

# Draft for Discussion

## Issues regarding California Air Resources Board's Proposed Regulation of Multi-Purpose Solvent and Thinner Consumer and Commercial Products

Issue	ARB Response
Has SCAQMD already taken emission reduction credit for architectural coatings cleanup and thinning with its 25g/l limit in Rule 1171?	In 2003, SCAQMD amended Rule 1171 to remove the architectural coatings exemption to the 25 g/l cleanup limit, effective in 2005. The District took approximately a 7.5 tpd reduction credit. Consumer Products Paint and Lacquer Thinner emissions have roughly been the same order of magnitude as the architectural coatings thinning and cleanup emissions. To date, we have not accounted for Paint and Lacquer Thinner in the Consumer Product inventory, but have kept the Thinning and Cleanup emissions in the architectural coatings inventory. To take credit for reducing Consumer Products Paint and Lacquer Thinner emissions would seem to be double counting the reductions SCAQMD already took credit for in Rule 1171.
Will a 3% by weight VOC limit adversely impact SCAQMD businesses subject to Rule 1171?	The SCAQMD believes the Consumer Product VOC limit will not apply to its stationary sources, but it can since it is not only homeowners that buy solvents at home stores. It is our understanding that small and medium size businesses can purchase the solvents they are allowed to use via SCAQMD exemptions in Rule 1171 at home stores. Therefore, a 3% by weight VOC limit that effectively bans such allowed solvents would seem to adversely affect the industries SCAQMD has chosen to exempt.
Can the 3% by weight VOC limit be just for clean-up solvents and exempt thinning?	SCAQMD claims that almost no architectural coatings require high VOC thinning solvents. Therefore, it would appear that thinning could be exempted with no adverse impact.
Has there been sufficient testing completed to justify a 3% by weight VOC limit for consumer products paint and lacquer thinners?	<p>ARB staff believes that a lower VOC limit for clean up solvents is technologically feasible. The clean-up portion of the March 2007 IRTA report titled "<i>Low-VOC, Low Toxicity Alternatives for Consumer Product Cleanup and Thinning Solvents</i>" covered cleanup of spray guns, rollers, and brushes. These are the most common application equipment used by contractors and consumers. Each of the end users found that the alternative clean up solvents worked as well as or better than their current solvent. However, industry has commented that acetone blends meeting 25 g/l do not clean multi-component spray equipment adequately. More work may need to be done with spray equipment manufacturers.</p> <p>Acetone may not be an appropriate thinner for all solvent based coatings. ARB staff evaluated the testing documented in the March 2007 IRTA report titled "<i>Low-VOC, Low Toxicity Alternatives for Consumer Product Cleanup and Thinning Solvents</i>" and we have some questions regarding the testing protocols for the thinning portion of their report.</p> <p>Discussions with SCAQMD need to occur to determine if a 3% by weight VOC limit would ban TBAC which is a thinning solvent needed for TBAC based coatings, allowed by SCAQMD Rule 1113 and 1151.</p>
Acetone has a higher flammability risk than current solvents used for cleanup or as paint and lacquer thinners.	<p>There are some forms of mineral spirits and paint thinners that have a health rating (see Appendix A) equal to acetone and a flammability rating lower than acetone. Other common solvents are safer than acetone on the flammability scale, but are more of a health risk for the user (see Appendix A).</p> <p>ARB staff agrees that acetone has a higher flammability rating than mineral spirits. However, acetone has the same flammability rating and flash point as lacquer thinners.</p> <p>The widespread consumer use of acetone needs to be evaluated for possible fire safety issues.</p>

Issue	ARB Response
Concern has been raised that increased use of acetone could increase ozone formation since acetone evaporates more quickly than current solvents and thus more acetone would be used.	<p>ARB agrees that more acetone may be used due to its faster evaporation rate. However, there is not enough data to suggest that 63% more acetone is being used. In the IRTA report titled "Assessment, Development, and Demonstration of Low-VOC Cleaning Systems for South Coast Air Quality Management District Rule 1171" (August 2003), several facilities tested reported they used about 10% more acetone than their current cleaning solvent. This could be investigated further for more robust data.</p> <p>The MIR value for acetone is approximately half that of mineral spirits. Therefore, a facility would have to emit more than twice as much acetone before the amount of ozone formed from acetone exceeds that formed by mineral spirits.</p>
Consumers may prefer mineral spirits to acetone due to issues such as contractor preference, odor, blushing, and miscibility.	<p>The May 2004 ARB report entitled: "Improvement of Emission Inventories for Industrial Coatings and Thinning and Cleanup Solvents" surveyed what was being use in the field and found that, in general, commercial painters and households used mineral spirits and lacquer thinners more than acetone for thinning and clean-up. The report did not survey whether the painters would prefer one solvent over the other for thinning or clean up. The IRTA report did show that some companies preferred the alternative solvent for use as a cleaning agent and had switched.</p> <p>ARB staff agrees that acetone has a strong odor. However, other solvents also have a strong odor.</p> <p>ARB staff agrees blushing may be a concern with acetone-based lacquers. However, under the 2007 SCM, architectural coating lacquers will be subject to a VOC limit of 275 g/l. Of the products that currently meet this new limit, only 0.4% are acetone based. Additionally, the product data sheets for the products that do comply do not recommend thinning. Therefore, ARB staff believes that blushing in architectural coating lacquers is not an issue. It may still be an issue in some wood products coating (e.g., furniture) applications.</p> <p>ARB staff agrees that acetone is miscible in water and high water content could result in gumming of solvent based resin systems, impairing the performance.</p>
Exemptions should apply where needed.	ARB staff agrees that a 3% by weight VOC limit is not suitable for some solvent cleaning operations. At a minimum, these should include the exemptions listed in SCAQMD's Rule 1171. Additionally, small companies that do not fall under the scope of Consumer Products may inadvertently be affected by this rulemaking if they buy their supplies from a retail store.
What would be the impact of setting a reactivity-based limit of say 1.0 lb O <sub>3</sub> /lb product?	A 1.0 MIR limit would likely achieve about half of the reductions that a 3 % VOC by weight limit would achieve.
What is the enforceability of SCAQMD's Rule 1171 without Consumer Product's 3% by weight VOC limit?	ARB staff acknowledges that SCAQMD will have difficulty enforcing its VOC limit of 25 g/L for architectural coatings cleanup without ARB requiring the 3% by weight VOC limit for cleanup.

Appendix A is a table of flammability ratings for common solvents. Appendix B is a list of the interested parties' comments.

**2007 IRTA report titled "Low-VOC Low Toxicity Alternatives for Consumer Product Cleanup and Thinning Solvents"** <http://www.irta.us/Consumer%20Products%20DTSC.pdf>

**2003 IRTA report titled "Assessment, Development, and Demonstration of Low-VOC Cleaning Systems for South Coast Air Quality Management District Rule 1171"**  
<http://www.irta.us/SCAQMD%20No.%2001172%20Final%20Executive%20Summary%20-%20Tech%20Assessment.pdf>

## Appendix A: Flammability Ratings

Table 1

Solvent	HMIS Health <sup>1</sup>	HMIS Flammability <sup>2</sup>	Flash Point <sup>3</sup>
Acetone	1	3	0°F
Paint Thinner	1	2	107°F – 114°F
VM&P Naphtha	1 – 2	3	40°F
Lacquer Thinner	1 – 2	3	0°F
Toluene	2	3	40°F
Xylene	2	3	79°F
Mineral Spirits	1 – 2	2	105°F

### 1. HMIS Health Ratings

0 = Minimal Hazard – No significant risk to health.

1 = Slight Hazard – Irritation or minor reversible injury possible.

2 = Moderate Hazard – Temporary or minor injury may occur.

### 2. HMIS Flammability Ratings

0 = Minimal Hazard – Material that will not burn.

1 = Slight Hazard – Materials that must be preheated before ignition will occur. Includes liquids, solids, and semi-solids having a flash point above 200°F

2 = Moderate Hazard - Materials which must be moderately heated or exposed to high ambient temperatures before ignition will occur. Includes liquids having a flash point at or above 100°F but below 200°F.

3 = Serious Hazard - Materials capable of ignition under almost all normal temperature conditions.

Includes flammable liquids with flash points below 73°F and boiling points above 100°F as well as liquids with flash points between 73°F and 100°F.

### 3. Flash Point

The flash point of a flammable liquid is the lowest [temperature](#) at which it can form an ignitable mixture in air.

Reference: National Paint and Coatings Association. Explanation of HMIS Ratings. Online at [http://www.paint.org/hmis/hmis\\_ratings.pdf](http://www.paint.org/hmis/hmis_ratings.pdf)

## **Appendix B: Interested Parties' Comments**

**Issue: ARB does not intend to seek reductions from the paint and lacquer thinner categories.**

### **IRTA:**

I am writing with comments on the revised proposal for categories to be considered in the 2008 Consumer Products Regulation Amendments. In August, 2007, CARB proposed establishing a VOC content limit for the categories "Multi-Purpose Solvent" and "Paint and Lacquer Thinner" of three percent by weight. The new limit would have reduced VOC emissions from these categories by 13.64 tons per day by 2010.

The Institute for Research and Technical Assistance (IRTA) conducted a research project that focused on identifying, developing, testing and demonstrating low-VOC, low toxicity alternatives to multi-purpose solvents and paint and lacquer thinner used in cleanup and as thinners. IRTA's findings indicated that there were alternatives for all applications that met about a 2.5 percent VOC limit. CARB apparently based their original proposal to establish a three percent VOC limit on the results of the project.

On January 11, CARB sent out a new proposal for the 2008 VOC reductions. The new proposal does not include any proposed VOC emission reductions for the "Multi-Purpose Solvents" or "Paint and Lacquer Thinner" categories. These categories are now combined with several others in "Categories for Future Consideration". In effect, CARB has decided not to require VOC reductions in these categories.

### **South Coast AQMD**

"The AQMP inventory also highlights the growing impact of VOC emissions from consumer products, which are the largest single source of VOC emissions in the South Coast Air Basin. We are relying on your Board to substantially accelerate your emission reduction programs to achieve healthful air for the 16 million residents of the South Coast Air Basin, and this regulation serves as an opportunity to make a significant step in this direction.

However, the AQMD staff believes that this opportunity will be missed by removing the proposed three percent by weight VOC limit for Multi-Purpose Solvent and the Paint and Lacquer Thinner categories from the August 2007 Staff Proposal, and instead recommending it only for future consideration. This action would forgo 13.85 tons per day of VOC reduction statewide which is 72 percent of the reductions originally proposed in August of 2007. This is especially discouraging considering AQMD's extensive experience with ultra-low VOC alternatives in these use categories."

**Issue: Has there been sufficient testing completed to justify a 3% by weight VOC limit for consumer products paint and lacquer thinners?**

**NPCA:**

The IRTA report documented or analyzed only a limited number of coating operations (13 in total) and only a very few products, the majority being highly specialized coatings. NPCA believes that this is not enough data to be sure that industry concerns over the use of acetone as a cleaning and thinning solvent are adequately addressed - additional testing is needed.

NPCA is concerned that many coating resins systems, including linseed oil wood stain and urethane modified alkyd varnishes are not soluble in the alternative solvents recommended in the IRTA report (acetone, methyl acetate or Low Vapor Pressure (LVP) materials). Thus, application properties will be seriously affected when using the alternative solvents with these resin systems. If coatings users and consumers are dissatisfied with inappropriately thinned products they will most likely throw the materials away thereby increasing the potential for improper hazardous waste disposal and unnecessary evaporation. Further, consumers may actually use more alternative solvents in an attempt to rectify any resin system incompatibility problems, thereby negating the purpose of the regulation in decreasing air emissions.

3% by Weight - The proposed 3% by Weight VOC limit is the equivalent of a ban on anything but the alternative solvents identified in the IRTA report (acetone, methyl acetate or Low Vapor Pressure (LVP) materials). This is especially problematic for TBAC, which has been delisted for certain uses (auto-refinish coatings and industrial maintenance coatings) in SCAQMD. TBAC must remain viable for these uses. Further, CARB's proposal would be in effect be more stringent than SCAQMD Rule 1171 since CARB's rulemaking applies to both thinning and cleaning operations (Rule 1171 applies only to cleaning).

Incompatibility with Oil Based Paint - Another reason acetone is unsuitable as a thinner for oil-based paints is that many resins are of low polarity as compared to acetone and are totally incompatible with acetone. For instance, linseed oil is quickly and easily cleaned with mineral spirits but turns into a gummy mess if mixed with acetone. Most long oil and medium oil alkyds react similarly. Shellac coatings can behave similarly if mixed with acetone rather than an alcohol.

**IRTA:**

The NPCA letter indicates that IRTA documented or analyzed only a limited number of coating operations and only a very few products, the majority being highly specialized coatings. The letter states that additional testing is necessary.

IRTA selected coatings and operations for testing based on the fact that they would be likely to purchase and use paint and lacquer thinner for thinning and cleanup. These included wood coating operations, autobody operations, metal coating operations and architectural coating operations. We worked with companies in these sectors as surrogates to consumers that would apply similar coatings and use paint and lacquer thinner products purchased at home improvement stores for thinning and cleanup. The facility operators and painters were asked to judge the effectiveness of the cleanup and thinning with the alternative low-VOC, low toxicity products compared with high VOC paint and lacquer thinner.

IRTA's project results are comprehensive and CARB can reduce the VOC limit of paint and lacquer thinner to the originally proposed limit of three percent for two reasons. First, very few coatings require thinning with high VOC solvents like paint and lacquer thinner. The South Coast Air Quality Management District (SCAQMD) has conducted a survey of 267 coating products available from home improvement and hardware stores. The results of the survey indicate that 87 of the products require no thinning according to the supplier, 164 are to be thinned with water and 13 are to be thinned with low-VOC solvents like acetone or perchlorobenzotrifluoride (PCBTF). Only three of the 267 products were designed to be thinned with a high VOC solvent. Two of the three products that are to be thinned with VOC solvents are industrial maintenance coatings and are not likely to be applied in an application where a retail product is used. The one remaining coating to be thinned with the high VOC solvent is an alkyd enamel coating. The SCAQMD survey results indicate that only very specialized coatings require thinning with a high VOC solvent.

Second, virtually all coatings sold today can be cleaned up with low-VOC cleaners and this has been demonstrated in practice. IRTA completed two research projects several years ago that demonstrated that cleaners with about 2.5 percent VOC content could be used for virtually all coating operations. The projects were sponsored by EPA and SCAQMD. IRTA worked with several sectors including wood furniture coating, metal coating, autobody coating, architectural coating, and aerospace coating. Based on the results of the projects, in 2005 SCAQMD adopted a lower VOC limit of 25 grams per liter for the category of cleanup of coating and adhesive application equipment in SCAQMD Rule 1171. The fact that thousands of industrial facilities with coating operations have been meeting the low VOC limit for several years demonstrates that a three percent limit for cleanup material is undeniable feasible.

NPCA indicates that some coating residues are not soluble in acetone and that acetone is incompatible with oil based paint. The letter states that "linseed oil is quickly and easily cleaned with mineral spirits but turns into a gummy mess if mixed with acetone." NPCA also indicates that long oil and medium oil alkyds "react similarly". Finally, NPCA states that shellac coatings "can behave similarly if mixed with acetone."

These comments are not accurate or relevant. First, linseed oil coatings and shellac coatings are no longer used on wood furniture except for niche purposes and have not been used for more than 100 years. Obviously, NPCA is stretching by including them as coatings that can't be cleaned or thinned with acetone. Second, IRTA tested acetone with these materials and found that acetone is indeed soluble in two of them. IRTA obtained a sample of linseed oil and added acetone. The acetone was soluble in the linseed oil and thinning with acetone was effective and complete. IRTA also tested acetone with an alkyd enamel which would likely be classified as a medium oil alkyd. Again, acetone was soluble in the coating and it thinned it effectively and completely. In both cases, the acetone mixed with the materials did not turn "into a gummy mess". Third, shellac coatings can be thinned with low-VOC materials. Shellac coatings are not soluble in acetone as NPCA indicates; one paint supply store suggest that ammonia is an appropriate thinner for shellac, however. As you know, ammonia is not classified as a VOC. The testing results and information on shellac thinners demonstrate that zero VOC materials are appropriate cleaners and thinners for the materials mentioned by NPCA.

IRTA did not rely exclusively on acetone for the thinning tests as IRTA's report clearly indicates. For wood coating and architectural coating, plain acetone was successfully used for

thinning. In other cases, IRTA assed small amounts (one percent or 2.5 percent) of a lower vapor pressure solvent that would be classified as a Low Vapor Pressure (LVP) with zero VOC under CARB's consumer products regulations. The most effective thinner for other types of coating systems was a blend of 97.5 percent acetone and 2.5 percent DPM, a propylene glycol ether. The addition of the DPM inhibited the evaporation of the acetone and the applied coatings were smooth and did not have performance defects. The NPCA could communicate to its members that this blend would be a good product to offer as a thinner in place of the high VOC materials used today.

NPCA brings up tert-butyl acetate (TBAC) and indicates that the three percent limit would put its use in "auto-refinish coatings and industrial maintenance coatings" in jeopardy. TBAC has been deemed exempt by CARB in the Autobody Suggested Control Measure (SCM). The SCM is not a regulation and air district regulations must exempt the chemical before it can be counted as an exempt solvent. SCAQMD's Rule 1151 exempts TBAC only for use in autobody primers. CARB has not exempted TBAC in their architectural coating SCM. SCAQMD's Rule 1113 exempts TBAC for use only in industrial maintenance primers. It is not clear what TBAC use in coating formulations has to do with consumer product cleanup and thinning material since the exemptions for TBAC all apply to industrial operations. Even so, NPCA's championing of TBAC does illustrate that their concerns about acetone's safety are hypocritical. TBAC forms a metabolite called tert-butyl alcohol which is a carcinogen. The Hazard Evaluation System & Information Service (HESIS) indicates that the risk to a worker using TBAC at the current worker exposure limit is 74,000 in a million, an extremely high cancer risk.

**South Coast AQMD:**

"For thinning applications, AQMD staff conducted a survey of coatings available for purchase at retail outlets such as paint and hardware stores. Of the 267 products, only three products recommended thinning with a product higher than CARB's proposed limit of three percent by weight.

Total Products Survey	267
No thinning required or do not thin	87
Thin with water	164
Thin with ultra-low solvent (acetone, PCBTF, or other)	13
Thin with a high VOC solvent	3

Two of the three products requiring thinning with a high VOC solvent are highly specialized industrial maintenance coatings. According to their product sheets, they are "suggested for storage tanks, railcars, tank trucks, mechanical equipment, sewage plants, refineries, off-shore drilling platforms, marine service, pulp and paper industry, mining and chemical plants." The third product is an alkyd enamel rust preventative coating recommended "for industrial and commercial applications on steel, aluminum, galvanized metal, and wood to protect against atmospheric corrosion." Thus only one of 267 coatings recommends a high VOC thinning solvent in an application where a retail product would likely be used. The survey data suggests that only highly specialized coatings recommend high VOC solvent thinning."

**South Coast AQMD:**

The use of ultra-low VOC solvents for coating clean-up operations has been well established in the South Coast Air Basin. In 2005, the AQMD adopted a 25 g/l limit for coating equipment cleaning for all types of coatings including architectural, automotive, aerospace, wood, metal,

and plastic. The only exceptions to the limit have been for highly specialized coatings such as thin-metal laminate, satellite, radiation effect, solvent-borne fluoropolymer, ultraviolet and electron beam coatings. The success of the rule limit over the last three years in such a wide range of coating activities clearly demonstrates the feasibility of ultra-low VOC coating clean-up solvents.

*Cut section: See above South Coast AQMD comment.*

The survey data suggests that only highly specialized coatings recommend high VOC solvent thinning, which are typically not sold at big box retail outlets, but at specialty shops or direct to contractor sales. Furthermore, CARB's recently-adopted Suggested Control Measure for Architectural Coatings include VOC limits that typically call for waterborne formulations for categories typically sold at retail outlets. Therefore, the clean up and any thinning if needed uses water and not high VOC solvents. The originally proposed limit of 3 percent could be implemented at the same time as the SCM limits are implemented to minimize concerns outlined by NPCA.

A review of labels of linseed oil wood stains and urethane modified alkyd varnished generally state that the products do not require thinning and do not list a recommended thinning solvent. Thus any type of thinning may seriously affect the application properties. Consumers should follow the directions on the label to avoid being dissatisfied with the performance and avoid unnecessary disposal and increased use issues.

TBAC would remain exempt for industrial uses (auto-refinish coatings (Statewide) and industrial maintenance coatings (AQMD area only)) where it has already been delisted. The consumer product regulations do not impose any restrictions on pollution-generating activities that take place at stationary sources. However, for non-industrial uses, TBAC would not be allowed as a multi-purpose solvent or as a paint or lacquer thinner. Furthermore, the recently-adopted SCM for architectural coatings does not delist TBAC for industrial maintenance use. As indicated in a response to an earlier comment, buyers of specialized industrial maintenance coatings do not purchase from typical retail outlets, but directly from the distributor or manufacturer.

**Issue: Acetone has a higher flammability risk than current solvents used for cleanup or as paint and lacquer thinners.**

**NPCA:**

The Report states that the goal of the IRTA report was to identify, test, and demonstrate low-VOC, safer alternatives (emphasis added). The report provides alternatives that it claims may be safer from a health perspective; however, this is not the case from a safety perspective given the volatility and flammability issues of acetone.

Safety - More importantly, acetone's volatility and flammability make it inappropriate for consumers as compared to odorless mineral spirits, sold as "paint thinner." Acetone has an extremely high vapor pressure (231.5 mmHg @ 25 C) and an extremely low flashpoint (as low as -17C), a combination that makes acetone dangerously flammable, or even explosively flammable as a vapor or spray mist. By contrast, Mineral Spirits III C has a relatively low vapor pressure (0.5 mmHg @ 25C) and a relatively high flashpoint (38C), and is classified as combustible rather than flammable. Substitution of acetone for mineral spirits could

significantly increase fire hazards associated with transportation, storage, use, and disposal of cleanup solvent. Thus, replacing paint thinner with acetone would greatly increase the risk of fire, and resulting injuries and property damage, especially in the fire-sensitive areas of California.

**IRTA:**

IRTA relied heavily on acetone alone or in blends as a cleanup material and thinner in the demonstration project. The NPCA letter argues that acetone is unsafe because of its low flash point and high volatility and that odorless mineral spirits (which the NPCA deems to be paint thinner) is much safer because of its lower vapor pressure and higher flash point. NPCA indicates the flash point of acetone is as low as -17 degrees C whereas the flash point of mineral spirits is higher, at 38 degrees C. NPCA states that use of acetone could significantly increase fire hazards and cause injuries and property damage.

There are three reasons that the NPCA concern about flammability is not justified. First, many products sold as lacquer thinner are not composed of mineral spirits and NPCA conveniently does not discuss them. The MSDS for one lacquer thinner product, called AWC Lacquer Thinner, indicates it is composed of 50 to 70 percent toluene, 15 to 25 percent MEK and 15 to 25 percent of MIBK. The MSDS also indicated that the flash point of the product is -2 degrees C which is not much higher than the flash point of acetone. Another product, called DTL10 Lacquer Thinner, is composed of acetone, toluene, a glycol ether acetate, IPA and petroleum distillates.

Second, paint and lacquer thinner products have lower explosion limits that are lower than the comparable limit for acetone. Paint thinner products are often composed of mineral spirits or petroleum solvents. One paint thinner product, supplied by Dunn Edwards and called Paint Thinner (Bortz), is a petroleum distillate. Although the flash point of the product is higher than the flash point of acetone, at 40 degrees C, the lower explosion limit of the Dunn Edwards product is listed at one percent. This is lower than the 2.5 percent lower explosive limit for acetone. Thus, acetone, from a fire safety standpoint, is actually safer than the lacquer thinner product.

Third, acetone has been used as a low-VOC solvent for various types of cleaning and thinning operations by industrial facilities in the South Coast Basin for many years. Acetone is routinely sold in home improvements and hardware stores on the shelves next to the paint and lacquer thinner. Consumers and small industrial facilities have obviously purchase and used these materials. There have been no acetone related fires since acetone has been used more extensively over the last several years.

On balance, acetone does not pose any more of a fire hazard than other materials that are marketed as paint and lacquer thinner today. In addition, acetone is a better product for consumers to use because it is lower in toxicity than nearly all other solvent. The two lacquer thinner products discussed above contain toluene which is classified as a Toxic Air Contaminant (TAC) by CARB.

**South Coast AQMD:**

A number of AQMD regulations rely on acetone to be a primary substitute solvent. As such, AQMD staff has evaluated the volatility and flammability of acetone and found that “compliance

with... federal, state, and local regulations and proper operation and maintenance of equipment should ensure the potential for explosions or accidental releases of hazardous material (from acetone use) is not significant.”

An increase in acetone usage may increase the number of trucks or rail cars that transport acetone within the state. However, the safety characteristics of individual trucks or rail cars that transport acetone will not be affected by the proposed regulation. The consequences (exposure effects) of an accidental release of acetone are directly proportional to the size of the individual transport trucks or rail cars and the release rate. Although the probability of an accidental release of acetone could increase, the severity of an incident involving acetone transport will not change as a result of the proposed regulation. This holds true for the transport of other replacement solvents.

Any increase in accidental releases of compliant acetone-base cleaning materials during transport would be expected to result in a concurrent reduction in the number of accidental releases of conventional cleaning materials. Many conventional cleaning solvents are as flammable as acetone, so there would generally be little or no net change in the hazard consequences from the reformulation of cleaning materials to comply with the proposed regulation.

Similarly, the storage or use of acetone would not be expected to result in significant adverse hazard impacts. The flammability classification by the NFPA are the same for acetone, methyl acetate, toluene, xylene, MEK, and ethanol. Recognizing that acetone has the lowest flash point, it still has a high lower explosive limit. Acetone vapors will not cause an explosion unless the vapor concentration exceeds 26,000 ppm. In contrast, toluene vapors can cause an explosion at 12,000 ppm; the concentration of mineral spirits or xylene vapors that could cause an explosion is even lower at 10,000 ppm.

CARB’s staff report, including the environmental impact report, has detailed analysis on the safety of acetone, and fully analyzes safety concerns discussed in NPCA’s comments. Additionally, the AQMD CEQA reports for Rule 1113 also provide a detail analysis of impacts of acetone, which were part of litigation between NPCA and AQMD, and have been supported by various legal opinions issued by judges in support of the AQMD.

**Issue: Concern has been raised that increased use of acetone could increase ozone formation since acetone evaporates more quickly than current solvents and thus more acetone would be used.**

**NPCA:**

Increased Emissions - Another concern with Acetone is that it has an extremely fast evaporation rate of 5.7 (relative to n-butyl acetate, a common reference standard for comparing evaporation rates of liquids). Mineral Spirits IIC has an evaporation rate of 0.09. Because cleanup of application equipment is a time-limited function, and emissions occur only during (and immediately after) the cleanup activity, evaporation rates tell us, in relative terms, how much of each solvent would be emitted during a cleanup. The ratio of the two evaporation rates is 63.3, which is to say that the amount of acetone emitted during a given cleanup would be 63.3 times greater than the amount of Mineral Spirits IIC emitted during a comparable cleanup. This would be irrelevant if acetone were completely non-reactive, but that is not the case.

Almost all VOC have some degree of reactivity, and atmospheric chemists have long known that different VOC species have different reactivities, which may vary by an order of magnitude or more. Current VOC regulations (with a few exceptions) seek only mass reductions of all VOC, without regard to reactivity - although policy considerations have resulted in the exemption of certain VOC deemed to be "negligibly reactive," such as acetone. Where regulations result in solvent substitutions, however, relative reactivity of solvents - including the reactivity of an exempt compound - becomes very important.

Emitting larger amounts of less reactive VOC, in place of smaller amounts of more reactive VOC, may not have any beneficial effect on ozone formation, or may even cause more ozone to form, or to form more rapidly so that population-weighted exposures increase. This is the case with respect to substitution of acetone for mineral spirits in cleanup operations. The ARB data sheets give Maximum Incremental Reactivity ("MIR") values for each solvent. MIR values indicate the amount of ozone that will form, under atmospheric conditions in which ozone is most sensitive to changes in VOC, as a result of the emission of a given amount of VOC (e.g., grams of ozone per gram of VOC emitted). MIR values are currently incorporated in the ARB statewide regulation for aerosol coatings.

The MIR value of acetone is 0.43, or about one-half of the MIR value of Mineral Spirits IIC at 0.81. In calculating ozone formation impacts, however, the lower reactivity of acetone is overwhelmed by its higher evaporation rate. With the substitution of acetone for mineral spirits, a decrease of 47 percent in reactivity is accompanied by an increase of 6,233 percent in mass of emissions, producing a net increase of 3,262 percent in ozone formation potential. In other words, the amount of ozone formed from emissions of acetone during a cleanup would be 33.62 times greater than the amount of ozone formed from emissions of mineral spirits during a comparable cleanup, as calculated below:

$$\frac{0.43}{0.81} \times 5.70 = 33.62$$

**IRTA:**

NPCA indicates that more widespread use of acetone will increase emissions substantially because acetone has a much higher evaporation rate than mineral spirits. Since acetone is marginally reactive, they suggest that there will be a net increase in ozone. The NPCA provides some calculations indicating that there will be a net increase of 6,233 percent in mass emissions.

The estimate of a 6,233 percent increase is nonsense. In IRTA's earlier project on cleanup alternatives, IRTA worked with several facilities using paint or lacquer thinner for cleanup of application equipment. A typical facility might use 120 gallons per year or 10 gallons per month for this purpose. When IRTA conducted testing of acetone as an alternative, the increase in use (emissions) amounted to no more than 10 or 15 percent, not 6,233 percent. Again, thousands of facilities in the South Coast Basin have been using plain acetone or acetone with 25 grams per liter VOC solvents added for many years. These facilities would obviously not the significant cost increase if they used 6,233 percent more cleanup solvent. One wood refinisher IRTA has worked with for several years has routinely used plain acetone as a thinner and cleanup solvent for at least five years. His use of acetone is the same as his previous use of lacquer thinner because it is based on a volume usage.

It's worth noting here that NPCA made similar comments on the mass emissions and the flammability of acetone during the SCAQMD rule change for cleanup materials in 2005. SCAQMD took the comments into account and did not find them persuasive.

The NPCA comments indicate that thinning with acetone can result in problems like blushing or poor flow and leveling in coatings. NPCA argues again that more acetone will be requires, multiple coatings might also be required and there will be more performance defects.

### **South Coast AQMD**

AQMD Rule 1171 has required the use of ultra-low VOC clean-up solvent for coating and adhesive application equipment since 2005. Since then, the AQMD has not noted a significant increase of solvent usage and certainly not an increase of 6,233 percent as suggested by the commenter. As an example, a typical auto refinishing shop may use five gallons per month of solvent for spray gun cleaning. Since the rule limit has been in place, most shops report the same or slight increase of between ten and 25 percent or about a gallon per month. In the scenario presented by the commenter, the same typical shop should have seen monthly solvent usage increased to over 311 gallons a month. To store that much solvent, shops would have had to build a specialized hazardous material storage facility which clearly has not occurred.

Furthermore, the commentator suggests that only straight chain alkane mineral spirits are used for clean up, and therefore uses the MIR value for Mineral Spirits IIIC. However, this is not the case since a detailed analysis of CARB's Reactivity Report for the Architectural Coatings survey shows usage of other mineral spirits that have significantly higher MIR values. Nonetheless, directly comparing mineral spirits (IIIC only) to acetone in terms of reactivity shows that an emission reduction would occur as long as acetone usage was less than twice the mineral spirits usage. This is consistent with the usage levels observed from companies that have switched from high VOC clean-up solvents to ultra-low VOC solvents. Additionally, the comment suggests that the only solvent used currently for application equipment cleaning is mineral spirits. Besides acetone and mineral spirits, common clean-up solvents include naphtha, toluene, xylene, and turpentine. The MIR values for these solvents can be up to ten times that of acetone. Both in terms of mass-based and reactivity-based emissions, the proposed limit will result in significant emission reductions. Lastly, the USEPA has exempted acetone as a VOC, but does not recognize a reactivity based approach for architectural coatings or clean-up solvents. CARB and AQMD continue to analyze the potential use of reactivity, but until this approach is formally adopted, acetone will be treated as an exempt solvent, whereas mineral spirits are considered a VOC.

**Issue: Consumers may prefer mineral spirits to acetone due to issues such as contractor preference, odor, blushing, and miscibility.**

### **NPCA:**

Mineral Spirit and Lacquer Thinner Preference - Both CARB reports entitled: "Improvement of Emission Inventories for Industrial Coatings and Thinning and Cleanup Solvents" (November 20, 2001; Revised May 2004), found that, in general, commercial painters and households preferred the use of mineral spirits and lacquer thinners over acetone for thinning and clean-up.

Odor - another reason mineral spirits are preferred over acetone is that acetone has a strong, offensively sharp odor, while mineral spirits have only a very mild odor, or none at all.

Unsuitability of acetone as a thinner for lacquers or heavy duty coatings - The extremely fast evaporation rate of acetone can result in problems, such as blushing or poor flow and leveling in any coating substantially thinned with acetone. Generally these types of problems would have to be corrected by a second application at the very least, and by stripping and recoating in severe instances. Blushing could become such a severe problem with some coatings that the coating operation would be impossible at any but the lowest relative humidity conditions. Further, acetone is hygroscopic (water-absorbing) so that it will adsorb water overtime when the container is open, in use, and partially filled. Needless to say, the water content of acetone can wreak havoc with an oil-based paint and cause serious performance defects.

**South Coast AQMD:**

The reports state that the use of mineral spirits and lacquer thinners is higher than acetone. There is no mention of a preference or a reason why the use is higher. Most likely the higher price of acetone as compared to mineral spirits or lacquer thinner is a significant factor in consumer choice.

According to EPA's Toxicological Review of Acetone, "Odor intensity increased with exposure concentration, but not exposure-related adverse subjective signs were reported. The health of the individuals was unaffected by exposure. Clinical chemistries, hematologies, urinalyses, electroencephalograms, electrocardiograms, and cognitive and pulmonary function tests remained normal and did not vary from preexposure levels. No neurological abnormalities occurred and the modified Romberg test and the heel-to-toe test remained normal." The odor issue was also analyzed in detail by CARB staff for the 2001 Suggested Control Measure for Architectural Coatings, as well as the AQMD CEQA analysis.

The use of neat acetone is not the only compliant alternative available for coating thinning. Acetone does have a high evaporation rate that, in some instances, may cause the coating to blush or have other negative performance characteristics. In those instances, blends of lower vapor pressure solvents, including exempt LVP solvents, other exempt solvents and small amounts of high VOC solvents can be formulated to have acceptable performance characteristics. Some of these slower evaporating ultra-low VOC solvents were demonstrated to be satisfactory for a variety of applications. These applications occurred in a commercial setting with factory experts determining the results. This was a far more demanding setting than an ordinary retail application.

While acetone may absorb water over time, it is much more likely that it will evaporate faster than it accumulates water. This situation can easily be avoided by simply closing the container when it is not in use.

The 2001 SCM staff report, as well as the AQMD CEQA documents, analyzed blushing impacts of acetone when used in lacquers, and determined that this was not a significant issue.

**Issue: Exemptions should apply where needed.**

**NPCA:**

Mitigation Measures - If over the objection of NPCA, CARB moves forward with this rulemaking it is important that it include the exemptions in other California Air Districts

including Bay Area Rule 4602 and SCAQMD Rule 1171, such that end-users would be provided the tools required to accomplish effective cleaning. These include, but are not limited to the following exemptions:

- Cleaning of resin, coating, ink and adhesive manufacturing equipment, and/or mixing, molding and application equipment
- Janitorial cleaning, including graffiti removal,
- Stripping of cured coatings, cured ink, or cured adhesives
- Cleaning conducted with: performance laboratory tests on coatings, adhesives, or inks; research and development programs; and laboratory tests in quality assurance laboratories.
- Cleaning with aerosol products
- Solvent cleaning operations using only wipe cleaning
- The cleaning of aerospace components, electrical and electronic components, precision optics, medical devices, modeling and application equipment

**IRTA:**

NPCA indicates that a whole range of exemptions would have to be allowed if CARB were to adopt a three percent VOC limit for paint and lacquer. Virtually all of the suggested exemptions are industrial applications or they are covered under other CARB consumer product categories. Consumers do not often clean aerospace components and janitorial products are regulated under another CARB category.

**South Coast AQMD:**

Multi-Purpose Solvents and Paint and Lacquer Thinners are primarily used for thinning coatings, general cleaning and maintenance, and clean-up of coating and adhesive application equipment. Since 2005, the AQMD has required stationary sources to use solvents with a VOC content of 25 g/L or less for general cleaning and maintenance and coating and adhesive equipment cleaning. This limit applies to all cleaning activities with a few exceptions for some highly specialized activities including laboratory testing, cleaning of electronics and precision cleaning. The limit also applies to all types of coating and adhesive clean-up operations including architectural, automotive, aerospace, wood, metal, and plastic. The only exceptions there have been for highly specialized coatings such as thin-metal laminate, satellite, radiation effect, solvent-borne fluoropolymer, ultraviolet and electron beam coatings. The success of the rule limit over the last three years in such a wide range of coating activities clearly demonstrates the feasibility of ultra-low VOC coating clean-up solvents.

**South Coast AQMD:**

The operations proposed for exemption by NPCA are all either industrial applications, refer to industrial applications (wipe cleaning) or cleaning applications covered under a different consumer product category. Cleaning during coating, ink or adhesive manufacturing and electronic manufacturing, laboratory and research operations, aerospace and medical device

manufacturing and electronic manufacturing and repair cleaning operations are all industrial application conducted at stationary sources. Wipe cleaning reference hand cleaning activities conducted at stationary sources as well. As stated earlier, the consumer product regulations do not impose any restrictions on pollution-generating activities that take place at stationary sources. Janitorial cleaning, stripping of cured coatings, and cleaning with aerosol products have separate consumer product limits that are not directly tied to the proposed limits for Multipurpose Solvents or Paint and Lacquer Thinners.

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