

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

**Final Staff Report
Proposed Amended Rule 1168 – Adhesive and Sealant Applications**

September 2003

**Deputy Executive Officer
Planning, Rule Development, and Area Sources**
Elaine Chang, DrPH

**Assistant Deputy Executive Officer
Planning, Rule Development, and Area Sources**
Laki Tisopulos, Ph.D., P.E.

**Planning and Rules Manager
VOC Rule Development**
Larry Bowen, P.E.

Author: William Milner - Air Quality Specialist

Reviewed By: Edward M. Muehlbacher, P.E. -Program Supervisor
William Wong – Senior Deputy District Counsel

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EXECUTIVE SUMMARY

The objective of this amendment to Rule 1168 – Adhesive and Sealants is twofold: (1) Comply with the June 7, 2002 South Coast Air Quality Management District (AQMD) Governing Board resolution requiring the AQMD to conduct a technology assessment that determines the feasibility of the January 1, 2004 scheduled reduction in VOC content for automotive and marine top and trim adhesive from 540 grams of VOC per liter to 250 grams of VOC per liter; and (2) to address the United States Environmental Protection Agency's (EPA) limited approval and disapproval of Rule 1168, because a current exemption for light curable adhesives and sealants was inconsistent with the Clean Air Act requirements.

Due to the continued experimental nature of multipurpose top and trim adhesives and difficulties in open time, repositionability, achieving a bond resistant to high temperature, and/or low green strength of existing waterborne adhesives, exempt compound adhesive formulations, and hot melt job specific adhesives, it is recommended to postpone the implementation of a 250 grams VOC per liter standard until January 1, 2005. This will afford adhesive makers additional time needed to further validate the workability and performance of low-VOC adhesives and bring them into the marketplace. This action will postpone 0.21 tons per day of VOC reductions for an additional year.

To address the EPA's concern regarding the exemption for light curable adhesives and sealants, staff proposes to limit the exemption to those that contain a maximum of 50 grams of VOC per liter of adhesive or sealant and to refine the exemption to include recordkeeping requirements under Rule 109 – Recordkeeping of Volatile Organic Compound Emissions for these materials.

BACKGROUND

The September 15, 2000 amendments to Rule 1168 – Adhesives and Sealants included a prohibition of sales and use of non-compliant adhesives and the phase-out of small use exemptions beginning September 15, 2001. As a result, some businesses, including small automotive and marine top and trim shops were affected because they could no longer purchase their industry standard high-VOC contact adhesive; the only alternative would be the use of methylene chloride-based adhesives which would subject the operators to this toxic chemical. In an effort to ease the regulatory burden to small business, the AQMD Governing Board directed staff to use enforcement discretion with regard to the sale and use of contact adhesives on September 21, 2001, until staff could recommend an appropriate solution to the problem.

After researching the technology of existing low-VOC alternative adhesives, staff came back to the Governing Board on June 7, 2002, with a recommendation to create a category for automotive and marine top and trim adhesives and set an interim limit of 540 grams of VOC per liter until January 1, 2004, coupled with an additional year of sell-through and use for products meeting this limit and manufactured before this date. The 540 grams of VOC per liter limit was based on established adhesives. On January 1, 2004, the VOC limit for automotive and marine top and trim adhesive will be reduced to 250 grams per liter. This future limit was based on staff's evaluation of an adhesive applied at a local top and trim shop that met this future limit. The performance of that adhesive would be closely watched during a "beta testing" program to establish its long term performance in the field. Once monitoring was complete, the AQMD could analyze the data and assess the feasibility of using the adhesive for multiple substrates at

top and trim shops basin-wide. In order to protect the integrity of the top and trim industry, the Governing Board directed staff by resolution to conduct a technology assessment and determine the feasibility of regulating automotive and marine top and trim adhesives at a maximum VOC content of 250 grams per liter, less water and less exempt solvent, because the scheduled implementation date is January 1, 2004.

In addition, on April 26, 2002, the EPA finalized in the Federal Register (FR) a limited approval and limited disapproval of the September 15, 2000 amendments to Rule 1168 (67 FR 20645) contained in the California State Implementation Plan (SIP). The EPA cites Rule 1168 as largely consistent with the relevant Clean Air Act (CAA) requirements. However, the exemption for light curable adhesives and sealants was cited as inconsistent with the CAA and therefore full SIP approval of Rule 1168 was not granted. Subsequent conversations with EPA identified the problem to be two fold, in so much as a VOC limit should be established under which exemption for light curable adhesives and sealants could apply and that recordkeeping under Rule 109 should be required.

Universe of Sources of Top and Trim Facilities/Affected Sources

Since most top and trim facilities fall outside the constraints of a written permit by virtue of using less than a gallon of adhesive per day [Rule 219(l)(18)(C)], they become area sources. As such the AQMD does not have much permit data. Staff has used internet data through a web search to identify the numbers of facilities that are related to automotive and marine top and trim. The data is summarized as follows:

Table 1: Numbers of Known Industries

Industry Type	Numbers of Advertising Operations
Top and Trim	792

This industry is one that is relatively new to the regulatory world, and have had approximately one year to become familiar with, and use, the higher solids and faster evaporating contact adhesives meeting the current interim VOC limit of 540 grams per liter, less exempt compounds. Out of the approximate 800 facilities, greater than 95% are small owner-operated businesses that use between 5 and 10 gallons of adhesive per month. At the present time, only large new vehicle conversion shops are using low VOC adhesives, but not without difficulties. The following technology review describes the types of adhesives that are in use or will soon be available for this marketplace.

TECHNOLOGY REVIEW

Top and Trim Adhesives - 540 gm VOC/l

The top and trim industry uses adhesives to attach various natural and synthetic materials to a variety of differing substrates including hard plastics and plastic foams, synthetic rubber, metal, and wood. Normally, these operations result in aftermarket trim including upholstery, carpeting, wood veneer, and dash covering, vinyl tops, convertible tops, headliners, door panels, seat covering, and sunroofs.

Several products are on the market and contain 490 to 540 grams of VOC per liter, less exempt compounds. These are multipurpose spray grade contact adhesives that work for a variety of automotive and marine applications. They contain some exempt compounds such as acetone (25 to 35% by weight), and have solids contents on the order of 22 to 25% by volume. The applied VOC emissions resulting from their use are on the order of 340 to 385 grams per liter of material used (2.8 to 3.2 pounds per gallon). These glues have replaced the higher VOC materials because of the June 2002 amendments. These adhesives have VOC contents in the range of 540 grams per liter, are cost-effective and work for the industry.

Waterborne Adhesives

Waterborne contact adhesives are still available and are in use at a few top and trim facilities. These materials are formulated with the same neoprene rubber base, in water, with rosin acids and very little VOC (up to 80 grams per liter, less water). These materials are much more expensive (up to \$140 per 5-gallon pail) and require the use of gravity feed spray equipment for about \$300, if the container can be placed above the article to be sprayed. If not, an HVLP gun with an activator pump will be needed for an additional cost of approximately \$850. These products work well on foam to foam, foam to wood and foam to vinyl. They may not perform well on direct spray overhead applications due to low initial green strength. They have virtually no tack and release capability, which affects applications where materials need to be repositioned as in curvature bonding. Bonding to metal or plastic is also difficult. Some are prone to fabric staining through bleed through.

Since the dry time of waterborne contact adhesives are longer, the reduction of open time is reduced by the addition of a salt activator. The increased costs of waterborne adhesives is somewhat offset by the increase in solids content (50-60% by volume). However, applied adhesive expense is about 1.5 to 1.8 times greater. These adhesives are not without some success. The following company is using them today.

Known Conversion

El Capitan Vans

El Capitan Vans is a van conversion facility located in Westminster, CA. Stock vans are customized to fit individual requirements. El Capitan uses a 3M activated waterborne adhesive (Fastbond 100) to install various trim materials to metal, synthetic foam rubbers, and wood. Examples of this are the application of dense foam rubber padding to metal flooring and wheel wells and carpeting to the rubber padding, headliner material to molded plastic foam shells and various wood surfaces to foam backed vinyl or leather trim. In each case, at least one of the surfaces is porous.

The conversion to waterborne adhesive has not been simple as the glue is very aggressive and cannot be repositioned without reapplying adhesive. Precision placement of trim materials is necessary around contours. Cold day applications (increased tack time) are overcome with the addition of more activator. The adhesive works best when applied in a mist rather than higher or more complete coverage. Incidental problem areas are addressed through the use of hand-held aerosol spray adhesive.

Acetone-Based Adhesives

Acetone-based contact adhesives are also available with zero VOC and are being used in the automotive after-market for bonding supported vinyl, as in manufactured door panels of older or vintage cars, vinyl top installations or re-installations, and for headliner application. The solids contents can vary from 20 to 50% solids by volume. The cost of the adhesive also varies with solids content. Vendor price quotes range from \$125 to \$150 per five-gallon pail. Current spray equipment should satisfactorily work to apply these adhesives. Acetone is flammable and has a strong odor. The user should consult their local fire department for restrictions on flammable solvents such as acetone that may exist.

A new acetone-based (acetone diluent) contact adhesive has been developed and complies with the future VOC limit of 250 grams of VOC per liter, less exempt compounds. The use of this material will require the purchase of a new needle and spray cap assembly due to the high viscosity of this material. This adhesive is undergoing field testing at the present time for automotive top and trim applications in neoprene rubber, with heat resistance of 205°F. The adhesive has been applied at temperatures ranging from 50 degrees Fahrenheit to 92 degrees Fahrenheit with a 2 gallon pressure pot and an HVLP spray gun.¹

Known Conversion

Krystal Coach

Krystal Coach is a large limousine manufacturer which also manufactures a line of tour buses. The facility is subject to a VOC emission limit which forces them to use low-VOC adhesives and automotive coatings at their facility in Brea, CA, to maintain production schedules. They use a variety of hot melt, waterborne, pressure sensitive tapes and acetone-based adhesives for a variety of applications. The most difficult applications are headliner and vinyl top installations. Krystal bonds a zero VOC closed cell foam tape to the roof and follows that with the application of an acetone-based contact adhesive (3M 4491) to bond supported vinyl fabric to the closed cell foam. Although they claim this is best glue they can find in low-VOC, staining of white vinyl does occur if open times are not exact. In addition to the vinyl top installation, headliners are glued to bare interior roof metal with the same adhesive that has no repositionability and little green strength. Some failures occur in drooping headliner after a car has been sold. The current solution is to repair it outside of California with high-VOC adhesives. Both situations are exacerbated by the excessive length of a limo, as well as the number of compound curves to negotiate. Krystal has expressed that the use of low-VOC contact adhesive has been problematic, further they have been required to replace expensive adhesive application systems and equipment every time a new adhesive is tried, and the maintenance associated with application equipment is high.

Hot Melts

Sprayable hot melts are in-use for light duty applications such as application of leather seating and door panel trim, and carpeting to metal, vinyl, fiberglass and other plastics. The adhesives are approximately \$60 per equivalent gallon (100% solids) and are very cost effective compared to standard high-VOC contact adhesives. The material comes in 1¾" and 2" slugs that are melted inside an accompanying spray tool that costs \$880 and \$1,800. Materials display high

¹ TACC International correspondence with the AQMD, 5/19/2003

heat resistance and are available with long and short tack times. Krystal Coach is using a variety of hot melt technologies.

Experimental Adhesives

TACC International's product K243 is a low-VOC neoprene rubber contact adhesive that has and is undergoing experimental use. The following outlines to date the extent of that testing.

Black Levent Vinyl Top Material to Fiberglass Hard Shell (Corvette)

- Applied at 92°F
- 12 Minutes Dry Time
- No failure to Date

0.030 Gauge Aluminum to Plywood

- Applied at 69°F
- Bonded and Bent up to 108 Degrees
- No Failure to Date

Convertible Sail Cloth Top to Stayfast Cloth and to Metal Framework

- Applied at 50°F
- 12minutes Dry Time
- No Failure to Date

Headliner Material to ABS Plastic

- Applied at 70°F
- No Wait Time Necessary
- No Failure to Date

Sovereign Industrial Adhesives also has several experimental adhesives being used at a new vehicle convertible top converter in Ventura County². Some of the formulations are zero VOC-acetone based, and some contain as much as 78% acetone by volume, but do not comply with the future limit of 250 grams VOC per liter when the volume of acetone is excluded. The company uses three products to bond glass windows to fabric, fabric to fabric, and rubber weather seals to fabric and polyvinyl chloride (PVC) plastic tops.

LIGHT CURABLE EXEMPTION

On April 26, 2002, the EPA finalized in the FR a limited approval and limited disapproval of the September 15, 2000 amendments to Rule 1168 (67 FR 20645) contained in the California SIP. The EPA cites the September 15, 2000 version of Rule 1168 as largely consistent with the relevant requirements in the Clean Air Act. However, the provision of Rule 1168 that received limited disapproval was the exemption for light curable adhesives and sealants. Specifically, in subsequent clarification, EPA contends "Rule 1168 should require at least annual recordkeeping for products containing 50 grams or less of VOC per liter and more frequent recordkeeping for other products, consistent with Rule 109 requirements, and the broad exemption that "the provisions of this rule, except (i)(2), shall not apply to light curable adhesives and sealants (and) should be removed""³.

²Variance Progress Report to the Ventura County Air Pollution Control District, Robbins Auto Top, 5-27-03

³E-Mail from EPA to William Milner from Yvonne Fong, 6-17-03

To correct this deficiency, the AQMD proposes to modify the exemption for light curable products so long as the VOC content is less than 50 grams per liter, less water and less exempt compounds and that the recordkeeping requirements of section (e) be maintained. However, EPA must approve this SIP correction by November 28, 2003, for the AQMD to avoid sanctions authorized by the Federal Clean Air Act. The restricting VOC content limitation of 50 grams per is consistent with the definition of super compliant materials in Rule 219, and corrects the SIP deficiency under EPA's constraints for light curable exemption. To address toxic considerations, it is unlikely that light curable adhesives will be formulated with a non-VOC hazardous air pollutant (HAP) for two reasons: (1) the current exemption precludes the use of light curable adhesives and sealants (or any adhesive or sealant for that matter) from concentrations of chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene which are HAPs, (2) material safety data sheets for these products list no hazardous air pollutants, and (3) a larger user source for light curable materials is in the medical field. It is unlikely that the Food and Drug Administration (FDA) would approve any HAP containing adhesives and sealants that are implanted into the human body, or for syringes and medical tubing that would deliver medications into the human body.

STAFF PROPOSAL SUMMARY

- ⇒ Limit the exemption for light curable adhesives and sealants to those having a VOC content of a maximum of 50 grams per liter, provided records of use are maintained pursuant to Rule 109 – Recordkeeping for Volatile Organic Compound Emissions, less water and less exempt compounds.
- ⇒ Extend the compliance date to January 1, 2005 for automotive and marine top and trim to afford adhesive manufacturers more time to further validate the workability and performance of low-VOC adhesives and bring them to the marketplace without haste.

EMISSIONS INVENTORY AND EMISSIONS POSTPONED

The starting emissions inventory for all known automotive and marine top and trim operations is based on manufacturers supplied data as given in the June 2002 staff report. Table 2 below represents slight differences in emissions compared to the June 2002 staff report because most top and trim contact adhesives now contain small quantities of acetone (non-VOC), which reduce overall emissions below the worst case scenario presented in the June 2002 Rule amendment package. All listed VOC contents are representative of data reflected in actual material safety data sheets.

Table 2: Top and Trim Operations

Typical In-Use Adhesive Prior to June 2002	
Volume Sold in Gallons per Year	85,000
VOC Content of the Material (gm/l)	616
VOC Content, Less Exempt Compounds (gm/l)	616
Coverage (sq. ft./gal)	237
VOC Emissions (Tons/Day)	0.60

Compliant Adhesive Used June 2002 to Present	
New Volume Sold in Gallons per Year	65,194
VOC Content of the Material (gm/l)	340
VOC Content, Less Exempt Compounds (gm/l)	540
Coverage (sq. ft/gal)	309
VOC Emissions (Tons/Day)	0.253
Adhesive that Complies with January 1, 2004 Emission Limit	
New Volume Sold in Gallons per Year	32,232
VOC Content of the Material (gm/l)	125
VOC Content, Less Exempt Compounds (gm/l)	250
Coverage (sq. ft/gal)	625
VOC Emissions (Tons/Day)	0.046
Difference in Emissions Between 540 and 250	
Product (tons/day)	0.21
(lb/day)	414

Therefore the total quantity of VOC emission reductions delayed by this proposed amendment is 0.21 tons per day (414 lb VOC/day).

CALIFORNIA ENVIRONMENTAL QUALITY ACT

Pursuant to the California Environmental Quality Act (CEQA) and the AQMD's Certified Regulatory Program (Rule 110), the AQMD is preparing a draft Subsequent Environmental Assessment (SEA) for Proposed Amended Rule 1168 – Adhesive and Sealant Applications. The draft SEA will be released for a 45-day public review period. Comments received during the review period will be responded to and included in the Final SEA. Copies of the draft SEA can be obtained by calling the AQMD's Public Information Center at (909) 396-3600, upon its release.

SOCIOECONOMIC ANALYSIS

The proposed amendments to Rule 1168 provide additional relief to affected facilities by extending the compliance date for automotive and marine top and trim adhesives. Such extension will not result in additional cost or other socioeconomic impacts.

Cost Effectiveness and Incremental Cost Effectiveness

Health and Safety Code Section 40920.6 requires an incremental cost effectiveness analysis when there is more than one control option to achieve the emission reduction objective of the proposed amendments, relative to ozone, CO, SOx, NOx, and their precursors. Since the proposal provides an extension of time before reductions in VOC occur, no additional control is required. Therefore, the incremental cost effectiveness analysis requirement does not apply.

LEGISLATIVE AUTHORITY

The California Legislature created the AQMD in 1977 (The Lewis-Presley Air Quality Management Act, Health and Safety Code Section 40400 et seq.) as the agency responsible for developing and enforcing air pollution control rules and regulations in the Basin. By statute, the AQMD is required to adopt an Air Quality Management Plan (AQMP) demonstrating compliance with all state and federal ambient air quality standards for the Basin [California Health and Safety Code Section 40460(a)]. Furthermore, the AQMD must adopt rules and regulations that carry out the AQMP [California Health and Safety Code Section 40440(a)].

REQUIREMENT TO MAKE FINDINGS

Before adopting, amending, or repealing a rule, the California Health and Safety Code Section 40727 requires the AQMD to adopt written findings of necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the public hearing and in the staff report. In addition, Section 40727.2 requires a written analysis comparing the proposed rule with existing federal regulations, and any other AQMD existing or proposed rules and regulations that apply to the same source type.

Comparison of Proposed Rule 1168 and Other Federal Regulations

There are no federal regulation regarding the use of adhesives and sealants. There are no other AQMD rules that apply to the same source type.

Draft Findings

Necessity - The AQMD Governing Board has determined that a need exists to amend Rule 1168 – Adhesive and Sealant Operations, to afford additional time to further validate the workability and performance of low-VOC adhesives and bring them into the marketplace. A need exists to modify the exemption for light curable adhesives and sealants so that Rule 1168 – Adhesive and Sealant Applications can be incorporated into the SIP.

Authority - The AQMD Governing Board obtains its authority to adopt, amend, or repeal rules and regulations from the California Health and Safety Code Sections 39002, 39650, 40000, 40001, 40440, 40702, 41508, and 41700 et seq.

Clarity - The AQMD Governing Board has determined that the proposed amendment to Rule 1168 is written or displayed so that persons can easily understand its meaning that are directly affected by it.

Consistency - The AQMD Governing Board has determined that Proposed Amended Rule 1168 is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, federal or state regulations.

Non-Duplication - The AQMD Governing Board has determined that the proposed amendment to Rule 1168 does not impose the same requirements as any existing state or federal regulations, and the proposed amended rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the AQMD.

Reference - In adopting this regulation, the AQMD Governing Board references the following statutes which the AQMD hereby implements, interprets or makes specific: California Health and Safety Code Sections 40440(a) (rules to carry out the Air Quality Management Plan), and 40440(eb) (~~cost-effectiveness~~)(requirements for best available retrofit control technology), 41508, 41700 (nuisance), and Federal Clean Air Act Section 172(c)(1) (RACT).

Problem - The AQMD Governing Board finds and determines that there is a problem that Proposed Amended Rule 1168 will alleviate, that is the problem of implementation of experimental low-VOC adhesives by the automotive and marine top and trim industry. Although the Proposed amended Rule 1168 postpones VOC emission reductions, the reductions will be fully recaptured by January 1, 2006, considering existing 1-year sell through provisions.

COMMENTS AND RESPONSES

The AQMD held a public workshop and CEQA scoping meeting on July 17, 2003. Those comments received are summarized below:

Comment

Since the AQMD is postponing the VOC limit of 250 grams per liter for automotive and marine top and trim adhesives until January 1, 2005, it is not evident that the experimental products referred to in the staff report will be found to perform satisfactorily for this industry especially in high temperature applications. As such, and in keeping with the July 2002 amendment where the Governing Board passed a resolution requiring the District to conduct a technology assessment to determine the feasibility of the January 1, 2004 limit, we request a that the Governing Board pass a resolution that again requires the AQMD to determine the feasibility of adhesives meeting a 250 gram per liter limit. Further, the Board must ensure that in completing the technology assessment, staff should assess the entire universe of available top and trim adhesives and not those of an individual company. Nowhere in staff's assessment is there an indication that top and trim adhesives are subject to elevated temperature, and we believe that heat resistance should be clarified as an important factor in successful applications of top and trim adhesives.

Response

Staff agrees to include a resolution for the Board's approval to determine the technical feasibility of top and trim adhesives at 250 grams of VOC per liter, less water and less exempt compounds by 2005. However, staff disagrees that the technology assessment reflected adhesives manufactured by one company. Staff gave examples of adhesives that are being used and/or tested today and manufactured by three different companies. Staff also agrees that high heat resistance is imperative to successful bonding of top and trim materials and does allude to that in our discussion on acetone-based adhesives. However, staff will add language to make that clearer.

Comment

The preliminary staff report proposed that the exemption for light curable adhesives and sealants be limited in VOC content to a maximum of 30 grams per liter. Staff articulated the reason for proposing this limit was because of potential equity problems with other substrate specific VOC limits such as wood-to-wood and metal-to-metal adhesive applications that are set at this limit. We believe no such equity disparity exists because light curable materials are not used for these

applications. In addition, and in order to maintain consistency with Rule 219 – Equipment not Requiring a Written Permit, where super-compliant materials are defined to be those with a VOC content of no more than 50 grams per, we believe that 50 grams per liter is a more appropriate cutoff point.

Response

Upon further review, staff agrees with the commenter.