SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

STAFF REPORT
PROPOSED AMENDED RULE 1168 – ADHESIVE AND SEALANT APPLICATIONS

December 2004

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EXECUTIVE SUMMARY

The objective of this amendment to Rule 1168 – Adhesive and Sealant Applications is to implement the findings of a technology assessment on the feasibility of the automotive and marine top and trim adhesive volatile organic compound (VOC) limit of 250 grams of VOC per liter, the viability of using non-methylene chloride-based solvent cements to weld certain hard plastic fabrications, and the feasibility of the January 1, 2005 VOC limits for polyvinyl chloride (PVC) welding, chlorinated polyvinyl chloride (CPVC) welding, and associated primer.

Although initial results were promising on the availability and use of top and trim adhesives meeting the 250 grams VOC per liter standard by January 1, 2005, more recent information reveals that additional time will be required to develop acceptable products meeting that limit. Therefore, staff is recommending that the compliance date for the 250 grams of VOC per liter standard be moved to January 1, 2007 and the current limit of 540 grams of VOC per liter remain in effect until then. Welding hard plastics such as acrylic, polycarbonate, and polyethylene terephalate glycol (PETG) without methylene chloride as part of the formulation is not technically feasible, and staff is recommending a limited exemption from the prohibition of sales of adhesives used for these purposes at a level that is health protective. In addition, staff believes it is technically infeasible to reduce the VOC content for PVC and CPVC solvent cements used to weld such plastic pipes and fittings together beyond the current rule limits of 510 and 490 grams of VOC per liter respectively. However, manufacturers have made some headway in reducing the VOC content of PVC and CPVC primers, as well as acrylonitrile butadiene styrene (ABS) welding products that will help to partially offset the VOC emission reductions foregone with the retention of current VOC limits for PVC and CPVC welding.

BACKGROUND

In part, the September 15, 2000 amendments to Rule 1168 included the addition of sales and use prohibitions for non-compliant adhesives and sealants, and the phase-out of small use exemptions beginning September 15, 2001. These rule revisions affected several small businesses that apply adhesives in low volumes. One such industry is automotive and marine top and trim where typical activities include the recovering of door panels, seats, dashboards, convertible tops, and floor covering, as well as the installation of sunroofs and vinyl tops. The June 2002 amendments created a special category for top and trim adhesives and set an interim VOC limit of 540 grams per liter until January 1, 2004, and a final VOC limit of 250 grams per liter thereafter. Staff performed a technology assessment in 2003 to determine the feasibility of the 250 grams of VOC per liter limit for top and trim applications. Based on the findings of this evaluation, implementation of the January 1, 2004 limits was delayed to January 1, 2005. The primary arguments for supporting a delay of the lower VOC limit were difficulties in application of waterborne top and trim adhesives (precise tack time, low initial strength, and lesser heat resistance), coupled with the market availability of acetone-containing adhesives meeting the 250 grams of VOC per liter limit. Both types of adhesives, as well as hot melt glues, were being used at larger automotive conversion shops but there were performance and application concerns with water and acetone-based adhesives. Acetone based replacement adhesives are still in development and to date have not shown the necessary high heat and stain resistant characteristics that are needed for the performance demands of this industry.

In addition, previous amendments to Rule 1168 in December 1992, April 1997, and October 2003 postponed the technology forcing final emission limits for adhesives and primers used to weld plastic pipes and pipe-fittings together and allow more time for development of low-VOC formulations. Efforts to develop compliant low-VOC adhesive technology has had limited success due to difficulties in substituting exempt compounds for VOC solvents in PVC and CPVC welding formulations, obtaining other regulatory agency and product approval requirements, such as those of the National Sanitation Foundation (NSF), as well as conformity with specified strength requirements of applicable American Society of Testing and Materials (ASTM) standards.

Also, as part of the June 7, 2003 amendment, the Governing Board approved a ban on the sale of adhesives and sealants containing toxic chemicals such as methylene chloride, perchloroethylene, ethylene dichloride, chloroform and trichloroethylene; completely phasing-out the use of these solvents by January 1, 2005. The ban was justified by the availability of alternative compliant adhesives and sealants. One exception to the availability of non-methylene chloride containing adhesives is solvent welding of hard acrylic, polycarbonate and polyethylene terephalate glycol plastic fabrications. As a result, an additional year (and subsequent one-year sell-through provision) was provided to allow for the continued development of acceptable replacements for methylene chloride formulations.

Universe of Affected Sources

The types of industries included within the scope of these proposed amendments are installers of automotive and marine top and trim, plumbers and city/county public works municipalities, and several businesses related to fabricating numerous products such as display cases, signage, trophies and aquariums out of sheet plastic.

Nearly all the affected companies do not require written permits pursuant to Rule 219, because of low spray volumes, or hand applications of solvent cements and solvent welding solutions. The socioeconomic report in the June 7, 2002 amendment package estimates of the total number of affected companies by industry. These are listed in Table 1.

Table 1: Numbers of Known Industries

Industry Type	Numbers of Operators
Automotive Top and Trim	752
Marine Top and Trim	40
Plumbers	8,000+
Plastic Fabricators	270

TECHNOLOGY REVIEW

(1) Top and Trim Adhesives

In the October 3, 2003 amendment to Rule 1168, staff recommended postponing the 250 grams of VOC per liter limit for top and trim adhesives by an additional year. This was primarily due

to the experimental nature of acetone-based contact adhesives in use in the automotive top and trim market, and the difficulties expressed by the industry in using waterborne adhesives. Since the October 2003 amendment, one large automotive converter transitioned to a new acetone-based adhesive designed initially for the aerospace industry. The performance and workability seemed to meet their specifications and complied with the future VOC limit of this specialty application. Staff also believed that small shops could also use this adhesive for their operations. However, staff has since confirmed that use of this acrylontrile rubber-based cement has been discontinued due to unacceptable heat resistance in the field and a staining problem with light colored vinyl top material. The 540 grams per liter product is easier to use and is demonstrated to work. Staff also believes that waterborne products available in the marketplace are viable as well and will work for certain applications but cannot be used as a single multipurpose top and trim adhesive. Staff believes that with more time, a multipurpose top and trim adhesive for all users will be developed and recommends that limit go into effect January 1, 2007.

Currently Compliant High-VOC Adhesives

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. They 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 percent by weight), and have solids contents on the order of 22 to 25 percent by volume. The applied VOC emissions resulting from their use are approximately 340 to 385 grams per liter of material used (2.8 to 3.2 pounds per gallon), and are the mainstay for small business operators today, and cost approximately $10-$12 per gallon.

Waterborne Adhesives

Waterborne contact adhesives are 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), or as dispersions of acrylic resin and synthetic rubber in water with no VOC. These materials are much more expensive (up to $140 per 5-gallon pail) and require the use of gravity feed spray equipment which costs as little as $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 and fabrics to foam, wood, supported vinyl, cardboard and other porous substrates. Some products may not perform well on direct spray overhead applications due to low initial green strength; however, some technical data sheets claim instant bond strength after application. Most waterborne top and trim adhesives have little or no tack and release capability, which may affect applications where materials need to be repositioned as in curvature bonding. Bonding to rubber, metal or plastic is also difficult. Some are prone to fabric staining through bleed-through; users should consult manufacturers' specification data to determine substrate compatibility.

Since the dry time of waterborne contact adhesives are longer, open time can be reduced by the addition of a salt activator. The increased costs of waterborne adhesives is somewhat offset by the increase in solids content (50 to 60 percent by volume). However, applied adhesive expense is about ten percent greater (approximately $28 per gallon), considering higher solids, when compared to a 540 grams of VOC per liter solvent-borne adhesive. It is generally true that when applying waterborne adhesive, one of the two adjoining substrates must be porous to allow the water to leave. 3M, Simalfa, and Casa Adhesive Systems manufacture a host of compliant waterborne adhesives that are being used in Original Equipment Manufacturer (OEM) facilities. The following company is using two of them today.

Known Conversion

- ✓ **El Kapitan Vans**

  El Kapitan Vans is a van conversion facility located in Westminster, CA. Stock vans are customized to fit individual requirements. El Kaptitan uses both an activated waterborne polychloroprene and a single component latex adhesive 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 adhesives 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 polychloroprene adhesive works best when applied in a mist rather than higher or more complete coverage. This adhesive has been in use for nearly 3 years. The latex adhesive has been in use for a little less than a year, as they find it to work better than the activated product on their carpet applications. Incidental problem areas are addressed by hand-held aerosol spray adhesive. Hand-held aerosol adhesives are exempt from Rule 1168, but subject to the California Air Resources Board's Consumer Products Regulation.

Acetone-Based Adhesives

Acetone-based contact adhesives are still under development and one problem with current formulations is they tend to stain light colored materials. In addition, neoprene rubber-based cements, which display the necessary long-term heat resistance are not yet viable in the workplace at or below 250 grams of VOC per liter. Attempts to formulate low-VOC acetone-based adhesives with satisfactory performance have yet to be fruitful in all operations and for all colors of materials. To date, adhesive manufacturers have developed at least four products but have not achieved full marketability in the top and trim industry.

Sovereign Industrial Adhesives has tested several adhesives at a new vehicle convertible top converter in Ventura County[1]. However, these adhesives have not yet met all the customer performance requirements. Some of the formulations are zero VOC acetone-based. 3M also has an acetone product that is near zero VOC, which had shown promise, yet was ultimately

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

found to be unsuitable by the end user. In addition, a canister adhesive (Westech HSC13) is available that has had some limited success, and the manufacturer claims it to be excellent for automotive headliners. The VOC content is less than 80 grams per liter. ITW TACC had formulated a high-solids adhesive in acetone but have made the business decision to stop production at this time. Unfortunately, the technical viability of these products is not yet proven, and manufacturers need more time for research, development, and performance testing of products with low-VOC content, but with high volumes of exempt compound.

Known Partial Conversion

- ✓ **Krystal Koach**

  Krystal Koach is a large limousine manufacturer that also manufactures a line of tour buses. The facility is subject to a VOC emission limit that 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. Through August 2004, Krystal Koach bonded a zero VOC closed cell foam tape to the roof and followed that with the application of near zero VOC acetone-based contact adhesive to bond supported vinyl fabric to the closed cell foam to form a vinyl top. This adhesive was an acyrlonitrile butadiene rubber (NBR), which has inherently good heat resistance of 212°F. The product was described to be repositionable, have good tack time and very high strength when dry. However, due to staining of light colored vinyl top materials and insufficient long term heat resistance, Krystal Koach no longer uses this product. Kyrstal Koach continues to use activated waterborne neoprene cement and hot melt adhesives in applications where high heat resistance (220°F) is not a factor.

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 percent solids) and are very cost effective compared to standard high-VOC contact adhesives. The material comes in 1¾" and 2" slugs that melt inside an accompanying spray tool that ranges in cost from $880 to $1,800. Materials display high heat resistance and are available with long and short tack times. Krystal Koach is using a pressure sensitive hot melt technology, but not for areas of the vehicle that are subject to the highest temperature swings.

Cost Issues for Top and Trim Facilities

Initially, staff believed that all top and trim facilities, including small shops, could use a mix of acetone-based adhesives on plastic and metal substrates and waterborne adhesives for all other substrates that would perform adequately and help to minimize the increase in cost of adhesives. Staff has reevaluated its assessment. Due to problems with the acetone-based adhesives, such as those at Krystal Koach, staff now believes that adhesive manufacturers need additional time to develop and field test the new formulations that will meet the high heat resistance and adhesive clarity requirements for this industry in a cost effective manner.

Staff addressed the increased costs to top and trim facilities in the 2002 amendment to Rule 1168. Staff believes that the future reformulation of high performance, high clarity sprayable exempt compound based adhesives for this industry will result in increases in adhesive costs to the industry. In addition, top and trim shops may have to purchase stainless steel spray equipment for waterborne adhesive use where applicable. Although it is impossible to predict the exact cost of new chemistries not yet marketed, staff will assume the same range of cost will be in-line with that of the acetone-based products recently developed for vinyl top applications. That adhesive cost was $49.00 per gallon, and required no spray equipment changes. Table 2 details the increased costs to small businesses based on the use of a 50/50 split of waterborne neoprene adhesive and a projected new adhesive chemistry applicable for high heat and non-staining applications, versus an existing 540 grams VOC per liter adhesive.

Table 2: Estimated Increased Costs to a Typical Small Top and Trim Shop

Adhesive Type	Gallons Used Per Year	Gallons of Solids Used Per Year	Costs Per Year
Existing 540 gm VOC/l Adhesive	120	28.2	$310/yr
Replacement Waterborne Adhesive (0 – 80 gm VOC /l)	28.2	14.1	$790yr
Replacement New Chemistry (≤250 gm VOC/l)	60	14.1	$2,940/yr
Stainless Steel Spray Gun (10-yr Cost Distribution)	-	-	$120
Typical Annual Cost Increase			$3,540/yr

(2) PVC and CPVC Welding

These products provide the mechanism for bonding same substrate materials such as plastic plumbing and electrical parts and plastic sheeting together by direct fusing to form a leak-tight continuous joint. Both plastic types typically require the use of a primer to soften the joint areas prior to the application of the cement. The finished plastic piping systems deliver drinking and irrigation water, discharge and vent sewage, transport liquid chemicals, and act as a conduit for electric and telephone wiring. Building and Uniform Plumbing codes mandate that International Association of Plumbing and Mechanical Officials (IAPMO) specifications be met. American Society for Testing and Materials (ASTM) and National Sanitation Foundation (NSF) requirements set the basis for IAPMO approval.

Since these products are exposed to drinking water, ASTM standards allow the use of only a few organic compounds; these are tetrahrydrofuran, methyl ethyl keytone, cyclohexanone, and acetone. Acetone, is an exempt compound and does reduce VOC content however, there are certain solubility limits that restrict the total volume of acetone that can be added to a specific formulation, which in turn limits the benefit of VOC content reduction once the volume of

acetone is subtracted out. High quantities of acetone cause surface crazing, a phenomenon that is not conducive to proper welding. Plastic pipe and pipefittings must be dissolved with a primer to soften the joint before application of the cement. Acetone is the only approved exempt compound under NSF ruling and it does not dissolve PVC or CPVC. Furthermore, in order for the joint to have durability, 20 to 25 percent of the reactive diluent must remain in the assembly to provide proper wetting. To date, newer formulations containing more acetone result in applications that do not meet ASTM requirements. This also applies to the primer. Solvent cement manufacturers have spent approximately 11 years trying to formulate low-VOC cements and primers that meet applicable standards with little avail.

During the June 7, 2002 amendment staff was hopeful that an adhesive technology (specifically epoxy) could replace solvent welding. Laboratory tests on such products show high bond strengths (lap shears) after 16 hours. However, there is no bite, into the PVC and this may interfere with long-term performance. Hydrostatic pressure burst testing also shows failure after two hours, indicative of failure under higher pressures. The requirement under ASTM 2564 standards is to withstand to pressure up to 400 pounds per square inch. In addition, they showed the potential for constricted flow paths due to the configuration of the designed taper of pipefittings and the relative high viscosity of the epoxy adhesive. Two-component mixes are also more challenging to work with compared to one component solvent cements offered today. To date, staff cannot identify lower-VOC adhesives that can be used to adequately bond PVC and CPVC pipes and pipefittings, that meet Rule 1168 technological forcing limits, and only slight reductions are available in primers.

Water-based formulations have also been tried and were found to lead to excessive dry times and low bond strength; water has a high surface tension while the surface tension of rigid plastic is low. Therefore, the ability of waterborne products to adequately wet the surface and provide the mechanism for welding is inadequate.

Staff has determined that the current limits of 510 grams of VOC per liter for PVC welding and 490 grams of VOC per liter for CPVC welding represent reasonably available control technology limits.

Previously, staff was told that PVC/CPVC primer and ABS cements at 550 and 325 grams of VOC per liter, respectively, will be available from the two largest manufacturers of these products for both industrial and architectural applications by the first of the year. Based on this information, staff proposed a compliance date of January 1, 2005, for the lower VOC primers and ABS cements. However, in mid November 2004, staff was informed that one of the manufacturers needed an additional six months to complete the certification process for its primer under the NSF standards and make it available in the marketplace. In order to ease the transition into the marketplace for both lower-VOC primer and ABS cement, staff now recommends establishing a compliance date of July 1, 2005, for the lower VOC limits for PVC/CPVC primer and ABS cement.

Although establishing a limit of 550 grams of VOC per liter falls short of the expected emission reductions from the current future limit of 250 grams of VOC per liter limit for PVC/CPVC primers, there are some emission reductions achieved. Combining this reduction with the

emission reduction achieved from the 325 grams of VOC per liter limit for ABS cements partially offsets the loss of expected emission reductions from PVC/CPVC welding and associated primers. A one-year sell-through and use of cements and primers meeting the existing limits will cover the transition period.

(3) Other Plastic Welding – Methylene Chloride

Acrylic, polycarbonate, and polyethylene terephalate glycol plastic (PETG) sheeting is used to build various plastic parts, including card deck shoes, food bins, aquariums, trophies and display cases of all kinds. Typical assemblies are cut from sheet acrylic, polycarbonate or PETG into specified geometries, dry fitted and welded in place with a syringe applicator. The solution, which contains large percentages of methylene chloride but is used in very small volumes, wicks under the adjoining surfaces, fusing them together. The process from welding to packaging takes 15 to 20 minutes. Exempt compounds, such as acetone, do not provide the degree of solvation that methylene chloride does and results in weak bonds. However, manufacturers have replaced some of the total mix with methyl acetate (an exempt compound) to result in lower concentrations of methylene chloride. The formulations now contain roughly 40 to 60 percent by weight of methylene chloride, depending on the viscosity of the applied cement (light, medium or heavily bodied cements).

In the July 7, 2002 amendment package, staff recognized that phasing out the use of methylene chloride based solvent cements for hard plastic may be difficult to achieve by reformulation. Efforts by manufacturers of these adhesives over the last two years have resulted in reducing the maximum methylene chloride content from 91 percent by weight to 40 to 60 percent. The inferior performance of substitute products compared to methylene chloride makes a complete phase out of methylene chloride in this specific application infeasible. However, the maximum annual use of such solvent welding products for each end user is quite small because a syringe full of solvent welding material can weld many parts. To limit health risk associated with the use of these products, staff proposes to limit the methylene chloride content of these adhesives to 60 percent by weight and proposes to restrict the sales to and use by any single facility to 20 gallons per year of methylene chloride containing products used for solvent welding of acrylic, polycarbonate and PETG plastics. This approximates the current maximum annual usage of larger fabricators. Emissions from existing sources at this level are well within current health-based standards using a worst-case scenario for an impacted receptor.

EMISSIONS INVENTORY AND NET EMISSION REDUCTIONS FOREGONE

The recommended action to retain the current VOC limits for PVC and CPVC welding, coupled with the reduction in VOC content for ABS welding and adhesive primers for plastic will result in net emissions reductions foregone. Table 3 below summarizes the inventory and the emissions foregone, resulting from these proposed amendments. This data was obtained through earlier revisions of Rule 1168, as supplied by the manufacturers. Today's emissions are estimated by assuming a two percent growth rate. Mileage does not play a major factor in solvent cement operations due to higher solids content. Future year estimated emissions are calculated based on the ratio of the lower VOC content to its higher VOC content predecessor, multiplied by the earlier inventory year, and increased by a two percent per year growth rate.

Table 3: Emissions Inventory and Emissions Foregone

Plastic Welding Type	*1/1/1993 VOC Limits (gpl)*	1/1/1993 Emission Inventory (Ton/Day)	Current VOC Limits (gpl)	Current Emission Inventory Projected at 2% Growth Rate Through 1/1/2005 (Ton/Day)	Proposed VOC Limits (gpl)	Emission Inventory Adjusted for Proposed Limits (Ton/Day)	1/1/2005 VOC Limits (gpl)	Emissions Inventory Based on 1/1/2005 VOC Limits (Ton/Day)
PVC	850	0.75	510	0.57	510	0.57	285	0.32
CPVC	850	0.24	490	0.18	490	0.18	270	0.10
ABS	850	0.99	400	0.59	325	0.48	400	0.59
Primer	650	0.66	650	0.84	550	0.71	250	0.32
Totals		**2.64**		**2.17**		**1.93**		**1.33**

Emissions Foregone Retaining All Current VOC Limits (Ton/Day)	Emissions Foregone at Proposed VOC Limits (Ton/Day)
0.84	**0.60**

Therefore, the net of emission reductions previously expected that will not be achieved will be 0.60 ton of VOC per day.

The following table estimates the emission reductions delayed until January 1, 2007. The previous rule development has estimated the use of automotive top and trim adhesives to be 65,194 gallons per year, as derived from manufacturer's data. The assumptions are that the solventborne 540 grams VOC per liter adhesive, less water and less exempt compounds (362 grams of VOC per liter, as applied including water and exempt compounds) has a solids content by volume of 23.5 percent, and that replacement low-VOC adhesives at the rule limit of 250 grams VOC per liter, less water and less exempt solvent will contain 35.0 percent solids by volume, and the total volume of solids to be applied to the same regardless of the VOC content of the adhesive.

Table 4: Automotive and Marine Top and Trim Emissions Delayed

Solventborne 540 grams VOC per liter	
Gallons Used per Year	65,194
Gallons of Solids	15,321
Emissions in Tons/Yr	98.6
Replacement Low-VOC Adhesive at 250 grams of VOCper liter	
Gallons Used Per Year	43,773
Gallons of Solids	15,321
Emissions in Tons Per Year	22.8
Emissions Delayed in Tons per Year	**75.8**
Emissions Delayed in Tons per Day	**0.21**

METHYLENE CHLORIDE INVENTORY FOR SOLVENT WELDING AND TOXICITY ESTIMATION

There is one primary manufacturer of methylene chloride-based solvent welding products for use in the AQMD. Based on the company sales of methylene chloride cements to the acrylic, polycarbonate, and PETG plastic fabrication industries, methylene chloride emissions are estimated at 0.058 tons per day. A solvent substitution with the exempt compound methyl acetate has replaced another toxic compound trichloroethylene. Trichloroethylene is also scheduled for phase-out on January 1, 2005, and unlike methylene chloride, does not have one-year sell-through provision. The largest manufacturer of solvent welding products has reduced methylene chloride content in its lowest viscosity product by 34 percent, and by 23 percent on its heavier bodied cement. The company has performed tests on its products with reduced methylene chloride and has determined that these reductions are the maximum available reductions they can formulate without compromising the strength of the welded joint, while still maintaining reasonable production dry time.

In considering an exemption from the prohibition of sales of adhesives and sealants containing methylene chloride, as it relates to acrylic, polycarbonate and PETG welding, staff concludes that a limited exemption that limits both the concentration of methylene chloride in formulation and total throughput would minimize health risk to the maximum extent possible.

The individual risks and health indices can be established based on the Risk Assessment Procedures for Rules 1401 and 212, as published by the AQMD. The procedure may be extended to Rule 1402 evaluations, which sets the basis for AB2588 compliance. The attached table in Appendix A shows the various health risks associated with methylene chloride, as it is used by the plastic fabrication industries at a maximum of 20 gallons per year of 60 percent by weight of methylene chloride solvent welding formulations. The calculations show the maximum cancer risk would occur in West Los Angeles with a value of approximately 3 cases per million residents and 2 cases per million workers. The health indices for acute and chronic exposures (HIA and HIC (short and long term health exposure indices)) at this level are below

the allowable maximums of 3.0 and the cancer burden (increase of cancer cases with a population) is well below 0.5.

SIP SETTLEMENT AGREEMENT

The 1999 SIP settlement agreement (the Agreement) between the National Resources Defense Council, Coalition for Clean Air and Communities for a Better Environment and the South Coast Air Quality Management District requires that when the limits under Rule 1168 cannot be achieved, the Board must find that it is infeasible to implement the measure by 2003. On June 7, 2002, the Governing Board authorized a delay of the implementation of technology forcing limits for PVC welding, CPVC welding, associated primers and for other plastic cement welding to January 1, 2005. The emissions delayed for these products was 0.85 tons per day. The emissions delayed for top and trim adhesives as part of the October 3, 2003 amendment to Rule 1168 were calculated to be 0.2 tons per day, which is the same quantity of this proposal. Furthermore, if a limit is found to be technologically infeasible, the AQMD may make up the shortfall through alternative measures within two years after implementation of Rule 1168 as it was amended in 1998. In this case that shortfall has been more than compensated by the September 15, 2000 amendments to Rule 1168, which achieved year 2010 reductions of 8.0 tons per day of VOC. These reductions are well in excess of the required 1.3 tons of VOC reductions required from VOC reduction measures of the Agreement. Therefore, the emissions forgone by this amendment to Rule 1168 of 0.60 tons per day from plastic cement welding and associated primers, and an additional 0.2 tons of VOC per day reductions that will be delayed until January 1, 2007 for the automotive and marine top and trim industry, do not negatively affect the Agreement.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

Pursuant to the California Environmental Quality Act (CEQA) and the AQMD's Certified Regulatory Program (Rule 110), the AQMD has prepared a draft Environmental Assessment (EA) for Proposed Amended Rule 1168 – Adhesive and Sealant Applications. The draft EA was released for a 45-day public review period beginning on October 5, 2004 and a revised draft Subsequent Environmental Assessment (SEA) was released on November 4, 2005. Comments received during the review period were responded to and included in the Final EA. Copies of the draft EA can be obtained by calling the AQMD's Public Information Center at (909) 396-2039. A copy of the final SEA is included as an attachment to the adoption Board letter.

Subsequent to the release of the Revised Draft Subsequent Environmental Assessment (SEA) for PAR 1168, PAR 1168 was modified to delay the PVC and CPVC primer and ABS welding VOC content limit requirements from January 1, 2005, to July 1, 2005. The Revised Draft SEA for PAR 1168 includes an alternative that delays the PVC and CPVC primer and ABS welding Final VOC content limit requirements for two years (Alternative B). Alternative B would result in 1,030 pounds per day of VOC emissions foregone from PVC and CPVC primer instead of the 773 pounds per day of VOC emissions foregone expected by the project. Alternative B would also not produce 220 pounds per day of VOC emission reductions from the new ABS welding VOC content requirement, because this requirement was not included in Alternative B.

While the emissions reductions foregone from the delay of PVC and CPVC primer and ABS welding VOC content limit requirements from January 1, 2005, to July 1, 2005 is a modification to the previously proposed project, this modification is considered to be within the scope of the analysis of the environmental impacts resulting from implementing Alternative B. The Revised Draft SEA clearly presented Alternative B and the adverse environmental impacts from choosing Alternative B. The Revised Draft SEA also clearly states that the Governing Board can choose all or part of any of the alternative even if the alternative or portion of the alternative may generate environmental impacts that are significantly worst than those proposed in the project. Therefore, the Revised Draft SEA need not be recirculated, in this situation, since the adverse environmental impacts of Alternative B, and the ability of the Governing Board to choose this or other alternatives or parts of the alternatives were fully disclosed to the public in the Revised Draft SEA.

The Final SEA includes a detailed description and analysis of adverse environmental impacts from the delay the PVC and CPVC primer and ABS welding VOC content limit requirements from January 1, 2005, to July 1, 2005.

SOCIOECONOMIC ANALYSIS

Since there is no change to the current VOC limits for PVC and CPV welding as well as the associated primers, there is no additional cost for this provision. In the case of ABS solvent cements, the manufacturers reformulated by acetone substitution for VOC. The price of acetone is roughly the same as the VOC solvent, therefore no price increase of the reformulated ABS cement should occur. Likewise, the exempt solvents used to replace some of the methylene chloride in the formulation used to bond acrylic, polycarbonate and PETG plastics cost approximately the same. Staff has determined that the current VOC limits for automotive and marine top and trim adhesives are not technically feasible until 2007. However, all additional costs to the top and trim industry for the final limits have been accounted for in previous rule amendments. As such, there are no additional costs or other socioeconomic impacts for these proposed amendments.

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 foregoes and delays scheduled emission reductions due to technical infeasibility, no additional control options are available and therefore there is no incremental cost effectiveness. As determined in the previous rule amendment, additional costs to a typical top and trim shop are expected to be $3,540 by January 1, 2008, on an annual basis, considering existing one-year sell-through and use provisions. No incremental cost increases are expected to occur for ABS cement and PVC/CPVC primer, since there are no other lower emission control options.

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

Findings

Necessity - The AQMD Governing Board has determined that a need exists to amend Rule 1168 – Adhesive and Sealant Operations, to account for the technical infeasibility of the final VOC limits for PVC welding, CPVC welding, and for solvent welding of acrylic, polycarbonate, and PETG plastic welding. This proposed amendment to Rule 1168 will also incorporate achieved reductions in VOC content for ABS welding products and for primers used in association with PVC and CPVC welding by July 1, 2005. The AQMD Governing Board has also determined that a need exists to delay final implementation of a 250 grams of VOC per liter limit until January 1, 2007, due to the unavailability of compliant automotive and marine top and trim adhesives.

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 amendments to Rule 1168 are written or displayed so that persons that are directly affected by it can easily understand its meaning

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 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(c) (cost-effectiveness), 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 low-VOC adhesives that meet performance requirements, including those of other agencies, for PVC welding, CPVC welding, associated primers for PVC and CPVC welding do not exist and for solvent welding of acrylic, polycarbonate, and PETG plastic acceptable non-methylene chloride formulations are not available. The AQMD Governing Board also finds and determines that there is a problem that Proposed Amended Rule 1168 addresses, and seeks to alleviate, through further research, development, and performance testing by manufacturers of automotive and marine top and trim adhesives, to develop acceptable performing low-VOC adhesives for this industry by January 1, 2007.

CONCLUSIONS AND RECOMMENDATIONS

- ✓ Retain the VOC limit of 510 grams of VOC per liter for PVC welding.
- ✓ Retain the limit of 490 grams of VOC per liter for CPVC welding.
- ✓ Reduce the VOC limit for ABS welding from 400 grams of VOC per liter to 325 grams of VOC per liter. Products are available to meet this standard, and will be supplied by the largest makers of ABS welding products by July 1, 2005.
- ✓ Reduce the VOC limit for adhesive primers for plastic from 650 grams of VOC per liter to 550 grams of VOC per liter. Products are available to meet this standard, and will be supplied by the largest makers of primers for plastics by July 1, 2005
- ✓ Postpone compliance with the 250 grams of VOC per liter less water and less exempt compounds limit for automotive and marine top until January 1, 2007, and maintain the current limit of 540 grams of VOC per liter until then.
- ✓ Limit the concentration of methylene chloride in solvent welding formulations for welding acrylic, polycarbonate and PETG plastic fabrications to 60 percent by weight, and combine this with a purchase limitation of 20 gallons per year per facility, as demonstrated by purchase records and invoices of methylene chloride containing solvent welding formulations. Require such records to be made available to the Executive Officer upon request.
- ✓ Rearrange the low-solids material-based VOC content applicability from the bottom of the sealants table to a new subparagraph (c)(2)(A) for improved rule clarity.
- ✓ Add Table of Standards headings (Table 1, Table 2, Table 3 …etc.) for easier reading and further clarity of their order of use by adding a new subparagraph (c)(2)(B).

COMMENTS AND RESPONSES

Industy Comments

Comment No. 1

Although a one-year sell through provision is allowed in Rule 1168 for PVC and CPVC primers and ABS cements, as one of the largest public water districts it is our policy not to rely solely on manufacturers performance data, but rather conduct testing on lower VOC content products at our own laboratory to ensure reliable water distribution. We will need an additional year to accomplish the necessary testing and gain NSF certification.

Response

Staff has contacted IPS Corp., the largest manufacturer of plastic pipe cements and primers for industrial use have obtained NSF certification. Both primer and ABS cement will be available in the marketplace by the end of this year. IPS has advised staff that the compliant products have been offered to the water district since July. The compliance date of July 1, 2005, will allow for the year of testing that the water district policy requires. Oatey, is yet another solvent cement manufacturer that will have products that are NSF certified also by the end of the year. Nonetheless, all users of primers and ABS cements can continue to purchase higher VOC products, compliant with the current limits, and manufactured before July 1, 2006 and use them as needed under the rule's one-year sell through and use provisions. The July 1, 2005 proposed compliance date is a six-month time extension of the January 1, 2005 compliance date in the original staff proposal. Staff believes that this amount of time should be adequate for all users to transition to compliant products, including those conducting NSF testing on their own behalf, despite the NSF certification obtained by the manufacturers.

Comment No. 2

As a supplier of top and trim adhesives to many small users in the field, our customers have limited resources and are neither aware of or have had the opportunity to evaluate the products cited in the Preliminary Draft Staff Report. We cannot find the acetone rich adhesives spoken of in the staff report through normal channels of distribution, thus rendering them not available or suitable for use in the top and trim industry. We manufacture a waterborne product ourselves but there are limitations of heat resistance, non-porous material adhesion, low green strength and dry time. There is a lack of discussion in the Staff Report as to the high heat resistance of the experimental adhesives cited.

We continue to invest in low-VOC technologies and have made some progress. We request additional time to perform trials at various top and trim shops in order to report our findings, and further recommend no change to the rule at this time until adequate performance testing and technical review is accomplished. We have gathered signatures of 29 end users that cite economic hardship to their businesses should the 250 grams of VOC per liter be initiated on January 1, 2005.

Response

Staff has previously identified in its May 2002 Staff Report that the main concerns with waterborne neoprene contact adhesives are that they do not display the same heat resistance as their high-VOC counterparts. Dry time is significantly longer (about twice as long), bonds to metal and plastic are more difficult, and the cost is higher. In addition, this report identifies

many of the drawbacks of waterborne contact adhesives, including non-porous material adhesion, low green strength and dry time. Following application guidelines is very important to achieve proper bonding. If waterborne adhesive is applied too thick, or recommended dry times are not met, pockets of unpolymerized or underpolymerized adhesive beneath the surface may leak out the perimeter at elevated ambient temperatures. There are no performance compromises when using waterborne emulsions over solventborne ones if applied properly. The final product, polychloroprene, is the same in either case. Polychloroprene has inherently high cohesive strength and good heat resistance, although solventborne formulations containing neoprene rubber display higher heat resistance to their waterborne counterparts. Waterborne emulsions come premixed and ready to use, or with an activator. Characteristics such as rate of cure, viscosity, elasticity, etc. are varied by the formulation, which includes initiators and chain-length modifiers. Therefore, application and performance characteristics are not insurmountable, particularly when a combination of two-part waterborne neoprene or single component acrylic copolymer formulations exist and are being used where extreme high heat resistance is not a factor. Staff admits that without reliable exempt compound-based adhesives, full conversion to low-VOC adhesives is not possible at this time, particularly where heat resistance is a factor. Waterborne adhesives cited in this report have been in the marketplace for years, successfully used in certain applications, and at substrate temperatures not typically exceeding 180°F. The acetone-based adhesive that had been cited in the Preliminary Draft Staff Report for use in vinyl top applications did not perform adequately in the field. Therefore, staff recommends extending the compliance date requiring the use of 250 grams of VOC per liter adhesives until January 1, 2007, and retaining the current 540 grams of VOC per liter of adhesives in the interim.

Comment No. 3
The following comment is a summary of the concerns expressed at the public workshop held on June 29, 2004.

Solvent-based adhesive at 540 grams of VOC per liter are the only adhesives available to make a proper bond. Some of the top and trim industry is still grappling with the use of these products. It is our experience as suppliers of adhesives for a variety of applications that waterborne contact adhesives used in the top and trim industry do not perform well. There is an increase in usage due to material waste, and therefore an increase in cost, and they stain by bleeding through light colored materials. Reducing the allowable VOC limit for these adhesives to 250 grams per liter will only exacerbate the problem. Acetone-based adhesives are based on SBR-(styrene-butadiene rubber) and lack sufficient heat resistance. All of these factors lead to downtime, repairs, and warranty work that add to the overall costs of a job. Both facilities cited as using low VOC adhesives are no longer using them at all.

We see a tremendous amount of black market and bootlegged adhesives that exceed the current VOC limit of 540 grams per liter. It is our opinion that this is a result of a lack of enforcement of Rule 1168 as it applies to the small business top and trim marketplace.

Response
As stated in the Preliminary Staff Report, starting on page 3, staff has identified applications where waterborne adhesives do work well. These are foam and fabric to foam, wood, supported vinyl, cardboard and other porous substrates. Staff also stated that there can be difficulties with

waterborne adhesives due to the potential for bleed through, low initial green strength and little or no tack and release capability, however, two-part (or activated) waterborne materials provide better adhesion and polymerization, and are being used today. One-part adhesives by Simalfa are also being used for trim, where applicable (Gulfstream Aerospace is an example). Careful application of waterborne adhesives maximize the mileage of high-solids adhesives. (See the response to comment number 2 for additional discussion).

The acetone-based adhesive cited that was being used at Krystal Koach and since discontinued is not an SBR product, it is an NBR (acrylonitrile-butadiene rubber) based adhesive. El Kapitan Vans continues to employ waterborne adhesives. Staff acknowledges that reapplication of adhesive may occur due to the learning curve of using such products, but this waste should be reduced over time as applicators become more proficient in applying and using them. Furthermore, staff re-visited the companies that are using low-VOC adhesives and re-verified their use as of August 2004. Upon learning and verifying the discontinuance of the use of acetone-based cement, staff concludes that additional time is necessary to further develop these products and now recommends delaying the the January 1, 2005 VOC limit of 250 grams per liter to January 1, 2007. Adhesive manufacturers are still engaged in finding a solution to a multipurpose top and trim adhesive and require more time to research and test these products before releasing them to the professionals in this business.

The issue of alleged non-compliance has been brought to the attention of compliance staff for follow-up.

EPA Comment

The rule revision contains significant relaxations to some VOC content limits. For EPA to approve such a revision SCAQMD must demonstrate compliance with Clean Air Act section 110(l), which prohibits SIP revision that interfere with attainment, reasonable further progress or any other provision of this Act.

AQMD Reponse

Under the 1997 SIP approved AQMP, the total emission reduction commitment under control measure CTS-02E – Further Emission Reductions from Adhesives – Rule 1168 was 1.3 tons/day on a summer planning inventory basis by the year 2010. The September 15, 2000 amendments to Rule 1168 were wide-sweeping and obtained 8.0 tons per day of reductions in VOC emissions on the same basis. Therefore, the 0.6 tons per day of emissions foregone on PVC, CPVC solvent cements and associated primer are more than compensated for with excess emission reductions of 6.7 tons of VOC per day achieved under the year 2000 revision to Rule 1168. Furthermore, the 2003 AQMP established a .3 ton per day set aside to account for emission reductions delayed or forgone resulting from future rule amendments reflecting technical infeasibilities.

APPENDIX A

Toxic Risk Assessment Table for Methylene Chloride Welding of Acrylic, Polycarbonate and PETG Plastic Fabrications

Air Monitoring Station	Q (max) tons per year of MeCl	Distance From source at which MICR becomes 1 x 10^{-6} (ft)	Unit Risk Factor	MICR (Resident) 25 ft	MICR (Worker) 25 ft	HIA (Acute)	HIC (Chronic)	Cancer Burden *(Increase of Cancer to a Population)*
Anaheim	0.07	27.22	1.00E-06	2.57E-06	1.69E-06	0.66	0.0064	0.03
Azusa	0.07	28.31	1.00E-06	2.39E-06	1.58E-06	0.66	0.0060	0.03
Banning	0.07	35.84	1.00E-06	1.61E-06	1.06E-06	0.66	0.0040	0.02
Burbank	0.07	33.52	1.00E-06	1.79E-06	1.18E-06	0.66	0.0045	0.02
Canoga Park	0.07	31.07	1.00E-06	2.03E-06	1.34E-06	0.66	0.0051	0.02
Compton	0.07	32.53	1.00E-06	1.88E-06	1.24E-06	0.66	0.0047	0.02
Costa Mesa	0.07	30.30	1.00E-06	2.12E-06	1.40E-06	0.66	0.0053	0.02
Downtown L.A.	0.07	37.20	1.00E-06	1.52E-06	1.00E-06	0.66	0.0038	0.02
El Toro	0.07	31.07	1.00E-06	2.03E-06	1.34E-06	0.66	0.0051	0.02
Fontana	0.07	28.31	1.00E-06	2.39E-06	1.58E-06	0.66	0.0060	0.03
Indio	0.07	30.05	1.00E-06	2.15E-06	1.42E-06	0.66	0.0054	0.02
King Harbor	0.07	32.53	1.00E-06	1.88E-06	1.24E-06	0.66	0.0047	0.02
La Canada	0.07	28.12	1.00E-06	2.42E-06	1.60E-06	0.66	0.0060	0.03
Lancaster	0.07	38.20	1.00E-06	1.46E-06	9.65E-07	0.66	0.0037	0.02
Lennox	0.07	31.63	1.00E-06	1.97E-06	1.30E-06	0.66	0.0049	0.02
Long Beach	0.07	34.24	1.00E-06	1.73E-06	1.14E-06	0.66	0.0043	0.02

Los Alamitos	0.07	32.22	1.00E-06	1.91E-06	1.26E-06	0.66	0.0048	0.02
Lynwood	0.07	32.53	1.00E-06	1.88E-06	1.24E-06	0.66	0.0047	0.02
Malibu	0.07	26.89	1.00E-06	2.63E-06	1.73E-06	0.66	0.0066	0.03
Newhall	0.07	36.28	1.00E-06	1.58E-06	1.04E-06	0.66	0.0040	0.02
Norco	0.07	29.36	1.00E-06	2.24E-06	1.48E-06	0.66	0.0056	0.03
Palm Springs	0.07	33.52	1.00E-06	1.79E-06	1.18E-06	0.66	0.0045	0.02
Pasadena	0.07	29.36	1.00E-06	2.24E-06	1.48E-06	0.66	0.0056	0.03
Pico Rivera	0.07	30.55	1.00E-06	2.09E-06	1.38E-06	0.66	0.0052	0.02
Pomona	0.07	26.42	1.00E-06	2.72E-06	1.79E-06	0.66	0.0068	0.03
Redlands	0.07	26.58	1.00E-06	2.69E-06	1.77E-06	0.66	0.0067	0.03
Reseda	0.07	30.30	1.00E-06	2.12E-06	1.40E-06	0.66	0.0053	0.02
Riverside	0.07	27.93	1.00E-06	2.45E-06	1.62E-06	0.66	0.0061	0.03
Santa Ana Cyn	0.07	26.28	1.00E-06	2.75E-06	1.81E-06	0.66	0.0069	0.03
Upland	0.07	32.85	1.00E-06	1.85E-06	1.22E-06	0.66	0.0046	0.02
Vernon	0.07	35.42	1.00E-06	1.64E-06	1.08E-06	0.66	0.0041	0.02
Walnut	0.07	32.53	1.00E-06	1.88E-06	1.24E-06	0.66	0.0047	0.02
West L.A.	0.07	25.19	1.00E-06	2.98E-06	1.97E-06	0.66	0.0075	0.03
Whittier	0.07	31.63	1.00E-06	1.97E-06	1.30E-06	0.66	0.0049	0.02