

**California Environmental Protection Agency**

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**Air Resources Board**

**Staff Report: Initial Statement of Reasons  
For the Proposed Amendments to the  
California Consumer Products Regulation  
Relating to Aerosol Adhesives**

**Release Date: April 7, 2000**

**State of California  
California Environmental Protection Agency  
AIR RESOURCES BOARD  
Stationary Source Division**

**STAFF REPORT: INITIAL STATEMENT OF REASONS  
FOR THE PROPOSED AMENDMENTS TO THE CALIFORNIA  
CONSUMER PRODUCTS REGULATION RELATING TO AEROSOL  
ADHESIVES**

**PUBIC HEARING TO CONSIDER AMENDMENTS TO THE  
CALIFORNIA CONSUMER PRODUCTS REGULATION**

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# Initial Statement of Reasons for the Proposed Amendments to the California Consumer Products Regulation Relating to Aerosol Adhesives

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## **I. SUMMARY**

In this summary, a plain English discussion is presented of the Air Resources Board (ARB or Board) staff's proposal including new volatile organic compound (VOC) limits for aerosol adhesives and an assessment of the technological and commercial feasibility of the existing VOC limit. Also, a discussion of the staff's proposal and rationale to prohibit the use of toxic compounds, such as methylene chloride, in the formulation of aerosol adhesive products is provided. This 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.

### **A. Introduction**

California Health and Safety Code (HSC) section 41712, requires the ARB to adopt consumer product regulations that achieve the maximum feasible reduction in VOC emissions. State law requires that all consumer product regulations be technologically and commercially feasible. In addition, HSC sections 39657 and 39658 require the ARB to identify toxic air contaminants (TACs) that are emitted in California, and to establish airborne toxic control measures to reduce exposure to identified TACs.

In January 1992, the Board adopted standards for aerosol adhesives as part of the Phase II Consumer Products Regulation. For aerosol adhesives, two tiers of standards for VOC content were adopted: a 75 percent by weight (%) standard effective January 1, 1995, and a 25% VOC standard effective January 1, 1997. In November of 1996, the ARB delayed implementation of the 25% VOC standard until 2002, because at that time the Board found that the standard was not technologically, nor commercially feasible.

State law also requires the Board to hold a public hearing on or before July 1, 2000, on the need for, and the feasibility of, establishing a more stringent standard than the 75% VOC limit. At this hearing, the Board is to consider amendments to the aerosol adhesive standards if it determines that more stringent limits for aerosol adhesives are feasible and at a minimum, represent best available retrofit control technology (BARCT).

### **B. Summary of Proposed Amendments**

#### **Why is staff proposing amendments to the aerosol adhesive standards?**

Staff's proposal to revise the aerosol adhesive standards of the consumer products regulation is based on a recent technical evaluation of the standards. Staff's technical evaluation consisted of conducting an in-depth survey on the composition and VOC content of products sold in California in 1998 and an assessment of manufacturer's research and development efforts to formulate lower VOC products. Staff found that the future 25% VOC limit will not be attainable by 2002, as presently required. However, staff did find that other VOC limits, lower than the current 75% VOC limit, are achievable and meet the criteria for being technologically and commercially feasible.

Staff also found that toxic compounds such as methylene chloride, perchloroethylene, and trichloroethylene are still being used in aerosol adhesives, although in small amounts. In the technical assessment, staff found that aerosol adhesives can be formulated without these toxic compounds and that alternative products already exist. Eliminating these toxic compounds from aerosol adhesives would reduce the cumulative exposure and risks from aerosol adhesives and other sources of these toxic compounds.

### **What amendments to the aerosol adhesive standards are being proposed?**

#### *Eliminate the 25% VOC standard-*

Based on staff's technical assessment, the future 25% VOC standard will not be attainable by 2002. The original basis for the 25% VOC standard was the anticipation that water-based technology would prove to be technologically and commercially feasible. Attempts to manufacture and commercially market a water-based aerosol adhesive have not been successful. Except for methylene chloride, staff has not identified an acceptable solvent or hardware technology to meet the future 25% VOC standard.

#### *New Categories of VOC Standards-*

In evaluating the ability to meet more stringent VOC standards, staff considered the requirements of Health and Safety Code (HSC) section 41712 that requires the ARB to establish standards that do not eliminate any consumer product form from the marketplace. This section also requires the ARB to establish standards that are based on best available retrofit control technology (BARCT) for aerosol adhesives and are technologically and commercially feasible. Accordingly, staff proposes new VOC standards that are contained in Table I-1.

Staff is proposing that aerosol adhesives be divided into three major categories, with one of the categories further subdivided into six subcategories. The new categories are special purpose applications, mist sprays, and web sprays. The categories are proposed to recognize each category's and subcategory's unique performance criteria in relation to the lowest achievable VOC limit.

The proposed standards were developed based on staff's evaluation of the 1998 aerosol adhesives product survey, staff's technology assessment, and discussions with industry experts. The proposed standards include VOC limits that staff believes represent BARCT and are technologically and commercially feasible. Staff found that these VOC limits represented the maximum VOC emission reductions feasible, based on the current knowledge of aerosol adhesive technologies.

In developing the proposed VOC limit for each category and subcategory, staff evaluated the lowest achievable VOC level that could be found in current products being commercially marketed, or in anticipated products that could be marketed in the

near future. Staff found that in many cases, products formulated with methylene chloride, perchloroethylene, and trichloroethylene could meet a VOC level substantially below the current 75% VOC standard. However, because these compounds are toxic, staff chose to exclude the use of those compounds as a compliance option. Therefore, staff is proposing VOC standards that represent the maximum VOC reductions that are technologically and commercially feasible, without the use of methylene chloride, perchloroethylene, or trichloroethylene.

**Table I-1  
Proposed New Product Category VOC Limits**

Product Category	Weight Percent VOC
Mist Sprays	65
Web Sprays	55
Special Purpose	
Mounting	70
Flexible Vinyl	70
Automotive Headliner	65
Polystyrene Foam	65
High Pressure Laminate	60
Polyolefins	60

*Labeling Requirements-*

Staff is proposing new requirements for aerosol adhesive product labeling that would require manufacturers to indicate on the product labels the appropriate product category. This requirement would facilitate compliance with the proposed VOC limits and discourage misapplication.

*Toxics Prohibition-*

Staff proposes to prohibit methylene chloride, perchloroethylene and trichloroethylene, which are toxic air contaminants (TACs), in the formulation of aerosol adhesives. Staff found that these toxic compounds are used very little in aerosol adhesives, and manufacturers have formulated safer alternative products. Also, these toxic compounds are used in other consumer and industrial products. Eliminating these TACs in aerosol adhesives would reduce the overall exposure and risk to these TACs.

*Reporting Requirements and Technology Review-*

Staff is also proposing to continue the requirement that industry report the status of research and development efforts to assist in the potential to meet lower VOC standards in the future. Along with this information, staff proposes that a technology assessment be conducted at a future date. Staff believes that in the future, new solvent and hardware technology may be developed to further reduce VOCs in aerosol adhesives.

### *Other Amendments-*

Finally, staff is proposing other minor changes to improve the overall clarity of the proposed standards and to facilitate incorporation of the proposed amendments into the existing consumer products regulation.

## **C. Effects of the Proposed Amendments**

### **Who would be affected by the proposed amendments?**

The amendments would affect any person who uses, sells, supplies, offers for sale, or manufactures for use in California any aerosol adhesive product subject to the standards. This includes manufacturers, distributors, wholesalers, retailers, and end users.

The primary impact would be on manufacturers and marketers of aerosol adhesives, who would have to reformulate most 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 products would have to be reformulated, suppliers of chemicals, propellants, containers, valves, and other aerosol product components may be impacted.

### **What products would be affected by the proposed amendments?**

In the 1998 aerosol adhesive product survey, information was provided for 136 products. Of these products, 33 were formulated with either methylene chloride, perchloroethylene, trichloroethylene. Together, these 33 aerosol adhesive products comprise about three percent of the total marketshare. The remaining aerosol adhesives are formulated with VOCs, or a mixture of VOCs and exempt compounds, such as acetone. These products make up the majority of the marketshare.

Of the 136 products reported, about 80 percent, or 111 would need to be reformulated to meet the proposed standards and the toxic prohibition. For the 33 products formulated with methylene chloride, perchloroethylene and/or trichloroethylene, staff has determined that there are alternative products available that do not contain these toxic compounds. One product formulated with water is no longer being produced because of manufacturing and application problems.

### **Would the performance of aerosol adhesives products be affected and would complying products be available to meet the demand?**

There would be some changes in the characteristics of the reformulated aerosol adhesive products. However, staff does not expect significant impacts on product performance. The proposal includes establishing three general categories of products: mist, web and special purpose. The special purpose category is further distinguished

by six subcategories to address specific performance characteristics needed for certain special applications. Except for the web category, complying products already exist in the market. However, for all of the proposed categories, manufacturers have indicated that existing products can be reformulated, or new products developed, to meet market demand.

#### **D. Requirements in State Law**

##### **Do the proposed amendments meet the requirements of State law pertaining to aerosol adhesives?**

Yes. As discussed earlier, State law requires the Board to prepare a study and hold a public hearing on or before July 1, 2000, to evaluate the need for, and the feasibility of, establishing a more stringent standard or standards than the current 75% VOC standard. The Board is to consider amendments to the aerosol adhesive standards if it determines that more stringent limits for aerosol adhesives are feasible and at a minimum, represent best available retrofit control technology (BARCT). The Board must also determine if the limits are technologically and commercially feasible.

In response to State law, staff conducted a technology assessment to determine if a more stringent standard or standards are feasible. Staff determined that lower VOC limits are feasible and staff is recommending that the Board find that the VOC limits contained in the proposed amendments meet BARCT and are technologically and commercially feasible. Staff also is recommending that the Board find that the future 25% VOC standard, effective January 1, 2002, is not technologically and commercially feasible and does not represent BARCT.

##### **Do the proposed amendments meet the requirements of State law pertaining to toxic air contaminants?**

Health and Safety Code sections 39657 and 39658 require the ARB to identify toxic air contaminants (TACs) that are emitted in California, and to establish airborne toxic control measures to reduce exposure to identified TACs. Health and Safety Code section 39658 further requires the ARB to determine the need and appropriate degree of regulation for each TAC and to assess the availability, suitability, and relative efficacy of other substitute compounds that are less hazardous.

The Board identified methylene chloride in July 1989, trichloroethylene in October 1990, and perchloroethylene in October 1991 as TACs. The Board determined that these TACs are probable human carcinogens and did not establish a threshold level, below which there would be no adverse health effects.

Staff, in addressing the requirements of HSC section 39658, has prepared a "need assessment" to determine the need and appropriate degree of regulation. This evaluation is contained in Appendix G. According to staff's evaluation, the use of aerosol adhesives containing methylene chloride, perchloroethylene and

trichloroethylene can pose a potential health risk. Together with other numerous consumer and industrial products and processes that contain these and/or other TACs, cumulative exposure and risk to these TACs may be significant. Therefore, any reduction of these TACs in aerosol adhesives would reduce the cumulative exposure and risks from these toxic compounds.

## **E. Regulatory Development Process and Evaluation of Alternatives**

### **How did the ARB staff develop the proposed amendments?**

The staff developed the proposed amendments with participation of stakeholders including: 3M Products Company, Sherwin Williams, Camie-Campbell, Amrep, DAP, Hydrosol, and WilsonArt. The National Paint and Coatings Association (NPCA) has actively coordinated the participation of the manufacturers and has been instrumental in gaining consensus among the industry group. Also, the U.S. EPA and five local air pollution control districts participated in the process.

The staff first worked with industry in developing a survey form to gather information on 1998 aerosol adhesive product sales and formulations, and on the manufacturers' research and development efforts. The survey form was mailed out in March 1999. Staff subsequently gathered product sales literature and visited potential industrial users including a silk screening plant, countertop manufacturer, framing shop, and embroidery shop. Staff also called potential industrial users to gather information on uses and manufacturers. After reviewing the survey results, staff held conference calls with several manufacturers to discuss their individual survey responses.

Staff also worked with the NPCA and several companies in evaluating industry recommendations for new VOC limits for aerosol adhesives. Staff's discussions with industry resulted in several refinements to the recommendations, which assisted staff in developing the proposed amendments.

Several meetings were conducted with individual companies, as well as a public meeting and a public workshop, to discuss the results of the survey, the technical assessment, and the proposed recommendations for new VOC limits. Staff also plans to conduct another public workshop after the release of the Staff Report to further discuss the proposed amendments.

### **What information was gathered from the ARB's 1998 Aerosol Adhesive Survey?**

The 1998 aerosol adhesive product survey requested: (1) general information about the responding companies; (2) product specific formulations including VOC content, solvents, sales data and cost-information; and (3) information on the company's research and development effort to achieve the 25% VOC standard by January 1, 2002. The company information and product specific cost information were needed to perform staff's economic impact analysis. The product specific formulation and sales information were needed to determine the VOC emissions inventory.

The staff worked with the industry and the trade association to ensure that the responses to the survey were complete as possible. To allow the industry access to the information during development of the proposed amendments, staff worked with the industry to develop non-confidential summaries of the survey data. As a result, staff believes the survey data represents over 90 percent of the emissions associated with aerosol adhesive products.

## **F. 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 would need to replace some of the VOC solvents or propellants in their formulations with exempt compounds or 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 solids;
- Reconfigure spray delivery systems; and
- Use exempt propellant, hydroflurocarbon-152a.

### **Are the proposed VOC limits technologically and commercially feasible?**

The ARB has previously established criteria for determining whether VOC standards are technologically and commercially feasible in the consumer product regulations, and this criteria is contained in Appendix B. Staff believes that the proposed VOC limits meet this criteria and are, therefore, technologically and commercially feasible. Staff's evaluation of the latest aerosol adhesive technologies concludes that products can be reformulated to gain incremental emission reductions through the use of exempt compounds, modifications to active ingredients, and improvements to hardware.

The proposed VOC limits specify three general adhesive categories, with one of these categories further sub-grouped to allow successful reformulation of products used for specialized applications. Although the proposed limits require most aerosol adhesives to be reformulated, aerosol adhesive manufacturers concur with staff that the proposed VOC limits are attainable by 2002. In addition, the proposed amendments also meet the requirements of BARCT, as defined by the 1990 ARB California Clean Air Act guidance document, "Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology".

## **Is the proposed prohibition on certain toxic compounds feasible and are there alternatives?**

Manufacturers have reduced the use of methylene chloride, perchloroethylene and trichloroethylene in aerosol adhesive formulations from historical use due to the toxic nature of these compounds. Manufacturers have eliminated these compounds from most of their product lines altogether to reduce product liability and to meet requests from consumers for safer products. However, some manufacturers have continued to produce limited products containing methylene chloride, perchloroethylene and trichloroethylene to address specific performance criteria that some customers have requested. Staff's discussions with these manufacturers indicate that several are about to phase-out these toxic compounds from their product lines. Other manufacturers indicate that their limited sales of these products in California have little effect on their overall business, and they would likely exclude these products from California sale if these toxic compounds were no longer available for use.

Although these toxic compounds are little used in aerosol adhesives, public and worker exposure can be significant due to the cumulative exposure that results from all products and sources that use toxic compounds. Methylene chloride and perchloroethylene are used in many consumer and industrial products, as well as in industrial processes such as degreasing operations. Eliminating the use of toxic compounds in aerosol adhesives would help reduce the cumulative exposure to the general public and to workers.

As part of the process to develop an airborne toxic control measure, HSC section 39658 requires an assessment of efficacy of alternative substitutions. Staff, in conducting the technology assessment for aerosol adhesives, found that there are alternative products that do not contain these toxic compounds that provide similar performance and applications. Manufacturers have readily commented that the use of these toxic compounds is not necessary to meet the various types of applications and demands for aerosol adhesives. The NPCA, which represents manufacturers with the majority of the market share and products, have indicated that they would support a prohibition of these compounds in aerosol adhesives.

### **G. Aerosol Adhesive Emissions**

#### **What is the emissions inventory for aerosol adhesives?**

The 1990 emissions inventory for aerosol adhesives was based on a manufacturer survey of products sold in California for 1990. Manufacturers were requested to report their California sales and VOC content for each product. At the time, aerosol adhesives were regulated by both the local air pollution control districts (districts) and the State. The districts regulated industrial use while the State regulated consumer use. In this context, manufacturers responded to the product survey by reporting only products they marketed for consumer and institutional use. Based on the product survey, emissions

from aerosol adhesives in 1990 were estimated to be about 150 tons per year (TPY), or about 0.4 tons per day (TPD).

Last year, staff conducted another manufacturer product survey for products sold in California in 1998. This survey requested manufacturers to submit California sales for all uses of aerosol adhesives. State law, enacted in 1996, provided the ARB with new authority to regulate all aspects of aerosol adhesives that include industrial, commercial, and consumer products. The authority of districts to set more stringent standards for industrial uses of aerosol adhesives ceased at that time. State law provided that districts would regain this authority on January 1, 2000. The revised emission inventory for 1998 is estimated at about 700 TPY, or about 1.9 TPD. The differences between the 1990 and the 1998 inventories are accounted for by the growth in product sales and the inclusion of industrial uses of aerosol adhesives that were excluded from being reporting on the 1990 inventory.

### **What are the emission reduction benefits from the proposed amendments?**

Aerosol adhesives account for about 700 TPY of VOC emissions. Based on the existing future effective 25% VOC limit, the VOC emission reductions are estimated to be about 1.2 TPD. Under the proposed amendments, staff expects VOC emissions reductions to be about 0.2 TPD. The 0.2 TPD estimate includes the increase in VOC emissions resulting from reformulating current products to eliminate the use of methylene chloride, perchloroethylene and trichloroethylene. It is expected that the reformulation of these toxic products would include the use of VOC solvents or propellants to replace these toxic compounds.

The proposed toxic prohibition on these toxic compounds would reduce statewide methylene chloride emissions by about 18 TPY. Perchloroethylene and trichloroethylene emissions would be reduced by about 0.5 TPY combined.

## **H. Economic Impacts**

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

Under the proposed amendments, manufacturers would have to meet less stringent standards than are currently scheduled to take effect. Therefore, the proposed amendments would result in an overall cost savings to affected businesses. However, staff conducted an analysis of the costs manufacturers would incur to reformulate their existing products to meet the proposed VOC limits. This was done in order to provide full disclosure of economic information that may be of interest to industry and members of the public.

As stated earlier, the proposed VOC limits would primarily impact aerosol adhesive manufacturers and marketers (companies which contract out the manufacturing of their products). Staff recognizes that other industries could also be impacted to a lesser

degree, but this 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.

In conducting an economic impact analysis, staff 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 the analysis, staff relied on a combination of publicly available financial databases and information provided by aerosol adhesive manufacturers.

Based on this analysis, staff expects most manufacturers to be able to absorb the added costs of the proposed amendments without an adverse impact on their profitability. The complete economic analysis is contained within Chapter VIII.

The proposed amendments are not expected to have a significant impact on employment, or business creation, elimination, or expansion. Also, the proposed amendments are not expected to have a significant impact on the competitiveness of California businesses compared with those outside of California. This is because companies that sell aerosol adhesive products in California have to meet the proposed VOC limits, whether located in or outside of California.

### **Would the proposed amendments be cost-effective?**

Cost-effectiveness is one measure of a standard's efficiency in reducing a given amount of pollutant (often reported in dollars to be spent per pound of VOC reduced). Under the proposed amendments, manufacturers would have to meet less stringent standards than are currently scheduled to take effect. Therefore, the proposed amendments would result in a cost savings to affected businesses relative to the future 25% VOC limit. However, staff conducted an analysis of the cost-effectiveness of reformulating existing products to meet the proposed VOC limits. To conduct our analyses, staff relied on specific formulation data from the 1998 ARB product survey, industry journals/literature, and discussions with industry representatives. Our analyses considered separately the impacts on the cost-effectiveness from annual costs, including annualized nonrecurring (fixed) costs (e.g., total research and development (R&D), product and consumer testing, equipment purchases/modifications, development of new labels, etc.) and annualized recurring costs (e.g., changes in raw materials, separate California inventory, etc.).

Based on these analyses, the cost-effectiveness of the proposed aerosol adhesive standards is estimated to be \$6.02 per pound of VOC reduced. This estimated cost-effectiveness is consistent with the existing ARB consumer products regulation, including the Mid-term Measures and Mid-term Measures II Regulations, which varied from no cost to about \$7.10 and \$6.30 respectively, per pound of VOC reduced.

## **Would consumers have to pay more for aerosol adhesives subject to the proposed amendments?**

Staff estimates the cost per unit increase to be about \$0.30 per unit. To the extent manufacturers pass these costs along to the consumer, the actual retail price changes may be lower or higher than indicated by this analysis. However, the overall price increase associated with the proposed amendments should represent less than an eight percent increase in per unit cost to the consumer. Chapter VIII shows staff's detailed analyses of the unit cost increase.

### **I. Environmental Impacts**

As discussed earlier, the proposed amendments would eliminate the existing 25% VOC standard and replace it with several new standards that are less stringent; resulting in about 1 TPD less emission reductions statewide. Therefore, the proposed amendments would achieve less VOC reductions than the existing 25% standard to be implemented in 2002. However, these changes are necessary to preserve the technological and commercial feasibility of the VOC limits and to be representative of BARCT. The proposed amendments allow manufacturers to continue to manufacture consumer acceptable products that would meet the market demand. These considerations should override any loss in VOC reductions that may occur as a result of the proposed amendments.

It should be noted that manufacturers would still need to reduce the VOC content of most of the products they are selling in order to meet the proposed January 1, 2002, VOC limits. This is because the proposed VOC limits are lower than the currently applicable limit of 75% VOC which became applicable on January 1, 1995. Staff estimated that the proposed January 1, 2002, VOC limits would achieve about 0.2 TPD reduction in VOC emissions relative to the current 75% VOC limit for aerosol adhesives, which would result in a positive impact on air quality and public health.

The proposed amendments would also have a positive impact by reducing public and worker exposure to toxic compounds. Eliminating the use of methylene chloride from aerosol adhesives would result in reducing emissions of this compound by about 18 TPY. Perchloroethylene and trichloroethylene emissions would be reduced by about 0.5 TPY combined.

Based on staff's analysis, as detailed in Chapter VII, no other adverse environmental impacts are expected to result from the proposed amendments. Also, 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 were evaluated and found to not be significant.

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

The U.S. EPA and the ARB have listed methylene chloride, perchloroethylene, and trichloroethylene, as hazardous air pollutants and toxic air contaminants, respectively. These compounds have been shown to cause adverse health effects in humans when exposed to established acute threshold concentrations of these compounds. Also, the ARB has determined that these toxic compounds are probable human carcinogens and that no minimum threshold levels exist, below which there are no adverse health effects.

Staff estimates that the risks to workers and the general population from the current use of aerosol adhesives containing these TACs are likely small. Staff estimated worker exposure to be several orders lower than established Occupational Safety and Health Administration workplace standards. In regard to the risk to the general population, staff estimated, using a conservative model, the potential cancer risk to range from 3 to 30 chances in a million. Less conservative assumptions in the model would predict cancer risks several times lower.

Although staff believes that the risks resulting from the current use of aerosol adhesives containing methylene chloride, perchloroethylene, and trichloroethylene are small, staff acknowledges that there are consumer and industrial products and processes that use these toxic compounds. Cumulative exposure and risks from the sources may be significant. The proposed amendments would eliminate the use of these compounds in aerosol adhesives, which would reduce emissions, public and worker exposure, and risks to these toxic compounds.

## **Do the proposed amendments satisfy the commitments in the SIP?**

No. The proposed amendments to the aerosol adhesive standards would relax the future effective 25% VOC limit and would result in less emission reductions, resulting in a small SIP shortfall. Also, contributing to the SIP shortfall is the use of acetone, an exempt compound, since the 1994 SIP treats acetone as a VOC and no credit is given in "1994 SIP currency" when acetone is used to reduce VOC emissions.

The projected shortfall is estimated to be about 0.28 TPD of VOC emission reductions statewide in 2010 from what was assumed in the 1994 SIP. Although using acetone to meet the proposed VOC limits provides real emission reductions, these benefits are not credited in "1994 SIP currency".

As discussed earlier, based on the current inventory, the proposed amendments would achieve about 0.2 TPD of VOC emission reductions, or about a 10% reduction in emissions. If the percent reduction based on the current inventory is applied to the 1994 SIP inventory, the proposed amendments would provide about 0.05 TPD of VOC reductions. Again, because the 1994 SIP gives no credit for acetone, the SIP shortfall remains 0.28 TPD.

Compared with the currently effective 75% standard for aerosol adhesives, the proposed amendments are expected to provide emission reductions statewide toward meeting the State and federal clean air goals. Federal ozone nonattainment areas rely on emission reductions from consumer products, including aerosol adhesives, to meet federal ozone standards between 2005 and 2010, depending on the area. However, using "1994 SIP currency", the staff's proposal would fall short of the 1994 SIP baseline emission reductions target by about 0.28 TPD of VOC emission reductions statewide in 2010. Staff will address this shortfall when the statewide control strategy is revised in 2001. At that time, staff will be assessing all feasible cost-effective emission reductions, including re-examining the standards currently in place for a broad range of consumer products under the jurisdiction of the ARB.

## **J. Future Activities**

### **What future activities are planned for aerosol adhesives?**

The proposed amendments would extend the requirement for manufacturers to track and report their research and development efforts towards reformulating their products with lower VOCs. ARB staff intends to use this information to conduct a technology assessment in 2004 to determine if the aerosol adhesives VOC limits should be lowered.

Currently, there are new solvents being evaluated for ozone reactivity, toxic effects, and other environmental concerns that may have the potential to be used in the formulation of aerosol adhesives. These exempt solvents may hold promise in providing manufacturers with better solvent properties and the ability to further lower the VOC content in aerosol adhesives. The proposed technological assessment would consider any future advancement in exempt solvents as well as advancements in polymer and hardware technology.



## **II. RECOMMENDATION**

Staff recommends that the Board adopt the proposed amendments to the aerosol adhesive standards of the consumer products regulation.

Based on the technical assessment of the future 25% VOC standard that becomes effective in January 2002, staff is recommending that the Board determine that this standard is not technologically nor commercially feasible. Staff is also recommending that the Board determine that the proposed VOC limits for aerosol adhesives are technologically and commercially feasible and represent BARCT. Staff is also recommending that the Board determine that the use of toxic compounds such as methylene chloride is not necessary in the formulation of aerosol adhesive products since alternative solvents and products are available.



### **III. BACKGROUND**

This chapter summarizes the background regarding the ARB's authority to adopt consumer product standards and to regulate toxic air contaminants.

#### **A. Legislative History**

The ARB's authority to regulate aerosol adhesives and other consumer products is contained in Health and Safety Code (HSC) section 41712. Health and Safety Code Section 41712 was originally enacted by the California Clean Air Act in 1988. By 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 standards.

Health and Safety Code section 41712 requires the ARB to adopt regulations to achieve the maximum feasible reduction in VOCs emitted from consumer products. As part of the regulatory adoption process, the ARB must determine that adequate data exist to adopt regulations. The ARB must also find that the regulations are necessary, technologically and commercially feasible, and do not eliminate a product form.

By 1996, several districts had adopted adhesives rules that included standards for aerosol adhesives. District standards for aerosol adhesives were not uniform. In 1996, the legislature amended Health and Safety Code section 41712 by enacting Assembly Bill 1849 (AB 1849, Sher; Stats. 1996, Chapter 766). The AB 1849 amendments gave the ARB sole authority (until January 1, 2000) to set standards for all uses of aerosol adhesives to ensure uniform standards applicable on a statewide basis. The ARB's 75% VOC standard for aerosol adhesives was expanded to cover all aerosol adhesive applications: consumer, commercial, and industrial. Beginning January 1, 2000, local districts are free to adopt more stringent standards.

Assembly Bill 1849 also requires the ARB to conduct an evaluation on the need for, and feasibility of, establishing a more stringent standard and to hold a public hearing by July 1, 2000. At the hearing, the ARB is to report the findings of their evaluation and to propose appropriate standards reflective of best available retrofit control technology.

In addition to regulating criteria pollutants, the ARB is also granted authority under HSC sections 39656 to 39658, identify and regulate toxic air contaminants. The HSC Section 39656 and 39658 specify criteria that the ARB must follow to formally identify a compound as a toxic air contaminant, and to develop an airborne toxic control measure (ATCM). Health and Safety Code section 39658 also specifies that the ARB must conduct an assessment to determine the need and appropriate level of regulation for each ATCM. To date, the ARB has identified over 200 compounds as toxic air contaminants and has promulgated several ATCMs to reduce exposure to these compounds.

## **B. Consumer Products Regulation Background**

The ARB's plan to reduce emissions from consumer products has led to the adoption of several consumer product regulations:

- Antiperspirant and Deodorant Regulation (1989)
- Phase I Consumer Products Regulation (1990)
- Phase II Consumer Products Regulation Amendments (1992)
- Alternative Control Plan (1994)
- Aerosol Coatings Regulation (1995, 1998)
- Mid-term Measures (1997)
- Hairspray Credit Program Regulation (1997)
- Mid-term Measures II (1999)

The first regulation, the antiperspirant and deodorant regulation (Title 17, California Code of Regulations (CCR), sections 94500-94506.5), was adopted in November 1989 and reduced VOC emission limits from antiperspirants and deodorants.

The ARB then adopted a more comprehensive consumer products regulation (Title 17, CCR, sections 94507-94517) in two phases. The Phase I consumer products regulation was approved in October 1990 and placed limits on 16 consumer product categories. The second phase (Phase II) consumer products regulation, approved by the Board in January 1992, added ten additional consumer product categories, including household adhesives, to the Table of Standards (which specified the allowable VOC content of consumer products within specified time periods). Household adhesives were categorized as "aerosol" and "all other forms." For aerosol adhesives, two tiers of standards for VOC content were adopted: a 75% standard effective January 1, 1995 and a 25% standard effective January 1, 1997.

The third ARB regulation, known as the alternative control plan (Title 17, CCR, sections 94540-94555) was approved by the ARB in September 1994. The Alternative Control Plan (ACP) is a voluntary, market-based regulation, which provides manufacturers flexibility by allowing compliance to an aggregate emissions cap, or "bubble". This regulation supplements the consumer products regulations by allowing aerosol adhesive manufacturers additional flexibility when formulating their products. The ARB adopted the fourth regulation, the aerosol coatings regulation (Title 17, CCR, sections 94520-94528) on March, 1995 which placed limits on 35 categories of aerosol coating products. During the same rulemaking, the ARB also adopted amendments to the ACP to make it possible to "bubble" emissions from aerosol coating products.

The Board approved several amendments to the consumer products regulation (mid-term measures) after a July 24, 1997, public hearing. At that time, the commitment in the 1994 SIP was partially met with the approval of VOC limits for 18 new categories of consumer products.

On November 13, 1997, the Board approved the second voluntary regulation, the hairspray credit program regulation. The hairspray credit program and related amendments provide for a market-based emission reduction credit program for both credit generation from hairsprays and credit use within the consumer products arena. The hairspray credit program is contained in Title 17, CCR, sections 94560-94575.

On November 19, 1998, the Board adopted amendments to the aerosol coatings regulation; the consumer products regulation; and the antiperspirant and deodorant regulation. The amendments modified the December 31, 1999, VOC limits in the aerosol coatings regulation, and the effective dates for these VOC limits. Minor changes were also made to the definitions and administrative requirements in the aerosol coatings regulation.

The ARB evaluated aerosol adhesive manufacturers' progress towards meeting the 25% VOC standard in 1996<sup>[LL1]</sup>. The ARB determined that manufacturers could not meet the VOC standard without reformulating with methylene chloride. In addition, manufacturers indicated that other low VOC technologies were too costly and not commercially feasible. Accordingly, in 1996 the Board extended the compliance date for the 25% VOC standard from January 1, 1997, to January 1, 2002, to allow more time for manufacturers to comply with the standard without using methylene chloride.

In December 1998, the California Air Pollution Control Officers Association finalized a determination of reasonably available control technology and best available retrofit control technology (RACT/BARCT) for adhesives and sealants. The determination was made to comply with the California Clean Air Act requirements governing the inclusion of RACT/BARCT control technology in district air quality plans (CCR sections 40918-40920). The RACT/BARCT determination includes a 25% VOC limit for aerosol adhesives, effective January 1, 2002. However, it is noted in the determination that the future 25% VOC limit should consider the results of the ARB's technical assessment.

### **C. Regulating Toxic Air Contaminants in Consumer Products**

The ARB has previously addressed toxic compounds in consumer products. In 1989, the Board adopted the antiperspirant and deodorant regulation, which prohibited the use of any TACs in these products.

In 1995, the ARB, regulated methylene chloride by treating this compound as a VOC in aerosol coating products. Also, in 1996 and subsequent revisions in 1997 and 1999, the Board approved provisions to the consumer products regulation to include reporting requirements on the use of perchloroethylene and methylene chloride from all products covered by the consumer products regulation. In 1998, the ARB added new provisions to the aerosol coating products regulation to prohibit any new uses of perchloroethylene.

At the upcoming Board meeting scheduled for April 2000, the ARB will consider a proposed ATCM to prohibit the use of methylene chloride, perchloroethylene and trichloroethylene, in aerosol brake cleaning and other automotive products.

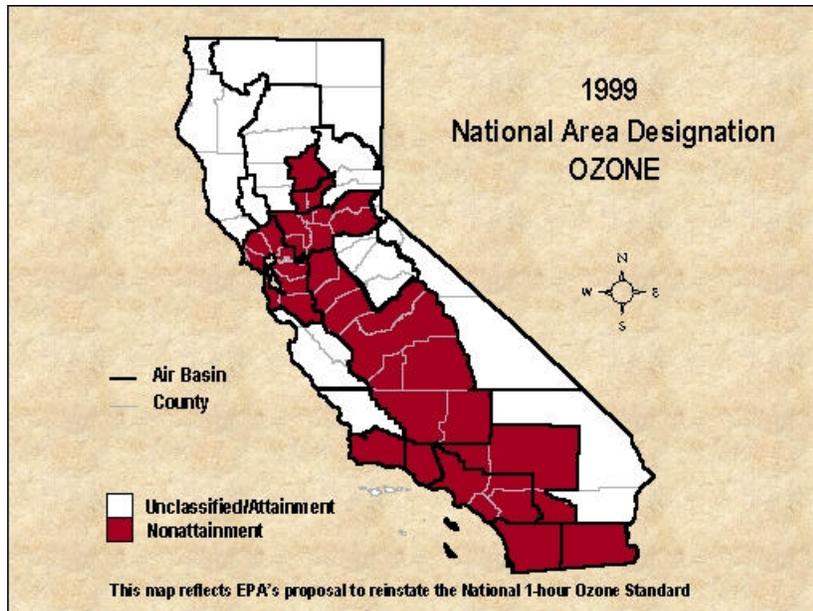
#### **D. The State Implementation Plan (SIP)**

California continues to violate the State and federal ozone standards. As shown in Figure III-1, most of the State does not meet the federal ozone standards. California's plan for achieving the federal ozone standard is contained in the California SIP that was approved by the Board in 1994. The 1994 SIP for ozone projects that an 85 percent reduction in consumer products emissions (from the 1990 baseline year) is necessary to attain the federal ozone standard in the South Coast Air Basin by 2010.

The consumer products component of the SIP, approved by the Board on November 15, 1994, is a multi-faceted program comprised of "near-term," "mid-term," and "long-term" control measures. Under the SIP, the various control measures were anticipated to reduce emissions by 30 percent from the near-term measures, 25 percent from the mid-term measures, and 30 percent from the long-term measures. The near term measures are composed of the antiperspirant and deodorant regulation, the consumer products regulation and the ACP. Aerosol adhesives are part of the consumer products regulation.

On November 15, 1994, the ARB submitted the consumer products Phase II regulations to the United States Environmental Protection Agency (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 regulation was published in the Federal Register on August 21, 1995<sup>[LL2]</sup>.

**Figure III-1  
Federal Ozone Non-attainment Areas**



During the 1996 rulemaking to delay the 25% VOC standard for aerosol adhesives, the ARB determined that the delay would result in a SIP VOC reduction shortfall of 0.2 TPD in 2002. However, the ARB also accounted for this shortfall through additional emission reductions from other aerosol coating product categories not contained in the SIP

### **E. Comparable Federal Regulations**

On September 11, 1998, the U.S.EPA promulgated a national consumer products regulation, the “National Volatile Organic Compound Emission Standards for Consumer Products (40 CFR Part 59, Subpart C, sections 59.201 et seq.; see the September 11, 1998, Federal Register, Vol. 63, No. 176, pages 48819-48847).” This action promulgates national VOC emission standards for 24 categories of consumer products. The rule became effective on September 11, 1998. There are similarities and differences between the California and national consumer products standards. The national standard for aerosol adhesives is the same as the existing 75% VOC standard in California. The national rule does not preclude states from adopting more stringent standards.

Although the national consumer products regulation is similar in many aspects to the California regulation, it is less effective in reducing VOCs. The national regulation does not include second tier standards, mid-term measure categories, or aerosol coatings. The national standards are projected to achieve a 20% VOC emission reduction, while California’s existing consumer product and aerosol coatings standards would achieve a

40% VOC emission reduction. Additionally, the federal consumer products regulation does not apply to toxic compounds.

## IV. DISCUSSION OF AEROSOL ADHESIVES

The use, composition, and emissions of aerosol adhesives are discussed in this chapter.

### A. Aerosol Adhesives Use

Aerosol adhesives are used in both consumer and industrial markets. These adhesives are commonly used for arts and crafts, graphic arts, automotive bodywork, upholstery, construction, silk screening, floral bouquets, embroidery, industrial assembly line work, and packaging. In the past, aerosol adhesives were mainly sold through industrial distributors. Small quantities were also sold to consumers through neighborhood hardware stores. With the introduction of large discount home improvement centers, aerosol adhesives are now sold in high volume within the consumer market.

Aerosol adhesives can be categorized into two types based on spray patterns<sup>[LL3]</sup>: mist and web. Mist type adhesives produce a uniform pattern of discrete particles and are specifically formulated for use on lightweight materials for both repositionable and permanent bonding. Web sprays, on the other hand, are designed with very little atomization to produce a non-uniform lace-like or cobweb-type pattern and are specifically formulated to permanently bond porous substrates and provide gap-filling properties.

Although more expensive than liquid adhesives, aerosol adhesives have certain advantages. Aerosol adhesives have fast drying solvents, which enable the adhesive to bond quicker. They are hand-held, which allows for portability. Because they are self-contained, no applicator, or clean-up equipment is required. For low use and field operations, they can be more cost-effective and more convenient to use<sup>[LL4]</sup>.

### B. Composition

Aerosol adhesives are primarily solvent-based. Solvent-based aerosol adhesives consist primarily of propellants (which exist in an equilibrium state between the gaseous and liquid forms), a mixture of solvents, and active ingredients (mainly 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 solids. Generally, a balance of fast and slower evaporating solvents is used, with a larger proportion of fast evaporating solvent. Each of the components, active ingredients, solvents, and propellants, are discussed below.

#### *Active Ingredients:*

The active ingredients are highly proprietary. They consist of rubbers, tackifying resins, and additives. Rubbers are long-chained polymers that provide elasticity. Rubbers typically used in aerosol adhesives are styrene-isoprene-styrene, styrene-butadiene-styrene, styrene-butadiene, ethylene vinyl acetate, and neoprene. Tackifying resins are

long-chained polymers that combine with rubbers to give the adhesive its stickiness. Typical tackifying resins are rosin esters, hydrocarbon resins, and terpene resins. Additives are added to aerosol adhesives in small quantities to produce desired characteristics. Common additives are antioxidants, plasticizers, heat stabilizers, and end block protectors[LL5]. End blockers are special chemicals added to aerosol adhesives to maintain the integrity of the polymer molecule chains.

#### *Solvents:*

The solvent acts as a carrier for the active ingredients by solubilizing and carrying the active ingredients dispersed or dissolved among the solvent molecules. Strong solvents are generally required to solubilize the solids. Solvents used in aerosol adhesives have been continually evolving.

In the past, methylene chloride was a commonly used solvent. Methylene chloride is an excellent solvent, and is considered a non-VOC, or exempt compound. However, methylene chloride is toxic. In 1987, the Consumer Product Safety Commission (CPSC) established a labeling guidance for products containing methylene chloride. The CPSC considers such products to be hazardous substances under [LL6]the provisions of the Federal Hazardous Substances Act and requires a warning on the label.

Methylene chloride is also considered to be a toxic air contaminant by the ARB [LL7]and a hazardous air pollutant by the U.S. EPA, pursuant to section 112(b) of the federal Clean Air Act Amendments of 1990 [42 U.S.C. section 4712(b)]. In addition, the OSHA set stringent standards and medical surveillance requirements for occupational exposure to methylene chloride. The OSHA standards will be fully implemented by April 2000[LL8]. Thus, adhesive manufacturers are evaluating alternative solvents to formulate their products.

1,1,1-trichloroethane (TCA) is also an excellent solvent and an exempt compound. However, TCA is being phased-out under the Montreal Protocol on Substances that Deplete the Ozone Layer, as amended in June 1990 and November 1992, and under Title VI of the federal Clean Air Act[LL9]. Manufacturers began phasing TCA out of their formulations in the early 1990s.

More recently, adhesive manufacturers have been experimenting with blends of acetone and VOC solvents such as hexane, heptane, and toluene. Since acetone is an exempt compound, formulations with acetone have the benefits of lower VOC levels without toxicity or ozone depleting problems. However, acetone has some limitations in product formulations due to the solubility of the active ingredients, and its damage to certain substrates. Manufacturers' progress in formulating with acetone is discussed further in Appendix F.

### *Propellants:*

Propellants are used to expel or apply the adhesives from the can. There are several types of propellants available: liquid hydrocarbons (VOCs), compressed gases, and hydroflourocarbons. Liquid hydrocarbons are generally used as propellants for aerosol adhesives. Manufacturers prefer to use liquid hydrocarbons because they are inexpensive, and more soluble in the solvent. The increased solubility allows the propellant to aid in the atomization of the spray and to maintain an even pressure throughout the life of the product. Manufacturers typically use blends of propane, butane, and isobutane, to meet specified vapor pressures. Dimethyl ether, though more expensive, is often used in formulations to keep the mixture solubilized.

### **C. Previous Product Surveys and Emissions**

The ARB conducted three previous surveys for aerosol adhesives. Surveys were conducted for sales of consumer and institutional and industrial products for years 1990 and 1995. Products that were considered “industrial only”, as well as products weighing more than one pound, were excluded from the survey. The surveys were conducted to gather information to calculate emissions and to determine the status of research and development efforts to reduce VOC emissions. A third survey was conducted for 1997 sales as part of the 1997 Consumer and Commercial Product Survey for Mid-term Measures II.

The 1990 survey data were used to develop the Phase II limits. The survey category for adhesives was called “household adhesive and sealant.” About one-third of the products reported in this category were formulated for use as sealants. Twenty-one companies reported sales of 65 products for aerosol household adhesives and sealants. Total sales reported were about 310 TPY and total VOC emissions calculated were about 150 TPY.

The 1995 survey data were used to develop the recommendations in the 1996 status report to the Board. Nine companies reported sales of 46 products. Total sales reported were about 240 TPY and total VOC emissions calculated were about 160 TPY.

The third survey was conducted for 1997 sales in anticipation of the statutory-required technical assessment. However, staff later determined that the 1997 survey did not meet the full survey requirements specified in the consumer products regulation. Hence, the staff sent out another survey for 1998 product sales and research. From this survey, staff identified 136 products, which totals about 1040 TPY in sales and about 700 TPY in VOC emissions.



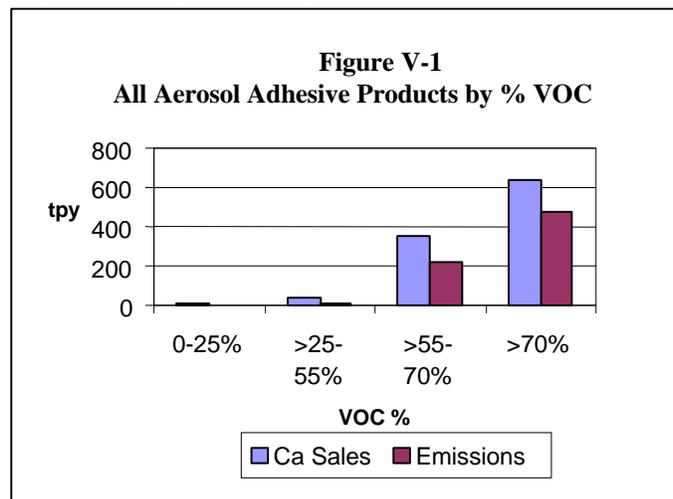
## V. EVALUATION OF THE AEROSOL ADHESIVE VOC STANDARD

The consumer products regulation requires the Board to prepare a study on the feasibility of establishing a standard(s) more stringent than the present 75% VOC standard. As discussed in Chapter III, the Board adopted the 75% VOC standard in 1992, but also adopted a second tier standard of 25% VOC, which was later modified to become effective 2002. As part of the evaluation, ARB staff surveyed aerosol adhesive manufacturers and private label companies to gather information on product sales, formulations, and research and development efforts. A copy of the survey package is included in Appendix D. The sales and emissions information was compiled and evaluated. A detailed staff analysis of the 1998 product survey database is included in Appendix E. The manufacturer's research and development efforts were also surveyed and was supplemented with additional information gathered from phone calls, letters, and workshops. Details on the research and development efforts are included in Appendix F.

### A. 1998 ARB Aerosol Adhesives Survey

In March 1999, staff mailed a survey to manufacturers and other responsible parties to gather information on product sales and formulations and on research and development efforts to produce lower VOC products. In general, staff used the existing consumer products survey mail list as the basis for the aerosol adhesives survey. The list was expanded with names found from shelf surveys, the Internet, and from end users. After compiling the survey results, staff provided survey summaries showing company and product listings, the breakdown of sales and emissions by adhesive type, and VOC ranges and averages.

A total of 47 companies submitted information on sales of aerosol adhesives in California. There are a total of 136 products with about 1040 TPY of associated sales, about 700 TPY of VOC emissions, and about 18 TPY of methylene chloride emissions. The overall average ratio of methylene chloride to VOC solvent use was 3 percent. Figure V-1 graphically shows the product distribution in TPY of sales and emissions by VOC level for all products. With the exception of gasket adhesives, formulations of products with less than 55 percent VOC contained methylene chloride, perchloroethylene, or water. Of the product formulations less than 55% VOC, gasket adhesives made up only about 24 percent of the product sales.



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The sales results were reported according to the following categories: mounting, high performance, repositionable, and general purpose.

In discussions with industry, it became apparent that if necessary, the categories could be simplified to facilitate the development of new standards.

The NPCA proposed a new system of categorizing aerosol adhesives based on three categories: special purpose, general mist, and general web. Staff has revised the categories general mist and general web to mist and web to remove any ambiguity associated with the term “general” as it applies to product labels versus product VOC limits. The web and mist categories refer to spray type. A mist spray is a fine particle, evenly distributed spray; and a web spray is a non-uniform, heavy spray. The proposed special purpose category applies to adhesives formulated specifically for permanent mounting of artwork, repair and edge bonding of countertop laminates, automotive headliners, polyethylene sheeting, flexible vinyl, and polystyrene foam. The categories are discussed in detail in Chapter VI.

Table V-1 shows the product distribution based on the NPCA proposed categories segregated according to products with and without methylene chloride, perchloroethylene, and trichloroethylene. The product grouping does not reflect how companies plan to market their products. Instead it represents the number of products, based on the product survey and product labels, indicating these products have special purpose characteristics. Although all manufacturers have not determined their marketing plans for the proposed categories, they state that their products marketed under the special purpose category should account for about 20 percent of their product sales. They also state that products marketed under the special purpose category would adhere to strict labeling requirements that would limit market appeal to a specific end user. Therefore, staff expects the final mix to have fewer products in the special purpose category than is shown in Table V-1.

**Table V-1  
Product Distribution by Category**

Category	Number of Products	Sales (tpy)	Emissions (tpy)	VOC Range (%)	Wt-Avg VOC (%)
<b><i>Without MeCl/Perc/TCE*</i></b>					
Mist	25	444	321	29-92	72
Web	13	41.1	26.4	43-95	64
Special Purpose	65	519	344	0-89	66
<b><i>With MeCl/Perc/TCE*</i></b>					
Mist	10	1.9	0.6	19-44	29
Web	7	15.3	4.8	21-40	31
Special Purpose	16	17.1	6.0	26-75	35

\*Methylene chloride, Perchloroethylene, and Trichloroethylene are abbreviated as follows: MeCl, Perc, TCE.

It is interesting to note that while the 33 products formulated with methylene chloride, perchloroethylene, or trichloroethylene represent about 25% of all products reported, sales of these products comprise only about 3 percent of the total aerosol adhesives sales.

### **B. 1999 Technology Assessment**

In 1996, staff conducted a technology assessment of aerosol adhesives and identified several potential methods for reducing VOC concentrations in aerosol adhesives. In the 1998 product survey, staff gathered additional information on research and development efforts to reduce the VOC content in aerosol adhesives. Manufacturers reported their findings for various technologies. Staff followed up with phone calls and industry meetings to supplement the information in the survey responses. The following sections discuss staff's 1999 technical assessment, present day formulations, and manufacturer's research and development efforts. Details on staff's technical assessment are found in Appendix F.

### **C. Present Formulations**

Aerosol adhesives are composed of active ingredients, which are mainly rubber and resin solids; solvents; and propellants. The weighted-average solvent and propellant contents reported in the survey were 39 percent and 36 percent, respectively. All VOC components are found in the solvent and propellant portions of the formulation. Typical VOC solvents are pentane, hexane, cyclohexane, heptane, and aromatic hydrocarbon compounds such as toluene and xylene. Typical VOC propellants are propane, butane, isobutane, and dimethyl ether. Both non-VOC and exempt compound solvents and propellants are available in the marketplace. Substitution of the VOC components with alternative components is the easiest way to achieve reductions in VOC content.

## **D. Research and Development Efforts**

### **1. Solvents**

In the 1996 technical assessment, staff found that the only formulations that met the 25% VOC standard were those formulated with methylene chloride. However, manufacturers have begun to slowly phase-out methylene chloride use because of government regulations and customer preference for non-chlorinated formulations. Labels now commonly advertise “non-chlorinated” formulations. Several manufacturers have stated that they would not pursue this solvent technology because of its toxicity, and ARB staff is not considering its use as a reformulation option.

Manufacturers have been studying alternative exempt compounds or non-VOC solvents. In the 1998 survey, manufacturers were asked for their assessment on the use of water, acetone, methyl acetate, parachlorobenzotrifluoride, and volatile methyl siloxanes.

Several companies tested prototype water-based formulations. One company even commercially marketed a water-based formulation. However, manufacturers could not overcome problems inherent to water-based formulations. The major problems associated with water-based formulations are freeze/thaw stability and long drying time. Freeze/thaw stability is the ability to remain stable after undergoing periods of freezing temperatures. The company that produced the commercial formulation had to manufacture and ship the product in warm temperatures. The company also had to instruct users on how to apply the adhesive since water-based adhesives are less forgiving when applied incorrectly. The second factor, drying time, is very crucial to production operations; a longer drying time slows down production time. Recently, the only manufacturer of a water-based aerosol adhesive has discontinued its production due to the manufacturing and application problems discussed above.

Many manufacturers have been experimenting with acetone substitution. Acetone is a fast drying solvent that is now widely used in aerosol adhesives. Acetone is also reasonably priced and has an acceptable odor. However, manufacturers have experienced incompatibility with the rubbers/resins at high concentrations. The maximum content of acetone tolerability in the solvent mixture is about 50 percent. Currently, formulations are not at their maximum and manufacturers believe that they can increase the concentration of acetone to some degree. Other issues that can limit the full use of acetone are its tendency to attack polystyrene foam and its tendency to form wetter bonds. The issue involving attack on polystyrene can be minimized by altering the formulation to make the solvent evaporate faster (less soak-in) or to add a slow evaporating component that remains on the surface until the acetone evaporates [LL10]. Adjustments can also be made to extending the distance between the can and the substrate during application. Longer distances allow much of the acetone to evaporate before reaching the surface. Also, allowing the surfaces to dry adequately allows the acetone to evaporate before becoming trapped into the adhesive bond.

Methyl acetate is chemically similar to acetone, but is more expensive. Thus, manufacturers have not invested much time into reformulating with this compound.

Several companies have also tested parachlorobenzotrifluoride (PCBTF). This compound is an exempt compound. Parachlorobenzotrifluoride, which is similar to toluene, can often substitute for toluene and other aromatics. Unfortunately, there are only about 30 formulations containing aromatic compounds. One manufacturer said that aromatics are not suitable for aerosol adhesive formulations because they are slow drying and because some aromatics are Proposition 65 compounds. If aromatic compounds are used, they are typically used in concentrations less than 5 percent of the total formulation. Thus, the use of PCBTF would not result in significant reductions. Another drawback is the price of PCBTF, which is 14 times more costly than toluene. Nevertheless, there is one commercially available product that is formulated with PCBTF.

Two other solvents, volatile methyl siloxanes (VMS) and t-butyl acetate were also reported. VMS fluids are low molecular weight silicone fluids. They are low in toxicity and almost odorless. Companies responded that the evaporation rate is too slow, the solubility is poor, and the cost is high. While specific information on t-butyl acetate was not requested in the survey, staff requested information on this compound from companies after the survey was mailed. Manufacturers reported that this compound is also slow drying, had poor solubility, and had an unacceptable odor.

## **2. Propellants**

Manufacturers were asked to report on their findings on the use of HFC-152a and compressed gas propellants. Hydrofluorocarbon-152a is a non-VOC, non-ozone depleting propellant that can replace part of the hydrocarbon propellants currently used in aerosol adhesives. The vapor pressure and molecular weight of this compound is similar to that of hydrocarbon propellants. This compound is used as a propellant in hair sprays and mousses. However, in aerosol adhesives, the only formulation in the 1998 inventory using HFC-152a is the one water-based formulation. Companies reported high cost compared to the cost of VOC propellants and incompatibility with adhesive rubbers and resins. Also, HFC-152a, when formulated with products containing acetone, requires the content of acetone to be reduced to maintain product stability. Hydrofluorocarbon-152a can make up 5-15 percent of the formulation.

Compressed gas propellants such as nitrogen and carbon dioxide have been used successfully in aerosol products for many years. However, they are not used in aerosol adhesives. Manufacturers reported that aerosol adhesives work better with a gas that can also serve as a solvent, such as hydrocarbon propellants (propane, butane, and dimethyl ether). Aerosol adhesives need a steady pressure to deliver a constant spray pattern. Also, because these gases would comprise such a small percentage of the contents of the can, their presence would not lower the VOC contents much and they do not contribute much to drying the adhesive during delivery. Even if compressed gases could deliver a constant spray pattern throughout the life of the product, the VOC

reductions would be minimal because the compressed gas would comprise a very small percentage of the formulation compared to soluble propellants.

### **3. Other Technologies**

Two other technologies reported were high solids and hardware modifications. These are two methods that work together to produce a lower VOC product. By increasing the solids content of the formulation, the solvent portion is automatically reduced. However, the higher solids content increases the viscosity of the formulation which leads to problems with product dispensing. Hardware modifications would help to overcome the problems associated with high viscosity. Manufacturers in general have reported that high solids alone will produce minimal reductions in VOC, increased viscosity, and poor spray pattern. Manufacturers have found that they can combine high solids with acetone substitution to maximize VOC reduction potential. One company has successfully used high solids combined with acetone substitution and hardware modifications to reduce VOC content by over 10 percent and expects to achieve even further future reductions.

The use of high solids formulations is more costly because polymers and resins tend to cost more than the solvents they replace. However, even though the price per can may be higher, the coverage per can should be greater. This would help to offset the increased price of the product.

### **E. Findings**

Based on the 1999 technical assessment, staff found that manufacturers will not be able to meet the 25% VOC standard by January 1, 2002, unless they reformulate with methylene chloride. The 25% standard was based on reformulating with water as the solvent. Manufacturers have not been able to formulate an acceptable water-based product.

Staff found that there are presently no other exempt compound solvents that can be used to lower the VOC content to 25%. Methylene chloride is the only readily available solvent that can be used to meet the 25% VOC standard by 2002.

The U.S. EPA has received petitions to review many other solvents for consideration as exempt compounds. To qualify for exempt status a compound must meet low reactivity, low ozone depleting, and low toxicity standards. Manufacturers do not see any compound near exemption status that is suitable as a VOC replacement solvent in aerosol adhesives.

However, manufacturers have existing products that can be reformulated to meet VOC levels lower than the existing 75% standard. Based on the product survey, some products are already at or below a 60% VOC content. Some manufacturers have already taken the lead to optimize the reformulating options discussed earlier, and there

are indications that additional reductions in VOC content can be made for some products.

Staff has determined that it is technologically possible for all aerosol adhesives to meet lower VOC standards than the existing 75% standard. For the aerosol adhesive categories discussed earlier, staff has determined that the following VOC levels in Table V-2 are technologically and commercially feasible.

**Table V-2  
Achievable VOC Levels for Aerosol Adhesives**

Product Category	Weight Percent VOC
Mist Sprays	65
Web Sprays	55
Special Purpose	
Mounting	70
Flexible Vinyl	70
Automotive Headliner	65
Polystyrene Foam	65
High Pressure Laminate	60
Polyolefins	60

Staff has determined that about 80 percent of existing aerosol adhesive products would need to be reformulated to meet these VOC limits. This represents about 75 percent of total product sales. The differences in VOC limit for each category and subcategory is based on the limitations of each reformulation option as they relate to the type of product application. For example, web spray adhesives generally have a higher solids content and, therefore, less solvent. Mist spray adhesives are formulated with more solvent to achieve a lower viscosity level, which aids in delivering a fine mist spray. The additional amount of solvent required would partly consist of VOC compounds. The special purpose categories contain specific performance characteristics that need to be maintained in the product application and require the use of higher VOC levels. For example, some categories cannot tolerate high levels of acetone because of sensitivity to substrate acetone attack. Other categories require special rubbers/resins that are more difficult to solubilize and are incompatible with acetone. The rationale for the proposed VOC limits is discussed in Chapter VI and the detailed 1999 technical assessment is contained in Appendix F.



## **VI. DESCRIPTION AND RATIONALE OF THE PROPOSED AMENDMENTS**

This chapter describes and provides the rationale for the proposed amendments to the aerosol adhesives standards, which include:

- Elimination of the 2002, 25% VOC standard;
- Recommended VOC limits lower than 75%;
- Add labeling requirements;
- Prohibit the use of certain toxic compounds;
- Requires the submittal of research and product information in 2004 to support a technology assessment;
- Perform other minor revisions.

Staff determined that the proposed new standards constitute BARCT and are technologically and commercially feasible, as required by State law. In developing the proposed amendments, staff relied on the 1998 product survey, an evaluation of recent research and development efforts by manufacturers, and on-going technical discussions with industry. These efforts are detailed in staff's technical assessment contained in Appendix F.

The proposed amendments are discussed below.

### **A. Elimination of the 25% VOC Standard**

As discussed in Chapter V, staff has determined that the 25% VOC standard is not technologically or commercially feasible, as required by State law. Staff found that the 25% VOC standard can only be met by using methylene chloride or water-based technology. Neither of these technologies are acceptable compliance options. Therefore, staff proposes to eliminate the future 25% VOC limit, which becomes effective on January 1, 2002.

### **B. Aerosol Adhesive VOC Limits**

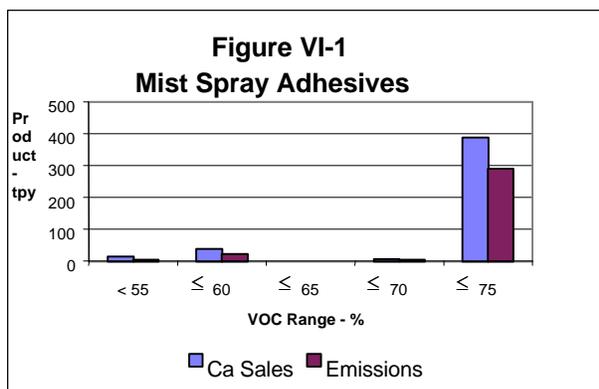
Staff is proposing that three new categories of standards be established consisting of mist, web, and special purpose categories. The proposed VOC limits for these categories are as follows:

<b>Category</b>	<b>Proposed VOC Limits</b>
Mist	65%
Web	55%
Special Purpose:	
- Mounting	70%
- Flexible Vinyl	70%
- Automotive Headliners	65%
- Polystyrene Foam	65%
- High Press. Laminates	60%
- Polyolefins	60%

Staff found that each category is formulated for specific uses of aerosol adhesives. Below is a discussion of the development and rationale for the VOC limits of the proposed categories.

### 1. Mist Sprays

As discussed previously, industry recommended to categorize their aerosol products into three groups. One category consisted of products that are formulated to produce mist sprays. Industry indicated that products in this category are purchased by consumers for their mist properties and are used on many types of substrates and applications. These products are designed for general purpose adhesive use.

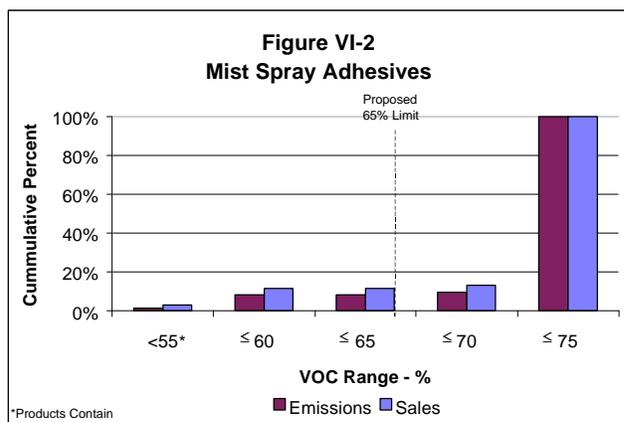


In addressing the mist category, staff evaluated the distribution of products based on their VOC content. Figure VI-1 shows that most mist sprays are formulated above 70% VOC. Some mist sprays contain significantly less VOCs (i.e. less than 55% VOC), but these products are formulated with methylene chloride, perchloroethylene, and/or water. As indicated earlier, staff is proposing a toxics prohibition as part of the amendments, so

products containing methylene chloride would no longer be available. Also, the only water-based product has been recently discontinued due to manufacturing and application problems (see Appendix F for staff's technical assessment).

Staff's discussions with industry indicate that mist sprays are formulated to expel a "dispersion" of adhesive, solvent and propellant. Mist sprays must be formulated with high solvent content to allow for better suspension of the adhesive particles within the can so when the can is shaken and the actuator is depressed, the result will be a fine particle mist with a fairly uniform droplet size distribution. Since many solvents are VOCs, a higher solvent content generally results in a higher VOC content. Therefore, a

higher VOC content is required for these adhesives to maintain the fine-mist properties of this category of aerosol adhesives. These mist properties are needed in the types of general purpose applications that require a smooth and uniform appearance. Staff concurs that with the current limited availability of non-VOC and exempt compound solvents, mist sprays require a threshold level of VOC content to maintain the performance of mist sprays.



Staff is recommending a VOC level for mist sprays at 65% VOC. In evaluating the product distribution, as shown in Figure VI-2, at 65% VOC, complying products comprise about 12% of the marketshare. This means that about 88% of the marketshare would need to reformulate to meet a standard of 65% VOC. Staff estimates that reformulation of these products would provide about 37 TPY of VOC emission reductions. However, 10 products meeting the proposed limit are formulated with

methylene chloride. These products would likely be reformulated with VOC compounds and would result in a small increase in VOC emissions. At a VOC limit of 65%, staff estimates the net VOC emission reductions from this category would be 37 TPY, or about 12% of the emissions from the mist spray category. Also, about 5 pounds per day of methylene chloride emissions would be reduced.

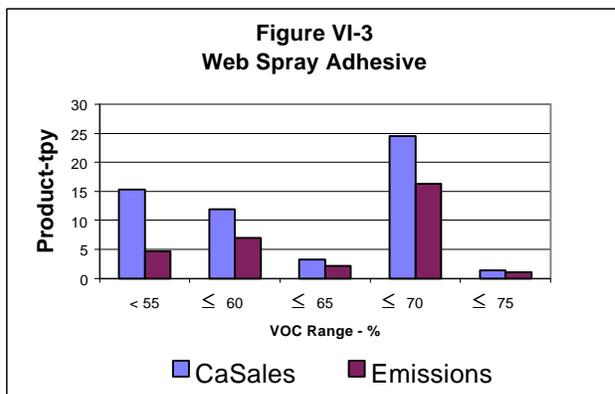
Staff also proposes a definition for mist sprays shown below and is contained in Appendix A.

*“Mist spray adhesive means any aerosol adhesive which is not a special purpose spray adhesive and which delivers a particle or mist spray, resulting in the formation of fine, discrete particles that yield a generally uniform and smooth application of adhesive to the substrate.”*

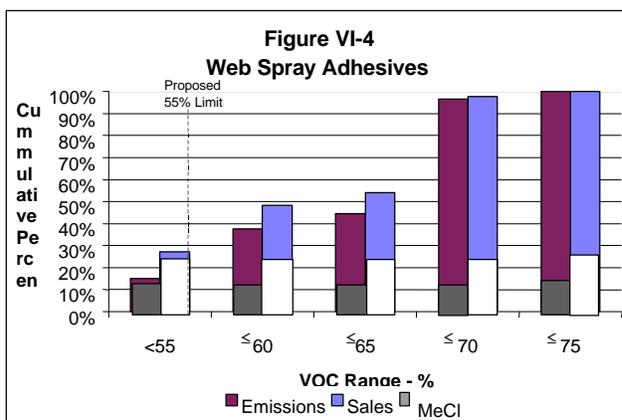
## 2. Web Sprays

The web category proposed by staff consists of products that are formulated to produce a spray pattern resembling a lace or spider’s web pattern. These products are purchased by consumers because they are best suited for particular applications such as bonding large areas and for gap filling. Web sprays are formulated to expel a “solution” of adhesive, solvents and propellant. In the case of web adhesives, the formulation provides for a fairly homogeneous mixture of resins and rubbers, solvents and propellants. When coupled with proper actuator technology, the resulting spray pattern is non-uniform and somewhat characteristic of cobwebs.

Because these products do not require fine atomization of adhesive particles, Industry advised that more flexibility exists to reformulate this category of aerosol adhesives to lower VOC formulations. The web spray adhesive products are mainly used for general adhesive purposes.



The distribution of web spray products, as shown in Figure VI-3, indicates a wider range of VOC formulations than for mist sprays. Figure VI-3 shows that most spray adhesives were formulated to contain between 55 to 70% VOC. Again, the products at or below 55% VOC are formulated with methylene chloride, and these products would no longer be available as a result of staff's proposal to prohibit methylene chloride.



Staff worked with industry representatives, including NPCA and individual companies, to determine what VOC level could be met for these general purpose web spray aerosol adhesives. Based on these discussions, staff is proposing a 55% VOC limit even though no existing product without MeCl meets this level.

Figure VI-4 shows the cumulative amount of product sales and emissions at or below the various VOC levels. As can be seen, about 70 percent of the marketshare would need to be reformulated to a lower VOC level. This would provide about 4 TPY per day of emission reductions. However, about 30 percent of the market share (products formulated at 55% VOC or lower) for this category contains methylene chloride. Reformulating these products with VOC compounds would result in a VOC increase of about 4 TPY. As a result, the proposed VOC limit would only provide about 0.2 TPY of VOC emission reductions, or less than 1% of all web spray category emissions. However, about 8 TPY of methylene chloride emissions would be reduced.

Figure VI-4 shows the cumulative amount of product sales and emissions

A proposed regulatory definition of web spray shown below and is contained in Appendix A.

*“Web spray adhesive means any aerosol adhesive which is not a mist spray or special purpose spray.”*

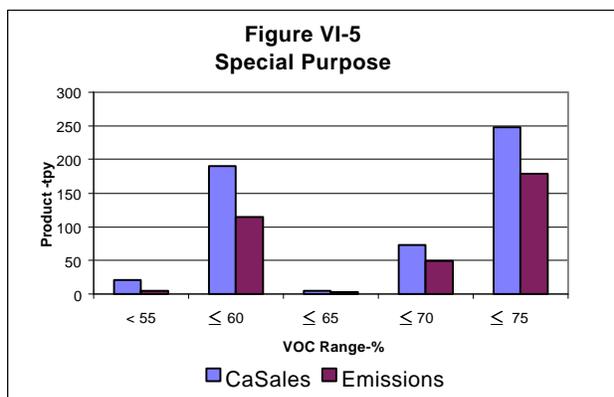
### 3. Special Purpose

The special purpose category includes web and mist sprays that are formulated to perform under extreme temperature, strength or chemical conditions. Staff has found that these products can not be formulated like other general purpose mist and web sprays due to various concerns with substrate integrity and polymer compatibility.

In evaluating aerosol adhesive products that could fall under the special purpose category, staff defined specific groups of aerosol adhesives products that need to be considered. Staff found that products containing acetone can damage certain substrates when acetone comprises a certain threshold level of the formulation. As discussed in our technical assessment, acetone is the main exempt solvent used by manufacturers to reformulate to lower VOC levels. Staff also found that some substrates or mounting articles can only tolerate limited amounts of acetone. Also, staff found that certain applications can fail when exposed to extreme temperatures and chemical attack from plasticizers found in substrates or bonded material.

From this evaluation, staff was able to define six distinct subcategories under the special purpose category. These subcategories include: mounting, flexible vinyl, automotive headliners, polystyrene foam, high pressure laminates, and polyolefins.

From the product survey and product labels, staff placed products that indicated special purpose characteristics into this category. Figure VI-5 illustrates the product sales and



emissions according to their VOC content range. As shown, about half of the special purpose products fall between 60 to 70% VOC, and account for about 50% of the sales and about 45% of the emissions for this category. Also, the sales and emissions from this category represent 56% of sales and about 50% of emissions from all categories of aerosol adhesives.

It should be emphasized that staff's placement of these products in the special purpose category is likely overestimated since many of these products would ultimately be marketed as general purpose products. At this time, staff does not have information to estimate how all these products would be marketed under the proposed categories. Manufacturers have stated that their specific marketing plans have not been developed, but they estimate that their products marketed as special purpose would be about 20 percent of their total product sales.

## **Mounting and Flexible Vinyl (70% VOC Limit)**

### *Mounting:*

This category of adhesives includes specialized formulations, which are used to permanently or temporarily bond sensitive art materials such as paper and photographic stock. In addition, these products are often required to be acid free and non-yellowing to ensure adequate archival performance. In general, these products are mist sprays and are either used for photographic work, or for repositionable mounting work (such as ad agency presentation boards, etc.). The adhesives are generally applied in a light even distribution of adhesive to preclude visual detection.

Staff has found that these products are generally formulated with high VOC levels to address the performance characteristics discussed above. However, in discussions with industry, staff found that the critical application, which need these characteristics, are limited to permanent mounting of photographic stock and artwork that are sensitive to high levels of acetone. In evaluating the product database for these products, staff has identified only 4 products that fall within the criteria and three of them are formulated above 70% VOC. Industry agrees that these products could be formulated to 70% VOC with no degradation of performance. Therefore, staff proposes 70% VOC as the appropriate standard for mounting adhesives.

### *Flexible Vinyl:*

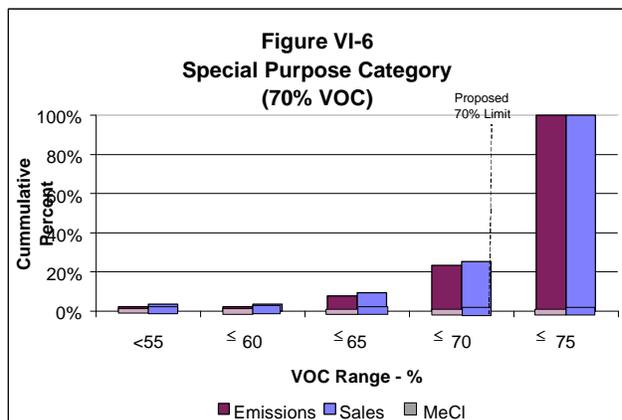
This category of adhesives is predominantly web sprays and are used to bond flexible vinyl materials and leather to various surfaces.

As a result of staff's evaluation, it was determined that aerosol adhesives specifically formulated for use on flexible vinyls (and leathers for automotive applications) require higher VOC formulations. The adhesives used on flexible vinyl and leather are required to contain certain adhesives that are resilient to plasticizers. Plasticizers are release agents, which are used to ensure softness and material pliability. However, these same agents eventually migrate to the top surface where they act to release the adhesive bond. Leather materials used in automotive applications generally contain oils that can interfere with proper adhesive bond formation.

To counteract the effect of plasticizers, aerosol adhesive manufacturers typically use higher molecular weight rubbers and resins. The denser adhesives require more solvents to be dissolved. Staff found that the flexible vinyl adhesives are also used for automotive repair uses, such as bonding vinyl roofs. Therefore, flexible vinyl adhesives are also required to have high strength and high temperature resistance.

Because lower density adhesives are not currently available which can meet the stringent demands of these adhesives, staff proposes a 70% VOC level for this category to allow more solvent, which ensures adequate solvency.

Based on the product survey, flexible vinyl aerosol adhesives are formulated between 60 to above 70% VOC. One product was below 55% VOC, but contained methylene chloride and would no longer be available under staff's proposed prohibition on methylene chloride.



*Marketshare and Emissions (70% VOC Limit):*

From the product survey, staff grouped all products that indicated mounting and flexible vinyl applications. Figure VI-6 illustrates both the product sales and emissions according to their respective VOC content range. As can be seen from the figure, about 75 percent of the market share in this category does not meet the proposed limit. Reformulation of these products would provide about

0.2 TPY of VOC emission reductions. However, complying products containing methylene chloride would need to be reformulated and could result in a VOC increase of about 0.2 TPY. As a result, there is no net decrease in VOC emissions from this category. Also, methylene chloride emissions would be reduced by a small amount.

**Automotive Headliner and Polystyrene Foam (65% VOC Limit)**

*Automotive Headliners:*

While staff was developing the subcategory list within the special purpose adhesive, industry suggested that headliner adhesives met the definition of special purpose and pointed out that these adhesives should be considered separately. They indicated that several of their products have been specifically formulated to bond automotive headliners. Headliner applications may involve bonding either lightweight materials (e.g. fabrics and foams), or heavier materials (e.g. foam insulation, fiberboard, leather and supported vinyl) to the interior roof of automobiles. Since the ARB survey did not specifically request the identification of automotive headliner adhesives, the staff collected this information from product labels. For products where staff did not have labels, staff contacted companies to verify whether the product can be used for headliners.

Staff found that headliner adhesives require the use of strong, heat resistant rubbers and resins. Automotive headliner adhesives are exposed to temperatures of at least 160 °F, and are used to bond various media (fabrics, plastic, metal surfaces) thereby requiring high strength and plasticizer resistance as well.

In the product survey, headliner adhesives were all classified as web sprays ranging between 60 to over 70% VOC. One product containing methylene chloride was formulated to below 55% VOC. Based on discussions with the NPCA, staff has

determined that it is possible to reformulate these adhesives to a 65% VOC level. About one-third of the products identified as headliners were found to be formulated below 65% VOC. Therefore, staff proposes to limit adhesives used for automotive headliner installation to 65% VOC.

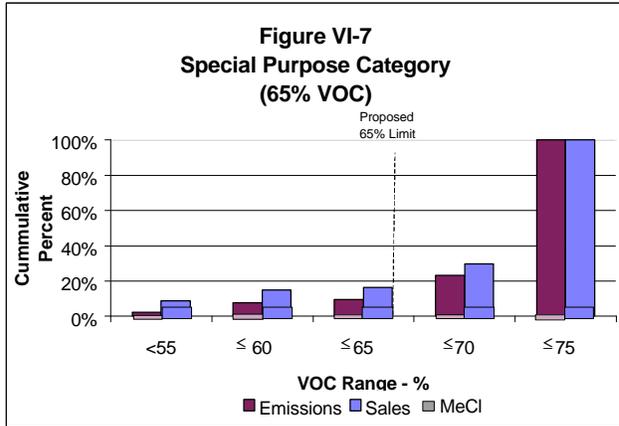
*Polystyrene Foam:*

This special purpose subcategory contained several adhesive products. These adhesives are used to bond expanded polystyrene foam (i.e. EPS, beadboard, etc.), and Styrofoam<sup>®</sup>, and are formulated for high strength and substrate compatibility. There was a fairly even distribution of products categorized as either mist or web sprays. Staff found that most users of these products either use the products for assembling packaging materials, for arts and crafts, or for home construction projects.

Staff's survey indicated that several products were formulated for polystyrene foam applications, with a wide range of formulations between 55% to over 70% VOC. The products at or below 55% VOC were typically formulated with methylene chloride. Products above 70% VOC were mist sprays and the web spray products were formulated between 55 to 70% VOC.

Some of these adhesives were formulated with acetone as the solvent component. Acetone was found to partially dissolve some of the lighter density polystyrene materials, which limits the amount of acetone that these products can contain. Upon further investigation by staff, it was also determined that the problem of "substrate attack" was also caused by the way in which these products are applied. Evidently, when these products are applied in close proximity to the substrate, the effects of "substrate attack" are aggravated.

Based on the ARB survey and through discussions with industry, staff found that when products are formulated to low levels such as 55% VOCs, manufacturers tend to use higher acetone levels, which further exacerbates the problem of substrate incompatibility. However, industry indicated that it was possible to reformulate polystyrene foam aerosol adhesives to below 65% VOC with little or no substrate attack. Any concerns of substrate attack at 65% VOC could be mitigated by better instructions on the label to preclude misapplication. Industry concurred with staff's findings as well. Therefore, staff proposes to limit polystyrene foam adhesives to under 65% VOC.



**Marketshare and Emissions (65% VOC Limit):**

For this subcategory, staff grouped automotive headliner and polystyrene foam adhesives. Figure VI-7 illustrates both the product sales and emissions according to their respective VOC content range. Excluding products formulated with MeCl, about 16 percent of the sales for these products are formulated below 65% VOC. Therefore,

about 84 percent of the marketshare for the products in this category would need to be reformulated to meet a 65% VOC limit. The VOC emission reductions associated with reformulation of these products is about 12 TPY. However, 11 products in this category contain toxic compounds. The emission increase from reformulating these products would result in a VOC increase of about 5 TPY. Therefore, staff estimates that at the proposed 65% VOC limit, total VOC emission reductions would be about 7 TPY for this category. Also, about 8 TPY of methylene chloride emissions would be reduced.

**High Pressure Laminates and Polyolefins (60% VOC Limit)**

*High Pressure Laminates:*

Another specialized group of aerosol adhesives are designed for use on high pressure laminates. High pressure laminates (HPL) are thin hard plastics manufactured into sheets and are typically rolled up for shipment. These sheets are used to cover tables, desks, workbenches, etc. The adhesives used are required to have enough strength to resist the tendency for the HPLs to roll up on themselves. The HPL adhesives must be fast bonding and able to withstand the abuse of impact or being brushed up against by people or objects.

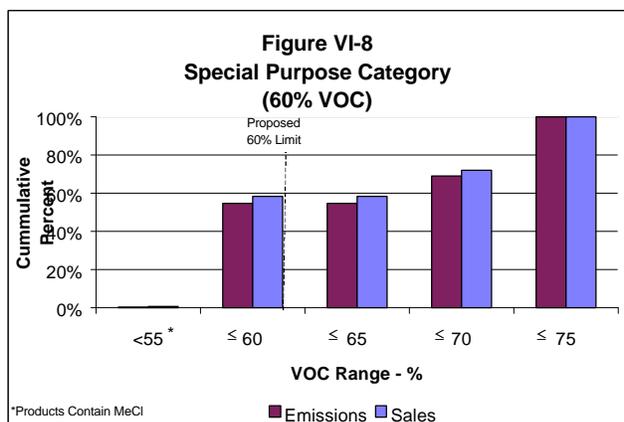
From the product survey, staff found that virtually all the aerosol adhesives for this category were web sprays formulated between 55% to 70% VOC. The formulations at or below 55% were formulated with methylene chloride, while the formulations above 60% did not contain any toxic compounds. There were also three products formulated at slightly below 60% VOC that did not contain methylene chloride.

Staff has found that these aerosol adhesives can be formulated at 60% VOC and still maintain the high performance characteristics of this product category. Therefore, staff proposes to limit the VOC content of this subcategory to 60%.

## Polyolefins:

Polyolefins are a group of plastics including polyethylene and polypropylene. These materials exhibit very low surface energy with little or no attraction for adhesives. Therefore, the adhesive resins and rubbers must be formulated to compensate for the low energy substrates. Staff found that most of these products consisted of web sprays and were labeled as recommended for construction and asbestos abatement.

Based on the products database, staff found that these products were formulated between 55% to 70% VOC. Staff found that some of the products in this category were formulated to 60% VOC, and industry confirmed that this level could be met by all adhesives in this subcategory. Therefore, staff recommends a 60% VOC limit for polyolefins.



### Marketshare and Emissions (60% VOC Limit):

From the product survey, staff grouped products that indicated high pressure laminates and polyolefin applications. Figure VI-8 illustrates both the product sales and emissions according to their respective VOC content range. As shown, to meet the proposed limit, about 40 percent of the marketshare in this category would need to be reformulated. Staff estimates that reformulating these

products will provide about 12 TPY VOC emission reductions. However, 3 products in this category contain toxic compounds. The emission increase from reformulating these products would result in a VOC increase of about 0.4 TPY. Therefore, the net VOC emission reduction for this category is about 12 TPY. Methylene chloride emissions would be reduced by about 0.7 TPY.

## Special Purpose Definition

The proposed regulatory definition of special purpose adhesives is shown below and is contained in Appendix A.

*Special purpose spray adhesive” means an aerosol adhesive that meets any of the following definitions:*

(A) *“Mounting adhesive” means an aerosol adhesive designed to permanently mount photographs, artwork, and any other drawn or printed media to a backing (paper, board, cloth, etc.) without causing discoloration to the artwork.*

- (B) *“Flexible vinyl adhesive” means an aerosol adhesive designed to bond flexible vinyl to substrates. Flexible vinyl means a nonrigid polyvinyl chloride plastic with at least five percent, by weight, of plasticizer content. A plasticizer is a material, such as a high boiling point organic solvent, that is incorporated into a vinyl to increase its flexibility, workability, or distensibility, and may be determined using ASTM Method E260-91 or from product formulation data.*
- (C) *“Polystyrene Foam Adhesive” means an aerosol adhesive designed to bond polystyrene foam (e.g. Styrofoam®, expanded polystyrene foam, etc.) to substrates.*
- (D) *“Automobile Headliner Adhesive” means an aerosol adhesive designed to bond together layers in motor vehicle headliners.*
- (E) *“Polyolefin Adhesive” means an aerosol adhesive designed to bond polyolefins (e.g. polyethylene, polypropylene, etc.) to substrates.*
- (F) *“High Pressure Laminate Adhesive” means an aerosol adhesive designed for the touch-up, repair, or edgebonding of high pressure laminates. For the purposes of this definition “high pressure laminate” means sheet materials which consist of paper, fabric, or other core material that have been laminated at temperatures exceeding 265 degrees F, and at pressures between 1,000 and 1,400 psi.*

### **C. Labeling Requirements**

In order to qualify as a “Special Purpose Spray Adhesive” the product must meet one or more of the “Special Purpose Spray Adhesive” definitions. However, if the product label indicates that the product is suitable for use on any substrate or application not listed under the “Special Purpose Spray Adhesive” definition, then the product shall be classified as either a “Web Spray Adhesive” or a “Mist Spray Adhesive.”

If a product meets more than one of the definitions specified as “Special Purpose Spray Adhesive” and is not classified as a “Web Spray Adhesive” or “Mist Spray Adhesive”, then the VOC limit for the product shall be the lowest applicable VOC limit specified for “Special Purpose Spray Adhesives.”

### **D. Prohibition on the Use of Toxic Compounds**

Staff proposes a prohibition on the use of toxic compounds: methylene chloride (MeCl), perchloroethylene (Perc), and trichloroethylene (TCE) in aerosol adhesives, effective January 1, 2002. These compounds are used very little in aerosol adhesives and there are alternative formulations available that are formulated without these compounds.

Under the California Toxic Air Contaminant (TAC) Identification and Control Program, the ARB has previously identified MeCl, Perc and TCE as toxic air contaminants. MeCl was identified as a TAC at a Board hearing held in July 1989. The details of staff's evaluation is contained within the ARB staff report, "Staff Report: Proposed Identification of Methylene Chloride as a Toxic Air Contaminant", dated May 1989. In October 1990, the Board identified trichloroethylene as a TAC, and the technical evaluation is contained within the ARB staff report, "Staff Report: Proposed Identification of Trichloroethylene as a Toxic Air Contaminant", dated August 1990. At an October 1991 hearing, Perc was identified as a TAC by the Board. Staff's technical evaluation for Perc is contained within the ARB staff report, "Initial Statement of Reasons for Rulemaking: Proposed Identification of Perchloroethylene as a Toxic Air Contaminant", dated August 1991.

Based on recommendations from the Department of Health Services, in addition to corroboration from the Scientific Review Panel and the Office of Environmental Health Hazard Assessment (OEHHA), the ARB determined that all three compounds are probable human carcinogens, and insufficient data exists to establish minimum threshold levels, below which there would be no adverse health effects.

Once compounds are identified as TACs by the ARB, Health and Safety Code section 39666(c) requires the ARB to develop air toxic control measures (ATCMs) based on an assessment of the need for and appropriate level of regulation. Staff's assessment on the need to regulate MeCl, Perc and TCE in aerosol adhesives is contained in Appendix G. In regard to toxic air contaminants for which no minimum threshold levels have been identified, the law requires that ATCMs be adopted,

"to reduce emissions to the lowest level achievable through application of best available control technology (BACT) or a more effective control method, unless the State Board or a district Board determines, based on an assessment of risk, that an alternative level of emission reduction is adequate or necessary to prevent an endangerment of public health."

In evaluating the risks from the TACs in aerosol adhesives, staff conducted a risk assessment based on the modeling evaluations used to assess aerosol brake cleaners (ARB report, "Initial Statement of Reasons for Proposed Amendments to the California Regulations for Reducing Volatile Organic Compounds From Consumer Products and Aerosol Coatings Products", October 1996, and the ARB report, "Initial Statement of Reasons for Proposed Airborne Toxic Control Measure for Emissions of Chlorinated Toxic Air Contaminants From Automotive Maintenance and Repair Facilities", March 2000). It should be emphasized that staff's objective was to establish that potential risks exist from the use of aerosol adhesives containing these TACs, as opposed to bracketing the actual risks from their use.

For worker exposure, staff estimated the 8-hour time weighted average for products containing MeCl and Perc. For MeCl, the 8-hour time weighted average was estimated to be 0.97 ppm, and Perc was estimated at 0.26 ppm. The federal OSHA time weighted

exposure limit for MeCl and Perc is 25 ppm and 100 ppm, respectively. As shown, workplace exposure is well below the applicable OSHA standards. An assessment of the only aerosol adhesive product containing TCE revealed that worker exposure to this product is two orders of magnitude lower than the federal OSHA 8-hour time weighted average standard of 100 ppm.

To assess the potential risk to the general population, staff estimated the potential cancer risk of products using MeCl only, and products with MeCl and Perc combined. For MeCl, the potential cancer risk ranged from about 0.2 in a million to 6 in a million, depending on the distance from the source. For the combined product using MeCl and Perc, the combined risk ranged from 3 in a million to 30 in a million, again depending on distance. The highest annual average concentration and risk occurs nearest the source (20 meters), while the lowest exposure and risk occurs farthest from the source (150 meters). Therefore, the actual risk is dependent on receptor location. Staff, in conducting this evaluation, did not evaluate possible receptor locations or population density within the proximity of the source. It should be noted that these estimates would be several factors lower if more typical assumptions were used in the assessment. Also, staff did not assess the potential risk from TCE since the use of TCE in aerosol adhesives is much lower than MeCl and Perc. Considering this, staff estimates that the risk associated with TCE in aerosol adhesives is lower than from products containing both MeCl and Perc.

Although the risks from MeCl, Perc, and TCE in aerosol adhesives are likely to be low, these risks should be taken into account with the exposure and associated risks from other sources of these TACs. Methylene chloride, PERC and TCE are found in numerous consumer and industrial products and processes, when taken in whole, can pose a significant cumulative risk. Therefore, it is necessary to address sources or products individually to reduce the risk from these TACs.

According to the 1998 product survey, only 33 products out of 136 contained either MeCl, Perc, and TCE. The combined sales in 1998 were also found to be a small portion of the overall sales as well. Representatives from NPCA, 3M Products Company, Camie-Campbell and Sprayway Products, support a prohibition on MeCl, Perc, and TCE. The industry representatives indicated that several companies have established internal policies on eliminating the use of MeCl, due to toxicity concerns with their workers. Also, aerosol adhesive consumers have asked for safer products.

As mentioned earlier, there are alternatives to the use of aerosol adhesives formulated with MeCl, Perc and TCE. Some manufacturers have stated that their current products formulated with these TACs can be reformulated without these compounds. Some manufacturers have stated that they would elect to no longer sell these products in California. If these products are no longer available, consumers would have to switch to alternatives that do not use these compounds. Based on our discussions with industry, staff does not anticipate any significant issues with alternative formulations as a replacement to products using these toxic compounds.

Therefore, the staff believes that it would be beneficial to preclude the use of MeCl, Perc, or TCE to reduce the cumulative exposure of these compounds in consumer products to the general population. In addition, the prohibition would only affect a small number of products, and would not eliminate any aerosol adhesive product forms in the marketplace.

### **E. Future Technology Assessment**

Staff intends to conduct a future technology assessment in 2004 to recognize possible development efforts in resins, rubbers, solvents, propellants, and hardware technology that may lead to lower VOC levels. Staff also believes that a future technology assessment would be beneficial to evaluate new exempt solvents that may be added in the future. There are solvents currently being considered by the U.S. EPA for exempt status. These solvents may hold promise in providing manufacturers with better solvent properties and the ability to lower the VOC content in aerosol adhesives. Industry has stated that they would support a future technology assessment.

To aid in the collection of data, staff proposes to amend the dates in section 94513(d) Special Reporting Requirements for Aerosol Adhesives. The reporting date would change from March 31, 1999 to March 31, 2004. The product sales year would change from 1998 to 2003. Lastly, the reference to “the January 1, 2002, VOC limit” would change to “a lower VOC limit.”

### **F. Other Amendments**

Staff proposes additional revisions under the definitions section, including separating out the definition of aerosol adhesives from the general definition of “adhesive” and to amend the definition of “aerosol adhesive” within the consumer products regulation to further define “mist”, “web”, and “special purpose” adhesives. Staff also proposes to amend the definition of “consumer products” to include all uses of aerosol adhesives.

## VII. ENVIRONMENTAL IMPACTS OF THE PROPOSED AMENDMENTS

This chapter discusses the environmental impacts of the proposed amendments to the aerosol adhesives standard.

### A. Overview of Environmental Impact Analysis

The ARB staff evaluated the environmental impact of the proposed amendments and determined the amendments would allow slightly more emissions than under the existing 25% VOC limit. As discussed in Chapter VI, staff's proposal eliminates the current 25% VOC standard (effective 2002), and replaces it with new VOC standards for three aerosol adhesive categories (mist, web, special purpose). In addition, the proposal precludes the use of certain toxic compounds.

Because the proposed VOC limits are higher than the 25% VOC standard, the proposed amendments are considered a relaxation of the current consumer products regulation. When the 25% VOC standard was adopted in 1992, staff projected a reduction of 0.2 tons per day. This estimate was based on an aerosol adhesive inventory of about 0.4 tons per day, which was derived from the previous 1990 ARB consumer products survey. At that time, the 25% VOC standard was estimated to achieve a 50% emission reduction from aerosol adhesive products.

New information has become available to update the aerosol emissions inventory as well as the technical feasibility of reducing the VOC content in aerosol adhesives. As discussed earlier, staff conducted a 1998 product survey and revised the aerosol emissions inventory to about 1.9 tons per day. The main reason for the large discrepancy is that the 1990 ARB consumer product survey did not include aerosol adhesives used for industrial uses. The 1998 product survey included all uses of aerosol adhesives. Using the revised emission inventory, the proposed amendments would reduce emissions by about 10%, or about 0.2 tons per day in 2002.

The intent of the proposed amendments is to preserve the commercial and technological feasibility of meeting the VOC limits and to ensure that the basic market demand can be met for aerosol adhesives. Without the proposed amendments, many manufacturers would experience adverse economic impacts and a disruption of the aerosol adhesives market could occur. The proposed amendments would help to ensure that manufacturers develop consumer-accepted products to meet the basic demand. The staff believes that these considerations override any adverse impacts that may occur as a result of these amendments.

The staff has also evaluated the environmental impacts of prohibiting the use of methylene chloride, perchloroethylene, and trichloroethylene. Based on the toxicity concerns associated with these compounds, staff expects a positive environmental benefit associated with the proposed amendment to preclude their use. A more detailed discussion is included below.

## **B. Legal Requirements Applicable to Analysis**

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential adverse environmental impacts of the proposed standards. Because the ARB's program involving the adoption of regulations has been approved by the Secretary of Resources (see Public Resources Code, section 21080.5), the CEQA environmental analysis requirements are to be included in the ARB's Staff Report in lieu of preparing an environmental impact report or negative declaration. In addition, the ARB will respond in writing to all significant environmental issues raised by the public during the public review period or the public Board hearing. These responses are to be contained within the Final Statement of Reasons for the proposed amendments. Public Resources Code section 21159 requires that the environmental impact analysis conducted by the ARB include the following: 1) an analysis of the reasonably foreseeable environmental impacts of the methods of compliance, 2) an analysis of reasonably foreseeable mitigation measures, and 3) an analysis of reasonably foreseeable alternative means of compliance with the standard. Our analysis of the reasonable 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 foreseeable mitigation measures that would achieve additional emissions reductions from aerosol adhesives, while at the same time preserving the feasibility of the limits and preventing disruption in the marketplace. Staff's analysis of the feasibility of the limits is contained in Chapter V and VI.

Alternative means of compliance with the aerosol adhesives portion of the consumer products regulation have been studied. One compliance option is available to manufacturers of aerosol adhesive products, the ACP. The ACP is a voluntary market-based regulation that utilizes the concept of an aggregate "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 would not exceed the emissions that would have otherwise resulted from products formulated to meet the applicable VOC limits. At this time, the ACP is the only alternative to aerosol adhesive manufacturers that staff has identified.

## **C. Emissions Reductions and Potential Environmental Impacts**

### **1. Impact on Ground Level Ozone**

As discussed, the proposed amendments would result in an adverse environmental impact because they are a relaxation of the existing 25% VOC limit. However, the intent of the proposed amendments is to preserve the commercial and technological feasibility of the VOC limit and to ensure that basic market demand is being met. The ARB staff believes that these considerations override any adverse impacts that may occur as a result of these amendments.

Based on the 1998 product survey, aerosol adhesives emit about 1.9 tons per day VOCs. With a control effectiveness of about 10%, the proposed VOC limits would reduce these emissions by about 0.2 tons per day. If one uses the revised emission inventory from the 1998 product survey, and calculates emission reductions relative to the existing future 25% VOC limit, then the proposed VOC limits would allow about 1 ton per day more emissions. The staff believes that this conservative approach is consistent with the intent of the CEQA requirements, in which full public disclosure on environmental impacts is provided.

## **2. Impact on Particulate Matter (PM10)**

Reducing VOCs has a positive environmental impact by reducing the amount of secondary particulate matter (PM) in the atmosphere. Depending on ambient meteorological conditions and temperature, gas-to-particle conversion of VOCs may occur. One of the chemical mechanisms of gas-to-particle conversion involves the oxidation reactions of VOCs to form semi-volatile or low vapor pressure products that combine with other molecules to form new particles, or which condense on preexisting particles. Therefore, by reducing any VOCs from today's aerosol adhesives, a net benefit would occur as less VOCs are available to form PM10 in the atmosphere.

It is conceivable that the proposed amendments would have an adverse impact on fine particulate matter (PM10), because the proposed VOC limits represent a relaxation of the 25% VOC limit. Therefore, the proposed VOC limits would not reduce as much VOCs, and therefore particulate matter, as originally estimated.

On the other hand, using the baseline inventory from the 1998 product survey and considering the current 75% VOC limit, the proposed amendments would reduce VOCs, and particulate matter, from today's levels. [u11]

## **3. Impact on Global Warming**

Staff does not expect the proposed amendments to have an adverse impact on global warming. Global warming is based on the premise that certain emissions absorb infrared radiation in the atmosphere, thereby increasing the overall average global temperature. To meet the VOC limits proposed, manufacturers may likely choose to replace typical hydrocarbon propellants. One possible option for manufacturers, discussed in Appendix F, includes the use of hydrofluorocarbon (HFC) compounds, such as HFC-152a. Because HFC-152a is excluded from the definition of VOC in the consumer products regulation and is negligibly reactive, HFC-152a may be used to a limited extent to reduce the overall VOC content of the aerosol adhesive formulation.

The use of HFC-152a can contribute to global warming, however, even if all aerosol adhesive products contained HFC-152a, the impact to global warming would be negligible. Hydrofluorocarbons are non-chlorinated methane and ethane derivatives, which contain hydrogen and fluorine. Hydrofluorocarbons absorb infrared energy and

therefore can contribute to global warming. Based on the 1998 product survey, about 1.9 tons per day of VOCs are emitted from aerosol adhesives.

To estimate a worst case scenario of global warming impact, staff assumed that all propellant would be replaced with HFC-152a. The HFC-152a compound has 50 times more global warming potential than the hydrocarbon propellants currently used. Estimating that the average aerosol adhesive product under the proposal contains 70 percent VOCs (including solvents and propellants), and that 50% of that amount is propellant, then if all propellant was changed to HFC-152a, the overall increase in HFC emissions would be 0.7 tons per day (i.e. 1.9 tpd x 70% x 50%).

This is a very small increase in HFC-152a emissions, and would have a negligible impact on global warming. In comparison, it is estimated that 100 million tons per day of carbon dioxide, the primary greenhouse gas, is emitted into the atmosphere from existing emission sources.

While this analysis assumes total propellant replacement with HFC-152a, staff believes that this would not be the case, due to other solubility issues and due to the high price of HFC-152a.

#### **4. Impact on Ozone Depletion**

The staff has determined that the proposed amendments would have a minimal impact on stratospheric ozone depletion. The stratospheric ozone layer shields the earth from harmful ultraviolet (UV) radiation. Depletion of the earth's ozone layer allows a higher penetration of UV radiation to the earth's surface. The increase in UV radiation leads to greater incidence of skin cancer, cataracts, and impaired immune systems, reduced crop yields and diminished ocean productivity. Because chemical reactions which form tropospheric ozone are driven by UV radiation, it is conceivable that a reduction in stratospheric ozone can also result in an increase in photochemical smog, due to the increased UV radiation.

As discussed above, staff believes that manufacturers could substitute current propellants with limited amounts of HFC-152a. Hydrofluorocarbon-152a is excluded from the list of compounds that are scheduled for phase-out as ozone depleting under the federal Clean Air Act requirements. Therefore, if manufacturers choose to use HFC-152a, then no additional decrease in stratospheric ozone is expected.

#### **5. Impact on Water Quality and Solid Waste Disposal**

Relative to the current formulations of aerosol adhesives, the proposed amendments are not expected to result in any adverse impact to water quality or on solid waste disposal. Consumers are not likely to convert to using water-based brush applied adhesive products, due to the convenience of aerosol adhesives. Because of this, staff does not expect any changes to packaging or disposal of aerosol adhesive products due to the proposed amendments.

## **D. Health Risk Assessment of Prohibiting the Use of Toxic Compounds in Aerosol Adhesives**

As discussed earlier, the ARB previously identified MeCl, Perc, and TCE as TACs. Furthermore, the Board determined that these TACs are probable human carcinogens and did not establish minimum threshold levels, below which there would be no adverse health effects.

Prohibiting the use of toxic compounds would result in reducing MeCl emissions by 18 TPY, perchloroethylene by 0.4 TPY and trichloroethylene by 0.06 TPY. For a detailed discussion of the health effects of the use of toxic compounds in aerosol adhesives, please see Appendix G. The conclusion of staff's analysis indicates that the overall exposure to MeCl, Perc and TCE is expected to be low for persons using aerosol adhesives containing the toxic compounds and for the public at large.

Staff also recognizes that toxic emissions from aerosol adhesives only represent one source of emissions for public exposure to these compounds. MeCl, Perc, and TCE are also used in numerous other consumer and industrial products (e.g. paints and architectural coatings, brake cleaners, solvent degreasers, etc.). Therefore, staff believes that the public is exposed to cumulative levels of MeCl, Perc, and TCE. The proposed toxics prohibition would reduce the overall cumulative exposure to MeCl, Perc, and TCE.

## **E. Impacts on the State Implementation Plan**

### **1. Impacts on the 1994 Ozone SIP and Inventory**

The 1994 State Implementation Plan (SIP) for Ozone is California's master plan for achieving the federal ozone standard in six areas of the state by 2010. The SIP includes state measures to control emissions from motor vehicles and fuels, consumer products and pesticide usage, local measures for stationary and area sources, and federal measures for sources under exclusive or practical federal control. U.S. EPA approved the SIP in September 1996 (62 Federal Register 1150-1201 (January 8, 1997)). Although U.S. EPA has not yet approved subsequent plan revisions for ozone, these plans also rely on measures in the SIP.

As the ARB has implemented the SIP over the last five years, some measures have delivered more reductions than anticipated, while other measures have delivered fewer reductions due to technical or economic concerns. However, once the SIP is approved by the U.S. EPA, the emission inventories and assumptions are frozen. Evaluations of the impacts on the SIP of new measures or modifications to existing measures must use the same emission inventories and assumptions as were used in the 1994 SIP.

## 2. SIP Lawsuit Settlement

In 1997, a lawsuit was filed against South Coast Air Quality Management District, ARB, and U.S. EPA by three Los Angeles based environmental groups for failure to implement specific measures contained in the 1994 SIP (Coalition for Clean Air v. South Coast Air Quality Management District). In January 1999, the Board approved a settlement regarding ARB's portion of the SIP litigation. The lawsuit settlement addresses near-term emission reduction shortfalls of 42 tons per day of ROG and 2 tons per day of NOx in the South Coast Air Basin in 2010. ARB must implement programs over the next few years to achieve the specific emission reduction goals outlined in the lawsuit settlement.

## 3. Review of SIP Baseline Measure: Aerosol Adhesives

Because the aerosol adhesive standards were already adopted at the time the 1994 Ozone SIP was developed, emission reductions from those standards were incorporated into the SIP baseline. In the 1994 SIP, a 50 percent reduction in VOC emissions from aerosol adhesives was anticipated by limiting the VOC content of these products to the 25% VOC limit. Table VII-1 contains the forecasted uncontrolled emissions for aerosol adhesives statewide in 2010, and the projected emission reductions due to limiting the VOC content to 25%. As indicated in the table, projected emission reductions in 2010 under the SIP are about 0.28 TPD.

**Table VII-1  
Aerosol Adhesive Control Baseline Measure  
Using 1994 SIP Emissions Inventory  
Statewide in 2010 (in tons of ROG per day)**

1994 SIP Category	Uncontrolled Emissions	1994 SIP Controlled Inventory	Reductions Assumed in 1994 SIP
Aerosol Adhesives	0.56	0.28	0.28

## 4. Impacts of Proposed Amendments

The proposed amendments to the aerosol adhesive standards would relax the 25% VOC limit and would result in less emission reductions. In terms of "1994 SIP currency" the relaxation of the standard and the loss in emission reductions would result in a small SIP shortfall. Also, contributing to the SIP shortfall is the use of acetone, an exempt compound, since the 1994 SIP treats acetone as a VOC and no credit is given in "1994 SIP currency" when acetone is used to reduce VOC emissions.

As shown in Table VII-2, the projected shortfall in “1994 SIP currency” is estimated to be about 0.28 TPD of VOC emission reductions statewide in 2010 from what was assumed in the 1994 SIP. Although using acetone to meet the proposed VOC limits provides real emission reductions, these benefits are not credited in “1994 SIP currency”.

**Table VII-2  
Aerosol Adhesive Control with Proposed Amendments  
Using 1994 SIP Emissions Inventory  
Statewide in 2010 (in tons of ROG per day)**

1994 SIP Category	Uncontrolled Emissions	Emission Reduction Assumed in 1994 SIP	Emission Reduction due to Proposal	Emission Reduction Shortfall in “1994 SIP currency”
Aerosol Adhesives	0.56	0.28	0	0.28

As discussed earlier, based on the current inventory, the proposed amendments would achieve about 0.2 TPD of VOC emission reductions, or about a 10% reduction in emissions. If the percent reductions based on the current inventory is applied to the 1994 SIP inventory, the proposed amendments would provide about 0.05 TPD of VOC reductions. Again, because the 1994 SIP gives no credit for acetone, the SIP shortfall remains 0.28 TPD.

### 5. Summary of 1994 SIP Analysis of Proposed Amendments

Relative to the current formulations of aerosol adhesives, the proposed amendments are expected to provide emission reductions statewide toward meeting the State and federal clean air goals. Federal ozone nonattainment areas rely on emission reductions from consumer products, including aerosol adhesives, to meet federal ozone standards between 2005 and 2010, depending on the area. However, using “1994 SIP currency”, the staff's proposal would fall short of the 1994 SIP baseline emission reductions target by about 0.28 TPD of VOC emission reductions statewide in 2010. Staff will address this shortfall when the statewide control strategy is revised in 2001. At that time, staff will be assessing all feasible cost-effective emission reductions, including re-examining the standards currently in place for a broad range of consumer products under the jurisdiction of the ARB.



## VIII. ECONOMIC IMPACTS OF THE PROPOSED AMENDMENTS

This chapter discusses the economic impacts that would be expected from the implementation of the proposed amendments to the aerosol adhesives standards, including the proposed prohibition on MeCl, Perc and TCE in aerosol adhesives.

### A. Introduction

Currently, only 7 products comply with the 25% VOC standard. As a result, under the current standard, all remaining products would require reformulation to this standard. Since the proposed VOC limits represent an overall relaxation compared with the current standard, the proposed amendments actually represent a cost-savings relative to the existing standard. This is because more products (26) already comply with the proposed standards, and manufacturers have indicated that reformulation costs to meet the proposed standards would be significantly lower than to meet a 25% VOC standard.

However, even though the proposed amendments would result in a cost savings, staff realizes that manufacturers would need to reformulate many of the products they are currently selling in order to comply with the proposed VOC limits. Therefore, the analysis will focus on the “costs” of meeting the proposed VOC limits (including the proposed ban on toxic compounds) on aerosol adhesive manufacturers, other associated industries, and consumers. Our analysis also estimates the cost-effectiveness of the proposed amendments, and compares this to other consumer product regulations.

Economic impact analyses are inherently imprecise by nature. While staff has quantified the economic impacts to the extent feasible, some assumptions are necessarily qualitative and based on general observations and facts about the aerosol adhesive inventory and industry as a whole. The impacts analysis, therefore, serves to provide a general picture of the economic impacts typical businesses might encounter. Staff recognizes that the impacts on individual companies may vary from those estimated in this chapter.

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 Prohibiting the Use of Toxic Compounds in Aerosol Adhesive Formulations.

## **B. Summary of Findings**

Overall, most manufacturers or marketers of aerosol adhesives products would benefit from the proposed amendments. Staff's analysis shows that most affected businesses would be able to absorb the costs of the proposed amendments 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 in ROE of less than 4 percent, with an average change in ROE of about 1.5 percent. Because the proposed measures 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. Staff also found no significant adverse fiscal 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 is about \$6.00 per pound of VOC reduced.

## **C. Economic Impacts Analysis on California Businesses as Required by the California Administrative Procedures Act (APA)**

### **1. 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 on 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.

### **2. Findings**

Our findings show that most California businesses would 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 consumer products regulation for extensions to their compliance dates. Such extensions may provide sufficient time to minimize the cost impacts to these businesses. Also, the ACP of the consumer product regulations provides flexibility by allowing emissions averaging between aerosol

adhesive products which may help these businesses to mitigate their costs. Because the proposed amendments would not alter significantly the profitability of most businesses, staff does not expect a noticeable change in employment; business creation, elimination or expansion; and business competitiveness in California.

### **3. 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 1998 aerosol adhesives survey, and the staff's cost-effectiveness analysis discussed later in this chapter.

#### **a. Affected Businesses**

Any business which manufactures or markets aerosol adhesive products would potentially be affected by the proposed amendments. Also potentially affected are businesses which supply raw materials and equipment to these manufacturers or marketers, or distribute, sell or use aerosol adhesive products. The focus of this analysis, however, will be on manufacturers or marketers because these businesses would be directly affected by the proposed amendments.

The aerosol adhesive products are manufactured or marketed by 47 companies nationwide, of which seven are based in California according to the ARB's 1998 aerosol adhesive survey. These companies manufacture and market an estimated total of 136 products in California, of which 26 are compliant and 110 are noncompliant products. Of 110 noncompliant products 33 are formulated with toxic compounds. California based companies (mostly medium- or small-sized firms) account for 11 percent of noncompliant products manufactured or marketed in California.

#### **b. Study Approach**

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

- (1) A sample of three representative businesses of different sizes were selected from the list of 47 affected businesses based on the size of their sales and number of noncompliant products they manufacture or market.
- (2) Compliance cost was estimated for each of these businesses.
- (3) Estimated cost was adjusted for federal and state taxes.
- (4) The three-year average ROE was calculated, where data were available, for each of these businesses by averaging their ROEs for 1996 through 1998. 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 before the subtraction of the

adjusted cost to determine the potential impact on the profitability of the business. A reduction of more than 10 percent in profitability is considered to indicate a potential for significant adverse economic impacts.

The threshold value of 10 percent has been used consistently by the ARB staff to determine impact severity (ARB, 1990; ARB, 1991; ARB, 1995; ARB, 1998). This threshold is consistent with the thresholds used by the United States Environmental Protection Agency and others.

### **c. Assumptions**

The ROEs before and after the subtraction of the adjusted compliance costs were calculated for each size business using financial data for 1996 through 1998. The calculations were based on the following assumptions:

- (1) Selected businesses are representative of affected businesses.
- (2) All affected businesses were subject to the highest federal and state corporate tax rates of 35 percent and 8.835 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 available data, staff believes these assumptions are reasonable for most businesses at least in the short run; however, they may not be applicable to all businesses.

## **4. 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, staff found that of the seven California manufacturers making noncomplying aerosol coatings, the change in ROE varied from a negligible affect to a drop of about 4 percent, with most companies experiencing a drop of 1.4 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.

### **a. 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, staff does 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, staff estimates that price increases would be about 8 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.

### **b. Potential Impact on Employment**

The proposed amendments are not expected to cause a noticeable change in California employment and payroll because the contribution of the affected industry to the California economy is marginal. California accounts for a small share of manufacturing employment for aerosol adhesive products. According to the 1997 Economic Census, California employment in businesses classified as Standard Industrial Code 2891 and North American Industry Classification System 325520, which includes aerosol adhesive industry, was 1,728 in 1997, or about 8 percent of the national employment in the industry. This also represents only about 0.09 percent of the total manufacturing jobs in California. These employees working in 70 establishments generated about \$71 million in payroll, accounting for less than 0.1 percent of total California manufacturing payroll in 1997.

### **c. 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 spending on reformulation.

#### **d. 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 adhesives 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**

Staff has determined that the proposed amendments would 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 the Impacts on Per Unit Cost**

As stated earlier, currently only 7 products comply with the January 1, 2002, 25% VOC standard. As a result, under the current standard, all remaining products would require reformulation to meet this standard. Since the proposed VOC limits represent an overall relaxation compared with the current standard, the proposed amendments represent a cost-savings relative to the existing standard. This is because more products (26) already comply with the proposed standards, and manufacturers have indicated that reformulation costs to meet the proposed standards would be significantly lower than to meet a 25% VOC standard.

However, since many manufacturers would still have to reformulate their products to meet the proposed VOC limits, in the following analysis staff has evaluated the anticipated cost-effectiveness of the proposed amendments. Such an evaluation allows the staff 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, staff applied a well-established methodology for converting compliance costs to an annual basis. Staff 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.”

## 1. 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, development of new labels, etc.) and annualized recurring costs (e.g., raw materials, separate California inventory, etc.).

Staff 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, staff multiplied 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). Staff then summed 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:

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

Where:

$$\begin{aligned} \text{Annual Recurring Costs} &= \text{Total Recurring Cost (Recurring Cost per Product) x} \\ &\quad (\text{Total Non-compliant Products}) \\ \text{Annualized Fixed Costs} &= (\text{Fixed Costs}) \times (\text{Capital Recovery Factor}) \end{aligned}$$

Where:

$$\begin{aligned} \text{Fixed Costs} &= \text{Total Nonrecurring Cost (Nonrecurring Cost per} \\ &\quad \text{Product) x (Total Non-compliant Products)} \\ \text{Capital Recovery Factor} &= 0.24716 \text{ (7.5\% interest over 5 years)} \end{aligned}$$

## 2. Assumptions

Staff calculated the cost-effectiveness with an assumed project horizon of five years. Staff also assumed a fixed interest rate of 7.5 percent throughout the project horizon. Based on these assumptions, the Capital Recovery Factor 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 regulation, a 10 year project horizon and 10 percent interest rate were used, yielding a CRF of 0.16274.

In calculating the annual recurring costs, staff identified two separate costs that would occur each year. First, based on discussions with industry, some manufacturers have indicated that their reformulated products would not be marketed nationally, but rather would be sold only in California. This is because they believe that the reformulated products would not be cost or performance competitive with the rest of the nation. Therefore, staff expects that manufacturers would incur additional costs for separate raw material and finished product inventory, as well as additional storage costs. Based on these discussions with manufacturers, staff has estimated these costs to be about \$5000 per reformulated product, which calculates to approximately \$1,100 per day for the proposed standards.

In addition, staff has identified annual raw material costs associated with reformulating non-complying products with acetone. To do this, staff first determined the amount of each VOC used in aerosol adhesives (excluding propellants, since staff does not expect that VOC propellant usage would change with product reformulation) based on the 1998 Survey. It was also assumed that the solid content of each non-complying product would remain unchanged. Then, staff determined the sales weighted average (SWA) VOC price based on market prices available in the *Chemical Market Report* for the week ending November 26, 1999. Based on this data, the SWA VOC price was approximately \$0.18 per pound, and the price of acetone was \$0.14 per pound.

Staff then determined, for each non-complying VOC product, the cost differential of substituting VOC material with acetone. This substitution resulted in a cost-savings of approximately \$0.11 per pound of VOC replaced. For products containing toxic compounds (either methylene chloride or PERC), staff assumed that the market share of the product would be replaced with a product formulated to the category limit. In these cases, VOC replacement of the toxic compounds also resulted in a cost-savings as the price of methylene chloride is \$0.45 per pound, and PERC costs \$0.32 per pound. The analysis showed that per non-complying product, the average cost-savings was approximately \$45 per day. Therefore, the overall recurring annual costs for the proposed amendments is about \$1050 per day.

In calculating the fixed costs, staff based our assumptions on information provided by manufacturers as to the costs associated with product reformulation. Manufacturers indicated that fixed reformulation costs would include cost associated with research and development (including labor, materials, product and consumer testing, and new equipment), new labels and new product literature. Manufacturers indicated that these costs could range from \$10,000 to \$200,000 per product reformulation. However, staff believes that a typical reformulation cost would be about \$25,000 per product. This is well within the range of most cost estimates staff received from manufacturers. Staff believes that the high end of these cost estimates is not realistic because the proposed limits are not technology forcing and would not require new resin or product technology, and is not consistent with the need for most products to achieve an average 6% reduction in VOC content. Based on this reformulation cost per product, staff has estimated that overall fixed reformulation costs would total approximately \$2,000,000, with an annualized daily fixed cost of about \$1,350.

In determining the fixed costs associated with the proposed amendments, staff identified several non-complying products that were not considered in the above analysis. These products were excluded from our analysis for one of three reasons. Either the product was identical to another product within the category (ex., the same formulator labeled the same product formulation under different private labels), the product contained toxic compounds and the formulator had a VOC containing product with a similar use within the category, or the product contained toxic compounds and the product sales were less than 100 pounds per year. In using the last set of criteria to exclude products, staff believes that at such a low sales level, sales of the product would not justify the reformulation investment and the formulator would likely discontinue the sale of the product in California.

It is important to note, that in the analysis, staff assumed that all manufacturers would 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.

### 3. Results

The cost-effectiveness of the proposed VOC limits is presented in Table VIII-1. As shown in the table, cost-effectiveness is \$6.02 per pound of VOC reduced. This value is within the range of cost-effectiveness of other amendments to the consumer products regulation. For perspective, the cost-effectiveness of the Mid-Term Measures and Mid-Term Measures II Regulations varied from no cost to about \$7.10 and \$6.30 respectively, per pound of VOC reduced.

**TABLE VIII-1  
ESTIMATED COST EFFECTIVENESS**

California Sales (TPD)	VOC Reductions (TPD)	Annualized Fixed Cost (\$/day)	Annualized Recurring Cost (\$/day)	Total Annual Cost (\$/day)	Cost-Effectiveness (\$/lb-VOC reduced)
2.85	0.2	1,354	1,052	2,406	6.02

Staff has also determined the per-unit price increase of the proposed amendments. To calculate these costs, staff first calculated the SWA average can size based on sales by container size in the 1998 survey. Based on this data, the average can size was 11.25 ounces, which based on about 2 million pounds of aerosol adhesives sold statewide annually, results in about 3 million units sold. Considering the total annual cost of the proposed amendments is less than \$900,000 per year, the average price increase is about 30 cents per can. Assuming the cost increases between manufacturer, distributor

and retailer, staff estimates a maximum per unit cost increase of about 60 cents per unit.

Staff also conducted a shelf survey to collect retail product price data. Based on this data, staff determined the SWA price was about \$8.00 per can. Therefore, the overall price increase associated with the proposed amendments represents less than an eight percent increase in per unit cost to the consumer.

#### **F. Discussion of the Economic Impact of Prohibiting the Use of MeCl, Perc and TCE in Aerosol Adhesive Formulations**

Currently, 33 aerosol adhesive products are formulated with toxic compounds (MeCl, Perc or TCE). However, 26 of these products do not meet the January 1, 2002, 25% VOC standard, meaning they would have to be reformulated anyway under the current standard. Therefore, to the extent that staff believes compliance with the proposed amendments provides an overall lower cost of compliance than with the 25% VOC standard, the economic impacts on these products and product formulators should be lower than from the current standard, and the costs to these product formulators should be consistent with those costs calculated above.

However, there are currently 7 products formulated with MeCl which comply with the 25% VOC standard. Under the proposed amendments to ban the use of toxic compounds in aerosol adhesives, these products would no longer comply with the proposed standards and would require reformulation. Therefore, the formulators of these products would incur costs that they would not incur under the current standard. Of these 7 products, staff believes that only 5 are candidates for reformulation based on sales data. Therefore, these product formulators would likely incur the reformulation costs identified above (the reformulation costs for these products was included in the cost-effectiveness analysis in section E), or would elect to not market these products in California and their only costs would be lost sales. Assuming none of these 7 products are reformulated, and using the average per unit cost calculated above, with sales of about 6,200 units of these products, with a conservative net profit of 15% per unit, staff believes lost sales of these products would amount to about \$7,500 per year.

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- APPENDIX A: Proposed Consumer Products Regulation Order**
- APPENDIX B: Criteria for Determining Commercially and Technologically Feasible**
- APPENDIX C: Meeting Notices**
- APPENDIX D: 1998 Aerosol Adhesives Survey**
- APPENDIX E: Survey Results**
- APPENDIX F: 1999 Technical Assessment of Aerosol Adhesives**
- APPENDIX G: Health Risk and Needs Assessment of Methylene Chloride, Perchloroethylene and Trichloroethylene**