PCBTF to reach compliance. For example, as shown in Table VI-3 below, a typical 60 percent VOC solvent-based clear coating product with 15 percent solids and 25 percent acetone could replace 15 percent of its hydrocarbon propellant with HFC-152a to comply with the 50 percent limit.

TABLE VI-3: Solvent-Based Clear Coating Formulations	
Typical 60% VOC Product	**Complying 50% Formulation**
25% hydrocarbon propellant	10% HFC-152a propellant
35% VOC solvents	15% hydrocarbon propellant
25% acetone	35% VOC solvents
15% solids	25% acetone
	15% solids

Since about 83 percent of water-based clear coatings already comply with the proposed 50 percent VOC limit (ARB), manufacturers can reformulate their water-based products using existing technology to reduce the amount of DME propellant and/or VOC solvents.

Issue: The industry has proposed a higher 55 percent VOC limit for clear coatings.

Response: Although the industry has proposed a higher 55 percent VOC limit for clear coatings, we believe the 50 percent limit is technologically and commercially feasible. There are already 22 products representing 19 percent of the market that comply with the proposed limit without any incentive to lower their VOC content below the current 67 percent VOC limit. In addition, manufacturers have reported that they can reformulate their products to a 50 percent VOC level (Flecto; Chase). Noncomplying products can be reformulated using the options described in this chapter. We are also proposing to extend the effective date of the December 31, 1999, limits to January 1, 2002, to provide additional time for manufacturers to develop complying products.

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K-G Packaging. Telephone conversation with ARB staff. May 13, 1998. (K-G Packaging)

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2. Flat Coating Products:

Product Category Description:

Flat aerosol coating products are aerosol coatings with a low gloss level, as described below, or products that are labeled as flat coatings, whether or not they meet the gloss level criteria for a flat coating. Flat aerosol coating products are primarily general use aerosol coatings that do not fall under one of the other coating categories. However, special-use flat coatings would also fall under the flat coating category.

A coating must register a specular gloss level that is less than or equal to 15 on an 85° meter, or less than or equal to 5 on a 60° meter, to qualify as "flat." The gloss level is measured by a special gloss meter which measures the amount of light reflected off the coating specimen. The gloss meter consists of a light source that directs a beam at the coating and measures the reflected light in the mirror direction. The degree of the angle used to describe the meter (e.g. 85° meter) refers to the angle of the light beam which is reflected off the coating surface. The gloss value is a relative value compared to a known standard such as black glass.

Flat aerosol coatings are formulated as both solvent-based and water-based formulations. However, solvent-based formulations account for the majority of sales (98 percent). Flat aerosol coatings vary with the intended use of the product, cost, and the individual color. One of the key components of the formulation, in terms of its effect on the properties of the dried coating film, is the resin. There are several types of resins that are used in flat aerosol coatings. These include alkyds, acrylic and nitrocellulose lacquers, epoxies, polyurethanes, and various combinations of these resins. Alkyd resins are used most often and are usually "modified" with chemical groups which enhance particular properties such as drying time or hardness.

The flat aerosol coating category is the fourth largest aerosol coatings category in terms of sales, and the fifth largest category in terms of VOC emissions. As shown in Table VI-4, sales of flat coatings were estimated to be 3.2 tons per day in 1997, constituting about eight percent of the aerosol coatings market. They also account for eight percent of the total VOC emissions, at an estimated 1.6 tons per day in 1997.

TABLE VI-4
Flat Coating Products*

Number of Products	Category Sales (tons/day)	VOC Emissions (tons/day)
129	3.2	1.6

* Based on ARB 1997 Aerosol Coatings Survey

Proposed VOC Limit and Compliance:

As shown in Table VI-5 below, the proposed VOC limit for flat coatings is 40 percent by weight, effective January 1, 2002. This limit is higher than the December 31, 1999, limit of 30 percent. After review of the 1997 ARB Aerosol Coatings Survey data, research and development reports, and conversations with individual manufacturers, ARB staff determined that the 30 percent limit is not technologically and commercially feasible. Specifically, manufacturers have reported problems with "in-can" stability, sprayability, coating defects, and excessive cost at the 30 percent limit (Chase; Hydrosol; K-G Packaging; Plasti-kote; Seymour of Sycamore; Zynolyte).

TABLE VI-5
Flat Coating Products*

12/31/99 VOC Limit (wt.%)	1/1/2002 Proposed VOC Limit (wt.%)	Sales-Weighted Average VOC (%)	Complying Market Share (%)	Number of Complying Products	Emission Reductions (tons/day)
30	40	51	0	0	0.34

* Based on ARB 1997 Aerosol Coatings Survey.

At the ARB proposed limit of 40 percent, there are no complying products. However, there are many products that are currently very close to meeting the 40 percent limit. Specifically, based on the 1997 ARB Aerosol Coatings Survey, 16 percent of the market is at or below a 45 percent VOC level. In addition, as with all the proposed limits, we are extending the effective date to January 1, 2002, to allow manufacturers additional time for reformulation.

As explained in the section on clear coatings, noncomplying solvent-based products can be reformulated using the following options explained in Chapter V: (1) increasing the amount of acetone in the formulation; (2) increasing the amount of solids in the formulation; (3) using the exempt propellant hydrofluorocarbon 152a (HFC-152a); or (4) using the exempt solvent parachlorobenzotrifluoride (PCBTF).

Solvent-based flat coatings that are within a few percent of the proposed limit will most likely increase their acetone and/or solids content to achieve compliance. For products further from the proposed 40 percent limit, manufacturers can switch to a resin system that is: (1) lower in viscosity, allowing for a higher solids content; and (2) compatible with a higher acetone content. Another compliance option would be to utilize a combination of approaches including the use of HFC-152a or PCBTF. For example, as shown in Table VI-6 below, a typical 50 percent VOC solvent-based flat coating with 20 percent solids and 30 percent acetone could replace 10 percent of its hydrocarbon propellant with HFC-152a to comply with the proposed 40 percent limit.

TABLE VI-6: Solvent-Based Flat Formulations

Typical 50% VOC Product	Complying 40% Formulation
25% hydrocarbon propellant	10% HFC-152a propellant
25% VOC solvents	15% hydrocarbon propellant
30% acetone	25% VOC solvents
20% solids	30% acetone
	20% solids

Manufacturers can reformulate their water-based formulations using the options described in Chapter V. Specifically, they can: (1) replace some of their DME propellants or solvents with water or coating solids; (2) replace some of the DME propellant with HFC-152a; or (3) replace some of the VOC solvents with acetone.

Issue: The industry has proposed a higher 50 percent limit for flat coatings.

Response: Although the industry has proposed a higher 50 percent VOC limit for flat coatings, we believe the 40 percent limit is technologically and commercially feasible. Noncomplying products can be reformulated using the options described in this chapter (and in more detail in Chapter V). As mentioned above, there is a significant market share already very close to the proposed 40 percent limit. In addition, at least one manufacturer has stated that a level of 40 to 45 percent VOC is reasonable for flat and nonflat coatings (K-G Packaging). We are also proposing to extend the effective date of the December 31, 1999, limits to January 1, 2002, to provide additional time for manufacturers to develop complying products.

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Plasti-kote Company. Telephone conversation with ARB staff. May 22, 1998. (Plasti-kote)

Seymour of Sycamore. Telephone conversation with ARB staff. May 8, 1998. (Seymour of Sycamore)

Zynolyte Products Company. Telephone conversation with ARB staff. May 28, 1998. (Zynolyte)

3. Fluorescent Coatings:

Product Category Description:

Fluorescent coatings are highly visible coatings which convert absorbed incident light energy into emitted light of a different hue. Ambient light contains electromagnetic radiation, including the short wavelength, high energy, nonvisible light known as ultraviolet (UV) radiation, the longer wavelength visible light, and the even longer wavelength, lower energy, nonvisible infrared radiation. The visible region contains the spectrum of colors ranging through violet, indigo, blue, green, yellow, orange and red. The dyes in fluorescent coatings absorb light in the UV and visible regions and emit it in a narrow range of longer wavelengths in the visible region. This light, when added to the normally reflected light, gives articles their color and makes them appear to glow in the daylight.

Fluorescent coatings are not used as protective coatings. The intense color of the coating is relatively short lived, as the pigments show poor durability in coatings and fade quickly. Fluorescent coatings are used for decorative purposes, as marking coatings for construction and surveying, for safety uses, and in "upside-down" ground marking or striping coatings. However, it should be noted that upside-down marking coatings, whether fluorescent or not, fall under the ground traffic marking coating category rather than the fluorescent coating category.

Fluorescent coatings are virtually all solvent-based coatings. They are low gloss coatings typically using acrylic lacquer resins. The dyes used in fluorescent coatings provide the fluorescent quality of the coating, while the resin (acrylic or alkyd) acts as a binder and helps contribute to the color stability of the product. Fluorescent pigments used in aerosol coatings are made by incorporating fluorescent dyes into an insoluble matrix, which is then ground to the desired particle size (Radiant Color).

As shown in Table VI-7, fluorescent aerosol coating products in California account for sales of approximately 0.3 tons per day or about one percent of the total aerosol coating sales in 1997. These products also resulted in estimated VOC emissions of 0.2 tons per day, or approximately one percent of the total reported aerosol coating emissions for 1997.

TABLE VI-7
Fluorescent Coatings*

Number of Products	Category Sales (tons/day)	VOC Emissions (tons/day)
53	0.3	0.2

* Based on ARB 1997 Aerosol Coatings Survey.

Proposed VOC Limit and Compliance:

As shown in Table VI-8 below, the proposed VOC limit for fluorescent coatings is 60 percent by weight. This limit is higher than the December 31, 1999, limit of 45 percent. After review of the 1997 ARB Aerosol Coatings Survey data, research and development reports, and conversations with individual manufacturers, ARB staff determined that the 45 percent VOC limit is not technologically and commercially feasible. Specifically, in addition to the reformulation constraints for flat, nonflat, and primer coatings, manufacturers have reported that fluorescent coatings are much less tolerant of acetone (as explained below).

TABLE VI-8
Fluorescent Coatings*

12/31/99 VOC Limit (wt.%)	1/1/2002 Proposed VOC Limit (wt.%)	Sales-Weighted Average VOC (%)	Complying Market Share (%)	Number of Complying Products	Emission Reductions (tons/day)
45	60	66	24	27	0.02

* Based on ARB 1997 Aerosol Coatings Survey.

The proposed 60 percent limit is higher than the proposed 40 percent limit for flat, and primer coatings, because fluorescent formulations have additional formulation constraints. Fluorescent coatings use a more narrow range of resins (typically acrylic lacquers), and the fluorescent pigments are more sensitive to acetone. At the ARB proposed limit of 60 percent, there are currently 27 complying products comprising an estimated 24 percent of the market. These complying products are solvent-based formulations with high solids levels and moderate amounts of acetone.

Noncomplying solvent-based products can be reformulated to the proposed limit by increasing their solids (particularly extender pigments) and using some acetone. Many sources have reported that acetone is not compatible with fluorescent pigments. However, fluorescent pigments are available that can tolerate some acetone (Day Glo; Diversified Brands). In fact, fluorescent coatings contain about five percent acetone on average according to the ARB's 1997 Aerosol Coatings Survey. Another option to reformulate solvent-based fluorescent coatings would be to use HFC-152a or PCBTF.

Table VI-9 shows typical noncomplying and complying fluorescent coatings, with the major difference being that the complying formulation contains five percent acetone.

TABLE VI-9: Solvent-Based Fluorescent Coating Formulations	
Typical Noncomplying 65% VOC Product	**Typical Complying 60% Formulation**
25% hydrocarbon propellant	25% hydrocarbon propellant
40% VOC solvents	35% VOC solvents
35% solids	5% acetone
	35% solids

Issue: The industry has proposed a higher 65 percent limit for fluorescent coatings.

Response: Although the industry has proposed a higher 65 percent VOC limit for fluorescent coatings, we believe the 60 percent limit is technologically and commercially feasible. As stated above, 27 products representing 24 percent of the market already comply with the proposed 60 percent limit. In addition, noncomplying products can be reformulated using the options described in this chapter. We are also proposing to extend the effective date of the December 31, 1999, limits to January 1, 2002, to provide additional time for manufacturers to develop complying products.

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Radiant Color. Telephone conversation with ARB staff. May 18, 1998. (Radiant Color)

4. Metallic Coatings:

Product Category Description:

Metallic coatings are defined as topcoats which contain at least 0.5 percent elemental metallic pigment by weight and are labeled as "metallic," or with the name of a specific metallic finish such as "gold," "silver," or "bronze." Metallic coatings are defined as coatings containing at least 0.5 percent elemental metallic pigment because most metallic coatings have a metallic pigment content above this level. Below this level, coatings may have appearances more like a typical nonflat coating.

There are two forms of metallic coatings. One form, the "leafing" metallics, contain elemental metal as the sole pigment in the coating. Leafing refers to the distribution of the metallic pigment within the coating. In leafing pigments, the metallic pigment is carried to the surface of the coating film during drying and gives the appearance of an almost continuous film of metal. These coatings are designed to create the impression that the object coated is composed of gold, silver, brass, copper or aluminum.

The second form of metallic coating is known as "nonleafing." In nonleafing coatings, the metallic pigments do not form a continuous metallic layer on the surface of the coating. Rather, they are distributed within the coating film and produce a polychrome effect, when used in conjunction with semi-transparent colored pigments. The metallic pigment contained within the semi-transparent color causes the coating to sparkle. These colored metallics are often formulated to exactly match automobile finishes, and therefore fall into the exact match category with a 50 percent VOC limit. However, there are some nonleafing metallics that are not formulated as exact match coatings. If these coatings have an elemental metallic pigment content greater than 0.5 percent, and are labeled "metallic," or with the name of a specific metallic finish such as "gold," "silver," or "bronze," then they are categorized as metallics. Otherwise, they fall under the general flat or nonflat coatings.

As mentioned in the section on primers, "zinc-rich primers" (also called "galvanizing coatings") may contain greater than 0.5 percent elemental metallic pigment, but are not classified as "metallic" coatings because they are not labeled "metallic", or with the name of a specific metallic finish. These coatings are used for rust prevention and are very different from the decorative topcoats in the metallic category.

Metallic coating formulations are essentially all solvent-based formulations which differ from other types of aerosol coatings in that the primary or sole pigment is elemental metal, rather than the colored pigments. Manufacturers of leafing metallics achieve the leafing effect by coating the metallic pigments with stearic acid, which serves as a lubricant to aid in bringing the metallic flake to the surface of the coating. Copper metallics are formulated using 100 percent copper, while bronze, brass and gold metallics are prepared by varying the ratios of copper and zinc in the metallic alloy pigment. Since copper tarnishes upon weathering, copper metallics and those

metallics made with copper alloy pigments are not durable and are used primarily for interior applications. However, aluminum metallics have excellent durability and can be used for interior and exterior applications.

As shown in Table VI-10, metallic coatings are a significant segment of the aerosol coatings market. Metallic coatings are the fifth largest category in terms of sales with 176 products resulting in an estimated 2.5 tons per day sold in 1997. This comprises about 7 percent of the total aerosol coating market in California. The fourth largest category in terms of emissions, metallic aerosol coatings resulted in 1.8 tons per day of VOC emissions or approximately nine percent of the total aerosol coating emissions in California in 1997.

TABLE VI-10
Metallic Coatings*

Number of Products	Category Sales (tons/day)	VOC Emissions (tons/day)
176	2.5	1.8

* Based on ARB 1997 Aerosol Coatings Survey.

Proposed VOC Limit and Compliance:

As shown below, the VOC limit proposed for metallic coatings is 65 percent by weight. This limit is higher than the December 31, 1999, limit of 50 percent. After review of the 1997 ARB Aerosol Coatings Survey data, research and development reports, and conversations with individual manufacturers, ARB staff determined that the 50 percent VOC limit is not technologically and commercially feasible. Specifically, as explained below, manufacturers have reported that metallic coatings (particularly leafing aluminum metallics) face additional reformulation obstacles not faced by general flat or nonflat coatings.

TABLE VI-11
Metallic Coatings*

12/31/99 VOC Limit (wt.%)	1/1/2002 Proposed VOC Limit (wt.%)	Sales-Weighted Average VOC (%)	Complying Market Share (%)	Number of Complying Products	Emission Reductions (tons/day)
50	65	71	23	46	0.23

* Based on ARB 1997 Aerosol Coatings Survey.

The proposed VOC limit for metallics is higher than the limits for general flat and nonflat coatings because leafing metallic coatings (particularly aluminum leafing metallics) have additional formulation constraints. Specifically, leafing metallics cannot tolerate as much acetone as nonmetallic formulations. Acetone and other oxygenated solvents inhibit leafing by stripping the stearic acid from the metal flakes (Diversified Brands; Zynolyte; Silberline, 1988). In addition, high solids formulations increase viscosity, which can inhibit leafing.

At the ARB proposed limit of 65 percent, there are currently 46 complying products comprising an estimated 23 percent of the market. These complying products are primarily nonleafing formulations with significant amounts of acetone. However, there are leafing metallics at the 70 percent VOC level, indicating that manufacturers could achieve compliance with relatively small amounts of exempt solvents or propellants. Parachlorobenzotrifluoride (PCBTF) is probably the most likely reformulation option, if compliance cannot be achieved with greater levels of solids and/or acetone. PCBTF is reportedly an excellent solvent for leafing aluminum coatings because it does not strip the stearate coating from the aluminum pigments, or react with aluminum (Hare). Also, as explained in Chapter V, PCBTF has many properties in common with xylene, which is widely used in metallic coatings. Finally, a major supplier of aluminum pigments is currently evaluating whether to replace a large portion of the mineral spirits and aromatic solvents currently used as carrier solvents in their aluminum pigment pastes with PCBTF (Silberline, 5/27/98).

Table VI-12 shows a noncomplying leafing metallic and a proposed complying leafing metallic formulation with 5 percent PCBTF.

TABLE VI-12: Solvent-Based Metallic Coating Formulations

Typical 70%VOC Product	Complying 65% Formulation
25% hydrocarbon propellant	25% hydrocarbon propellant
45% VOC solvents	40% VOC solvents
10% acetone	10% acetone
20% solids	5% PCBTF
	20% solids

Issue: The industry has proposed a higher 70 percent limit for metallic coatings.

Response: Although the industry has proposed a higher 70 percent VOC limit for metallic coatings, we believe the proposed 65 percent limit is technologically and commercially feasible. As stated above, 46 products representing 23 percent of the market already comply with the proposed 65 percent limit. In addition, noncomplying products (including leafing aluminum metallics) can be reformulated as described in this section. We are also proposing to extend the effective date of the December 31, 1999, limits to January 1, 2002, to provide additional time for manufacturers to develop complying products.

REFERENCES

Air Resources Board. Aerosol Coatings Survey. November 25, 1997. (ARB)

Diversified Brands. Telephone conversation with ARB staff. June 2, 1998. (Diversified Brands)

Hare, Clive H. "Parachlorobenzotrifluoride, An Environmentally Friendly Solvent." Modern Paint and Coatings. January, 1998. (Hare)

Silberline Manufacturing Company. Product brochure. "Leafing Aluminum Pigments," 1988. (Silberline, 1988)

Silberline Manufacturing Company. Telephone conversation with ARB staff. May 27, 1998. (Silberline, 5/27/98)

Zynolyte Products Company. Telephone Conversation with ARB staff. June 1, 1998. (Zynolyte)

5. Nonflat Coatings:

Product Category Description:

Nonflat (or higher gloss) aerosol coating products are aerosol coatings with a specular gloss level greater than 15 on an 85° meter, or greater than 5 on a 60° meter (see the section on flat coating products for a description of gloss measurements). Aerosol coatings labeled as "high gloss" coatings do not qualify as nonflat unless the gloss criteria listed above are met. Nonflat aerosol coating products are primarily general use aerosol coatings that do not fall under one of the other coating categories. However, special-use nonflat coatings that exhibit the gloss level specified above, and do not fall under one of the other coating categories in the regulation, would also fall under the nonflat coating category.

Nonflat aerosol coatings are primarily general-use products employed for a wide variety of purposes where a glossy finish is desired. Some typical uses include protecting objects from rust and corrosion, "touching-up" finishes, and coating small objects or objects that would be hard to coat with a brush, such as wicker. Some are sold as general, all-purpose products, while others have specific qualities such as rust protection, unique decorator colors, water-borne formulas, specific resin types, such as epoxies or polyurethanes, or quick dry times.

Nonflat aerosol coating formulations are very similar to the formulations of flat aerosol coating products, as discussed previously. Nonflat coatings are formulated as both solvent-based and water-based products. However, solvent-based products represent the majority of sales (97%). Nonflat coatings have a higher concentration of resin relative to the total coating solids content, compared to flat coatings and primers. This higher concentration of resin gives nonflat coatings higher gloss than flat coating products. The higher concentration of resin may also account for the somewhat higher VOC levels and lower total solids levels relative to flat aerosol coatings, since resins contribute greater viscosity to coating formulations than other coating solids.

The nonflat aerosol coating category is by far the largest category of aerosol coatings with respect to sales and emissions. As shown in Table VI-13 below, nonflat aerosol coatings accounted for about 16.6 tons per day of sales, and 8.7 tons per day of VOC emissions in California in 1997. This accounts for approximately 41 percent of the emissions from all aerosol coatings.

TABLE VI-13
Nonflat Coatings*

Number of Products	Category Sales (tons/day)	VOC Emissions (tons/day)
826	16.6	8.7

* Based on ARB 1997 Aerosol Coatings Survey.

Proposed VOC Limit and Compliance:

The VOC limit proposed for nonflat aerosol coatings is 45 percent by weight effective January 1, 2002. This limit is higher than the December 31, 1999, limit of 30 percent. After review of the 1997 ARB Aerosol Coatings Survey data, research and development reports, and conversations with individual manufacturers, ARB staff determined that the 30 percent limit is not technologically and commercially feasible for nonflat coatings. Specifically, manufacturers have reported problems with "in-can" stability, sprayability, coating defects, and excessive cost at the 30 percent limit (Chase; Hydrosol; K-G Packaging; Plasti-kote; Seymour of Sycamore; Zynolyte).

TABLE VI-14
Nonflat Coatings*

12/31/99 VOC Limit (wt.%)	1/1/2002 Proposed VOC Limit (wt.%)	Sales-Weighted Average VOC (%)	Complying Market Share (%)	Number of Complying Products	Emission Reductions (tons/day)
30	45	53	5	33	1.4

* Based on ARB 1997 Aerosol Coatings Survey.

At the ARB proposed limit of 45 percent there are currently 33 complying products representing about five percent of the market. These products comply using a combination of acetone and coating solids.

As explained in the section on clear coatings, noncomplying solvent-based products can be reformulated using the following options explained in Chapter V: (1) increasing the amount of acetone in the formulation; (2) increasing the amount of solids in the formulation; (3) using the exempt propellant hydrofluorocarbon 152a (HFC-152a); or (4) using the exempt solvent parachlorobenzotrifluoride (PCBTF).

Solvent-based nonflat coatings that are within a few percent of the proposed limit will most likely increase their acetone and/or solids content to achieve compliance. For products further from the proposed 45 percent limit, manufacturers can switch to a resin system that is: (1) lower in viscosity, allowing for a higher solids content; and (2) compatible with a higher acetone content. Another compliance option would be to utilize a combination of approaches including the use of HFC-152a or PCBTF.

For example, as shown in Table VI-15 below, a typical 55 percent VOC solvent-based product with 20 percent solids and 25 percent acetone could replace 10 percent of its hydrocarbon propellant with HFC-152a to comply with the proposed 45 percent limit.

TABLE VI-15: Solvent-Based Nonflat Formulations	
Typical 55% VOC Product	**Complying 45% Formulation**
25% hydrocarbon propellant	10% HFC-152a propellant
30% VOC solvents	15% hydrocarbon propellant
25% acetone	30% VOC solvents
20% solids	25% acetone
	20% solids

Manufacturers can reformulate their water-based formulations using the options described in Chapter V. Specifically, they can: (1) replace some of their DME propellants or solvents with water or coating solids; (2) replace some of the DME propellant with HFC-152a; or (3) replace some of the VOC solvents with acetone.

1. ***Issue:*** ***The industry has proposed a higher 50 percent limit for nonflat coatings.***

Response: Although the industry has proposed a higher 50 percent VOC limit for nonflat coatings, we believe the proposed 45 percent limit is technologically and commercially feasible. Noncomplying products can be reformulated to the 45 percent limit using the options described in this chapter (and in more detail in Chapter V). As mentioned above, there are already 33 products representing five percent of the market that comply with the proposed 45 percent limit. In addition, at least one manufacturer has stated that a level of 40 to 45 percent VOC is reasonable for flat and nonflat coatings (K-G Packaging). We are also proposing to extend the effective date of the December 31, 1999, limits to January 1, 2002, to provide additional time for manufacturers to develop complying products.

2. ***Issue:*** ***The nonflat category consists of a wide range of products with different uses that cannot all be expected to meet the proposed 45 percent limit.***

Response: As stated above, we recognize that the nonflat category is diverse, including general, all-purpose products, as well as products with specific qualities such as rust protection, unique decorator colors, water-borne formulas, specific resin types, or quick dry times. However, we have a statutory requirement to achieve the most stringent feasible VOC limits and believe that the reformulation options described in this section (and in more detail in Chapter V) will provide the flexibility necessary to reformulate different types of nonflat coatings. We have also extended the effective date of the proposed limit to January 1, 2002, to provide additional time for manufacturers to reformulate their products. We note that the industry has not provided any information to date indicating that a specific type of nonflat could not be reformulated.

REFERENCES

Air Resources Board Aerosol Coatings Survey. November 25, 1997. (ARB)

Chase Products Company. Telephone conversation with ARB staff. May 15, 1998. (Chase)

Hydrosol. Telephone conversation with ARB staff. May 15, 1998. (Hydrosol)

K-G Packaging. Telephone conversation with ARB staff. May 13, 1998. (K-G Packaging)

Plasti-kote Company. Telephone conversation with ARB staff. May 22, 1998. (Plasti-kote)

Seymour of Sycamore. Telephone conversation with ARB staff. May 8, 1998. (Seymour of Sycamore)

Zynolyte Products Company. Telephone conversation with ARB staff. May 28, 1998. (Zynolyte)

6. Primer Coatings:

Product Category Description:

A primer is a coating formulated to be applied to a surface to provide a bond between that surface and subsequent coats. As such, primers contribute to the overall effectiveness of an entire coating system. Primers bond the substrate to subsequent coatings by providing a rough, slightly porous surface which adheres to both slick surfaces and glossy topcoats. Under the proposed aerosol coating products regulation, an aerosol coating must also be labeled as a "primer" to fall under this category.

Due to differences in formulation and function, auto body primers are specifically excluded from the general primer category. General primers reportedly cannot be topcoated with automotive topcoats because the solvents in these topcoats will cause "lifting" of general purpose primers.

Primers can fulfill a variety of functions. Depending on the type of product, primers must be able to protect against deterioration such as flaking, peeling, blistering, and corrosion from chemicals and environmental conditions. Primers can also help fill and level irregular substrates prior to subsequent coats such as basecoats or topcoats. In addition, primers can provide good hiding power for subsequent recoating of a substrate.

Primers are formulated similar to flat coating products, and include both water-based and solvent-based products. However, water-based products represent less than one percent of the sales in this category. General primers often utilize some type of modified alkyd resin system and often have a higher solids content compared with other coatings to provide better hiding and build. Some primers with specialized functions have unique formulations. For example, zinc-rich primers (or "galvanizing" coatings) are generally very high solids formulations containing zinc pigments. These primers can provide protection against corrosion for iron or steel surfaces.

The primer coating category is the third largest category in terms of sales and emissions according to the 1997 ARB Aerosol Coatings Survey. As shown in Table VI-16, primer coatings had estimated sales of nearly four tons per day, or about ten percent of the total aerosol coating sales in California in 1997. The VOC emissions from this category account for an estimated two tons per day, or ten percent of the total aerosol coatings emissions in California in 1997.

TABLE VI-16
Primer Coatings*

Number of Products	Category Sales (tons/day)	VOC Emissions (tons/day)
162	3.9	2.0

* Based on ARB 1997 Aerosol Coatings Survey.

Proposed VOC Limit and Compliance:

The proposed VOC limit for general primers is 40 percent by weight, effective January 1, 2002. This limit is higher than the December 31, 1999, limit of 30 percent. After review of the 1997 ARB Aerosol Coatings Survey data, research and development reports, and conversations with individual manufacturers, ARB staff determined that the 30 percent limit is not technologically and commercially feasible for primers. Specifically, as with flat and nonflat coatings, manufacturers have reported problems with "in-can" stability, sprayability, coating defects, and excessive cost at the 30 percent limit (Chase; Hydrosol; K-G Packaging; Plasti-kote; Seymour of Sycamore; Zynolyte).

TABLE VI-17
Primer Coatings*

12/31/99 VOC Limit (wt.%)	1/1/2002 Proposed VOC Limit (wt.%)	Sales-Weighted Average VOC (%)	Complying Market Share (%)	Number of Complying Products	Emission Reductions (tons/day)
30	40	51	<1	5	0.44

* Based on ARB 1997 Aerosol Coatings Survey.

At the ARB proposed limit of 40 percent there are currently five complying products with less than one percent of the market. However, based on the 1997 ARB Aerosol Coatings Survey, there are many products that are currently very close to meeting the 40 percent limit. Specifically, 14 products representing eight percent of the market are at or below a 45 percent VOC level.

As explained in the section on clear coatings, noncomplying solvent-based products can be reformulated using the following options explained in Chapter V: (1) increasing the amount of acetone in the formulation; (2) increasing the amount of solids in the formulation; (3) using the exempt propellant hydrofluorocarbon 152a (HFC-152a); or (4) using the exempt solvent parachlorobenzotrifluoride (PCBTF).

Solvent-based primers that are within a few percent of the proposed limit will most likely increase their acetone and/or solids content to achieve compliance. For products further from the proposed 40 percent limit, manufacturers can switch to a resin system that is: (1) lower in viscosity, allowing for a higher solids content; and (2) compatible with a higher acetone content. Another compliance option would be to utilize a combination of approaches including the use of HFC-152a or PCBTF. For example, as shown in Table VI-18 below, a typical 50 percent VOC solvent-based primer with 25 percent solids and 25 percent acetone could replace 10 percent of its hydrocarbon propellant with HFC-152a to comply with the proposed 40 percent limit.

TABLE VI-18: Solvent-Based Primer Formulations	
Typical 50% VOC Product	**Complying 40% Formulation**
25% hydrocarbon propellant	10% HFC-152a propellant
25% VOC solvents	15% hydrocarbon propellant
25% acetone	25% VOC solvents
25% solids	25% acetone
	25% solids

As mentioned above, there are very few water-based products in this category. However, manufacturers can reformulate their water-based formulations using the options described in Chapter V. Specifically, they can: (1) replace some of their DME propellants or solvents with water or coating solids; (2) replace some of the DME propellant with HFC-152a; or (3) replace some of the VOC solvents with acetone.

Issue: The industry has proposed a higher 50 percent limit for primers.

Response: Although the industry has proposed a higher 50 percent VOC limit for primers, we believe the 40 percent limit is technologically and commercially feasible. Noncomplying products can be reformulated to the 40 percent limit using the options described in this chapter (and in more detail in Chapter V). There are already 5 complying products on the market, and, as mentioned above, 14 products representing eight percent of the market at the 45 percent level (very close to compliance). In addition, we have extended the effective date of the proposed limit to January 1, 2002, to provide additional time for manufacturers to reach compliance.

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Air Resources Board Aerosol Coatings Survey. November 25, 1997. (ARB)

Chase Products Company. Telephone conversation with ARB staff. May 15, 1998. (Chase)

Hydrosol Incorporated. Telephone conversation with ARB staff. May 15, 1998. (Hydrosol)

K-G Packaging. Telephone conversation with ARB staff. May 13, 1998. (K-G Packaging)

Plastikote Company. Telephone conversation with ARB staff. May 22, 1998. (Plasti-kote)

Seymour of Sycamore. Telephone conversation with ARB staff. May 8, 1998. (Seymour of Sycamore)

Zynolyte Products Company. Telephone conversation with ARB staff. May 28, 1998. (Zynolyte)

7. Ground Traffic/Marking Coatings:

Product Category Description:

Ground traffic or marking coatings are used to apply striping or marking to outdoor surfaces such as streets, golf courses, parking lots, athletic fields, and construction sites. Coatings included in this category are often labeled as traffic coatings, marking coatings, athletic coatings, and marking chalk. The individual names refer to the applications for which the products were designed. As an example, traffic coating is designed to give long-lasting marking of traffic lanes or parking lots, whereas athletic coating is primarily for temporary use at recreational sites such as golf courses or soccer fields. All of these coatings are commonly referred to as "upside-down" coatings because they are applied in an inverted spray position. Unlike "regular" spray coatings, upside-down spray coatings do not have a dip tube. Lack of a dip tube allows for the inverted spray position. All upside-down coatings can be applied either by hand or with a striping machine, a simple pushing device that allows accurate striping of surfaces and has an adjustable spray width. Traffic and other marking coatings come in many different colors, including fluorescent colors, and are available as water- and solvent-based formulations.

Ground traffic or marking coatings are used by utility locators, forestry workers, landscapers, contractors, surveyors, and others whose work requires marking of surfaces or objects. Upside-down coatings can be applied to a variety of surfaces including asphalt, concrete, steel, grass, soil, wood and other surfaces. Depending upon the purpose of the marking and the type of surface, the applicator needs to choose a suitable upside-down coating. For example, applying traffic striping on high traffic concrete or asphalt streets requires a coating that withstands the wear from tires, rain, sun, and other environmental factors for a considerable period of time. A product used for the striping of a soccer field, on the other hand, may only need to last several weeks or months and should be formulated to not harm the grass or turf upon which it is applied. Generally speaking, coatings marked as traffic coatings are for more permanent applications whereas marking and athletic stripe coatings or chalks are chosen for more temporary jobs, such as the marking of power cables or gas lines at a construction side or the outlines of a landscape design. Although they are typically used for less permanent markings, athletic and marking coatings often have to withstand environmental factors such as rain and sun for several months.

Ground traffic or marking coatings are available as solvent-based and water-based formulations, and as fluorescent and nonfluorescent coatings. Water-based traffic and marking coating can be formulated as emulsions (using hydrocarbon propellants), or as solutions (using dimethyl ether propellant). For a description of fluorescent coatings, please refer to the "fluorescent coating" category discussion in this chapter. Ground traffic marking coatings are typically high in solids to prevent them from being absorbed into porous substrates.

The ground traffic or marking coating category is the second largest category with respect to sales. As shown in Table VI-19, sales of ground traffic or marking coatings account for 4.7 tons per day or about 12 percent of the total aerosol coating sales in California in 1997. The ground traffic or marking category is also the second largest category in terms of emissions,

producing about 2.8 tons per day of VOC emissions or 13 percent of the total reported emissions in California in 1997.

TABLE VI-19
Ground Traffic/Marking Coatings*

Number of Products	Category Sales (tons/day)	VOC Emissions (tons/day)
117	4.7	2.8

* Based on ARB 1997 Aerosol Coatings Survey.

Proposed VOC Limit and Compliance:

The proposed VOC limit for ground traffic or marking coatings is 45 percent by weight, effective January 1, 2002. This limit is higher than the December 31, 1999, limit of 40 percent. After review of the 1997 ARB Aerosol Coatings Survey data, research and development reports, and conversations with individual manufacturers, ARB staff determined that the existing 40 percent limit is not technologically and commercially feasible. Specifically, in addition to constraints on flat, nonflat, and primer coatings, manufacturers have reported the following concerns for ground traffic or marking coatings: (1) the category contains many fluorescent products which are more sensitive to acetone; and (2) the traffic striping products must be able to resist severe environmental conditions including temperature extremes, abrasion, oil, and gasoline (Aervoe Pacific; Plasti-kote; Seymour of Sycamore).

As shown in Table VI-20, at the ARB proposed 45 percent VOC limit, there are 29 complying formulations representing about nine percent of the market. These complying products include both solvent-based and water-based products, and both traffic striping coatings, and ground marking coatings.

TABLE VI-20
Ground Traffic/Marking Coatings*

12/31/99 VOC Limit (wt.%)	1/1/2002 Proposed VOC Limit (wt.%)	Sales-Weighted Average VOC (%)	Complying Market Share (%)	Number of Complying Products	Emission Reductions (tons/day)
40	45	60	9	29	0.74

* Based on ARB 1997 Aerosol Coatings Survey.

Noncomplying solvent-based ground traffic or marking products can be reformulated using the following options explained in Chapter V: (1) increasing the amount of acetone in the formulation; (2) increasing the amount of solids in the formulation; (3) using the exempt propellant hydrofluorocarbon 152a (HFC-152a); or (4) using the exempt solvent parachlorobenzotrifluoride (PCBTF).

Solvent-based ground traffic marking coatings that are within a few percent of the proposed limit will most likely increase their acetone and/or solids content to achieve compliance as shown in Table VI-21 below. For products further from the proposed 45 percent limit, manufacturers can switch to a resin system that is: (1) lower in viscosity, allowing for a higher solids content; or (2) compatible with a higher acetone content. Another compliance option would be to utilize a combination of approaches including the use of HFC-152a or PCBTF. These options may be more attractive to fluorescent ground traffic or marking coatings which may be less tolerant of acetone.

TABLE VI-21: Solvent-Based Ground Traffic/Marking Coating

Typical 65% VOC Product	Complying 45% Formulation
25% hydrocarbon propellant	20% hydrocarbon propellant
40% VOC solvents	25% VOC solvents
5% acetone	20% acetone
30% solids	35% solids

Manufacturers can reformulate their water-based formulations using the options described in Chapter V. Specifically, they can: (1) replace some of their DME propellants or solvents with water or coating solids; (2) replace some of the DME propellant with HFC-152a; or (3) replace some of the VOC solvents with acetone.

Issue: The industry has proposed a higher 55 percent limit for ground traffic or marking coatings.

Response: Although the industry has proposed a higher 55 percent VOC limit for this category, we believe the 45 percent limit is technologically and commercially feasible. As mentioned above, 29 products representing nine percent of the market already comply with the proposed limit. These products include both permanent traffic striping coatings, and temporary marking coatings. Noncomplying products can be reformulated to the 45 percent limit using the options described in this chapter (and in more detail in Chapter V). We are also proposing to extend the effective date of the December 31, 1999, limits to January 1, 2002, to provide additional time for manufacturers to develop complying products.

REFERENCES

Aervoe Pacific. Telephone conversation with ARB staff. Circa May, 1998. (Aervoe-Pacific)

Air Resources Board. Aerosol Coatings Survey. November 25, 1997. (ARB)

Plasti-kote. Telephone conversation with ARB staff. May 29, 1998. (Plasti-kote)

Seymour of Sycamore. Telephone conversation with ARB staff. May 29, 1998. (Seymour of Sycamore)

C. DESCRIPTION OF REMAINING SPECIALTY CATEGORIES

Product Category Description:

Table VI-22 summarizes the following information for each of the remaining 28 aerosol specialty coating categories as reported in the 1997 ARB Aerosol Coating Survey as of July 30, 1998:

- the number of products;
- the sales (in tons per day); and
- the VOC emissions (in tons per day).

The 28 specialty coating categories shown in Table VI-22 account for about 14 percent of the total emissions from aerosol coatings. As shown in Table VI-22, the VOC emissions from many of these categories are very small. To maintain the confidentiality of proprietary data, we do not provide the estimated sales and emissions for categories with fewer than four products reporting to the survey. We do not discuss each of these 28 categories in detail as we did with the seven categories in the previous section. However, detailed discussions of each of these categories (including product description, use, marketing, and formulation) are provided in the ARB staff report entitled "Initial Statement of Reasons for a Proposed Statewide Regulation to Reduce Volatile Organic Compound Emissions from Aerosol Coating Products and Amendments to the Alternative Control Plan Regulation for Consumer Products," February 3, 1995.

TABLE VI-22
Emissions Summary for 28 Specialty Categories*

Category	Number of Products	Category Sales (tons/day)	VOC Emissions (tons/day)
Art Fixatives or Sealants	16	0.33	0.20
Auto Body Primers	22	0.50	0.25
Automotive Bumpers and Trim Products	75	0.36	0.22
Aviation or Marine Primers	3	**	**
Aviation Propeller Coatings	1	**	**
Corrosion Resistant Brass, Bronze, or Copper Coatings	1	**	**
Exact Match Finishes, Engine Enamel	33	0.42	0.21
Exact Match Finishes, Automotive	321	0.73	0.38
Exact Match Finishes, Industrial	53	0.32	0.15
Floral Sprays	17	0.56	0.24
Glass Coatings	4	**	**
High Temperature Coatings	68	0.73	0.49
Hobby/Model/Craft Coatings, Enamel	34	0.15	0.10
Hobby/Model/Craft Coatings, Lacquer	7	0.01	0.01
Hobby/Model/Craft Coatings, Clear or Metallic	17	0.14	0.09
Marine Spar Varnishes	3	**	**
Photograph Coatings	6	0.02	0.01
Pleasure Craft Finish Primers	2	**	**
Pleasure Craft Topcoats	1	**	**
Shellac Sealers, Clear	3	**	**
Shellac Sealers, Pigmented	3	**	**
Slip-Resistant Coatings	8	0.01	~0.0
Spatter/Multicolor Coatings	23	0.21	0.10
Vinyl/Fabric/Leather/Polycarbonate	24	0.35	0.22
Webbing/Veiling Coatings	4	**	**
Weld-Through Primers	10	0.05	0.02
Wood Stains	4	**	**
Wood Touch-Up/Repair/Restoration Coatings	4	**	**
Total	767	5.4	2.9

* Based on ARB 1997 Aerosol Coatings Survey.
** Information not provided to protect confidentiality of proprietary information.

Proposed VOC Limits and Compliance:

Table VI-23 summarizes the following information for each of the remaining 28 aerosol specialty coating categories, as reported in the 1997 ARB Aerosol Coatings Survey as of July 30, 1998:

- VOC emissions (in tons per day);
- sales-weighted average VOC content;
- December 31, 1999, VOC limits;
- proposed January 1, 2002, VOC limits;
- number of products that comply with the January 1, 2002, limits;
- complying market share at the proposed limits; and
- VOC emission reductions at the proposed limits.

As shown in Table VI-23, the proposed limits are: (1) equal to the existing December 31, 1999, limits for 12 categories; (2) more stringent than the existing December 31, 1999, limits for 11 categories which do not represent the most stringent feasible VOC limits; and (3) less stringent for five categories which are not technologically and commercially feasible at the December 31, 1999, limits. The five categories with less stringent limits are: "high temperature coatings," "clear or metallic hobby/model/craft coatings," "industrial exact match coatings"; "webbing and veiling coatings"; and "wood touch-up, repair or restoration coatings." These five categories have unique reformulation constraints that make it more difficult for them to achieve the December 31, 1999, limits (Cardinal Paint; Forrest Paint; Gemini; Mohawk; Plasti-kote; Seymour of Sycamore; Testors; U.S. Cellulose; Zynolyte). Specifically, there on limitations on the amount of solids or acetone they can contain. We have extended the effective date for all 28 specialty categories to January 1, 2002, to provide adequate time for reformulation efforts.

All of the 28 categories shown in Table VI-23 (with one exception) have a high complying market share at the proposed VOC limits, which we believe demonstrates that these limits are technologically and commercially feasible. The one exception is the "corrosion resistant brass, bronze, or copper coating" category. However, the manufacturer of the only product in this category has stated that they can reformulate the product to the December 31, 1999, VOC limit (Protective Coatings Unlimited). The proposed VOC limits for many of these categories functions as an emissions cap, and will require less reformulation efforts than the seven larger categories mentioned previously. However, the less stringent limits for these categories will not impact emissions reductions as much as the limits for the general coating categories because the specialty coating categories individually account for a small share of the emissions from aerosol coatings. In addition, less stringent limits are necessary for these categories because they would not be as cost-effective to reformulate due to their low sales volumes.

The complying products are currently meeting the proposed limits through a combination of solids and acetone, and in a few categories, through the use of water-based formulations.

Products above the proposed VOC limits can reformulate using the options explained in Chapter V. Specifically, for solvent-based products, manufacturers can: (1) increase the amount of acetone in the formulation; (2) increase the amount of solids in the formulation; (3) use the exempt propellant hydrofluorocarbon 152a (HFC-152a); or (4) use the exempt solvent parachlorobenzotrifluoride (PCBTF). However, since there are generally many products that comply through a combination of solids and/or acetone, this is expected to be the primary method of reformulation. For water-based formulations, manufacturers can: (1) replace some of the DME propellants or solvents with water or coating solids; (2) replace some of the DME propellant with HFC-152a; or (3) replace some of the VOC solvents with acetone.

TABLE VI-23
Proposed VOC Limits for 28 Specialty Categories*

Category	VOC Emissions (tons/day)	Sales-Weighted Average VOC (wt.%)	12/31/99 VOC Limit (wt.%)	1/1/2002 ARB Proposed VOC Limit (wt.%)	Number of Complying Products**	Complying Market Share** (%)	Emission Reductions (tons/day)
Art Fixatives or Sealants	0.20	68	70	60	5	26	0.03
Auto Body Primers	0.25	50	50	45	6	52	0.04
Automotive Bumpers and Trim Products	0.22	61	75	75	51	71	0.01
Aviation or Marine Primers	**	44	70	70	3	100	0
Aviation Propeller Coatings	**	**	75	70	1	100	0
Corrosion Resistant Brass, Bronze, or Copper Coatings	**	**	70	70	0	0	0
Exact Match Finishes, Engine Enamel	0.21	49	60	50	7	64	0.01
Exact Match Finishes, Automotive	0.38	52	60	50	196	41	0.03
Exact Match Finishes, Industrial	0.15	47	60	70	29	99	0.0
Floral Sprays	0.24	42	85	70	11	94	0.01
Glass Coatings	**	68	80	65	2	67	0
High Temperature Coatings	0.49	68	55	60	21	23	0.07
Hobby/Model/Craft Coatings, Enamel	0.10	69	70	70	24	28	0
Hobby/Model/Craft Coatings, Lacquer	0.01	74	70	70	1	53	0
Hobby/Model/Craft Coatings, Clear or Metallic	0.09	65	75	80	14	88	0
Marine Spar Varnishes	**	46	70	60	2	~100	0
Photograph Coatings	0.01	76	70	70	1	39	0
Pleasure Craft Finish Primers/ Surfacers/Undercoaters	**	37	55	55	2	100	0
Pleasure Craft Topcoats	**	**	55	55	1	100	0
Shellac Sealers, Clear	**	58	70	70	3	100	0
Shellac Sealers, Pigmented	**	41	60	60	3	100	0
Slip-Resistant Coatings	0.0	40	70	60	7	100	0
Spatter/Multicolor Coatings	0.10	49	60	55	20	99	0
Vinyl/Fabric/Leather/ Polycarbonate	0.22	63	70	70	20	97	0
Webbing/Veiling Coatings	**	77	70	80	4	100	0
Weld-Through Primers	0.02	46	60	50	3	67	0.0
Wood Stains	**	57	75	75	4	100	0
Wood Touch-Up/Repair/ Restoration Coatings	**	65	75	90	2	96	0.0
Total	2.9				443		0.2

* Based on ARB 1997 Aerosol Coatings Survey.

** Information not provided to protect confidentiality of proprietary information.

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VII.

ENVIRONMENTAL IMPACTS

A. SUMMARY OF ENVIRONMENTAL IMPACTS

The ARB staff has studied the potential environmental impacts of the proposed amendments to the aerosol coatings regulation. This analysis shows that, overall, the proposed amendments to the aerosol coatings regulation would have an adverse environmental impact because they represent a relaxation of the December 31, 1999 (second-tier), VOC limits currently in the aerosol coatings regulation. Under the existing second-tier limits, we expect the reduction in VOC emissions would be about 18 tons per day. In this proposal, we are proposing less stringent VOC limits for 12 of the 35 categories, more stringent VOC limits for 11 of the 35 categories, and no change to the limits in the remaining 12 categories. With the proposed amendments to the second-tier limits, an overall reduction in VOC emissions of about 12.6 tons per day would be achieved. In addition, in this proposal, the second-tier limits would become effective on January 1, 2002, instead of December 31, 1999 (i.e., an additional two years before emission reductions would be achieved).

However, the intent of the proposed amendments is to preserve the commercial and technological feasibility of the VOC limits and ensure that basic market demand can be met. Without the proposed amendments to the VOC limits and the two years additional lead time, many manufacturers would experience adverse economic impacts and disruption of the aerosol coatings market. The amendments will help ensure that manufacturers will be able to develop consumer-accepted products to meet the basic market demand. Postponement of the effective date of the VOC limits will allow additional time for manufacturers to improve the emerging technologies that may be needed for the development of commercially viable products. We believe that these considerations override any adverse impacts that may occur as a result of these amendments.

We have also studied the potential environmental impacts of exempting methyl acetate from the VOC definitions in the aerosol coatings, antiperspirant and deodorant, and consumer products regulations. This analysis shows that no adverse environmental impacts should result from this proposed amendment. We expect a positive environmental impact if methyl acetate is substituted for more reactive compounds. Sections C and E below contain a discussion of the impacts associated with the proposed amendments and provide the basis for our findings.

B. LEGAL REQUIREMENTS APPLICABLE TO THE ANALYSIS

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential adverse environmental impacts of proposed regulations. Because the ARB's program involving the adoption of regulations has been certified by the Secretary of Resources (see Public Resources Code, section 21080.5), the CEQA environmental analysis requirements are allowed to be included in the ARB Staff Report or Technical Support Document in lieu of preparing an environmental impact report or negative declaration. In addition, the ARB will respond in writing to all significant environmental points raised by the public during the public review period or at the Board hearing. These responses will be contained in the Final Statement of Reasons for the proposed amendments.

Public Resources Code section 21159 (analysis of methods of compliance) requires that the environmental impact analysis conducted by ARB include the following: (1) an analysis of the reasonably foreseeable environmental impacts of the methods of compliance, (2) an analysis of reasonably foreseeable feasible mitigation measures, and (3) an analysis of reasonably foreseeable alternative means of compliance with the rule or regulation. Our analysis of the reasonably foreseeable environmental impacts of the methods of compliance is presented in Sections C and E below. With regard to mitigation measures, staff has been unable to identify any reasonably forseeable mitigation measures that would achieve additional emission reductions from aerosol coatings, while at the same time preserving the feasibility of the limits and preventing disruption of the aerosol coatings market. Staff's analysis of the feasibility of the limits is contained in Chapters V and VI of this Technical Support Document.

Alternative means of compliance with the aerosol coatings regulation have been studied. One compliance alternative is already available to manufacturers of aerosol coating products, the Alternative Control Plan (ACP) Regulation. The ACP Regulation, Title 17, California Code of Regulations, sections 94540-94555, is a voluntary market-based regulation that utilizes the concept of an aggregate emission cap, or "bubble." An emissions bubble places an overall limit on the aggregate emissions from a group of products, rather than placing a limit on the VOC content of each individual product. To be approved, an ACP must demonstrate that the total VOC emissions under the bubble would not exceed the emissions that would have resulted had the products been formulated to meet the applicable VOC limit. In other words, some products in an ACP could exceed the established VOC limits in the aerosol coating regulation as long as those increased emissions were offset by additional products that over-comply with the established VOC limits. The ACP provides manufacturers with flexibility, but preserves the overall environmental benefits of emission reductions (ARB, 1994a).

At this time, the ACP is the only alternative to the aerosol coatings regulation in achieving equivalent VOC reductions from aerosol coating products. However, as discussed in Chapter V, we plan to propose an alternative reactivity-based regulation to the Board in 1999 to provide additional compliance flexibility.

C. EMISSIONS REDUCTIONS AND POTENTIAL ENVIRONMENTAL IMPACTS

1. Impact on Ground-Level Ozone

As previously stated, overall, the proposed amendments would have an adverse environmental impact because they represent a relaxation of the existing second-tier VOC limits. However, the intent of the proposed amendments is to preserve the commercial and technological feasibility of the VOC limits and ensure that basic market demand can be met. ARB staff believes that these considerations override any adverse impacts that may occur as a result of these amendments.

As reported in the 1997 ARB Aerosol Coatings Survey (ARB, 1997), aerosol coatings products are currently emitting about 21 tons per day of VOCs to the atmosphere. Using the January 8, 1996, limits as a baseline, the proposed limits would reduce these emissions by 3.6 tons per day. If one uses the December 31, 1999, limits as a baseline, the proposed limits would result in an increase in emissions of 5.4 tons per day.

This environmental analysis takes a conservative approach and assumes that the baseline for the analysis is the emission reductions that would be achieved if the currently specified December 31, 1999, VOC limits were implemented. Because the proposed amendments will achieve less emission reductions than the currently specified December 31, 1999, limits would achieve, and will achieve emission reductions beginning on January 1, 2002, instead of on December 31, 1999, the analysis concludes that the proposed amendments will have an adverse environmental impact.

We believe that this conservative approach is consistent with CEQA's goal of providing full disclosure of potential environmental impacts to the Board and the public. It should be noted, however, that manufacturers will still need to reduce the VOC content of the products that they are presently selling (i.e., products that comply with the currently effective January 8, 1996, limits) in order to meet the proposed January 1, 2002, limits. This is because the proposed January 1, 2002, VOC limits are lower than the currently applicable limits, which became effective on January 8, 1996. If the January 8, 1996, VOC limits were used as the baseline instead of the December 31, 1999 limits, then the proposed amendments could be characterized as resulting in an emissions reduction, instead of an emissions increase.

It could be argued that the January 8, 1996, limits should be used as a baseline because of the way that Health and Safety Code section 41712(i) is structured. (A description of this section can be found at the beginning of Chapter I). Section 41712(i) requires the second-tier final limits to be initially set at a level that would achieve a 60 percent reduction by December 31, 1999, regardless of whether it is feasible to actually achieve this goal. Built into the language of the statute is a required hearing by December 31, 1998, on the feasibility of the limits, and a possible delay in the implementation of the limits if they are determined to be infeasible by that date. Since the possibility of a delay and less stringent limits is built into the process established by

the Legislature, one could argue that the December 31, 1999, VOC limits are really provisional limits which may or may not be implemented, and that therefore it is more appropriate to utilize as a baseline the January 8, 1996, limits that actually apply today.

However, there is no need to resolve the issue of what baseline is really the "correct" one. As explained above, in the interests of full disclosure the ARB staff has decided to take a conservative approach, and the December 31, 1999, limits are assumed as the baseline for the purposes of this analysis.

2. Impact on Particulate Matter

Overall, the proposed amendments would have an adverse environmental impact on particulate matter because they represent a relaxation of the December 31, 1999, VOC limits. As discussed above, however, the proposed amendments would achieve emission reductions beyond that achieved from the January 8, 1996, VOC limits that are currently applicable.

Reducing VOCs has a positive environmental impact by reducing the amount of secondary particulate matter (PM) in the atmosphere. Depending on ambient conditions and temperature, gas-to-particle conversion of VOCs and their reaction products may occur. One mechanism of gas-to-particle conversion involves oxidation reactions of VOCs to form semi-volatile or low vapor pressure products which combine with other molecules to form new particles or which condense on preexisting particles (Seinfeld, 1989; Finlayson-Pitts, 1986). Therefore, by reducing the VOC content of aerosol coatings, a positive environmental impact results as fewer VOCs would be emitted to form PM_{10} in the atmosphere.

3. Impact on Global Warming

We do not expect the proposed amendments to have an adverse impact on global warming. The theory of global warming is based on the premise that emissions of anthropogenic pollutants, together with other naturally-occurring gases, absorb infrared radiation in the atmosphere, thereby increasing the overall average global temperature. To meet the VOC limits proposed for aerosol coatings, manufacturers may choose to replace or blend the typical hydrocarbon propellants. Options for propellant replacement include using hydrofluorocarbon (HFC) compounds such as HFC-152a. Because HFC-152a is excluded from the definition of VOC in the aerosol coatings regulation and is negligibly reactive, it may be used to reduce the overall VOC content of an aerosol coating product. The use of HFC-152a can contribute to global warming; however, we have determined that even if all aerosol coating products were reformulated to use HFC-152a, the impact on global warming would be negligible.

Hydrofluorocarbons are non-chlorinated methane and ethane derivatives which contain hydrogen and fluorine. The most likely HFC to be chosen to replace hydrocarbon propellants is HFC-152a (Applegate, 1995). Hydrofluorocarbons absorb infrared energy and therefore can contribute to global warming (Wallington, 1994). The global warming potential (GWP) of

HFC-152a is 50 times greater than hydrocarbon propellants and 150 times greater than carbon dioxide. Because HFC-152a is most likely to be considered as a propellant replacement, our analysis is based on its use (Applegate, 1995; Du Pont, 1992). Based on the 1997 ARB Aerosol Coatings Survey, about 21 tons per day of VOCs are emitted from the use of aerosol coating products. Estimating that the average aerosol coating product contains about 50 percent VOC and half of that is VOC propellant, then if all the propellant is replaced with HFC-152a, the emissions of HFC-152a would increase by no more than 10.5 tons per day. This small increase in HFC-152a emissions would have a negligible impact on global warming. By comparison, although it has a much smaller global warming potential, nearly 100 million tons per day of carbon dioxide, the primary man-made greenhouse gas of concern, is emitted into the atmosphere from existing processes. Furthermore, ARB staff believes that it is highly unlikely that all of the hydrocarbon propellant will be replaced with HFC-152a to meet the proposed VOC limits. The primary reason is that HFC-152a is more expensive than hydrocarbon propellants ($1.85 per pound versus $0.25 per pound, respectively) making it a more expensive reformulation option for manufacturers. The ARB staff acknowledges that these price differences are subject to change, at which point the use of HFC-152a may increase. However, ARB staff will continue to monitor the availability and price changes of HFC-152a. To comply with the proposed VOC limits, manufacturers may also switch to other non-VOC compounds such as acetone.

As mentioned above, carbon dioxide is the primary man-made greenhouse gas of concern. However, the 1997 ARB Aerosol Coatings Survey data indicate that, currently, carbon dioxide is not used in these products. Although carbon dioxide is used to some degree as a replacement propellant in consumer products, it is not considered a very likely replacement for hydrocarbon propellants to meet the proposed limits. Therefore, its use in aerosol coating products due to the proposed amendments would have little or no impact on global warming. In addition, most of the carbon dioxide that is used as a propellant is a recycled by-product of existing processes. Therefore, the use of carbon dioxide would not contribute to a net increase in global warming (ARB, 1995b).

4. Impact on Stratospheric Ozone Depletion

The ARB staff has determined that the proposed amendments would have minimal, if any, impact on stratospheric ozone depletion. The stratospheric ozone layer shields the earth from harmful ultraviolet (UV) radiation (U.S. EPA, 1995b). Depletion of the earth’s ozone layer allows a higher penetration of UV radiation to the earth's surface (U.S. EPA, 1995b). The increase in UV radiation penetration leads to a greater incidence of skin cancer, cataracts, and impaired immune systems (UNEP, 1996). Reduced crop yields and diminished ocean productivity are also anticipated (U.S. EPA, 1995b; UNEP, 1996). Because the chemical reactions which form tropospheric ozone are driven by UV radiation, it is conceivable that a reduction in stratospheric ozone may also result in an increase in the formation of photochemical smog because of the increased levels of UV radiation on the earth’s surface (ARB, 1995a).

Compounds such as CFCs and halocarbons (e.g. halons, 1,1,1-trichloroethane (TCA), and carbon tetrachloride) cause the destruction of the stratospheric ozone layer (U.S. EPA, 1995b). These compounds are generally very stable and do not degrade appreciably in the troposphere (Wallington, 1994; U.S. EPA, 1995b). Instead, they gradually diffuse into the stratosphere where they release chlorine or bromine radicals, which degrade ozone molecules.

When the aerosol coatings regulation was initially adopted in 1995, a provision (Title 17, CCR, section 94522(d)) was included to ensure that manufacturers do not increase the use of ozone-depleting compounds when they are reformulating products to comply with the VOC limits. However, the provision does allow any ozone-depleting compound to be present as an impurity in an aerosol coating in a combined amount with perchloroethylene equal to or less than 0.01 percent, by weight, of the product.

Because it lacks chlorine, HFC-152a probably contributes only slightly to ozone depletion (Wallington, 1994). As evidence of this, HFC-152a is not included on the list of compounds that are scheduled for phase-out under the federal Clean Air Act requirements. If manufacturers choose HFC-152a as a replacement for hydrocarbon propellants, no additional decrease in stratospheric ozone is expected (ARB, 1995b; Daly, 1993).

5. Impacts on Water Quality and Solid Waste Disposal

We do not expect an adverse impact on water quality or solid waste disposal from the proposed amendments. Consumers are not likely to convert to the use of water-based or solvent-based, brush-on paints because the proposed amendments allow for a variety of reformulation options in each aerosol coating category. Without the need to convert to brush-on paints there would be no impact resulting from the use of cleanup equipment or products such as brushes, paint thinner, mineral spirits, various containers, water, and water disposal. Because of this, we do not anticipate any changes in packaging or disposal of aerosol coating products due to the proposed amendments.

D. IMPACTS ON THE STATE IMPLEMENTATION PLAN FOR OZONE

1. Background

The Federal Clean Air Act amendments of 1990 require an ozone attainment plan from every area unable to meet the national ambient air quality standard for ozone. To assist California air districts to meet the challenge of attaining the ozone standard, the ARB and air districts developed the California State Implementation Plan (SIP) for Ozone (ARB, 1994b). State law provides the legal authority to ARB to develop regulations affecting a variety of mobile sources, fuels, and consumer products. The regulations that are already adopted, and measures proposed for adoption constitute the ARB's portion of the SIP. The SIP serves as a "road map" to guide California to attain and maintain the national ambient air quality standard

for ozone. The SIP was submitted to the U.S. EPA on November 15, 1994, and the consumer products element was formally approved on August 21, 1995.

The consumer products element of the SIP is comprised of near-term, mid-term, and long-term measures. The near-term measures are comprised of existing consumer product regulations, the Alternative Control Plan, and the aerosol coating regulation. Of the 265 tons per day (including aerosol coatings) of VOC emissions available for regulation from this category, the near-term measures are designed to achieve a 30 percent reduction from the 1990 baseline emissions, by 2000. The SIP commitment for aerosol coatings is a 60 percent reduction from the 1989 baseline by 2005.

2. Summary of Findings

In evaluating the second-tier VOC limits, we believe that some limits are not technologically and commercially feasible, and other limits are not the most stringent feasible VOC limits. We also believe that a 60 percent reduction in VOC emissions from aerosol coatings is not technologically and commercially feasible.

Therefore, we are proposing less stringent VOC limits for twelve product categories with second-tier limits that are not technologically and commercially feasible. We are also proposing more stringent VOC limits for eleven product categories with second-tier limits that are not the most stringent feasible VOC limits. For all of the proposed VOC limits, we are proposing to extend the December 31, 1999, effective date to January 1, 2002, to provide adequate time for manufacturers to reformulate their products.

Table VII-1 presents the SIP commitments for aerosol coatings and the mid-term measures, which are combined in the SIP. As shown in the table, the combined emission reductions from the mid-term measures and the proposed amendments to the aerosol coatings regulation achieve the emission reduction commitment for 2002. However, the emission reduction commitments for 2005 and 2010 are not achieved. When we made our SIP commitment we acknowledged that we would need to revisit the aerosol coatings regulation to determine if a 60 percent reduction in emissions is technologically and commercially feasible. Because of this, we have not yet submitted the aerosol coatings regulation to the U.S. EPA as a SIP revision. We expect to obtain the necessary emission reductions from alternative measures in time to demonstrate that rate-of-progress and attainment requirements will still be met.

As discussed above, we have raised the final VOC limits for twelve product categories because we believe that the December 31, 1999, limits are not technologically and commercially feasible even with the maximum five year extension. Therefore, this proposal would achieve a 42 percent reduction in aerosol coating emissions instead of the 60 percent reduction commitment in the SIP. However, we believe that a 42 percent reduction in aerosol coating

TABLE VII-1

Aerosol Coatings and Mid-term Measures
Reduction Requirements

SIP Reductions for 2002 (tons per day)

	South Coast	Sacramento	Southeast Desert	Ventura
SIP Commitment				
aerosol coatings & mid-term	**8**	**1.1**	**.6**	**.4**
Current Proposal				
aerosol coatings	5.4	.8	.5	.3
mid-term	+3.8	+.5	+.4	+.2
Total	**9.6**	**1.3**	**.9**	**.5**

SIP Reductions for 2005 (tons per day)

	South Coast	Sacramento	Southeast Desert	Ventura
SIP Commitment				
aerosol coatings & mid-term	**39.2**	**5.6**	**3.5**	**2.2**
Current Proposal				
aerosol coatings	5.4	.8	.6	.4
mid-term	+7.8	+1.0	+.8	+.4
Total	**13.2**	**1.8**	**1.4**	**.8**

SIP Reductions for 2010 (tons per day)

	South Coast
SIP Commitment	
aerosol coatings & mid-term	**43.2**
Current Proposal	
aerosol coatings	5.4
mid-term	+8.3
Total	**13.7**
	(29.5 tpd shortfall in South Coast)*

* The consumer products emissions inventory used to develop the 1994 SIP commitments overestimated the uncontrolled emissions from the mid-term measures categories. The actual shortfall is therefore less than that shown.

emissions represents the most stringent feasible VOC limits that are technologically and commercially feasible. Because these proposed amendments will achieve the SIP commitment for VOC emission reductions in 2002, but not in 2005, this disparity must be addressed in a future update to the SIP.

As part of this effort, we believe that a complete update to the SIP inventory for consumer products is needed. In addition to conducting the 1997 Aerosol Coatings Survey, we are currently conducting a comprehensive survey of the overall consumer product usage and emissions in California. We plan to provide a memorandum to the Board this fall on the status of our survey efforts. We believe this effort is necessary to have an accurate and up-to-date consumer product inventory to use as a basis for addressing our consumer product SIP commitments. The up-to-date consumer product inventory will serve as the basis for amending the official SIP inventory in the year 2000. We will also continue to evaluate emerging technologies for aerosol coatings to determine if further reductions are feasible in the future.

E. ENVIRONMENTAL IMPACTS OF THE PROPOSED AMENDMENT TO THE VOC DEFINITIONS FOR CONSUMER PRODUCTS

Summary of Environmental Impacts

Based on our analysis, we expect that the exemption of methyl acetate from the VOC definition in the antiperspirant and deodorant, consumer products, and aerosol coatings regulations (the consumer products regulations) would not have any significant adverse environmental impacts. In fact, we conclude that the proposed amendment would have a positive impact on tropospheric ozone levels if methyl acetate is substituted for higher reactive VOCs such as alcohols and aromatics. We conducted our analysis with consideration of potential impacts on air quality, water quality, landfill loading, and toxicity.

In analyzing the potential environmental impacts from the proposed exemption, we note that the modification is designed to allow the use of an additional alternative compound, methyl acetate, to comply with the VOC limits in the affected regulations. The Board has already determined that the consumer products regulations would have no significant adverse environmental impacts. Rather, the consumer product regulations would result in beneficial environmental impacts due to a reduction in VOC emissions as manufacturers reformulate their products to comply with the VOC requirements (ARB, 1990, ARB, 1992, ARB, 1995). In these reformulations, manufacturers will be relying on technologies for which the possible impacts have already been thoroughly analyzed and considered by the ARB.

In this analysis for the proposed exemption of methyl acetate, we were primarily concerned with the possibility of any adverse impacts to ground-level ozone and toxicity occurring as a result of reformulations using methyl acetate. Other impacts that we evaluated include the possibility for increased depletion of stratospheric ozone, increased global warming, and increased landfill loading. We also include an analysis of the reasonably foreseeable environmental impacts of the methods of compliance.

With regard to the reasonably foreseeable alternative means of compliance with the regulation, these have already been thoroughly analyzed and found to be environmentally beneficial by the Board. As noted previously, the reasonably foreseeable alternative means of compliance are the commercially and technologically feasible technologies already considered by the Board as being beneficial to the environment. Therefore, we foresee no adverse impacts from the alternative means of compliance in regard to the proposed VOC definition amendment.

In evaluating the cross-media potential impacts from the proposed exemption, we note that, at present, methyl acetate is not used in ARB-regulated consumer products. Several manufacturers have indicated that methyl acetate could be used as a partial substitute for the ethanol used in hairsprays. To the extent that this substitution occurs would be a positive impact because methyl acetate is much less reactive than ethanol. We also note that methyl acetate, in terms of evaporation rate, is similar to acetone, and could potentially be substituted for acetone. Because methyl acetate is less reactive than acetone this substitution would benefit air quality as well. However, we believe that this is unlikely because acetone is already an exempt VOC.

1. Impacts on Landfill Loading and Water Quality

With regard to landfill loading, the ARB staff was unable to identify any scenario in which the modified VOC definitions would result in any impacts to landfills beyond those already evaluated in the rulemaking record for the existing regulations. We conclude that products reformulated using methyl acetate would be packaged in the same types of containers and would be used in the same ways as existing products. Therefore, we expect no significant additional adverse impacts to landfills from the proposed exemption. We also expect no adverse impact on water quality because methyl acetate is readily biodegradable.

2. Impacts on Ground-Level Ozone

To determine the impacts on ground level ozone, ARB staff relied on an earlier analysis performed for acetone prior to its exemption from the consumer products regulations. This analysis was performed in 1995 as part of the rulemaking to amend the antiperspirant and deodorant regulation. ARB staff performed an analysis to determine the effect of a large increase in acetone emissions in the consumer products category. The analysis used the Urban Airshed Model to determine the amount of acetone that could be emitted in the Sacramento Air Basin modeling region to produce the same impact on ozone as the entire consumer product category emissions. A similar analysis was run for the South Coast Air Basin modeling region. Both modeling runs indicated that the mass of acetone emissions from consumer products would have to be four times greater than the total projected emissions from all consumer products to have the same ozone impact (ARB, 1995). Methyl acetate is about one fourth as reactive as acetone. Thus, we predict that methyl acetate emissions would have to be 16 times greater than the total projected emissions from all consumer products to have

the same ozone impact. Therefore, although increasing methyl acetate use could result in increases in ozone over those that would occur if a totally nonreactive substance is used, this effect is expected to be small.

We therefore conclude that because methyl acetate has a reactivity less than some other compounds which were exempted by ARB for low reactivity, the use of methyl acetate should not result in adverse impacts to ground-level ozone. More importantly, if methyl acetate is substituted for more reactive compounds (e.g., petroleum distillates, aromatics, alcohols), the net effect would be additional reductions in ground-level ozone. The overall reduction in ground-level ozone should, therefore, be the same or greater under the proposed modification than it would be under the existing regulations without the methyl acetate exemption.

The VOC definitions essentially classify organic compounds as "reactive," "exempt negligibly-reactive," or "exempt low-reactive" in terms of their propensity to form ozone within short timeframes (i.e., their "photochemical reactivity"). In ARB's existing Low Emissions Vehicle Program and the Consumer Products Reactivity Program (currently under development), the relative reactivity of different VOC species is compared using a scale developed by Dr. William P. L. Carter and based on the concept of maximum incremental reactivity (MIR) (Carter, 1997). Using MIRs for comparison, we find that methyl acetate's photochemical reactivity is very low (with an estimated MIR of about 0.12 gram ozone/gram methyl acetate as compared to methane with an MIR of about 0.01) and less than acetone and ethane, which ARB recently exempted based on an ozone formation screening analysis conducted for these compounds. Carter et al., investigated the reactivity of methyl acetate and determined that it is "one third to one-half as reactive as ethane" and "there is no scenario where methyl acetate is more reactive than ethane" (Carter, 1996). Based on these data, because methyl acetate's reactivity is greater than that of methane, we are proposing to designate methyl acetate as an "exempt low-reactive" compound.

3. Impacts on Stratospheric Ozone Depletion

It is well established in the scientific literature that certain halogenated compounds, particularly some chlorine-containing alkanes, contribute to the depletion of the stratospheric ozone layer. Because methyl acetate contains no chlorine, bromine, or nitrogen, we do not expect it to contribute to stratospheric ozone depletion. We also note that the atmospheric lifetime of methyl acetate is similar to that of ethane, i.e., too short to contribute to stratospheric ozone depletion.

4. Impacts on Global ("Greenhouse") Warming

The ARB staff does not expect the proposed exemption of methyl acetate to contribute significantly to existing global warming because of its short atomospheric lifetime. Currently, neither ARB nor the U.S. EPA recognizes methyl acetate as a greenhouse gas. On the other hand, ground-level or tropospheric ozone is widely recognized as one of the primary greenhouse gases (i.e., carbon dioxide, methane, oxides of nitrogen; chlorofluoro/bromo-alkanes) (ARB, 1996). Therefore, to the extent that manufacturers substitute methyl acetate for more reactive and ozone-forming compounds in their products (see "Impacts on Ground-Level Ozone"), the resulting reductions in ground-level ozone should help alleviate global warming.

5. Impacts on $PM_{2.5}$ Formation

We expect no adverse impact on PM formation due to the proposed exemption of methyl acetate. This is because the main tropospheric fate of methyl acetate is the reaction with the hydroxyl, or OH, radical. In addition, the impact of methyl acetate on $PM_{2.5}$ formation is expected to be negligible. Methyl acetate reacts with the OH radical and is likely to form $H(CO)O(CO)CH_3$ via the alkoxy radical $\dot{O}CH_2O(CO)CH_3$, as suggested by Carter (Carter, 1996). Although there is a modeling fit with the chemical mechanism, there is currently no experimental observation of the dicarbonyl product. Methyl acetate and its reaction products are not expected to undergo gas-to-particle partitioning, and thus should have little or no impact on $PM_{2.5}$ formation.

6. Impacts on Toxicity

To investigate the toxicity of methyl acetate, we asked the California EPA's Office of Environmental Health Hazard Assessment (OEHHA) to assess the health effects of methyl acetate (OEHHA, 1996). OEHHA determined in their initial evaluation that health effects have been seen with exposure to methyl acetate, but only in occupational settings. Health effects include irritated eyes and mucous membranes. At high doses, it causes unconsciousness in animals. Methyl acetate is also metabolized to methanol, a toxic solvent. Methanol can be a reproductive system toxicant at low doses. The American Industrial Hygiene Association has assigned methyl acetate a time-weighted average threshold limit value (TWA-TLV) of 200 parts per million. The Occupational Safety and Health Administration (OSHA) has assigned a permissible exposure level or PEL of 200 parts per million. OSHA identifies the affected systems as the respiratory system, the skin, and the eyes. Additional work, based on animal studies, shows that methyl acetate would be classified as slightly to moderately toxic. The OEHHA concluded that there are little or no data on the effects of methyl acetate at levels below the TLV, levels which might occur in the ambient environment at this time. The principal toxic effect of concern would be related to the effect of the metabolite methanol in sensitive humans. (OEHHA, 1996)

Furthermore, methyl acetate is not listed as a hazardous air pollutant (HAP) in the 1990 Clean Air Act Amendments nor is it listed as a "toxic chemical" under section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA). Methyl acetate also is not listed in the U.S. EPA's IRIS database. Thus, there are no values available for an Oral Reference Dose or an Inhalation Reference Concentration. Methyl acetate is also not considered to be an acute hazard by the inhalation route in California (Title 22. Social Security. Division 4. Environmental Health. Article 11. Criteria for Identification of Hazardous and Extremely Hazardous Wastes). It has also not been identified as a toxic air contaminant by the ARB. (OEHHA, 1996)

In summary, there are little or no data on the effects of methyl acetate at levels that might occur in the ambient environment. The principal toxic effect of concern would be related to the effect of the metabolite methanol in sensitive humans. We believe the data available on methyl acetate do no warrant a concern about health effects at this time. We also believe that methyl acetate may be used as a substitute for other solvents that may be carcinogenic or have other serious health effects. However, because of the lack of available data for methyl acetate, we will monitor the usage of it and consult with OEHHA on the need to further evaluate potential adverse health effects from ambient exposure to this compound.

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VIII.

ECONOMIC IMPACTS

A. INTRODUCTION

In this chapter, we discuss the economic impacts that would be expected from the implementation of the proposed amendments to the aerosol coatings regulation. We also discuss the economic impacts of exempting methyl acetate from the volatile organic compound (VOC) definitions in the aerosol coatings regulation, the antiperspirant and deodorant regulation, and the consumer products regulation. We realize that manufacturers need to reformulate the products they are currently selling in order to comply with the proposed VOC limits. Therefore, the analysis will focus on the "costs" incurred by manufacturers to meet the proposed VOC limits, including the impacts on aerosol coating manufacturers, other associated industries, and consumers. Our analysis also estimates the cost-effectiveness of the proposed amendments to the regulation. However, since the proposed VOC limits and extended effective dates represent an overall relaxation compared with the existing December 31, 1999 limits, the proposed amendments actually represent a cost-savings relative to the existing regulation. Even though the proposed amendments will result in a cost savings, the following analysis addresses the "costs" for manufacturers to reformulate their existing products. This is done in order to fully disclose economic information that may be of interest to the industry and members of the public.

Even though the proposed amendments result in a cost savings, the following analysis addresses for "costs" manufacturers to reformulate their existing products. This is done in order to fully disclose economic information that may be of interest to the industry and member of the public.

Economic impact analyses are inherently imprecise by nature, especially given the highly competitive nature of the aerosol coatings market. While we quantified the economic impacts to the extent feasible, some projections are necessarily qualitative and based on general observations and facts about the aerosol coatings industry. The impacts analysis, therefore, serves to provide a general picture of the economic impacts typical businesses might encounter. We recognize individual companies may experience different impacts than projected.

The overall impacts are first summarized in Section B, followed by a more detailed discussion of specific aspects of the economic impacts in the sections listed below:

(C) Economic Impacts Analysis on California Businesses as required by the California Administrative Procedure Act (APA);
(D) Analysis of Potential Impacts to California State or Local Agencies
(E) Analysis of the Cost-effectiveness and the Impacts on Per Unit Cost
(F) Discussion of the Economic Impacts of Exempting Methyl Acetate

It is important to note that we conducted the economic impacts analysis shown in this report to meet legal requirements under the APA. The economic impacts analysis was prepared in consultation with ARB's Economic Studies Section (section) of the Research Division. The section is staffed with professionals who carry out a broad range of assignments for the ARB and other organizations, including the Governor's Office; Cal/EPA boards, offices and departments; and local air pollution control agencies. The section manages extramural research contracts; develops methodologies; collects, analyzes and distributes economic and financial data; conducts economic and financial analyses, including the economic impact analyses of the Board's regulations; oversees the economic impact analyses of the regulations promulgated by all Cal/EPA boards, offices and departments; and carries out other related tasks as needed by the ARB. The staff hold Ph.D, J.D., M.B.A., M.A., and B.S. degrees in economics, business, chemical engineering, microbiology, and environmental resource science. Members of the section have taught economics, accounting, finance, and computer science at the university level; have given invited talks and presented technical papers to major universities, academic associations, and government agencies; and have worked in the private sector in credit analysis, accounting, auditing, production control, environmental consulting, and business law.

B. SUMMARY OF FINDINGS

Overall, most affected businesses will be able to absorb the costs of the proposed amendments to the regulation with no significant adverse impacts on their profitability. This finding is indicated by the staff's estimated change in "return on owner's equity" (ROE) analysis. The analysis found that the overall change in ROE ranges from negligible to a decline of about eight percent. However, the proposed amendments may impose economic hardship on some businesses with small or no margin of profitability. These businesses, if necessary, can seek relief under the variance provision of the aerosol coatings regulation for extensions to their compliance dates. Such extensions may provide sufficient time to minimize the cost impacts to these businesses. Because the proposed amendments would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment; business creation, elimination or expansion; and business competitiveness in California. We also found no significant adverse economic impacts on any local or State agencies.

The cost-effectiveness of the proposed VOC limits is similar to the cost-effectiveness of other ARB consumer product regulatory programs. Our analysis shows that the cost-effectiveness of the proposed amendments ranges from less than $1.00 to $3.00 per pound of VOC reduced. The overall cost-effectiveness across all categories of aerosol coatings is $1.57 per pound of VOC reduced.

C. ECONOMIC IMPACTS ANALYSIS ON CALIFORNIA BUSINESSES AS REQUIRED BY THE CALIFORNIA ADMINISTRATIVE PROCEDURE ACT (APA)

Legal Requirements

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states.

Also, State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance. The estimate shall include any nondiscretionary cost or savings to local agencies and the cost or savings in federal funding to the State.

Findings

Potential Impact on California Businesses - Our findings show that most California businesses will be able to absorb the costs of the proposed amendments with no significant adverse impacts on their profitability. However, the proposed amendments may impose economic hardship on some businesses with small or no margin of profitability. These businesses, if necessary, can seek relief under the variance provision of the aerosol coatings regulation for extensions to their compliance dates. Such extensions may provide sufficient time to minimize the cost impacts to these businesses. Also, the Alternative Control Plan provides flexibility by allowing emissions averaging between aerosol coating products which may help these businesses to mitigate their costs. Because the proposed amendments would not alter significantly the profitability of most businesses, we do not expect a noticeable change in employment; business creation, elimination or expansion; and business competitiveness in California.

Discussion

This portion of the economic impacts analysis is based on a comparison of the return on owner's equity (ROE) for affected businesses before and after inclusion of the cost to comply with the proposed amendments. The data used in this analysis were obtained from publicly available sources, the ARB's 1997 Aerosol Coatings Survey, and the staff's cost-effectiveness analysis discussed later in this chapter.

Affected Businesses

Any business which manufactures or markets aerosol coating products can be directly affected. Also, potentially affected are businesses which supply raw materials or equipment to these manufacturers or marketers, or distribute or sell aerosol coating products. The focus of this analysis, however, will be on manufacturers or marketers of aerosol coating products.

Of the 53 manufacturers of aerosol coating products included in the ARB's 1997 Aerosol Coatings Survey, a total of 43 made products in 1997 which would not comply with our proposed VOC limits. Three California based manufacturers account for three percent of the noncomplying products. The total number of noncomplying products reported was 3,366.

Study Approach

The approach used in evaluating the potential economic impact of the proposed amendments on these businesses is outlined as follows:

(1) Affected businesses which responded to the survey were classified by the size of their sales in order to select typical businesses.
(2) Compliance costs were estimated for these typical businesses.
(3) Estimated cost was adjusted for federal and State taxes.
(4) The three-year average ROE was calculated for each business by averaging the ROEs for 1994 through 1996. ROE is calculated by dividing the net profit by the net worth. The adjusted cost was then subtracted from net profit data. The results were used to calculate an adjusted three-year average ROE. The adjusted ROE was then compared with the ROE prior to inclusion of the compliance cost to determine the potential impact on the profitability of the business. A reduction of more than ten percent in profitability is considered to indicate a potential for significant adverse economic impacts.

The threshold value of ten percent has been used consistently by the ARB staff to determine economic impact severity (ARB, 1991; ARB, 1995). This threshold is consistent with the thresholds used by the United States Environmental Protection Agency and others.

Assumptions

The ROEs before and after the subtraction of the adjusted compliance costs were calculated based on the following assumptions:

(1) A typical business on a nationwide basis in the aerosol coatings industry is representative of a typical California business in the aerosol coatings industry;
(2) All affected businesses are subject to federal and State tax rates of 35 percent and 9.3 percent, respectively; and
(3) Affected businesses are not able to increase the prices of their products, nor can they lower their costs of doing business through short-term, cost-cutting measures.

Given the limitation of the available data, staff believes these assumptions are reasonable for most businesses at least in the short term; however, they may not be applicable to all businesses.

Results

Typical California businesses are affected by the proposed VOC limits to the extent that the implementation of these requirements would change their profitability. Using ROE to measure profitability, we found that of the three California manufacturers making noncomplying aerosol coatings, the change in ROE varied from a negligible affect to a drop of about eight percent, with most companies experiencing a drop of two percent or less. This represents a minor change in the average profitability of a California business.

The estimated potential impacts to businesses' ROEs may be high because affected businesses probably would not absorb all of the increase in their costs of doing business. They might be able to pass some of the cost on to consumers in the form of higher prices, reduce their costs, or do both.

Potential Impact on the Consumer - The potential impact of the proposed amendments on the consumer depends upon the ability of affected businesses to pass on the cost increases to consumers. In the short run, competitive market forces may prevent businesses from passing their cost increases on to consumers. Thus, we do not expect a significant change in retail prices in the short run. In the long run, however, if businesses are unable to bring down their costs of doing business, they could pass their cost increases on to consumers. In such a case, we estimate that price increases would be less than seven percent, as calculated later in this chapter, which represents a minor impact on consumers.

The proposed amendments may also affect consumers adversely if they result in reduced performance attributes of the products. However, this scenario is unlikely to occur for the following reasons. First, for most categories, there are complying products already

available on the market. Thus, industry already has the technology to manufacture compliant products that meet consumer expectations. Second, marketers are unlikely to introduce a product which does not meet consumer expectations. This is because such an introduction would be damaging not only to the product sale, but also to the sale of other products sold under the same brand name (impairing so-called "brand equity"). Finally, the Board has provided, under its existing consumer products program, flexibility to businesses whose situations warrant an extension to their compliance dates. For companies which can justify such variances, the additional time may afford more opportunity to explore different formulation, cost-cutting, performance-enhancing, or other marketing strategies which can help make the transition to new complying products nearly transparent to consumers.

Potential Impact on Employment - The proposed amendments are not expected to cause a noticeable change in California employment and payroll. According to *Ward's Business Directory of U.S. Manufacturing Industries,* California employment in businesses classified under Standard Industrial Code (SIC) 2851, which includes the aerosol coatings industry, totaled less than 600 employees in 1994, well under one percent of the total manufacturing jobs in California. These employees generated about $18 million in payroll, accounting for less than 0.1 percent of the total California manufacturing payroll in 1994.

Potential Impact on Business Creation, Elimination or Expansion - The proposed amendments would have no noticeable impact on the status of California businesses. This is because the reformulation costs are not expected to impose a significant impact on the profitability of businesses in California. However, some small businesses with little or no margin of profitability may lack the financial resources to reformulate their products in a timely manner. Should the proposed amendments impose significant hardship on these businesses, temporary relief in the form of a compliance date extension under the variance provision may be warranted.

While some individual businesses may be impacted, the proposed amendments may provide business opportunities for other California businesses or result in the creation of new businesses. California businesses which supply raw materials and equipment or provide consulting services to affected industries may benefit from increased industry spendings on reformulation.

Potential Impact on Business Competitiveness - The proposed amendments would have no significant impact on the ability of California's businesses to compete with businesses in other states. Because the proposed amendments would apply to all businesses that manufacture or market aerosol coatings regardless of their location, the proposed amendments should not present any economic disadvantages specific to California businesses.

D. ANALYSIS OF POTENTIAL IMPACTS TO CALIFORNIA STATE OR LOCAL AGENCIES

We have determined that the proposed amendments to the aerosol coatings regulations will not create costs or savings, as defined in Government Code section 11346.5 (a)(6), to any State agency or in federal funding to the State, costs or mandate to any local agency or school district whether or not reimbursable by the State pursuant to Part 7 (commencing with section 17500, Division 4, Title 2 of the Government Code), or other nondiscretionary savings to local agencies.

E. ANALYSIS OF THE COST-EFFECTIVENESS AND IMPACTS ON PER UNIT COST

Introduction

In the following analysis, we evaluate the anticipated cost-effectiveness of the proposed amendments. Such an evaluation allows us to estimate the efficiency of the regulation in reducing a pound of VOC relative to the efficiencies of other existing regulatory programs. To do this, we applied a well-established methodology for converting compliance costs to an annual basis. We then report the ratio of the annualized costs to the annual emission reductions in terms of "dollars (to be) spent per pound of VOC reduced."

Methodology

The cost-effectiveness of a limit is generally defined as the ratio of total dollars to be spent to comply with the limit (as an annual cost) to the mass reduction of the pollutant achieved by the limit (in annual pounds). Annual costs include annualized nonrecurring (fixed) costs
(e.g., total research and development (R&D), product and consumer testing, equipment purchases/modifications, etc.) and annual recurring costs (e.g., raw materials, labeling, packaging, etc.).

In this analysis, we essentially treated the proposed limit for each category of aerosol coating as a separate regulation. We determined the fixed and recurring costs for each category which had measurable VOC reductions; thus, a total of 14 individual cost-effectiveness analyses were conducted. In many of the specialty coating categories, either all of the products or nearly all of the products comply with the proposed limits; thus there is little or no compliance cost or reductions. A "lumped" cost-effectiveness calculation was performed for these 21 categories.

We annualized the nonrecurring fixed costs using the Capital Recovery Method as recommended under guidelines issued by the California Environmental Protection Agency (Cal/EPA). Using this method, we multiply the estimated total fixed costs to comply with each limit by the Capital Recovery Factor (CRF) to convert these costs into equal annual payments

over a project horizon (i.e., the projected useful life of the investment) at a discount rate (Cal/EPA, 1996). We then sum the annualized fixed costs with the annual recurring costs and divide by the annual VOC emission reductions to calculate the cost-effectiveness of each limit, as shown by the following general equation:

$$\text{Cost-Effectiveness} = \frac{(\text{Annualized Fixed Costs}) + (\text{Annual Recurring Costs})}{(\text{Annual Reduction in VOC emissions})} \quad (1)$$

where:

$$\text{Annualized Fixed Costs} = (\text{Fixed Costs}) \times \frac{i(1+i)^n}{(1+i)^n - 1} \quad (2)$$

$\frac{i(1+i)^n}{(1+i)^n-1}$ = Capital Recovery Factor (CRF)

i = discount interest rate over project horizon, (7.5%)

n = number of years in project horizon (5 years for annualized costs)

Fixed Costs = total nonrecurring cost per product category

= (Nonrecurring Cost per Product) x (Total Noncompliant Products in Category)

Assumptions

We calculated the cost-effectiveness with an assumed project horizon of five years. We also assumed a fixed interest rate of 7.5 percent throughout the project horizon. Based on these assumptions, the CRF is 0.24716. These assumptions are more conservative than those used in other cost-effectiveness analyses of air pollution regulations. For example, in calculating the cost-effectiveness of the Mid-term Measures consumer products regulations, a 10 year project horizon and 10 percent interest rate were used, yielding a CRF of 0.16274.

In calculating the recurring costs, we assumed that noncomplying products would use HFC-152a to meet the proposed limits. The sales weighted average (SWA) VOC content of the noncomplying products was calculated for each category. Generally, this value was about 10 weight percent above the proposed limit. As a conservative estimate, we assumed that this 10 percent VOC would be replaced by HFC-152a purchased at a cost of $1.85 per pound. Subtracting the cost of the propellant being replaced reduces this cost to about $1.60 per pound. In cases where the SWA VOC content of the noncomplying products was less than 10 percent above the limit, the smaller percentage value was used.

In calculating the fixed costs, we used the following methodology:

- Determine the manufacturers that make noncomplying products;
- Determine total complying and noncomplying sales of these manufacturers;

- If total sales of these manufacturers are less than 33,000 lbs per year (100 cans per day), then research and development will be done by existing staff and only a new propellant tank is required;
- If total sales are greater than 33,000 lbs per year, then a chemist would be hired for 1 year at a cost of $100,000 for research and development, and a new propellant tank is required;
- A new propellant tank and associated plumbing and controls costs $25,000;
- If a manufacturer's noncomplying sales represent less than 10 percent of their total sales, then research and development will be handled by existing staff as part of ongoing product development;
- Each manufacturer's fixed cost is apportioned over the categories in which it sells noncomplying products by the percentage of its noncomplying sales in that category relative to its total noncomplying sales;
- Total fixed costs for each category are the sum of the apportioned fixed costs for each manufacturer of noncomplying products in that category.

The assumptions used in the methodology described above are conservative. If a company has sales of 33,000 pounds per year, this equates to approximately 50,000 cans per year. At an estimated sales value of $3 per can (Plasti-kote), sales total $150,000, and the manufacturer's profits are significantly less than $1 per can (Plasti-kote). Even at $1 profit per can, this leaves a manufacturer with only $50,000 profit. Hence, for a manufacturer to hire a chemist for a year, total sales would probably need to exceed 100,000 pounds per year.

Based on discussions with industry members, the cost to install a propellant tank is approximately $25,000 (Aeropress). *Chemical and Engineering News* reports in their July 28, 1997, issue an average chemist salary in 1997 as $63,000. Hence with benefits, $100,000 per year is a reasonable estimate for a chemist's salary. Total fixed costs for large manufacturers are estimated to be $125,000 ($25,000 for a propellant tank + $100,000 for a chemist), and this value is consistent with discussions between staff and industry members (Zynolyte).

We assumed products reformulated to meet the proposed VOC limits will be marketed throughout the U.S. by national marketers. For the annual recurring costs, we assumed compliant reformulations would result in cost changes only as a result of changes in a product's raw materials and their associated prices. Changes in packaging, labeling, distribution and other recurring costs were assumed to be negligible relative to baseline levels of these costs.

It is important to note, that in this analysis, we assumed that all manufacturers will conduct their own research and development, purchase their own equipment, and make all other expenditures and efforts necessary to reformulate their products. Essentially, each manufacturer and marketer is assumed to directly conduct all reformulation and research and development efforts.

Results

The cost-effectiveness of the proposed VOC limits is presented in Table IX-1. As shown in the table, cost-effectiveness ranges from less than $1.00 to slightly over $3.00 per pound of VOC reduced, with a sales-weighted average for all proposed limits of $1.57 per pound of VOC reduced. This value is within the range of cost-effectiveness of other consumer products regulations. For perspective, the cost-effectiveness of the Phase III Consumer Products Regulation varied from no cost to about $5.60 per pound of VOC reduced, with an average of about $0.70 per pound of VOC reduced.

The per-unit price increase can be estimated based on the total annual cost in Table VIII-1. The total cost per day is $11,193, hence the yearly cost is about $4 million. The total sales are 38.22 tons per day, hence the yearly can sales, at an average container size of 10.5 ounces, are about 42.5 million units. The increased manufacturing cost is thus less than10 cents per unit. Assuming the cost increases between manufacturer, distributor and retailer, we estimate a maximum per unit cost increase of about 20 cents per unit. Given a typical aerosol coating sales price of about $3.00 per can, this represents less than a seven percent increase in per unit cost to the consumer.

F. DISCUSSION OF THE ECONOMIC IMPACTS OF EXEMPTING METHYL ACETATE FROM CONSIDERATION AS A VOC

Summary of Economic Impacts

We do not expect any adverse economic impacts to result from the proposed amendments to exempt methyl acetate from the aerosol coatings regulation, the antiperspirant and deodorant regulation, and the consumer products regulation. In fact, these proposed amendments would not require manufacturers to do anything differently. The amendments simply provide that any methyl acetate used in a product formulation or reformulation would not be counted as a VOC. Because of the increased flexibility in the reformulation of products that would result from this modification, we expect no significant adverse impact on: manufacturers' profitability; employment in California; the status of California businesses; or competitiveness of California businesses with other states. Manufacturers would only choose to reformulate using methyl acetate if it is the most cost effective reformulation option.

Businesses Affected

Any business which manufactures or markets products subject to the requirements of the consumer products regulations can potentially be affected by the proposed amendment. Manufacturers using the Alternative Control Plan Regulation (sections 94540-94555), for compliance would also be affected because the definitions in the consumer products regulations are incorporated in the Alternative Control Plan Regulation.

Economic Impacts

The proposed amendment to the VOC definition to exempt methyl acetate in the consumer products regulations would provide an additional option to manufacturers reformulating to meet upcoming VOC limits or for formulating new products. Therefore, we expect no adverse economic impact to manufacturers profitability. Manufacturers are likely to reformulate using methyl acetate only if it is the most cost effective compliance option. In these instances there could be a cost savings, that could potentially be passed on to consumers.

Because the proposed amendment to the VOC definitions affect all manufacturers and marketers in the same way, regardless of their location, California businesses would not be at a competitive disadvantage. Also, the proposed amendment would have no noticeable impact on employment and the status of business in California, because the exemption would impose no additional costs on businesses.

TABLE VIII-1
ESTIMATED COST EFFECTIVENESS BY AEROSOL COATING CATEGORY

Aerosol Coating Category	California Sales (ton/day)	VOC Reductions (ton/day)	Annualized Fixed Cost ($/day)	Annualized Recurring Cost ($/day)	Total Annual Cost ($/day)	Cost-Effectiveness ($/lb-VOC reduced)
General Categories						
Clear Coatings	1.60	0.16	328	411	739	2.31
Flat Paint Products	3.19	0.34	239	856	1,094	1.61
Fluorescent Coatings	0.33	0.02	32	59	91	2.28
Metallic Coatings	2.50	0.23	180	694	874	1.90
Nonflat Paint Products	16.57	1.41	495	4,271	4,766	1.69
Primers	3.93	0.44	205	1,018	1,223	1.39
Subtotals	28.12	2.60	1,479	7,309	8,787	
Specialty Categories						
Art Fixatives or Sealants	0.33	0.03	80	41	121	2.02
Auto Body Primers	0.50	0.04	4	101	105	1.31
Auto Bumper and Trim	0.36	0.01	23	35	58	2.90
Exact Match Engine Enamel	0.42	0.01	4	15	19	0.93
Exact Match Automotive	0.73	0.03	50	89	139	2.31
Ground/Traffic/ Marking	4.73	0.74	259	1,280	1,539	1.04
High Temperature Coatings	0.73	0.07	53	161	214	1.53
Vinyl/Fabric/Leather/ Pol	0.35	0.00	9	11	20	1.34
All Other Coating Categories*	1.95	0.03	136	55	191	3.19
Totals	38.22	3.56	2,098	9,097	11,193	**Overall 1.57**

***** **Contains the following categories:** Aviation or marine primers; aviation propeller coatings; corrosion-resistant brass, bronze, or copper coatings; exact match industrial; floral sprays; glass coatings; hobby/model/craft (h/m/c) enamel; h/m/c lacquer; h/m/c clear or metallic; marine spar varnishes; photographic coatings; pleasure craft finish primers, surfacers, or undercoatings; pleasure craft topcoats; shellac sealers, clear; shellac sealers, pigmented; slip-resistant coatings; spatter/multicolor coatings; webbing/veil coatings; weld-through primers; wood stains; and wood touch-up, repair, or restoration coatings.

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IX.

FUTURE ACTIVITIES

We are developing a voluntary compliance alternative based on the science of reactivity. Reactivity is a measure of a VOC's potential to form ozone in the air we breathe. Of the many different VOCs released into the atmosphere, each reacts at a different rate and through a different chemical reaction mechanism. The VOCs with high reactivity have a greater potential to form ozone, while other VOCs react slowly in the atmosphere, and are less likely to form ozone. Using a reactivity scale we can account for the differences in VOC reactivities, and use the differences to control emissions from aerosol coatings. Our reactivity program would be based on the maximum incremental reactivity (MIR) scale developed by Dr. William Carter of the University of California at Riverside. To ensure that the best available science is reflected in this scale, we are in the process of having Dr. Carter's work peer reviewed. Following this review, we plan to present our proposal to the Board in 1999.

We intend to propose a new voluntary regulation, the California Low Emissions and Reactivity (CLEAR) Regulation for Aerosol Coatings. With the CLEAR Regulation manufacturers would be able to choose to comply with either the mass-based or the reactivity-based VOC limits, which ever are more cost-effective. The proposed reactivity limits would be designed to achieve equivalent ozone reductions while providing compliance flexibility.

We also plan to develop voluntary reactivity programs for other consumer product categories and amend the Alternative Control Plan Regulation to allow emissions averaging on a reactivity-weighted basis for consumer products and aerosol coating products.

APPENDIX A:

Proposed Amendments to the Aerosol Coating Products Regulation, Antiperspirant and Deodorant Regulation, and the Consumer Products Regulation

APPENDIX B:

Aerosol Coating Products Survey Form

APPENDIX C:

Public Meeting Notices (Subgroups and Workshops)