Bay Area Air Quality Management District

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Bay Area Ozone Strategy
Control Measure SS 5

Regulation 8, Rule 32: Wood Products Coatings
Staff Report

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REGULATION 8, RULE 32
Wood Products Coatings
Staff Report - Table of Contents

I. EXECUTIVE SUMMARY

This Staff Report summarizes information regarding proposed amendments to Bay Area Air Quality Management District (BAAQMD or the District) Regulation 8, Rule 32: Wood Products Coatings ("Regulation 8-32"). These amendments are proposed to reduce emissions of Volatile Organic Compounds (VOCs) by reducing the VOC content limits for wood product coatings. The District committed to updating this regulation in Control Measure SS-5 in the District's 2005 Ozone Strategy.

VOCs contribute to the formation of ground-level ozone, which is the principal ingredient in smog. The Bay Area is not in compliance with State and federal ozone standards, and has committed to implement all feasible measures to reduce emissions of ozone precursors, including VOCs. Regulation 8-32 regulates VOC emissions from the wood products manufacturing industry by setting standards for the amount of VOC that can be used in the surface preparation, coatings application, and cleanup for the manufacture of wood products including furniture, bathroom vanities, kitchen cabinets, picture frames, outdoor speakers, architectural millwork, and other wood products.

The proposed rule amendments will reduce the amount of VOC allowed in various types of wood products coatings. District staff is proposing more stringent VOC standards because the performance of low-VOC solvent-based coatings and water-borne wood coating products has improved considerably over the last 10 years, and low-VOC products are now readily available that meet wood products manufacturers' needs. District staff is proposing reduced VOC limits for sealers, fillers, stains and wash-coats. These proposals are consistent with standards adopted in the Sacramento, San Joaquin Valley, and South Coast air districts in the past few years.

The proposed VOC limits typically require the use of higher solids content and exempt solvents, or water-borne wood coatings to achieve the desired emissions reductions. Compatibility of these coatings to wood substrates has improved significantly since this rule was last amended in 1996. Wood products manufacturers can accommodate the proposed changes with minor adjustments to their manufacturing processes.

VOC emissions from Bay Area wood coating operations are currently estimated to be 1.48 tons per day. The proposed amendments will reduce VOC emissions by 0.45 tons per day, a 30% reduction. The most significant costs of implementation are higher coating costs. A few manufacturers may need to add additional drying trays or ventilation during damp and cool winter months. Cost effectiveness of the proposed amendments is estimated to range in costs from $7,000 to $26,000 per ton of reduced VOC, depending on the increased coating costs and if any additional drying facilities are required.

Several amendments are proposed to improve the implementation and enforceability of the rule. These amendments include revisions to the way coatings are classified for purposes of VOC-content regulation, enhanced labeling requirements for wood products coatings, and editorial revisions to the rule language to make it easier for wood coatings users and the public to understand what is required. In addition, amendments to the alternate compliance option of emissions averaging and to the averaging procedure found in the Manual of

Procedures, Volume I are proposed to be consistent with U. S. Environmental Protection Agency policies.

II. BACKGROUND

A. Introduction

The wood products industry in the Bay Area encompasses about 650 businesses in all nine counties, including a wide variety of products, sizes of manufacturing operations, and finishing techniques. These businesses vary from one and two person shops engaged in cabinet making or furniture refinishing to manufacturing facilities employing in excess of 100 people. About 300 businesses in the Bay Area produce millwork and kitchen cabinets. Approximately 200 businesses produce household, office and public building furniture; and cabinetry for electronics, bookcases and display cases. Approximately 400 of these businesses are exempt from the requirements of Regulation 8-32 because they are very small, using less than 20 gallons of wood coatings per year and thus producing very low emissions. Businesses that refinish furniture are also currently exempt because they must use coatings identical or similar to the original coatings used to ensure an appropriate result. More than two thirds of the businesses that manufacture kitchen cabinetry and furniture employ 10 people or fewer.

Businesses in the wood coating industry also vary greatly in the types of coatings they use and the types of finishes they create. Wood coatings encompass a wide variety of materials, and application and finishing techniques, and customers require a significant range in the quality of finishes on products made of wood. A wood product may be coated with no more than a paint or primer or may, as is often the case of high quality furniture finishes, be coated in a multi-step process involving sealer, stain, sanding sealer, more stains and finally topcoats, with surface preparation between many of the steps. Some furniture finishes consist of as many as nine separate application steps. Coating materials must be selected for resistance to common household chemicals for kitchen cabinets, abrasion and “hot print” (hot object) resistance, clarity, color, gloss and film build. The coatings must be compatible, or in some cases, incompatible where the look of the finish depends on different drying rates of solvents. A typical kitchen cabinet will typically have three applications of coatings: stain to color the wood and enhance grain, sanding sealer to seal the wood and build a smooth surface, and a clear topcoat to produce a resistant finish with the desired gloss and clarity. Customer requirements for furniture and custom architectural millwork are different and usually more demanding than those for cabinetry and general wood products. Application techniques vary as well, from spray application to dipping, hand brushing or wiping. Overall, there is a much wider variety of finishing techniques used in the wood coating industry than in any other surface coating industry.

B. Source Description

Wood coating operations present an air quality concern because the coatings contain VOCs, which contribute to the formation of ground-level ozone. Ozone is the primary chemical component in smog, and it creates a health concern for people who breathe it at unhealthy levels, especially in vulnerable populations such as children and people with asthma. Ozone is created when VOCs react with nitrogen oxides in the atmosphere in the presence of heat and sunlight.

Regulation of emissions from coating operations focuses on the amount of VOC present in a coating. The VOCs in the coating evaporate as the coating dries, where they can contribute to the formation of ozone. Coatings regulations therefore impose restrictions on the amount of VOC allowed in various types of coatings, most often stated as a limit on the number of grams of VOC allowed per liter of coating.

Emissions occur when the solvents in the coating evaporate. The process steps may be done in a single spray booth or in a series of booths, separated by flash-off areas and drying ovens. The flash-off area allows a solvent to rise to the surface of the coating before ambient or high temperature curing operations can occur. Typically it is during the flash-off and curing / drying phases that VOC is emitted to the atmosphere. It is reasonable to assume that all of the solvents used in the coating process eventually reach the atmosphere. Very few of the manufacturers in the Bay Area currently use ovens or UV lighting for curing.

Wood coatings are available in two primary categories: high solids coatings and low solids coatings. High solids coatings contain more than 120 grams of solids per liter, and are used to color, protect and beautify the wood. The solids include pigments and resins (binders or film formers, and at times plasticizers) that remain after the coating dries, providing a finished coating and protection. Low solids contain less than 120 grams of solids per liter, and are used to enhance wood grain and provide a slight tint to the wood, but the effects are far more subtle.

Coatings can require only one coat, or several coats, depending on the finished effect needed. Generally, multiple coatings are applied in the following order: stain, wash coat, filler, sealer, and top coat. Each coating typically contains both solids and liquid solvents. The solvent portion may include VOCs, exempt solvents, and water. Conventional (high VOC) coatings normally contain 70 – 80 percent solvent. Water-borne coatings are those that contain water as a solvent or diluent. Merely having water in a coating, however, does not ensure that the coating complies with applicable VOC regulations, as many water-borne coatings also contain VOCs. Coatings with very high content solids (greater than 60%) usually have a reduced VOC content. Exempt solvents are those organic compounds that do not play a significant role in forming ozone. Since they react negligibly with nitrogen oxides in the air to form ozone, they are desirable substitutes for organic compounds that do form ozone (provided they do not have other negative effects, such as toxicity or depletion of stratospheric ozone). The most prominent exempt solvents used in wood coatings are acetone and parachlorobenzotriflouride. Each of these solvents has played a large role in developing low VOC wood coatings that work effectively to produce the desired wood finishes (although coatings that use acetone as a solvent substitute often require alterations to spray equipment to accommodate the rapid evaporation rate of highly volatile acetone).

Application techniques vary from airless and High Volume Low Pressure (HVLP) spray to hand wiped finishes. This variance in applications can have significant emissions ramifications. Therefore, coating regulations sometimes include requirements regarding application equipment or methods. Coatings applied with compliant application equipment have higher transfer efficiency; consequently, less coating is wasted through overspray. Maximum transfer efficiency and therefore minimum emissions are achieved through hand application methods: brush, wipe, pour and drain or dip and drain. However, the higher transfer efficiency is partially offset by solvent evaporation from open containers used in conjunction with these techniques.

Organic compound emissions from surface preparation and cleanup are easily minimized by good housekeeping practices. Surface preparation of wood products is almost entirely by physical processes such as sanding, and rarely is an organic solvent used. Clean up of equipment can also use a significant amount of solvent. Good housekeeping practices include keeping solvent containers closed when not in use, and using closed solvent recirculation for tool and spray gun cleanup. Strippers are typically only used in furniture refinishing. Most strippers consist of methylene chloride as the active agent, which is toxic, but has been determined to have negligible photochemical reactivity by the US EPA. Exposure to the toxicity of methylene chloride strippers is minimized by the use of gels which reduce evaporation. Nevertheless, refinishers using methylene chloride based strippers are subject to the District's toxic risk assessment requirements before obtaining permits.

C. Current Technology for Reducing VOC Emissions

There are four major categories of control strategies that can be used to reduce VOC emissions from wood coating operations. They are:

1. Low-solvent and water-borne reformulated coatings
2. Add-on control devices
3. Emerging technologies
4. Improved work practices

1. Reformulated Coatings

Nitrocellulose resin lacquer technology had provided the benchmark for expectations of many wood finishers over the last several decades. It was easily applied, inexpensive and provided a beautiful finish. These lacquers also provided the advantage of always being resoluble in their original solvent, so minor "touch-up" repairs to the coating surface could be made easily. However, nitrocellulose resin lacquers were only soluble in large amounts of organic solvent. Reductions in wood coating VOC limits have driven development of alternatives like water-borne technology, and improvement in some solvent-borne technologies like high-solids urethanes and polyester resins. The primary focus for improvement of emissions from wood coatings continues to be development of low VOC coatings, including water based coatings.

Low-solvent Reformulated Coatings

Low-solvent reformulated coatings that contain less solvent will reduce VOC emissions. Currently, low-VOC reformulated coating alternatives are available and can be used for general wood coating applications. The greater challenge is using these coatings for the more demanding applications like furniture and custom wood products manufacture, refinishing, and antiques.

Typically wood finishes must pass a variety of tests to produce an acceptable finish. The first of these tests, and ultimately the most important, is appearance. Conventional nitrocellulose lacquer has unique refractive properties that give richly colored woods a "warm" appearance. Furniture manufacturing in the United States tends to favor this natural appearance. Water-borne finishes have traditionally suffered from an appearance often described as "plastic", due to the resin systems used. The finishing of fine furniture is different from finishing cabinetry because the desired appearance is different. In furniture, often the intent is to allow the natural beauty of the wood to be accentuated; where cabinetry, particularly kitchen cabinetry, demands a finish that gives the appearance of a protective coat. Some cabinetry is finished to accentuate the natural beauty of the wood, while other finishes conceal the wood.

Secondary but no less important considerations for wood coating concern the protective nature of the coating. Specifically, scratch or mar resistance, hot imprint resistance, and chemical resistance are of concern. Furniture is subject to scrapes and scratches from any object set on a desk, dresser or coffee table. Whereas a deep scratch in any surface coating would be expected to need repair, furniture must be able to withstand minor scratches from everyday use. In addition, since wood is a relatively soft substrate, a coating must be able to have some flexibility. A coating that is overly hard or brittle will shatter from object impact, much like glass. A successful coating must flex slightly to "give" along with the underlying wood. Hot print resistance is the ability of a coating to resist "melting" or softening when a warm object such as a hot cup of coffee comes into contact with the surface. Otherwise, a hot coffee cup will stick to a table or desk. Hot print resistance is not a problem of solvent borne coatings that chemically polymerize, such as urethanes, polyester resins or conversion varnishes. Conventional nitrocellulose lacquers are also heat resistant. However, hot print resistance does tend to be a problem of coatings that form films by coalescence or fusion of adjacent particles as the volatile portion evaporates, which is typical of water emulsified coatings. In addition, coatings must also be resistant to a variety of chemicals, particularly household chemicals such as vinegar (acetic acid), alcohol, water, oils, detergent and ammonia. Products intended for home or office use must meet standardized or company specific tests, often using specific household products, such as hot coffee, cola, grape juice, tomato juice, mustard, lipstick, nail polish remover and ethanol. In addition, a "lipids acid" test has been developed to mimic the effects of human skin oils. All coatings, including the traditional lacquers, show varying degrees of resistance to different chemicals, but many of the water-borne coating have tended to be less resistant to household chemicals than solvent borne coatings.

Low-VOC coatings have been developed that can satisfy these requirements for many wood coating operations. However, even where there are satisfactory low-VOC alternative

coatings available, adopting them is not as simple as just switching to the new coating. Often application processes, drying processes and possibly curing equipment may need to be changed as well.

Water-Borne Reformulated Coatings

Coatings that use water instead of solvent as a medium have also been developed. These water-borne coatings are normally very low in VOC content. The overriding problem water-borne formulations face is the basic interaction between water and the wood. The absorptive nature of wood and the tendency of wood grain to swell when wet is the reason that water-borne technology for wood coatings has been slower to develop than for any other type of substrate. Swelling grain results in the necessity to sand a surface smooth, which in turn removes coating, resulting in the necessity of re-application, and, potentially, renewed swelling. This tends to be a much greater problem with "open grain" woods such as oak, walnut and mahogany than with "closed grain" woods such as birch, cherry and maple. Partial solutions to this problem have been found in modification of application techniques, including humidity control, the use of heat lamps or drying ovens, and control of room air flow. Improvements in the water-borne coatings themselves have made excellent progress over the last several years in greatly reducing, and in some cases eliminating this problem.

Staff discussed the use of coatings with several wood products manufacturers and wood coating suppliers. Some use solvent-based coatings, and some use water-borne (very low-VOC) coatings. The conversion from solvent based coatings to water-borne coatings involves more than simply changing the coating being applied. Water-borne coatings require the use of spray guns designed for spraying water-borne coatings, or existing spray guns must be retrofitted to include stainless steel or plastic parts to prevent rust. Application of water-borne coatings may require additional steps, and new techniques. The greatest concerns expressed are the interaction of the water in the coating with the wood causing grain swelling, and cool and somewhat damp climate in the Bay Area during the winter months which could lead to longer drying times.

While there have been no "breakthrough" improvements in water-borne technology for wood coatings, incremental improvements have enabled several coatings manufacturers to develop water-borne coatings, combined with application and drying techniques that meet the needs of most of their customers.

2. Add-On Abatement Devices

Add-on control devices are incorporated into a process to remove or destroy VOCs after the coating process occurs. There are three add-on control methods: thermal oxidation, catalytic oxidation, and adsorption. Although these add-on controls are effective at eliminating air pollution after it is emitted, the preventive approach of reformulating coatings to reduce VOC content is generally favored because it eliminates the pollution altogether rather than capturing it after the fact. In addition, most abatement devices are relatively costly compared to switching to low-VOC coatings. They also require energy to construct and operate, contributing to the generation of greenhouse gases.

- Thermal oxidation: Thermal oxidation involves incinerating VOCs to prevent them from being emitted. Incinerators are usually operated at a high temperature to efficiently destroy most VOCs found in the exhaust stream. Factors affecting incinerator performance are residence time in the combustion zone and incinerator temperature. Thermal oxidizers can achieve close to 100% VOC destruction for most VOCs. The major concern with thermal oxidation, in addition to capital cost, is that large amounts of fuel (usually natural gas) must be burned to destroy a dilute stream of VOCs, resulting in additional carbon dioxide from use of fuel, as well as the carbon dioxide generated from burning the VOCs. Carbon dioxide is a greenhouse gas, implicated in global warming.
- Catalytic Oxidation: Catalytic oxidation is similar to thermal oxidation, but it introduces a catalyst to dramatically increase the oxidation rate. The catalyst itself is not altered during the reaction. The increased reaction rate can greatly reduce the temperatures required, resulting in significant fuel savings. Catalytic units include higher installation costs and the possibility of catalyst poisoning by sulfur, metals, and phosphorous. Catalytic units can achieve in excess of 95% VOC destruction efficiency. Greenhouse gas emissions are less than with thermal oxidation, but still a concern with this control technology. There is one facility in the Bay Area that uses catalytic oxidation to reduce VOC emissions.
- Adsorption: Adsorption is a mass-transfer operation involving the conversion of VOC from a gas to a liquid or solid. The most common adsorption system uses activated carbon, which is effective in capturing most VOCs through physical adsorption. In addition, activated carbon can be regenerated by steam, nitrogen stripping, or by drawing a vacuum on the carbon. At minimum, two adsorption beds and a regeneration facility are required for an adsorption process. VOC removal efficiency can be as high as 95%. This control technology results in energy consumed in regenerating the activated carbon, as well as creating, transporting, and disposing of the activated carbon – all contributing to greenhouse gas emissions.

3. Emerging Technologies

Emerging technology efforts are underway to improve the techniques that show promise in the wood product coating industry. These developments include advances in spray booth design, new curing methods that involve three dimensional UV curing, and research into bio-filtration that will improve add-on controls. While many of these show potential, there have not been any breakthroughs that revolutionize the development of low VOC coatings, or application or drying techniques.

4. Improved Work Practices

Improved work practices, such as employing high transfer efficiency application methods and reducing the volume of clean-up solvent, can lower VOC emissions by minimizing the quantity of VOC-containing materials used. Most wood product facilities currently employ these practices to minimize VOC emissions.

D. Regulatory History

Regulation 8, Rule 32 was originally adopted in 1983, and has evolved considerably as the technology of low VOC wood coatings has improved. The following describes the significant developments in the rule.

High-Efficiency Application Devices

In 1983, low-VOC technology for wood coatings was not sufficiently developed to incorporate into the rule. Instead, the rule focused on requiring transfer-efficient application equipment. The regulation requires the use of certain coating application equipment to ensure high transfer efficiency. Businesses using spray equipment to coat wood products must use one of the following application methods: airless spray, air-assisted airless spray, electrostatic air spray, or high-volume low-pressure (HVLP) spray. This equipment reduces overspray and thus is more "transfer efficient" than conventional air spray. The use of such equipment reduces VOC emissions because less total coating is required to cover a given object.

VOC-Content Limits for Wood Coatings

The District incorporated VOC content limits into Regulation 8, Rule 32 in 1991. The limits were to be implemented in several stages, culminating in the lowest VOC limits to become effective in 1994 and 1996. The District's 1991 Amendments to Regulation 8-32 were analogous to South Coast AQMD's 1988 amendments to its Rule 1136 except for two major aspects.

First, South Coast had exempted 1,1,1 trichloroethane as a VOC, but that resulted in a one ton per day increase in emissions of that stratospheric ozone depleting compound. The 1991 Amendments therefore did not exempt 1,1,1, trichloroethane as a VOC. This approach, although not prohibitory, discouraged the reformulation of coatings using ozone depletors. Although controversial with coating formulators and producers of chlorinated solvents, the rule has been effective in guiding reformulation away from ozone depleting and toxic solvents. Ultimately, this approach was validated when the Clean Air Act Amendments of 1990 required a phase out of ozone depleting solvent production, and production of chlorinated solvents was completely phased out by the end of 1995. Other solvents that have been used in wood coatings were approved as exempt from the VOC limits, based on their very low tendency to form ozone in the atmosphere. Acetone, an example of such a solvent, was exempted from the VOC calculation in late 1995. Some manufacturers used acetone as a substitute for other solvents in lacquers. Other exempted solvents, like parachlorobenzotriflouride, were also used. The VOC limits that were adopted in 1996 accommodated solvent-borne materials consistent with the existing technology and with use of exempt solvents.

Second, the District created separate regulatory tiers for different types of wood products coating operations to reflect the needs of the various wood product manufacturers and

customers and the technologies available to meet those needs. The regulation had two tiers applicable to different types of coating operations, in recognition of the fact that different types of wood products have different needs in terms of the quality and durability of their finishes. The most stringent standards apply to general wood products. Somewhat less stringent standards apply to furniture, custom cabinetry and custom architectural millwork in light of the more demanding requirements. In 1996 a sub-category for custom and contract furniture was added. Custom and contract furniture, which typically require the highest quality finishes, was subject to the same VOC limits as furniture, custom cabinetry and custom architectural millwork, but was allowed extra time for implementation to improve both the coatings and application processes. These tiers and the VOC limits established in 1996 remain the VOC limits in the current rule.

As is typical with coating regulations, Regulation 8-32 also allows higher-VOC coatings to be used if the facility captures and controls the emissions from the coatings with an abatement device, such as a thermal oxidizer that incinerates the VOCs before they can be emitted into the atmosphere. One wood product manufacturer in the Bay Area has a thermal oxidizer.

Limited Exemptions for Special Applications

The 1991 Amendments also provided exemptions for refinishing, the production of antique replicas and musical instruments and for certain types of specialty finishes. These exemptions for certain uses do not involve significant emissions and/or are necessary for operations for which suitable low-VOC coatings have not been developed, such as furniture refinishing, crackle lacquers, and leaf finishes. In addition, the following exemptions and limited exemptions are part of Regulation 8, Rule 32.

- Coatings used on wood forms in the foundry industry. The exemption was based on the very small quantity of emissions involved, the exacting tolerances to which the forms must adhere, and the uniquely harsh environment where these coatings must perform.
- General wood products that are subject to extreme environmental conditions such as unusually abrasive or corrosive conditions or temperature extremes. These products, in certain limited circumstances, can be coated with higher-VOC coatings, allowing the use of high solids, hard film-forming coatings such as polyurethanes. Administrative requirements for petitioning for this limited exemption were included.
- Facilities that use and keep on site only low VOC coatings. An exemption from daily recordkeeping requirements was added for these facilities to provide an incentive to fully implement low-VOC technology, and to reduce emissions beyond the regulatory requirements.

Good Surface-Preparation and Cleanup Practices

The regulation also required good housekeeping practices to minimize emissions from solvent storage, surface preparation and cleanup activities.

Averaging VOC Content of Multiple Coatings

More strict VOC content limits can have differing impacts on the wood coating facilities in the Bay Area depending on their specific coating products and finishing techniques. In addition, some companies find low-VOC content coatings are effective with some but not all products. To provide flexibility in achieving compliance, an averaging provision was provided in the rule. Guidance for averaging calculations is included in the Manual of Procedures, Volume I: Enforcement Procedures. A facility can average as many coatings as necessary to achieve compliance. Larger facilities that emit more than 25 tons per year must discount any averaged emissions by 10%. This affects only a few facilities in the Bay Area.

In addition to the flexibility the averaging provision provides, it also encourages the ability to consider different mixtures of coatings that can result in lower emissions. The ability to offset these coatings with higher VOC technologies provides a driving force for facilities to continue experimentation with lower VOC (and water-borne) coatings. Coating systems can be created with overall emissions in mind, rather than compliance with individual categories. This is especially important for products that currently require several steps of surface preparation and several layers of coatings. Many companies continue to support this added flexibility. The Emission Averaging Procedure was included in the District Manual of Procedures to provide the calculation methodology, and provided an enforceable and EPA-approved method to implement averaging. Minor updates are proposed to the Emission Averaging Procedure.

Current Rule

The current rule was adopted in June, 1996 and is a culmination of the improvements described above in application techniques and lower VOC coatings available at that time, exemptions for the truly unique requirements of some wood coatings, and a compliance option of averaging to provide flexibility where needed..

Other District Coatings Rules

In addition to Regulation 8, Rule 32, the District has adopted several other rules applicable to coating operations involving wood products, including:

- Regulation 8, Rule 3, which limits VOC emissions from Architectural Coatings used in on-site coating of buildings or appurtenances (including cabinets finished at the site of installation).

- Regulation 8, Rule 4, which limits VOC emissions from general solvent and surface coating operations. Some minor types of coatings exempt from Rule 32 are subject to Rule 4, such as the stencil coating of wood products.
- Regulation 8, Rule 23, which limits VOC emissions from the application of coating, adhesive and ink to wood flat stock and wood paneling.
- Regulation 8, Rule 51, which limits VOC emissions from Adhesive and Sealant Products by regulating adhesive applied in-shop or on-site (except adhesive used in the manufacture of laminated paneling or other flat stock such as doors).

These rules combine to limit the VOC content of all coatings used on wood, or alternatively, reduce emissions through the use of abatement equipment. The rules also establish standards for abatement efficiency where abatement devices are used, require the use of operating procedures that minimize VOC evaporation, and require recordkeeping to demonstrate compliance.

III. PROPOSED RULE AMENDMENTS

The District proposes the following amendments to Regulation 8, Rule 32.

A. More Stringent Limits for VOC Content

The main purpose of the amendments the District is considering is to reduce the amount of ozone formed as a result of VOC emissions from wood products coatings. The primary mechanism for achieving this goal would be to reduce the amount of VOCs allowed in various types of wood coatings, as several other air districts have done.

The proposed amendments would impose more restrictive VOC limits for wood products coatings. For most coating types, the proposed new limits are 275 g/l (2.3 lb/gal) for high-solids coatings and 120 g/l (1.0 lb/gal) for low-solids coatings. This represents a significant reduction for some coatings. The current limits for most high-solids coatings are 500 or 550 g/l, double the proposed new limits; and the current limit for low-solids coatings is 480 g/l (4.0 lb/gal), four times the proposed new limit.

For three specific types of high-solids coatings where a 275 g/l limit currently would not be feasible, the District is proposing somewhat less stringent limits.

- First, for high-solids stains, the District is proposing a new limit of 350 g/l (2.9 lb/gal). High-solids stains generally require more VOCs to work effectively because solvent is required to provide penetration of the stain into the wood substrate. One air district in California has a VOC limit of 240 g/l, but every coating manufacturer has indicated there are on-going adhesion issues with these high solids stains and the subsequent sealing coating. The manufacturing adjustments, and subsequent problems with coating adhesion indicate that requiring 240 g/l high solids stains rather than the proposed 350 g/l limit is not technically or economically feasible. All other air districts in California have set the VOC limit for high solid stains at 350 g/l.

- Second, furniture, custom cabinetry and custom architectural millwork require more demanding finishes in both appearance and durability. Conversion varnish is a coating that uses a chemical reaction rather than evaporation to adhere to the wood and form a solid protective coating. Conversion varnish has the inherent advantage that it can serve as a sealer as well as a topcoat, so the sealing and topcoat steps can be done in one step. The proposed conversion varnish VOC limit is 550 g/l (4.6 lb/gal) VOC only when used as both a sealer and a topcoat in one coating application. This 550 g/l conversion varnish provides manufacturers more flexibility for coating non-custom furniture, custom cabinetry, and custom architectural millwork. If more than one coating application is used, both the sealer and topcoat must meet the 275 g/l VOC limits. This provides a 550 g/l conversion varnish for a one-step coating process when possible. Staff believes the availability of this 550 g/l conversion varnish will provide a better coating and streamline the manufacturing process with no greater VOC emissions. For general wood products, the conversion varnish VOC limit is proposed to remain at 275 g/l.
- Third, the proposed amendments for clear topcoats used on custom furniture leave the VOC limit at 550 g/l, instead of reducing it to the 275 g/l limit proposed for clear topcoats for other types of wood products. Custom furniture is a very small fraction (~ 4%) of all wood product manufacturing in the Bay Area, and custom furniture must meet very high standards and demanding customer expectations. Staff has found that it is not be feasible at this time to require the use of lower-VOC clear topcoats for custom furniture.

These proposed new VOC-content limits are consistent with limits that have been successfully implemented in other California air districts. Coatings can be manufactured to meet these more restrictive VOC limits by developing solids that are compatible with water, or compatible with the solvency provided by exempt solvents, primarily acetone and parachlorobenzotriflouride, as well as the solvency provided by the more typical solvents. For the furniture manufacturing industry, which requires very high quality finishes for its products, improvements in topcoats, pigmented coatings, sealers, and stains, coupled with the ability to use a higher VOC conversion varnish, will allow them to meet their customers' demanding requirements while still complying with the more restrictive VOC limits.

B. Revised Regulatory Categorization of Coating Types

The District is also revising the terminology it uses to categorize the various types of coatings. Staff is proposing alternate VOC limits (discussed below, in grams of VOC per gram of solid) to provide flexibility and continue to encourage development of new and innovative low VOC / high solids coatings. These alternate VOC limits require differentiating the broad category of sanding sealers into clear and pigmented sealers. These alternate VOC limits also require differentiating the broad category of pigmented coatings into pigmented topcoats and pigmented primers, sealers, and undercoats. The proposed categories are consistent with South Coast AQMD Rule 1136 that also provides the alternate VOC limits in grams of VOC per gram of solids.

In addition, conversion varnish is a type of coating that had not previously been uniquely identified. Conversion varnish is included as a specific identifiable coating because it can play an important role in reducing overall VOC emissions because it can serve as both a sealer and topcoat. Multi-colored coatings are also uniquely identified now, because they have a slightly higher VOC limit than pigmented topcoats when expressed as grams VOC per gram of solids, and are becoming somewhat more commonly used. In the general category of low solids coatings, toner was added in with wash-coat to more fully characterize that category of low solids coatings. Definitions for conversion varnish and toner are included in rule.

C. Alternative Compliance Option Based on Solids Content

The District is proposing alternative VOC standards based on the solids content of the coating rather than the overall volume of the coating. The ability to beautify and protect wood is generally dependent on the coating solids content (the resins and pigments that remain after the volatile portion evaporates). The higher the solids content, the less coating is needed to cover the wood. High solids content provides more layer of finished coating (called film build) from a gallon of coating and thereby reduces the total gallons of coating needed, which also reduces the total VOC emissions. Staff is therefore proposing to add an alternative compliance option for high solids coatings in the form of VOC standards expressed as grams of VOC per gram of coating solids. This form of a standard will continue to encourage coating manufacturers to develop high-solids coatings that maximize coverage with minimum solvent evaporation.

To incorporate this alternate compliance option, the proposed amendments would allow coatings to comply with either of the alternative VOC limits, one expressed as grams (or pounds) of VOC per liter (or gallon) of coating, and one expressed as grams (or pounds) of VOC per gram (or pound) of coating solids. The proposed limits for each category of coating are shown in Table 1. The proposed VOC limits are consistent with similar limits in South Coast AQMD Rule 1136, and will not create any unique requirements that could cause a disruption in the coatings industry. The limit for 550 g/l conversion varnish is set at 0.36 grams per gram of solids to ensure only high solids conversion varnish is used as the alternate compliance option, and is more restrictive than similar limit established by Sacramento Metropolitan AQMD Rule 463.

Table 1: Proposed Wood Coating VOC Limits

Coating Category	Current VOC Limits	Proposed VOC Limits Effective July 1, 2010		
		General Wood Products	Furniture, Custom Cabinets and Millwork	Custom Furniture
High Solids	g/l (#/gal)	g/l (#/gal) or [g/g]	g/l (#/gal) or [g/g]	g/l (#/gal) or [g/g]
Clear Sealer	–	275 (2.3) or [0.36]	275 (2.3) or [0.36]	275 (2.3) or [0.36]
Clear Topcoat	275 (2.3)	275 (2.3) or [0.35]	275 (2.3) or [0.35]	550 (4.6) or [0.36]
Single Application Conversion Varnish*	–	Considered a sealer or topcoat	550 (4.6) [0.36]*	Considered a sealer or topcoat
Sanding Sealer	550 (4.6)	See clear or pigmented sealers	See clear or pigmented sealers	See clear or pigmented sealers
Pigmented Coating	275 (2.3)	See clear or pigmented topcoats	See clear or pigmented topcoats	See clear or pigmented topcoats
Pigmented Primer, Sealer, and Undercoater	–	275 (2.3) or [0.21]	275 (2.3) or [0.21]	275 (2.3) or [0.21]
Pigmented Topcoat	–	275 (2.3) or [0.25]	275 (2.3) or [0.25]	275 (2.3) or [0.25]
Multicolored Coating	–	–	275 (2.3) or [0.33]	275 (2.3) or [0.33]
High Solids Stain	700 (5.8)	350 (2.9) or [0.42]	350 (2.9) or [0.42]	350 (2.9) or [0.42]
Filler	500 (4.2)	275 (2.3) or [0.18]	275 (2.3) or [0.18]	275 (2.3) or [0.18]
Low Solids	g/l (#/gal)	g/l (#/gal)	g/l (#/gal)	g/l (#/gal)
Low Solids Stain	480 (4.0)	120 (1.0)	120 (1.0)	120 (1.0)
Toner and Wash-coat	480 (4.0)	120 (1.0)	120 (1.0)	120 (1.0)

* When used as sealer and topcoat in one coating application

- g/l = grams VOC per liter of coating
- #/gal = pounds VOC per gallon of coating
- g/g = grams VOC per gram of solids in the coating

Under these proposed limits, a coating would be in compliance if it meets either of the alternative limits. The proposed regulation would create a rebuttable presumption that a coating is in violation if there is evidence that the coating is over either one of the limits. However, the presumption allows the operator to rebut the allegation, that is, show compliance with the alternate standard.

For low-solids coatings, the District is not proposing an alternative standard based on solids content at this time because low solids coatings are used to lightly tint, stain or prepare the surface for further coatings. A thick coating to form a protective film is not the primary objective, so there is no need to establish a VOC limit based on solids content.

D. Enhanced Labeling Requirements

The current rule requires coating manufacturers to a designation of VOC content on the container or as an accompanying specification expressed as both grams per liter and grams per gram of solids. Effective July 1, 2010, the proposed amendments would require manufacturers, re-packagers and retailers of wood coatings and components to label all containers with the coating VOC content, expressed in grams per liter. These labeling requirements are clarified to provide users the information they need to readily ensure they are using the proper compliant product. These labels will also ensure that District staff inspectors can verify the proper compliant coatings are being used.

In addition, each manufacturer shall provide product data sheets (or an equivalent medium) for their wood coatings and solvents subject to this rule, with sufficient information to determine compliance with the rule. This information shall include VOC contents of each coating and solvent in grams per liter (or pounds per gallon), VOC content in grams per gram (or pounds per pound) of coating solids for high solids coatings, thinning recommendations and VOC content of each coating after thinning.

Any product in the distribution system manufactured before July 1, 2010 may continue to be sold within the District in spite of not meeting the labeling requirements, but the user must meet the new VOC limits for the coating, as applied after manufacturer thinning recommendations.

E. Compliance Option for Other Coating Application Techniques

The current rule provides a list of acceptable coating application techniques and tools. The goal of these techniques and tools is to achieve at least 65% coating transfer efficiency. A concern was raised during the rule development process regarding the surface tension of water-based coatings, which may require different spray equipment or slightly higher air pressure at the air cap for High Volume Low Pressure (HVLP) spray guns. Staff was unable to verify that water-based coatings needed higher air pressure when using HVLP spray guns, but did find that spray equipment technology has improved, and the rule should allow for use of these higher technology spray guns. The proposed amendment establishes the option for other coating application methods that can demonstrate at least 65% transfer efficiency, with written approval by the APCO. The test method for measuring coating transfer efficiency is provided by South Coast Air Quality Management District's test method: "Spray Equipment Transfer Efficiency Test Procedure for Equipment User, May 24, 1989." Staff will continue to monitor spray application technology developments to be incorporated into Air District coating rules.

F. Cleanup of Spray Equipment

A proposed amendment establishes new requirements for cleanup of spray equipment and coating supply lines. Facilities must use solvent with less than 25 grams VOC per liter; or

use special practices to clean spray guns that minimize solvent evaporation or have a spray gun washer that meets the requirements of Regulation 8, Rule 16.

G. Emissions Averaging Procedure

Staff proposes amendments to the rule language and revisions to the existing Manual of Procedures, Volume I, Procedure 6 to incorporate requirements the EPA has developed in their guidance document "Improving Air Quality with Economic Incentive Programs" related to emissions averaging. The proposal requires any firm who averages VOC emissions must average to 90% of the VOC level of compliant coatings, and must meet the average for each 24 hour period (daily). Compliance with EPA policies is necessary to include Air District rules into federal State Implementation Plans (SIPs).

H. Exemptions

Staff reviewed the existing exemptions in the rule, and proposes to maintain them without any significant revisions. The exemption for refinishing, furniture replacement and custom replica furniture operations has been retained, because emissions from these activities are relatively minor, and because retention of the finish and look consistent with the original or matching furniture is critical to retaining the value of the furniture.

I. Other Minor Changes

In addition to the substantive revisions outlined above, staff is proposing certain minor editorial changes to the language of the rule and to the way in which the various regulatory provisions are organized within the rule's overall structure. These include minor language changes to make provisions grammatically consistent; updating SIC codes to NAICS codes; removal of redundant language; moving the provisions establishing the 120 g/l (1.0 lbs/gal) threshold for "high-solids" coatings to stand-alone definitions of "high solids" and "low solids" coatings; and removing redundant language in the definition of "Volatile Organic Compounds" regarding whether VOC-content standards should be applied by including or excluding water and exempt compounds.

IV. EMISSIONS AND EMISSIONS REDUCTIONS

The primary focus of the proposed amendments to 8-32 is the reduction in VOC emissions from wood coatings. These emissions reductions assume the use of transfer-efficient spray application equipment as currently required.

There are approximately 250 business permitted in the District that use a significant amount of wood products coatings. The District inventory is based on information from the 2006

NAICS County Business Patterns sort for the nine Bay Area counties. Emissions estimates include 1.26 tpd estimated VOC emissions from wood coatings, with an additional 0.22 tpd emissions from surface preparation and cleanup. Total emissions from wood coating operations are estimated to be 1.48 tpd.

Emissions expected after implementation of these amendments will total 1.03 tpd, a reduction of 0.45 tpd, or 30%. The most significant reductions come from the proposed reduction of VOC content in sanding sealers. The proposed amendments require both clear and pigmented sealers to reduce VOC content from 550 g/l to 275 g/l for all wood product types. Staff summarized market demand for each category of wood coating based on estimates from several coatings suppliers and distributors. Sealers represent approximately 35% of the wood coatings sold in the Bay Area. The proposed amendments require reductions in high solids stain VOC content from 700 g/l to 350 g/l, and high solids stains are approximately 20% of the coatings market. In addition, use of lower VOC topcoats or conversion varnish for furniture, custom cabinets and custom architectural millwork also will result in a significant reduction in VOC emissions. Additional minor reductions are achieved by reducing the VOC content of low solids stains, washcoats and fillers.

V. ECONOMIC IMPACTS

A. Compliance Costs

The proposed amendments have economic impacts in five potential areas.

1. Higher Coating Costs: Low VOC coatings generally cost more than higher VOC coatings. Coating suppliers and users indicate that low-VOC solvent based and new water based formulations cost approximately 1.3 to 2 times the cost of higher-VOC coatings that comply with the current rule. The higher costs of solvent based coatings come from development of coatings designed to take advantage of solvency from both exempt and conventional solvents. Some of the exempt solvents can be very expensive. The additional cost of water-borne formulations is based on development costs of water-borne resin systems. Using this range of higher coating costs, the cost of reducing VOC emissions appears to range from $7,000 - $22,000 per ton.

   In high-solids formulations, these costs can be offset by the additional coverage of high-solids materials. Anecdotal information from both coating suppliers and users indicate that higher coating costs can also be offset by reduced costs based on cleanup with water rather than solvent (in some cases), reduced hazardous waste costs, and reduced insurance rates from the reduced storage and use of flammable materials. The cost estimates in this report are conservative, in that they do not integrate any of these potential benefits into the economic analysis, but staff anticipates that such savings will occur.

2. New Spray Application Equipment: In some cases, a facility may need to modify their spray application equipment and manufacturing processes to adapt to the lower VOC coatings. Since all facilities now have compliant spray application equipment, adjustments, modifications or re-configurations of these spray guns when continuing to use solvent based coatings is relatively minor. However, conversion to stainless steel or plastic to accommodate water-borne coatings may be necessary, with costs typically less than $500 per spray gun.

3. Adjustments to Manufacturing Processes: A facility may have to alter its drying techniques, or adapt to additional sanding and coating steps, when it switches to water-borne or low-VOC solvent based coatings. Some wood manufacturers expressed concern about water-borne coating drying times in the cool damp winter months, but these concerns were expressed by a small minority of the affected parties. Manufacturers of water-borne coatings generally recommend air temperatures of 65-80^{o}F, and less than 80% humidity. These conditions are not common during the winter months in the Bay Area. Additional drying time may have an impact on manufacturing capacity if the facility is constrained by space. Many facilities can modify their production schedules to spray near the end of the day, and dry over-night. Staff polled coatings manufacturers' and distributors' experience in Southern California, and SCAQMD staff, to develop estimates of the impact of these proposed rule amendments on wood products manufacturing here in the Bay Area. Staff estimates that 10% of the wood product manufacturers in the Bay Area will switch to water based coatings, and may have to buy additional drying racks to provide additional drying time. District staff estimates that no more than a few facilities will need to install additional drying equipment, such as enhanced ventilation, ultra-violet lights, or heaters. Estimated costs for additional ventilation fans are $300 – 500 each, and UV lights or heaters cost $200 – 300 each. If a facility has extreme space limitations, construction of an additional drying space or room may be necessary. Estimated costs of construction for enhanced drying facilities can range from $25,000 – $100,000 in capital costs, with additional costs for electricity and maintenance. Since these facilities use additional energy, they also contribute to greenhouse gas emissions. Although staff does not believe construction of additional drying facilities is likely, staff has included the costs for enhanced drying facilities for two of the larger wood products manufacturing facilities in the economic analysis. Using this range of higher drying costs, the cost of additional drying capacity can add an additional $1,000 to $4,000 per ton of VOC reduced.

4. Installation and Operation of Control Equipment: For large facilities where control equipment is feasible based on economy of scale, costs of complying with this rule could include capital to install the control equipment, and then operating and maintenance costs to operate the control equipment. This approach allows the facility to continue to use higher VOC coatings. Although this is an option in the rule, staff does not believe any facility in the Bay Area will choose to install control equipment, rather than adjust their manufacturing processes to use the low-VOC coatings. Discussions with Bay Area users that have already switched to low-VOC solvent-

solvent-based or water-borne coatings say they have been pleasantly surprised that the conversion was less troublesome than expected. Cost of capital equipment can be quite high, depending on the size and capacity of the facility. Green Environment, Inc. in San Carlos, a consulting firm to the wood products industry, estimates control equipment costs would range between $500,000 and $2 million, and fuel costs to oxidize the VOC is estimated at 0.2 – 1 MMBtu/hr or roughly $5,000 – $15,000 per year. Cost effectiveness of this approach to control ranges from $5000 to $20,000 per ton of reduced VOC emissions. The costs of control equipment are offset by lower coating costs of high VOC coatings. Staff anticipates that no facility in the Bay Area would need to install control equipment to meet the proposed amendments to this rule.

5. Manufacturers' Labeling Costs. Coatings manufacturers may have to add information to their product labels (or accompanying material). This will be a one-time nominal cost for each specific product.

Costs to comply with the various specific proposed amendments are included in the discussion of the proposed amendments (Section V.A.1-5 above). Cumulatively, the costs for a small (1 – 4 employee) facility switching to low VOC solvent based coatings is less than $700 per year in extra coating costs. If a small facility switches to low VOC water based coating, the costs are estimated at $1000 capital, and $700 per year in extra coating costs. Larger facilities will see proportionally higher increases in coating costs, and capital to upgrade spray equipment. If a large facility needs to set up an additional drying room, capital requirements can total as much as $100,000 capital, amortized to an impact on operating costs of approximately $20,000 annually.

B. Incremental Cost Effectiveness

Proposed reductions in the VOC content of wood coatings will require wood product manufacturers to switch to lower VOC solvent based and water based coatings. These coatings cost 1.3 times to twice the cost of the existing high VOC content coatings. Cost of using these higher cost, lower VOC coatings ranges from $7000 to $22,000 per ton of reduced VOC emissions. Costs of additional drying capacity can add another $1,000 to $4,000 per ton of VOC reduced.

In lieu of converting to lower VOC or water-based coatings, the next increment of VOC reductions can only be achieved by retrofitting control equipment to the existing facilities. As stated above, control equipment is estimated to cost from $500,000 to $2,000,000. Amortized capital, fuel and maintenance estimated annual costs range from $100,000 to more than $415,000. This approach may be appropriate for the 5 – 8 largest wood products manufacturing facilities in the Bay Area – those that emit more than 5 – 10 tons per year of VOC's. Control equipment is far too expensive, and not cost effective for the remaining 250+ facilities in the Bay Area that emit less than 3 tons per year VOC. Costs are estimated to be $38,000 per ton of reduced VOC for the largest of these facilities, and $380,000 per ton of reduced VOC for the average of these facilities. Control equipment is not economically

feasible for 96% of the wood coating facilities in the Bay Area. Consequently, staff has not proposed amendments that require the addition of control equipment.

C. Socioeconomic Impacts

Section 40728.5 of the California Health and Safety Code requires an air district to assess the socioeconomic impacts of the adoption, amendment or repeal of a rule if the rule is one that "will significantly affect air quality or emissions limitations." Bay Area Economics of Emeryville, California has prepared a socioeconomic analysis of the proposed amendments to Regulation 8, Rule 32. The analysis concludes that the affected facilities will not be significantly impacted by costs stemming from the proposed amendments. No impact is expected on small business, or on jobs. Reduction of VOC limits on wood coatings is not expected to have any other adverse impact on the public, or the staff and resources of BAAQMD.

VI. ENVIRONMENTAL IMPACTS

A. CEQA

Pursuant to the California Environmental Quality Act, the District has had an initial study for the proposed amendments prepared by Environmental Audit, Inc. of Placentia, California. The initial study concludes that there are no potential significant adverse environmental impacts associated with the proposed amendments. A negative declaration is proposed for approval by the District Board of Directors. The negative declaration and initial study will be available to the public for comment.

B. Greenhouse Gas Emissions

In June, 2005, the District's Board of Directors adopted a resolution recognizing the link between global climate change and localized air pollution impacts. Climate change, or global warming, is the process whereby emissions of anthropogenic pollutants, together with other naturally-occurring gases, absorb infrared radiation in the atmosphere, leading to increases in the overall average global temperature.

While carbon dioxide (CO2) is the largest contributor to global climate change, methane, halogenated carbon compounds, nitrous oxide, and other species also contribute to climate change. Gases in the atmosphere can contribute to the greenhouse effect both directly and indirectly. Direct effects occur when the gas itself is a greenhouse gas (GHG). While there is relative agreement on how to account for these direct effects of GHG emissions, accounting for indirect effects is more problematic. Indirect effects occur when chemical transformations of the original compound produce other GHGs, when a gas influences the atmospheric lifetimes of methane, and/or when a gas affects atmospheric processes that alter the radiative balance of the earth (e.g., affect cloud formation).

VOCs have some direct global warming effects; however they may also be considered greenhouse gases due to their indirect effects. VOCs react chemically in the atmosphere to increase concentrations of ozone and may prolong the life of methane. Ultimately, VOCs oxidize to CO_2. The magnitude of the indirect effect of VOCs is poorly quantified and depends on local air quality. Global warming not only exacerbates ozone formation, but ozone formation exacerbates global warming. Consequently, reducing VOCs to make progress towards meeting California air quality standards for ozone will help reduce global warming.

Proposed amendments to Regulation 8, Rule 32 will have very little impact on the wood product manufacturing facilities' overall efficiency, so no significant net change in greenhouse gas emissions is anticipated. The firms that do need fans for extra ventilation or heaters for drying will consume no more than one percent additional energy, and cause slightly higher greenhouse gas generation.

VII. REGULATORY IMPACTS

Section 40727.2 of the Health and Safety Code requires an air district, in adopting, amending, or repealing an air district regulation, to identify existing federal and district air pollution control requirements for the equipment or source type affected by the proposed change in air district rules. The air district must then note any difference between these existing requirements and the requirements imposed by the proposed change.

There are no federal or state air pollution control requirements for wood coatings. Most California air districts currently have VOC emissions requirements for wood product coatings. The proposed amendments to Regulation 8, Rule 32 meet or exceed these other air district standards, with the exception of allowing higher VOC coatings for custom furniture manufacturing, and a VOC limit for high solids stains that is higher than one established in the San Joaquin Valley air district that has proven to be troublesome during implementation.

VIII. DISTRICT STAFF IMPACTS

Implementation of the proposed amendments is not expected to impose a significant administrative burden for the District, and is expected to clarify and support effective enforcement of these rules. Coating labels with coating VOC limits clearly marked will enable inspectors to more easily verify compliance. However, no net savings in inspector time is anticipated.

IX. RULE DEVELOPMENT PROCESS

The District has developed these proposed amendments and has documented its rationale for them in this workshop report. These proposals are based on existing regulations in the

Sacramento, San Joaquin Valley, and South Coast air districts. Potential impact on coatings manufacturers and the wood products industry was assessed through e-mail information exchange, discussions with coatings manufacturers, cabinet makers, furniture manufacturers, and antique refinishers, and visits to five different furniture and cabinet coating operations. A public workshop was held at the District office on May 18, 2009. Staff received comments and input during workshop and during the comment period. The following issues were raised, and resolution proposed as follows:

Use of Reactivity in Coating VOC limits

Reactivity refers to a VOCs potential to form ozone once it is released into the atmosphere, which can vary greatly among different types of VOCs. For example, a pound of xylene emitted into the atmosphere has the potential to form up to 7.5 pounds of ozone. By contrast, a pound of acetone emitted to the atmosphere has the potential to form only 0.5 pounds of ozone. Acetone is therefore said to be less reactive than xylene because it has less potential to react to form ozone. The reactivity of a VOC used in a coating therefore provides a much more direct measure of its contribution to ozone formation than does the mass amount of the VOC used. From an air quality perspective, it would be desirable to encourage the use of wood coatings made with low-reactivity VOCs over coatings made with high-reactivity VOCs.

During this rule development process, staff began evaluating the inclusion of a reactivity option into the proposal. Staff solicited input from coating and solvent manufactures, ARB, and US EPA, culminating in the Reactivity Summit hosted by EPA at Research Triangle Park, NC in May, 2009. Staff concluded that developing a reactivity proposal would require more time and resources than were allocated for this rule development process. Near-term emission reductions can be readily achieved by implementing the proposed mass based standards. Staff anticipates including reactivity based coatings rules as a further study measure in the 2009 Clean Air Plan.

Exemption for Tertiary Butyl Acetate (TBAC)

Several wood products coating firms and coating manufacturers recommended including tertiary butyl acetate as an exempt solvent. Staff does not propose to exempt TBAC in the definition of VOC for wood product coatings. This request was evaluated during the recent regulatory development of the December, 2008 amendments to Regulation 8, Rule 45: Motor Vehicle and Mobile Equipment Coating Operations (Rule 8-45). Staff evaluation of the exemption request concluded that because TBAC may potentially pose a cancer risk to humans, and because compliant coatings that do not contain TBAC are already available on the market, TBAC should not be proposed for exemption in the amendments to Rule 8-45. Additional testimony from staff at the California Office of Environmental Health Hazard Assessment (OEHHA) at the December 3, 2008 hearing regarding Regulation 8, Rule 45 informed the Board's decision not to exempt this compound.

No new toxicological data have been made available to District staff since the adoption of the amendments to Rule 8-45 in December 2008. However, Daniel Pourreau, representing LyondellBasell Chemical Company, the manufacturer of TBAC, referenced a conclusion made by a non-profit group, Toxicology Excellence for Risk Assessment (TERA). Their findings, published April 15, 2009, conclude that a two-year bioassay would be unlikely to add to the understanding of TBAC's toxicity for risk assessment purposes. The panel did state the need for additional research based on existing information to compare the kinetics of TBAC to that of tertiary butyl alcohol, and also to methyl tertiary butyl ether (MTBE), a listed toxic air contaminant.

In 1993, the District Board of Directors adopted a policy directing staff to consider the impacts of negligibly photochemically reactive compounds on a rule-by-rule basis and to not exempt compounds that deplete stratospheric ozone or are toxic. The proposed VOC limits have been in force in some other districts and coatings are available that do not use TBAC to comply.

Staff believes that the precautionary principle applies, which states that when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In addition, an exemption would run contrary to the California Green Chemistry Initiative and proponents of the exemption have not adequately shown that TBAC does not have potentially deleterious health effects. OEHHA staff, whose mission is to protect and enhance public health and the environment by scientific evaluation of risks posed by hazardous substances has not recommended that TBAC be exempted as a VOC.

Limit formaldehyde emissions from wood coatings

During the workshop, and in subsequent comments, it was stated that solvent borne coatings, particularly conversion varnishes and pre-catalyzed lacquers, emit formaldehyde, a listed Toxic Air Contaminant (TAC). One workshop participant suggested the Air District should set limits that allow only water-borne coatings to be used. Formaldehyde (CH_2O) is emitted from many sources, including motor vehicle exhaust, other fuel combustion, smoking, fires, building materials and industrial emissions. It is also an intermediate product in atmospheric chemistry, formed from more complex hydrocarbons and further reacting with oxides of nitrogen to form ozone. Formaldehyde is 22% by weight, or about 14,000 lbs, of the toxic compound emissions in the Air District's Community Air Risk Evaluation inventory (2005). Formaldehyde is 20% if the chronic toxicity-weighted emissions, 4% of the acute toxicity-weighted emissions, but due to relative toxicity of various compounds, only 1% of the cancer-weighted CARE inventory. Over 80% of the cancer-weighted inventory is from diesel particulate matter. Because of the vast number of sources, wood products coating is responsible for no more than 0.05 – 0.2% of formaldehyde emissions.

Conversion varnishes are commonly used on cabinets. Pre-catalyzed lacquers are commonly used on furniture. These types of coatings use resin systems that chemically react and cross-link during the curing process to provide a strong, hard, chemically resistant coating. During the curing process, these resin systems generate alcohols as a reaction product, and

sometimes also generate trace amounts of formaldehyde. The concern for formaldehyde emissions was first recognized in the late 1990's, and has been the focus of two studies conducted by the EPA. Most of the formaldehyde evolves during curing, so the immediate concern is to protect the workers from formaldehyde emissions. A secondary concern is that a minor amount of formaldehyde continues to evolve from the coating for 100 days or more. Consequently, the public could potentially be exposed to some limited formaldehyde emissions from cabinetry or furniture in their homes from the use of these coatings. Such exposure could occur only from conversion varnish or pre-catalyzed lacquer coatings, and only for a limited period of time. Also, formaldehyde may be emitted from some water-borne wood coatings.

Staff does not have enough information to estimate what the formaldehyde emissions from these coating reactions are. The proposed amendments are based on achievable VOC limits. Staff does not propose VOC limits that exclude all coatings except water-borne coatings because they are, in staff's view, not yet usable for all types of wood products. Staff has proposed as an administrative requirement (8-32-408) that manufacturers of wood coating products that are used in a significant amount (more than 1000 gallons) in the Bay Area must estimate formaldehyde emissions from their coatings, and provide staff with this information including the rationale behind the estimates. Should formaldehyde emissions from these coatings present a significant health risk; staff will work with each coating manufacturer to reduce this risk in a future rulemaking.

Eliminate exemptions for low reactivity solvents, and reduce VOC limits to 250 g/l.

One coating distributor asserts that water based coatings are currently available to satisfy all the needs of the wood products manufacturing industry. This distributor recommends eliminating all exemptions for low reactivity solvents; reducing the VOC limit for general wood products to 200 - 250 g/l effective July 1, 2010; and further reducing the VOC limits to 100 g/l effective July 1, 2012.

Water based wood coatings are effective, and have been used successfully in coating many styles and forms of wood products. Water based wood coating currently represent approximately 10% of the total wood coatings market. However, staff does not believe that water-borne coatings are available for all wood coating operations. Few operators would not switch to water-borne coatings if they were convinced that they were useable for their product line. Water-borne coatings have inherent advantages including less hazardous waste and fewer odors.

A substantial change to eliminate existing exempt coating solvents, and further reduce VOC content limits would be excessively disruptive to the wood products manufacturing industry, and staff is not confident that it is feasible without further study. Staff recommends proceeding with the proposed amendments to Regulation 8-32 to obtain the anticipated VOC reductions while further study is underway.

Raise air pressure on HVLP spray guns to improve transfer efficiency of water based coatings

One coating distributor asserts that water based coatings have higher surface tension, and need higher air pressure at the air cap of High Volume Low Pressure spray guns to improve transfer efficiency. Staff investigated this issue with a spray gun supplier and a spray gun distributor in the area, and found no corroboration of the problem, or that higher air pressure at the HVLP air cap would be the solution. However, staff found that spray gun technology has improved, and additional spray gun types and styles can provide high transfer efficiency. An amendment is proposed to provide the option for other coating application methods that can demonstrate at least 65% transfer efficiency.

Proposed VOC limit for conversion varnish is grams per gram solids is too lenient

One coating supplier pointed out that the proposed VOC alternate limit (stated in grams per gram of solids) for conversion varnishes was higher than necessary. Conversion varnishes tend to be very high in solids content, and the proposed VOC limit would allow very high VOC content. Staff reviewed VOC content per gram of solids data for conversion varnishes and clear topcoats, and established more stringent VOC limits expressed as grams per gram solids.

Proposed emissions averaging requirements do not meet EPA guidelines

EPA – Region 9 staff commented that proposed emissions averaging requirements do not meet EPA guidelines, and would not be adequate to meet the State Implementation Plan (SIP) requirements if 8-32 were submitted for inclusion in the SIP. Emissions averaging requirements have been revised to meet EPA guidelines.

The final proposed amendments, staff report, socio-economic report, CEQA analysis and negative declaration, and public hearing notice will be posted for public review.

X. CONCLUSIONS

Pursuant to the California Health and Safety Code Section 40727, before adopting, amending, or repealing a rule the Board of Directors must make findings of necessity, authority, clarity, consistency, non-duplication and reference. The proposal is:

- Necessary to supplement the District's ability to attain the State one-hour and eight-hour ozone standards, and meet the requirements of the Bay Area 2005 Ozone Strategy;
- Authorized by California Health and Safety Code Sections 40000, 40001 and 40702;

- Clear, in that the proposed amended regulation specifically delineates the affected industries, compliance options and administrative and monitoring requirements for industry subject to this rule;
- Consistent with other District rules, and not in conflict with state or federal law;
- Non-duplicative of other statutes, rules or regulations; and
- Implementing, interpreting or making specific the provisions of the California Health and Safety Code Sections 40000 and 40702.

A socioeconomic analysis prepared by Bay Area Economics has found that the proposed amendments would not have a significant economic impact or cause regional job loss. District staff have reviewed and accepted this analysis. A California Environmental Quality Act analysis prepared by Environmental Audit, Inc., concludes that the proposed amendments would not result in adverse environmental impacts. District staff have reviewed and accepted this analysis as well. The CEQA documents will be available for public comments prior to the public hearing. A CEQA Negative Declaration is proposed for adoption by the Board of Directors.

Staff recommends the adoption of the proposed amendments to Regulation 8, Rule 32: *Wood Products Coatings*, and approval of the CEQA Negative Declaration.

XI. REFERENCES

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