

## Enclosure 1

# STATUS REPORT ARCHITECTURAL COATINGS SUGGESTED CONTROL MEASURE June 2001

### *Availability of Exempt Solvents*

#### Background

The Board asked staff to investigate and report on the availability of exempt compounds (also known as exempt solvents) that can be used in architectural coatings. In response to testimony at the June 22, 2000, hearing, the Board expressed concern about the impact on reformulation efforts of small businesses if exempt solvents suitable for architectural coatings were not available.

Exempt solvents are a group of compounds or classes of compounds that have been determined by the United States Environmental Protection Agency (U.S. EPA) to have negligible contribution to tropospheric ozone formation. When a compound is "exempted," it is excluded from the U.S. EPA's definition of volatile organic compounds (VOC) for Federal regulations related to attaining the national ambient air quality standards for ozone. The effect of this exemption is that a manufacturer using an exempt solvent in formulating a coating would not have to count that solvent as a VOC in determining whether the coating meets regulatory obligations (U.S. EPA, 1999). Traditionally, the U.S. EPA exempts compounds based on petitions from manufacturers or trade associations representing manufacturers. The petitioners submit a variety of data supporting their petition, including photochemical reactivity, physical properties, health hazard potential, toxicology, and environmental fate.

Although the U.S. EPA currently exempts 45 compounds from the definition of VOC, until 1994 there were virtually no exempt compounds for use in architectural coatings, due to the exempt compounds' physical properties, cost, or adverse environmental impacts. Since 1994, several potentially useful solvents have been exempted, including parachlorobenzotrifluoride (PCBTf) and acetone, and the U.S. EPA has proposed exemption of t-butyl acetate (TBAC). These three solvents have the greatest applicability in architectural coatings. Acetone is currently being used in clear wood coatings and traffic paints. PCBTf and TBAC will be discussed below. Two other solvents exempted recently, perchloroethylene and methyl acetate, have a much lower potential for use in architectural coatings because of their toxicity or evaporation characteristics. One additional class of exempt compounds, volatile methylated siloxanes, are sometimes used as a functional ingredient in water-repellant coatings.

The ARB has its own process for exempting compounds from the VOC definition. Companies often petition the ARB, and even some districts, for exemption of compounds being considered by the U.S. EPA. The ARB currently exempts

21 compounds or classes of compounds in what is called Group 1 without restriction, while a few compounds are exempted as Group 2 because they are expected to have low, but not insignificant, ozone formation impacts. Through the use of surveys and other reporting requirements, the ARB tracks usage of Group 2 compounds to ensure there is no future degradation of air quality resulting from their increased usage. If the ARB finds that usage increases significantly, the exemption of such compounds will be revisited to ensure that future degradation of air quality does not result. Acetone, methyl acetate, perchloroethylene, and PCBTF are on the ARB's Group 2 list (ARB, 2000c). A provision of the SCM requires that the use of perchloroethylene and methylene chloride in architectural coatings be reported to the ARB because of concerns about the toxicity of these compounds.

Districts have varying policies about exempting compounds. Some districts automatically exempt compounds exempted by the U.S. EPA, while others perform their own evaluations and exempt only those that they deem appropriate, and still others exempt only those compounds found on the ARB's list.

#### Status Report:

##### *PCBTF*

The U.S. EPA exempted PCBTF from its VOC definition in 1994. PCBTF (sold under the trade name Oxsol® 100) has been produced by only one U.S. manufacturer, Occidental Chemical Corporation (OxyChem), as an intermediate in the manufacture of agricultural chemicals and pharmaceuticals. It was introduced primarily to replace 1,1,1-trichloroethane, a hazardous air pollutant (HAP) that was banned in 1996 because it is a stratospheric ozone-depleting substance. PCBTF is an excellent replacement for another HAP, xylene. PCBTF is attractive to paint formulators because it is neither a HAP nor a VOC, and allows formulators to preserve the use of some of the traditional resin systems, while reducing VOC enough to comply with regulatory limits (Hare, 1998; Hare, 1997).

A wide variety of coating resins, such as epoxies, urethanes, and alkyds, are soluble in PCBTF. However, PCBTF is insoluble in water, thus allowing the formulator to replace part of the VOC in traditional solvent-borne resin systems without sacrificing film properties or application characteristics (Hare, 1997; Hare, 1999a). PCBTF has limited solubility in nitrocellulose, but can be used, with certain formulation modifications, in traditional lacquer formulations (Hare, 1996). It could also be used to reduce the solvent in solvent-borne epoxy and polyurethane industrial maintenance applications. U.S. government and military specifications allow use of PCBTF as a thinner, in wipe cleaning, and in certain coating formulations (Clark et al., 1999).

The major disadvantage of PCBTF is its high cost (about \$2 per pound). It is also a very dense solvent, at 11.2 pounds per gallon, which means that, in comparison to less dense solvents, there is less solvent volume in the formula for a given weight of coating (Hare, 1998; Hare, 1997; Solvents Council, 1996). Finally, according to coating

manufacturers, PCBTF has an objectionable odor that makes it unsuitable for use in do-it-yourself products.

Just prior to the June 2000 Board meeting, OxyChem announced that it was withdrawing from the chemical intermediates business, which includes Oxsol® 100, because this business no longer meets the company's strategic objectives (OxyChem, 2000). The company closed the manufacturing plant, and began looking for a buyer of their intermediates business. The company reportedly placed restrictions on the amount of Oxsol® 100 it would sell to its customers.

Since the June 2000 hearing, the staff has learned that not only does OxyChem have their remaining inventory of Oxsol® 100 for sale, but PCBTF is readily available from many foreign sources such as Brazil, Italy, and China, with prices and quality reportedly comparable to the domestic source. There is some concern about purchasing PCBTF from foreign sources because the purity may be inferior to the domestic source, and contaminants may increase toxicity concerns (IRTA, 2000).

Several potential buyers are negotiating with OxyChem regarding purchase of its plant in Niagara Falls, New York. At this time, two million pounds of Oxsol® 100 remain in stock, and there has been no interruption of domestic supply. In addition, offshore producers have been penetrating the market (Rowe, 2001). Thus, PCBTF is expected to be readily available for the foreseeable future.

#### *TBAC*

*Tert*-butyl acetate (t-butyl acetate) is sold under the trade name of TBAC™ by Lyondell Chemical Company. Other suppliers are expected to market TBAC, but Lyondell (formerly ARCO Chemical) in January 1997 petitioned the U.S. EPA to exempt TBAC because of its low photochemical reactivity. In September 1999, the U.S. EPA published a proposal to exclude TBAC from its definition of VOC (U.S. EPA, 1999). The U.S. EPA is expected to issue a final rule approving Lyondell's petition to exempt TBAC. Lyondell also petitioned the ARB for an exemption from the State VOC definition for consumer products in February 2000.

Lyondell claims that TBAC is a unique solvent that is not a HAP, and can be substituted for various HAP solvents such as toluene and xylene, ozone depleters such as 1,1,1-trichloroethane, as well as other more reactive VOCs commonly used in architectural coatings (Lyondell). It is not an ozone depleter, has negligible global warming potential, does not contribute to particulate matter formation, is biodegradable, and has low environmental persistence (Porreau et al., 1999). TBAC is used today primarily because it is a non-HAP solvent (Kelly, 2001), but use is expected to increase dramatically if the U.S. EPA places it in the negligibly reactive category.

TBAC can be used as a solvent in two ways: to reduce the viscosity of a number of resins as supplied by the resin manufacturer, and to replace other more hazardous ester solvents in reformulation of solvent-borne coatings. TBAC is virtually insoluble in

water, so it is unlikely to be used in water-borne coatings. TBAC evaporates in an intermediate range, in contrast to other exempt solvents such as acetone or methyl acetate, which evaporate very rapidly and are thus somewhat limited in their use. TBAC is compatible with a wide range of resins. TBAC has a relatively low density, in comparison to PCBTF, which means that less weight of the solvent is needed for a given volume of paint (Porreau et al., 1999; Solvents Council, 1996). It is relatively inexpensive at \$0.65 per pound (Kelly, 2001).

The biggest shortcomings of TBAC are its odor and low flash point, which limit its applicability in interior coating applications and in products targeted to the consumer market. Lyondell has noted that the odor may be masked by certain fragrances such as sassafras and evergreen. The major architectural applications would be in industrial maintenance coatings, lacquers, exterior stains, and exterior waterproofing sealers (Kelly, 2001; Porreau et al., 1999).

The ARB staff is currently reviewing Lyondell's petition to exempt TBAC from the definition of VOC in ARB's regulations. Staff has advised Lyondell that more time is needed to assess total environmental and health impacts. The ARB conducts a complete review of the technical literature and completes a comprehensive analysis of the potential environmental impacts of such an amendment, including impacts on ground-level ozone, stratospheric ozone depletion, global warming, toxicity, and impacts to other media. The Office of Environmental Health Hazard Assessment has expressed concern that TBAC metabolizes to tert-butanol, which is a carcinogen (Kenny, et al., 2000). The State Water Resources Control Board is concerned because insufficient data are available to assess potential water quality impacts (Kenny, et al., 2000). In addition, the Department of Toxic Substances Control has performed a preliminary analysis on the persistence of TBAC in soil, and concludes that more information about uses of the chemical is needed for a comprehensive analysis (Kenny, 2000). The staff has advised districts not to exempt TBAC without consulting with ARB, since the assessment process is in progress and expected to be completed by the fall of 2001 (Kenny, 2001).

### Conclusion

While the ARB staff did not base the VOC limits in the SCM on the availability of exempt solvents such as Oxsol® 100 and TBAC, the staff understands the role that exempt solvents can have in reducing the VOC content of coatings. The staff does not believe, however, that the limited choice of exempt solvents will have a particular impact on small businesses, since non-complying products will need to be reformulated, regardless of the size of the manufacturer. All manufacturers have had ample time to perform research on TBAC while awaiting the U.S. EPA's final decision on exemption from the VOC definition. Acetone and PCBTF continue to be viable alternatives for some coating types.

The future of TBAC is uncertain until the U.S. EPA takes final action on Lyondell's petition. The ARB staff is currently evaluating Lyondell's petition, and attempting to

assess the multi-media impacts of TBAC's exemption. TBAC probably has even greater potential in non-architectural applications (Kelly, 2001), such as automotive refinish coatings, flexible packaging ink, pressure-sensitive adhesives, paint strippers, industrial degreasers, and aerosol coatings (Pourreau, et al., 1999). It is also uncertain whether districts will take action to exempt TBAC, should the U.S. EPA exempt it.

It appears that the supply of Oxsol® 100 has never been an issue, but the staff is continuing to monitor the progress of the anticipated sale of the OxyChem intermediates business, as well as the continued availability, price and purity of imported sources of PCBTF.

The use of exempt solvents is not a panacea for reformulation efforts in the long term. The available exempt solvents have unique characteristics that are of value in providing a particular function in a limited number of formulations. In fact, as explained in the next section, because of the requirement to calculate the VOC content of coatings "less water and exempt solvents," there is a limit to how much exempt solvents will help lower the VOC content when substituted for more reactive VOCs.

### ***Calculation of Reportable VOC Content***

#### **Background**

The Board asked staff to investigate the calculation of reportable VOC content based on testimony to the Board that the effect of the VOC calculation in the SCM and district rules is unfair. The Board directed staff to expedite discussions with stakeholders to evaluate whether this calculation method should be changed.

Since the 1970s, the U.S. EPA has required that the VOC content of many types of coatings be calculated on a "less water and exempt compounds" basis (which ARB calls "VOC regulatory"). The U.S. EPA has the authority to approve or disapprove district rules that are included in the State Implementation Plan (SIP). Thus, the U.S. EPA's requirement is a primary reason that district rules and the SCM utilize the VOC regulatory formula as the basis for the VOC limits and for the VOC content reported on product labels.

The VOC regulatory formula looks like this:

$$\text{VOC Regulatory} = \frac{(\text{weight volatiles}) - (\text{weight water}) - (\text{weight exempts})}{(\text{volume coating}) - (\text{volume water}) - (\text{volume exempts})}$$

In the VOC regulatory formula, volatiles are the compounds that evaporate when the coating is applied, i.e., VOC solvents, water, and exempt solvents. The weight of the water and exempt compounds is subtracted from the weight of the volatiles in the numerator. In the denominator, the volume of water and exempt compounds is subtracted from the volume of the coating. It is this requirement to subtract the water and exempt compounds in the denominator that is controversial. Subtracting water or

exempt solvents from the volume of the coating in the denominator makes the denominator a smaller number. The resulting VOC regulatory is a larger number than if the water or exempt solvents hadn't been subtracted from the denominator.

Consider a solvent-borne coating containing 60 percent VOC and 40 percent solids by volume. Using the formula above, there is no weight of water or exempt solvent to subtract from the weight of the coating in the numerator, nor is there any water or exempt solvent to subtract from the volume of coating in the denominator. Making an assumption about the density of the VOC, the VOC content would be 528 grams per liter (g/l).

Now, consider a water-borne coating containing 10 percent VOC, 50 percent water, and 40 percent solids by volume. Using the formula above, in the numerator the weight of the water is subtracted from the weight of the volatiles. If there were no requirement to subtract the water from the volume of coating in the denominator, and using the same density of the VOC as in the previous example, the VOC content would be 88 g/l. However, since the formula does require subtracting the water from the volume of the coating, the denominator becomes a smaller number, resulting in a larger VOC regulatory of 176 g/l.

Finally, consider a solvent-borne coating containing 10 percent VOC, 50 percent exempt solvent (acetone), and 40 percent solids by volume. Using the VOC regulatory formula, the weight of the exempt solvent is subtracted from the weight of the volatiles in the numerator, and the exempt solvent is also subtracted from the volume of coating in the denominator. Using the same VOC density as in the previous two examples, the VOC regulatory content is 176 g/l. If the exempts were not subtracted from the volume of coating in the denominator, the VOC content would be 88 g/l.

These examples illustrate why some manufacturers have expressed concern that in a water-borne coating, or a solvent-borne coating containing exempt solvents, the labeled VOC content is inflated considerably from what is actually in the can. In fact, in a water-borne coating containing 50 percent water, the labeled VOC content is about twice what it would have been had the VOC regulatory formula not been required. This effect is magnified as the volume solids content of the coating gets smaller. A solvent-borne coating containing exempt compounds would also have an inflated VOC regulatory, although typically the amount of exempt compound used is somewhat limited. Some manufacturers consider the VOC regulatory calculation to be a disincentive for formulating water-borne coatings, or solvent-borne coatings containing exempt solvents, to reduce the VOC content.

The rationale for the VOC regulatory calculation is that in determining VOC emissions, the chief concern is the mass of VOC emitted per volume of coating solids applied. Solids are the resins, pigments, and fillers in the coating. The VOC regulatory formula essentially represents the ratio of the weight of VOC solvents to the combined volume of VOC solvents and paint solids. The volume of solids in the coating theoretically is directly related to the coverage achieved by the product. Thus, by providing an

equivalent basis for comparing the polluting portion of solvent-borne and water-borne coatings (i.e., the solvent to solids ratio), the emissions per surface area are directly comparable for solvent-borne, water-borne, and exempt solvent-containing coatings.

#### Status Report:

To address the “less water and exempts” issue, staff has initiated a working group consisting of interested stakeholders from U.S. EPA, industry, and districts. The working group has met twice, in November 2000 and April 2001. To summarize and analyze the various issues related to the “less water and exempts” VOC calculation, the enclosed technical report (Enclosure 2) was prepared by ARB staff, and reviewed by the working group.

An analysis of many of the industry’s objections to the “less water and exempts” calculation raises the question: is the solids content of paint directly related to coverage? If, on one hand, one assumes that the solids content of paint is directly related to coverage, the VOC regulatory method is appropriate because it measures emissions of both water-borne and solvent-borne coatings on an equal basis, namely solids content. If, on the other hand, one assumes that solids are not related to coverage (i.e., a can of lower solids water-based paint covers just as well as higher solids solvent-based paint), then the VOC regulatory calculation may penalize water-based coatings. During the development of the SCM, a review of product data sheets suggested that there is not a consistent relationship between solids levels and coverage. To answer the solids vs. coverage question, the staff believes a research project is needed, in which paints would be formulated with varying solids levels, and application tests would measure coverage of each coating. A staff research idea on this issue was recommended for funding by the Research Screening Committee (RSC) in May 2001 as part of the ARB’s 2001-2002 Research Plan, and in July 2001, the RSC approved a research proposal submitted by California Polytechnic State University (Censullo, et al., 2001).

The other major issue that the stakeholders are discussing is, if it is determined that the VOC regulatory method is not the best way to calculate VOC content, what alternative is preferable? The best measure of VOC content, assuming that solids are directly related to coverage, would be to measure the ratio of the weight of VOC to the volume of coating solids. However, at this time there is not an acceptable test method for measuring the volume of solids in the laboratory. Secondly, the weight percent VOC (i.e., the ratio of the weight of the VOC to the weight of the coating) could be used, but this method does not account for coating solids. As a result, assuming that solids are related to coverage, two products with the same weight percent VOC could have very different solids content and coverage. A third calculation method might be to use the VOC regulatory formula, without subtracting the water and exempt solvents from the denominator. The ARB already uses this method for calculating emissions, and calls it “VOC actual.” Once again, one would need to know whether solids are closely related to coverage, since two products with the same VOC contents could have very different solids levels, and therefore coverage. Finally, with reactivity-based limits (see the

discussion at the end of this report), the ozone-forming potential of the emissions from the coatings is the basis of the standards, not the mass of emissions from the coatings. The VOC limits, expressed in grams of VOC per liter of product, would be replaced by product-weighted reactivities, expressed as grams of ozone per gram of product. Thus, with reactivity-based limits, the “less water and exempt solvents” issue disappears because the VOC regulatory calculation would no longer be used.

It should be noted that if the VOC limits were based on any other value or calculation method, the limits would be set to the same relative stringency to preserve the emission reductions. For example, based on survey data (ARB, 1999), if VOC actual replaced VOC regulatory, the VOC limit for flat coatings would decrease from the current 100 g/l, under VOC regulatory, to 40 g/l under VOC actual.

### Conclusion

The staff recommends that the working group continue to meet, and attempt to arrive at consensus on the best way to report VOC content of coatings. There would be industry impacts, such as labeling, if another method was chosen, and those impacts would have to be examined. The research contract to study the solids/coverage issue would seem to be the key to resolving basic issues with the “less water and exempts” calculation. The staff is also continuing to work on the feasibility of reactivity-based limits.

### ***Small Volume Exemption***

#### Background

The Board asked the staff to investigate the feasibility of a small volume exemption in the architectural coatings SCM. In response to testimony at the June 22, 2000, hearing, the Board expressed concern about the impacts of the SCM on small business. The Board members were interested in what specialty coatings are, how they are used, and whether some type of exemption should be considered for coatings that may be sold in small volumes. Based on testimony, Board members expressed concern about possible inequities related to the SCM's optional averaging provision. In this program, manufacturers would be able to average overcomplying products with noncomplying products, but there was concern that small manufacturers might not have low VOC products to average with their higher VOC products. Board members suggested that some provision might be made available to small manufacturers between the 2003 implementation date of the rule, until the averaging program sunsets in 2005. The Board asked staff to report back on the feasibility of offering a waiver for low volume specialty coatings that do not contribute significantly to the emissions from architectural coatings.

In developing the SCM, the staff did not include a small volume exemption for the following reasons: (1) emission reductions would be lost; (2) both large and small manufacturers make small-volume specialty coatings; (3) the VOC limits are

technologically and commercially feasible without such an exemption; and (4) such exemptions are often difficult to enforce. The staff considered, and rejected as infeasible, exceedance fees and a tonnage exemption (from the U.S. EPA's National Architectural Coatings Rule) as project alternatives in the Final Environmental Impact Report (EIR) (ARB, 2000b). The SCM does include delayed implementation dates, an exemption for quart-size containers, and several niche categories with higher VOC limits.

Specialty coatings and small business are defined below. The following flexibility options will be discussed: exceedance fee, tonnage exemption, small business exemption, limited exemption for specialty coatings, variances, and niche coating categories.

## Status Report

### *Definition of Specialty Coatings*

Specialty coatings are not defined in the SCM, but are referenced in the table of standards as coatings other than flat and nonflat (enamel) house paint. Specialty coatings are designed for specific substrates, to provide unique functionality, or to be used under harsh environmental conditions. Specialty coatings account for less than 40 percent of the volume of architectural coating sales, but produce about 65 percent of the emissions (ARB, 1999). Both large and small manufacturers make specialty coatings.

It is generally believed that some small manufacturers specialize in designing and marketing products for which the demand is so small that large volume manufacturers are not interested in competing. These so-called "niche" categories are often a variation on one of the major specialty categories, and may use an older, higher VOC, formulation technology. Reformulation may not be an economically viable alternative for some low volume specialty coatings. Some small manufacturers of niche coatings may not compete with major manufacturers in low- and zero-VOC technology, and as a result, averaging may not be an option for them. Small manufacturers often point out that they also have difficulty competing with larger companies' volumes, both in purchasing raw materials, and in the economies of scale related to making large batches of product.

About 75 percent of the total sales volume of architectural coatings in California is controlled by only 10 manufacturers (ARB, 1999). In the SCM's economic impact analysis, the staff looked at the impact on small business, both within California and outside of the State. The impact on profitability was found to be about two percent, which is minimal and falls within the range of other ARB regulations. Staff concluded that the competitiveness of small business would be unlikely to be harmed by the fact that large manufacturers can lower their costs through averaging, or because of their economies of scale. This is because small and medium-sized companies market niche products that generally do not compete with the major manufacturers based on price.

The smaller manufacturers make up a market segment that is driven less by price than by coating specialization, brand loyalty, customer service, warranties, and other features (ARB, 2000a).

#### *Definition of Small Business*

The U.S. Small Business Association (SBA) provides guidelines for the size of businesses that could be considered small, based on either the annual receipts or number of employees. For Standard Industrial Classification (SIC) 2851 (paints, varnishes, lacquers, enamels, and allied products), the cutoff recommended is 500 employees. However, in developing the National Rule, and based on input from stakeholders, the U.S. EPA defined small business based on the company's revenue. Their reasoning was that because coating manufacturing is not labor-intensive, revenue was a better predictor of a company's ability to respond to regulatory requirements. Therefore, the U.S. EPA defined small business as having less than \$10 million in annual national architectural coatings sales and less than \$50 million in annual national sales from all products. Using this definition, between 70 and 85 percent of the architectural coatings industry was categorized as small (U.S. EPA, 1998b).

The U.S. EPA received comments that small businesses would be harmed by the National Rule, based on the fact that small businesses manufacture coatings with higher VOCs than larger companies, and that smaller companies would require more time to reformulate products. The commenters also claimed that the rule would suppress the niche products that are the forte of small manufacturers, and would provide a competitive advantage to large companies. The U.S. EPA's small entity analysis revealed that small manufacturers tend to produce coatings with VOC contents 75 percent higher than the average of all surveyed manufacturers, but that they only account for 4 percent of the total volume of coatings sold. As a result of this analysis, the U.S. EPA decided to offer other options, besides reformulation, for small manufacturers to comply with the National Rule: creation of new product categories, increased compliance time, a tonnage exemption provision, and an exceedance fee provision (U.S. EPA, 1998a).

The South Coast Air Quality Management District (SCAQMD) defines a small business in its general definitions rule as one that employs 10 or fewer persons and that earns \$500,000 or less in gross annual receipts. In the SCAQMD's economic analysis for their 1999 architectural coating rule amendments, economic data were available for only 38 facilities, and only two of these 38 facilities qualified as small business (5 percent). Using the SBA's criterion of 500 or fewer employees, where employment data were available for 62 paint manufacturers in the SCAQMD, all 62 qualified as small businesses (100 percent). SCAQMD has a narrower definition for small business since, under other classifications, most of the companies affected by their architectural coatings rule could be small businesses (SCAQMD, 1999a).

The ARB defines a small business according to the California Government Code, sections 11342.510 through 11342.610. For a manufacturing company, a small

business would be independently owned and operated, would not be dominant in its field of operation, and would employ fewer than 250 people. Using this definition in relation to the ARB's 1998 architectural coatings survey, 80 of 155 companies reporting (a little over 50 percent) would be classified as small businesses. If the SBA definition is applied to the 1998 survey, 55 percent of the reporting companies are small businesses. If the SCAQMD definition is applied, 8 percent are small businesses.

Analysis of the 1998 architectural coatings survey (ARB, 1999) reveals that small businesses accounted for about 25 percent of the total volume reported in the survey. Out of about 900 products reported by small companies, about 400 products do not comply with the new VOC limits; that means about 45 percent of the products would need to be reformulated. In contrast, for the survey overall, about 49 percent of the products would require reformulation to meet the new limits. Of the 80 small businesses reporting, less than 30 (roughly 35 percent) have a significant percentage (more than half) of their reported products to reformulate.

Unlike the U.S. EPA, the ARB did not receive any adverse comments about negative impacts on small business. During the public process, there was a short discussion about the limited exemption for specialty coatings (discussed below), but there were no requests from small businesses to carry the idea further.

The staff concludes that the SCM's impact on the reformulation efforts of small businesses is relatively minor. In fact, based on 1996 sales data, the majority of small businesses are already in compliance with the new limits. The challenge of meeting the lower limits will be concentrated in a few companies with high rates of noncompliance.

#### *Exceedance Fee and Tonnage Exemption*

The U.S. EPA included an Exceedance Fee provision in the National Rule that allows sale of coatings that exceed the VOC limit if the manufacturer pays a \$0.0028 fee for every gram of excess VOC (a "pay-to-pollute" approach). The U.S. EPA also included a Tonnage Exemption, a form of low volume exemption, which allows the sale of limited quantities of non-complying coatings without paying a fee. Instead, there is a per-company limit on the exemption, using a sliding scale from 25 tons of VOC through the year 2000, reducing to 10 tons per year in 2002 and beyond. It is important to note that the U.S. EPA's regulation applies to many areas of the U.S. that have never been subject to an architectural coating regulation, whereas in California, manufacturers have been subject to such rules for more than 20 years.

The ARB staff rejected these provisions as flexibility options for the SCM primarily because these programs may slow attainment of air quality standards. The size of the exceedance fee may not be high enough to discourage the sale of high-VOC coatings, and some manufacturers may find it more attractive to use the tonnage exemption instead of reformulating. These provisions would be difficult to enforce on a district-wide level. Because of the extensive recordkeeping requirements, these options may not be attractive to small businesses (ARB, 2000b).

### *Small Business Exemption*

The SCAQMD included a two-year extension of the compliance date for lacquers, and the final limit of 50 g/l for flat coatings would not be applicable at all, for small manufacturers (defined in the rule as having annual gross receipts of \$2 million or less and 100 or fewer employees). The SCAQMD added this provision in Rule 1113's 1996 amendments to mitigate socio-economic impacts on small companies. The District staff pointed out that smaller lacquer manufacturers already have products that comply with the new limit, and small manufacturers have not expressed an interest in using this option (SCAQMD, 1999b). Throughout the history of Rule 1113, the SCAQMD has occasionally included temporary delayed compliance options for small businesses. However, the ARB staff did not receive any requests for this type of exemption, and did not consider adding such a provision because the SCM limits are not technology-forcing.

### *Limited Exemption for Specialty Coatings*

During the SCM development process, a district representative suggested the use of a limited exemption for specialty coatings that would be administratively granted by the district to allow low usage of non-complying coatings for specific purposes. A similar provision is included in Bay Area Air Quality Management District Rule 8-19, Surface Coating of Miscellaneous Metal Parts and Products.

The exemption would apply to the manufacture for sale, sale, or use of architectural coatings. By limiting the yearly emissions of coatings sold under this exemption, the emission reductions foregone (e.g., 0.1 ton per day of VOC) would be subtracted from the total reductions claimed by the district in the SIP. A petition to the Air Pollution Control Officer (APCO) for the exemption could be submitted by end users, or by sellers or manufacturers on behalf of the end user. The APCO would make a determination of the merits of the petition and, if warranted, grant permission for use of a specified amount of product. The petitioner would have to justify the need for the exemption based on job requirements and description, volume of coating, maximum VOC content, and a certification that complying coatings meeting the job performance requirements are not available. Petitions would be processed in the order received, and when the allotment of exempted gallons was depleted, no more petitions would be granted for the year. The written approval would contain conditions for volume and VOC limit.

This provision is not the same as a small volume exemption because it is granted for limited volumes of coatings at the district's discretion, and only if complying coatings are not available for the job. However, this exemption is more applicable to the final user of the coating than the manufacturer. It would not be very useful to small businesses as an alternative to reformulation because a very small pool of exempted gallons would be available each year. Also, since the petition is not specific to small companies, large companies would be in competition with small companies for the available exempted

gallons. The ARB staff did not include this option in the SCM because it is not particularly helpful for small manufacturers.

### *Variances*

Any manufacturer can apply for a product variance from the applicable VOC limit for a specific product, as detailed in Health and Safety Code sections 42365 through 42372. A product variance must be granted for, and attached to, a specific product, when it can be proven that the variance is necessary for the sale, supply, distribution, or use of the product. The district hearing board must follow strict guidelines in determining whether a variance can be granted. The variance can be issued for no more than two years, if a schedule of increments of progress is included. If, at the end of the two years, the product still cannot meet the applicable standard, the district must take action to either adopt or amend the rule to bring the product into compliance, or determine that no rule amendment is warranted.

The ARB staff believes the variance provision is a viable option for small manufacturers to use when they are unable to reformulate a product by the compliance date. The process is somewhat arduous and expensive, but the variance hearing is a public process in which data supporting the request are presented. The manufacturer in turn has to comply with certain restrictions and conditions, but the additional time may allow the manufacturer time to keep essential, but noncomplying, coatings on the market while researching a more permanent solution. However, it is not a substitute for reformulation of a large number of products.

### *Niche Coating Categories*

In the development of the SCM, the staff has been responsive to well-documented requests for higher limits for niche categories. For example, niche categories broken out from industrial maintenance coatings in the 2000 SCM include antenna coatings, antifouling coatings, flow coatings, rust preventative coatings, and temperature-indicator safety coatings. Other breakout categories include high gloss nonflats, bituminous roof primers, clear brushing lacquers, and waterproofing concrete/masonry sealers. Staff also thoroughly evaluated all of the niche categories included in the National Rule, and determined that only a few of these categories were justified for California. During the development of the SCM, if no complying products were found, adding a niche category was sometimes justified. In other cases, where manufacturers provided quantifiable, convincing arguments supported by data, the SCM provides niche categories with higher VOC limits. Modest reporting requirements are included for some of these categories to help quantify the small foregone emission reductions.

### *Other Flexibility Provisions for the Small Manufacturer*

The SCM has a delayed implementation date of about two and half years after Board approval, with three and a half years for implementation of the industrial maintenance limit. Although the SCM is not a regulation, and manufacturers are not subject to its

provisions until adopted by districts, the long implementation period gives small and large manufacturers ample notice to begin reformulation.

The SCM contains an exemption for coatings sold in containers one quart or less in size. That means that non-complying products can be sold in small containers, which is helpful for certain coatings such as stains and varnishes, where often only a small amount of coating is needed to complete a job.

The Board resolution requires the staff to perform technology assessments prior to the implementation dates of the lower limits. The staff will evaluate the progress of both small and large manufacturers in their ability to meet the new limits. This provides an opportunity to reassess the impacts on small businesses.

### Conclusion

The Board is understandably concerned about keeping small businesses in California, while at the same time preserving the emission reduction benefits of rules. However, the staff believes the SCM is technologically and commercially feasible by the compliance dates in the SCM. Any small volume exemption for small businesses would have a negative impact on the emission reductions. Large manufacturers could reasonably argue that they, too, sell some high-VOC products in small quantities, and that they should also be allowed to use the small volume exemption. Enforceability at the district level is a major concern for any flexibility option.

The ARB staff has not identified one best exemption program for small businesses that would replace averaging, and is not convinced of the need for such an exemption, since there was very little discussion of the need for such a program during the public process. There are currently several options for flexibility for small manufacturers, as well as large manufacturers, through averaging, the quart exemption, the sell-through provision, variances, and creation of niche categories. In the final analysis, any special exemption for small business would need to be limited in scope, to minimize the loss of emission reductions, and with adequate recordkeeping and reporting, to ensure enforceability.

The staff believes that many exemption programs are infeasible for small manufacturers with limited resources because of the paperwork and expense that necessarily accompany such a provision. The architectural coatings survey (ARB, 1999) showed that a majority of small companies are already complying with the VOC limits that go into effect in 2003 and 2004. The staff concludes that there is no justification for new flexibility options specific for small business, and that the most effective way to accommodate small volume coatings is to create niche categories, where the need can be documented.

## ***Reactivity-Based Control Strategy***

### Background

Different types of VOCs can react in the atmosphere to produce different amounts of ozone. This ozone forming potential is called hydrocarbon reactivity. The reactivity of a particular VOC is determined by the rates and mechanism of its photochemical reactions in the atmosphere. Reactivity estimates are available for a wide variety of VOCs, including VOCs emitted by architectural coatings.

The Board, through Resolution 00-23, directed the ARB staff to work with industry and other stakeholders in assessing the ozone-forming potential (reactivity) of architectural coatings, and to evaluate the feasibility of developing a reactivity-based control strategy. This analysis is to include: (1) assessing the reactivity of individual VOC species in consideration of the best available science; (2) conducting a comprehensive survey of the architectural coatings industry; and (3) assessing the extent to which VOCs emitted from architectural coatings contribute to ozone levels. The Board also directed the ARB staff to update the Board, by December 2002, on the advantages and disadvantages of a reactivity-based control approach, relative to a mass-based control approach, for architectural coatings.

Testimony at the June 2000 hearing underscored industry's interest in reactivity-based limits. Testimony suggested that improved science is a prerequisite to developing reactivity-based limits, and that the use of the next-generation environmental chamber, currently under construction at the University of California at Riverside (UCR), might be helpful in advancing the science.

### Status Report

#### *Reactivity of Individual VOC Species*

In a continuing commitment to fund research on reactivity, in June 2000 Chairman Lloyd earmarked \$60,000 to continue ARB research on reactivity of VOCs used in architectural coatings and other source categories. Chairman Lloyd instructed staff to discuss with Dr. W.P.L. Carter of UCR the possibility of using the new environmental chamber for a three-year research project (Lloyd, 2000).

The staff requested that Dr. Carter develop a comprehensive proposal to address the major uncertainties of the VOCs used in architectural coatings, using data from the 1998 survey (ARB, 1999) of architectural coatings. Dr. Carter submitted a proposal of research needs in February 2001 (Carter, 2001).

On March 1, 2001, ARB staff conducted a meeting of the Reactivity Research Advisory Committee (RRAC), with the participation of about 40 interested parties from industry, academia, and government agencies, to consider Dr. Carter's proposal and ideas

presented by the group. Due to the limited funds available, the RRAC identified two research priorities: (1) an environmental chamber analysis of Texanol® (2,2,4-trimethyl-1,3-pentanediol isobutyrate), a film-forming aid used in latex paints, and (2) development and evaluation of procedures to quantify reactivities and uncertainties for petroleum distillates (mineral spirits), a diverse group of solvents used in solvent-based and water-based coatings.

There have been no experimental reactivity determinations for Texanol®, since its low volatility makes it difficult to study under the existing chamber methodology. It is anticipated that the new environmental chamber will be used for the Texanol® work. This chamber provides conditions suitable for evaluating chemical mechanisms of VOCs at concentrations representative of current atmospheric conditions, as well as downwind of rural areas where oxides of nitrogen (NO<sub>x</sub>) levels are low (Carter, 2001).

The reactivity of some mineral spirits in architectural coatings has not been well documented, partially due to the large number of products available. Mineral spirits are by-products of petroleum refining, and a wide variety of distillate fractions and mixtures is used in architectural coatings. Dr. Carter proposed to develop a systematic procedure to estimate the compositional uncertainty of mineral spirits based on available compositional information. This uncertainty is in addition to the mechanism uncertainty assigned to MIR values. Detailed compositional data on the many petroleum distillate mixtures, necessitating considerable input from industry, will be required (Carter, 2001).

The RSC approved Dr. Carter's proposal at its March 2001 meeting, and the Board approved funding for the \$60,000 project at its April 2001 meeting. However, since Dr. Carter's original proposal identified tasks totaling at least \$300,000, staff submitted an additional research idea for the 2001-2002 Research Plan. The RSC recommended funding of \$240,000, as part of the ARB's Research Plan in May 2001, and the Board approved the Plan in July 2001. The staff is currently working with Dr. Carter and the RRAC to finalize a research proposal to utilize the additional funding. This second proposal will then be presented to the RSC for consideration at their fall meeting.

#### *Comprehensive Survey of the Architectural Coatings Industry*

The staff is performing a limited analysis of the solvents reported in the 1998 architectural coatings survey (ARB, 1999). In addition, a new survey of architectural coating manufacturers is currently in progress. The new survey will request information on the individual reactive organic compounds used in architectural coatings, on a product-specific basis. This survey should prove useful in identifying any further compounds for which reactivity data are needed, and for estimating reactivities of architectural coating categories.

### *Architectural Coatings VOC and Ozone Levels*

Members of the architectural coatings industry have questioned the extent to which VOCs emitted from architectural coatings contribute to ozone formation in the atmosphere, especially in the presence of low NO<sub>x</sub> levels. The industry has also questioned the assumption that VOCs are emitted from the coating film and are available to photochemically react with NO<sub>x</sub> to form ozone. The responses to comments in the Final EIR for the SCM (ARB, 2000b) address these issues in detail.

For compliance purposes, the VOC content can be measured from architectural coatings using U.S. EPA Method 24. Using this method, a small amount of coating is weighed, before and after heating it at 110°C for one hour. Even after this rigorous treatment, which simulates the emissions from a coating over its lifetime, less volatile VOCs may not evaporate, and thus are not counted as VOCs. However, the best available evidence indicates that the majority of VOCs in coatings evaporate, and are available to form ozone in the atmosphere.

The inventory for area sources like architectural coatings and consumer products is based on periodic surveys, in which manufacturers provide data on VOC content and sales of products in California. Manufacturers of architectural coatings are also required to provide a listing of all the VOCs, by name and weight percent, in each coating or group of similar coatings. Similarly, the ARB and districts utilize a variety of methods to measure emissions from stationary point sources and mobile sources in California. The proportion of the inventory contributed by architectural coatings is dependent on the contribution from other sources, but the inventories from all sources and the methods used to estimate emissions are based on the best available data.

The VOCs reported in the speciated survey are used to update the inventory, and are ultimately used in modeling. The ARB has focused on VOC reductions in the SCM because architectural coatings emissions are VOCs; however, the ARB's and districts' overall emission reduction strategy is based on statewide VOC *and* NO<sub>x</sub> control. Modeling of local VOC/NO<sub>x</sub> conditions is necessary to predict the effects of VOC and NO<sub>x</sub> on ozone concentrations. Under most conditions VOCs will promote ozone formation, but it is also true that under specific conditions, some VOCs can act as NO<sub>x</sub> sinks and, therefore, limit the amount of ozone formed. However, as detailed in the Final EIR, NO<sub>x</sub> concentrations typically found in California are high enough that VOC controls are an effective strategy throughout the State.

Architectural coatings are area sources similar to consumer products. To distinguish the effectiveness of mass-based consumer products VOC control strategies from mass-based mobile source control strategies, the Urban Airshed Model was used to simulate the impacts of consumer product emissions on peak ozone and population exposure for the South Coast Air Basin (ARB, 1996). The simulations were for the South Coast Air Basin for August 26-27, 1987, and used emissions and meteorology from the 1994 SIP. These simulations showed that consumer product emissions are about 60 percent as effective in reducing peak ozone as motor vehicle emissions per ton of VOC emitted.

Reductions of population exposure to ozone concentrations above 9 parts per hundred million (the State ozone standard) were the same for consumer products as for motor vehicles per ton of VOC emitted.

This modeling study shows that mobile source controls are more effective in reducing maximum ozone in peak concentration areas because motor vehicle emissions are more reactive than area source emissions. However, area source controls (such as for consumer products and architectural coatings) are very effective in reducing population-weighted exposures to ozone. Thus, on a population-weighted basis, any decrease in mass VOC emissions from area sources is very effective in reducing ozone exposures.

To summarize, the evidence suggests that VOCs from architectural coatings, as reported in the survey and measured by Method 24, are the same VOCs that are available to form ozone when they photochemically react with NO<sub>x</sub> in the atmosphere. The evidence suggests that VOCs emitted from architectural coatings do contribute to ozone formation in the atmosphere in the presence of the high NO<sub>x</sub> levels typical of the population centers in California. There is no evidence to question the fact that VOCs are emitted from the coating film and are available to photochemically react with NO<sub>x</sub> to form ozone. The industry has presented no data to support its argument that VOCs from architectural coatings do not contribute to the formation of tropospheric ozone. Therefore, we do not believe that research on this topic is necessary.

#### Conclusion

The ARB staff has begun the process of assessing the feasibility of reactivity-based limits for architectural coatings. The staff will report again on this reactivity-based assessment in December 2002.

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