VI.

DESCRIPTION OF PRODUCT CATEGORIES

In this Chapter, we provide for each of the 2004 Amendments product categories: 1) a product category description; 2) information on product use and marketing; 3) information on the product formulations; 4) a discussion of the proposed volatile organic compound (VOC) limit, our rationale for the proposed limit, and the options for compliance; and 5) if applicable, a discussion of the issues associated with the proposed VOC limit, as raised by some of the affected industry. The product categories are in alphabetical order.

A. Adhesive Removers

Product Category Description:

Adhesive Removers are products developed to remove or clean adhesive and adhesive residue of varying compositions from a variety of surfaces using combinations of solubility, swelling, and softening properties. For the purposes of this category, the term "Adhesive," as defined below, includes glues, and sealants. These terms are commonly used interchangeably.

By simple definition, products labeled as "Adhesive Remover," generically imply removal of multiple adhesive types. We used a very broad approach in surveying this category for the purpose of capturing the range of products used to remove adhesives. Recognizing the special requirements for different adhesive applications, with assistance of industry, staff subcategorized based on product use. Survey data paralleled this suggestion, indicating the appropriateness and need for subcategorization.

To understand the "Adhesive Remover" category, it is important to describe the various adhesives these products remove. An "adhesive" is a fluid or semi-fluid material consisting of one or more tackifying polymers and/or resins [resin] dissolved in a variety of solvents for the purpose of forming a physical bond between two materials. The dissolved resin is called the adhesive, and forms a physical bond when the solvents evaporate. Some adhesives require a second component (called a hardener) in order to form a secure bond. Adhesives requiring a hardener form physically reactive bonds between two materials. Some reactive adhesives come in two-part mixes, like epoxies or two-part acrylics, requiring the hardener to be mixed with the adhesive before bonding. Other reactive adhesives may use moisture, anaerobic conditions, UV light, or heat as the hardener. Examples of these adhesives, which do not require mixing, include silicones, urethanes, and some acrylics.

Adhesive technology is continually evolving. Today, however, hybridized adhesive systems that incorporate evaporative and reactive adhesive technologies are becoming more common. It should be noted that there are also "hotmelt" adhesives

available. Adhesives such as these are not unlike the common household "gluestick." Hotmelt adhesives are 100 percent solids, heated past their melting point, and applied in their molten state.

Using survey data, product labels, and assistance from manufacturers and industry associations, four product subcategories were identified within the "Adhesive Remover" category. The identified subcategories of "Adhesive Removers" are: "Floor or Wall Covering Adhesive Remover," "General Purpose Adhesive Remover," "Specialty Adhesive Remover," and "Gasket or Thread Locking Adhesive Remover." Adhesive remover products that remove adhesives intended for use on humans or animals are not included in the "Adhesive Remover" categories. Examples of adhesive removers used on humans or animals include those products to remove adhesives used in the medical or dental field, athletic adhesives, or adhesives associated with nail care.

Product Subcategory Description:

"Floor or Wall Covering Adhesive Remover" are products used to remove floor or wall coverings and the associated adhesive. "General Purpose Adhesive Removers" are products that remove cyanoacrylate adhesives as well as non-reactive adhesives such as hotmelt glues, thermoplastic adhesives, pressure sensitive adhesives, stickers, labels, stencils, et cetera. Non-reactive adhesives bond because of solvent evaporation. "Specialty Adhesive Remover" are products that remove reactive adhesives that are not regulated as "Floor or Wall Covering Adhesive Removers," "General Purpose Adhesive Remover," or "Gasket or Thread Locking Adhesive Remover." Finally, "Gasket or Thread Locking Adhesive Removers" are products used to remove gaskets or thread locking adhesives.

Table VI-1 below, summarizes sales and emissions from "Adhesive Removers," based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001). As shown in Table VI-1, "Floor or Wall Covering Adhesive Remover" are one of the larger emission sources within this category, with estimated VOC emissions of about 0.666 tons per day or (*1,332* pounds per day) in California.

Table VI-1
Adhesive Removers*

Product Subcategory	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Floor or Wall Covering Adhesive Remover	28	6132	1332
General Adhesive Remover	43	756	608
Specialty Adhesive Remover	19	974	920
Gasket or Thread Locking Adhesive Remover	15	198	62

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for adhesive remover products was 15%; staff believes the 2001 Survey covered 85% of the market.

Table VI-1(a) below, summarizes reactivity data from "Adhesive Removers," based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001). As shown in Table VI-1(a), the larger total ozone forming potential comes from products in the "Specialty Adhesive Remover" subcategory, with estimated total ozone forming potential of about 2.152 tons per day in California.

Table V1-1a
Adhesive Removers*

Product Subcategory	Total Ozone Forming Potential (tpd)	Sales Weighted Average MIR (lbs ozone / lbs product)**
Floor or Wall Covering Adhesive Remover	0.843	0.275
General Adhesive Remover	0.865	2.288
Specialty Adhesive Remover	2.152	4.418
Gasket or Thread Locking Adhesive Remover	0.050	0.513

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for adhesive remover products was 15%; staff believes the 2001 Survey covered 85% of the market.

Product Use and Marketing:

Adhesive removers are utilized by many types of consumers for a variety of adhesive removal needs. These products are sold in a variety of sales outlets including hardware stores and wholesalers; home centers; paint stores; hobby and craft stores; supermarkets and other grocery stores; automotive parts and accessories stores; and by mass merchandisers. Adhesive removers are also sold to industrial or institutional users through distributors or through direct sales by the manufacturer.

Floor or Wall Covering Adhesive Removers are products used to remove floor or wall coverings and the associated adhesive. Floor or wall coverings are indoor or outdoor, non-structural, decorative finishing materials, including counter top finishes. Floor or wall covering adhesive removers are formulated using both VOC and non-VOC technologies, including chlorinated solvents such as methylene chloride. These products may be marketed for multipurpose or specialty uses. Examples of how these products are labeled include: adhesive remover or cleaner for: mastic; carpet and glues; wet and cured urethane flooring adhesive; wallpaper; acrylic; cutback; latex; tiles; cove base; or sealer and adhesive remover.

Directions for product use vary by application. Many products recommend removing as much of the decorative covering as possible before applying the adhesive remover. To remove adhesive beneath porous coverings like wallpaper or carpet, directions suggest application by spraying or pouring the remover onto the covering. For semi or non-porous coverings like wood flooring or tiles, directions recommend saturating the covering with remover and allowing it to soak in and soften the adhesive. For tiles, holes may need to be drilled into the covering to allow for remover penetration. Difficult to remove coverings may require the surface be covered with foil for better results. After a recommended period of time, the surface is scraped using a floor or razor scraper to remove adhesive or covering residue. Typically the product is reapplied, and agitated using a bristled broom or floor scrubber to further soften or liquefy the adhesive. A large scraper or shovel is used to pry the covering from the substrate (if not previously removed), or to scrape the adhesive for removal. The final step is a wash and rinse of the surface.

General Purpose Adhesive Removers, as touched upon earlier, are typically products that remove non-reactive adhesives such as hotmelt glues; thermoplastic adhesives; pressure sensitive adhesives; resin cements; dextrine or starch-based adhesives; rubber or latex-based adhesives; as well as products that remove paper related items including stickers; labels; stencils; or similar adhesives (ARB, 2001), (Glue).

Although cyanoacrylate adhesives are technically “reactive,” survey data (ARB, 2001) as well as industry consensus, suggest that most cyanoacrylate adhesives can be removed using acetone. We included cyanoacrylate adhesive removers in this subcategory because many consumers consider “super glues” to be a general purpose adhesive.

Many products in this category are used to remove pressure sensitive adhesives commonly used for stickers; labels; decals; et cetera because they adhere to most surfaces with very slight pressure. Pressure sensitive adhesives are available in solvent and emulsion based forms. Pressure sensitive adhesives are often based on non-reactive rubber adhesives, acrylics, or polyurethanes (ARB, 2001). Pressure sensitive adhesives form viscoelastic bonds that are aggressively and permanently tacky; adhere without the need of more than a finger or hand pressure; and require no activation by water, solvent or heat. Pressure sensitive adhesives are available in a wide variety of resin systems and bond strengths (Global).

Adhesive removers in this subcategory are sold in both aerosol and non-aerosol forms and typically are high in VOC content. Products may be sprayed; poured; or applied with a cloth to remove the adhesive. In addition to dissolving the adhesive, some products may be formulated to swell and soften the adhesive. Products in this subcategory recommend that the dissolved or soft adhesive is scraped away with a spatula or putty knife, and wiped clean with a damp or dry cloth.

Specialty Adhesive Removers are products that remove reactive adhesives such as epoxies; acrylics; adhesive vinyl welds; urethanes; silicones; or structural adhesives and sealants. Reactive adhesives usually require two components, and often require the two components to be mixed together to form a polymerized (crosslinked) structure. A typical two component system involves an adhesive polymer or resin (part A) and a hardener or catalyst (part B). Mixing part A with part B initiates a chemical reaction that produces a very strong bond, as is the case with an epoxy. As mentioned previously, not all reactive adhesives require mixing. Some reactive adhesives are formulated such that the crosslinking may be initiated through exposure to an external element such as moisture; ultra violet light; heat; or anaerobic conditions. Urethane adhesives are an example of non-mixed, reactive adhesives because they react with moisture to form a polymerized structure.

Many believe that reactive adhesives are more difficult to remove than non-reactive adhesives. However, as noted with cyanoacrylate adhesives, this is not always the case. Nevertheless, reactive adhesive removers may require a combination of solvents to dissolve and untangle adhesive bonds, as well as ingredients that swell and soften the adhesive. Swelling the adhesive enlarges the openings in the polymeric resin, allowing smaller, penetrating solvents to maneuver between the bonds, softening and lifting the adhesive from the substrate. The adhesive is scraped away with a spatula or putty knife, and the surface is wiped clean with a damp cloth and allowed to dry. Directions may also recommend more than one application for removal of difficult adhesives.

“Gasket or Thread Locking Adhesive Removers” are excluded from the “Specialty Adhesive Remover” subcategory.

Gasket or Thread Locking Adhesive Removers are products used to remove gaskets or thread locking adhesives. Gaskets are materials located between two

flanges clamped together to ensure the integrity of the seal. They can be made from many different materials, including silicone, which is well-known in the marketplace. Many silicone gaskets are moisture cured – they react with moisture in the air or in the substrates to form a cured polymer layer with high strength. Thread locking adhesives are anaerobic adhesives that cure to form a solid polymer in the absence of oxygen. These types of adhesives are commonly used to adhere metal parts.

Gasket removers are products applied to remove gasket seals from flat or semi-flat metal parts, while thread locking adhesive removers are used to remove seals used to join cylindrical metal parts, (ie. shafts, bolts, etc.). Products in this subcategory typically perform both functions and are generically marketed as "gasket removers." Because many products in this subcategory contain varying amounts of methylene chloride, it is common for products to advertise paint removal claims on the labels. Products with paint removal claims may be marketed as "paint & gasket remover," or display graphics on the label indicating suitable for use for paint removal. Products that suggest suitable use for removing gaskets or thread locking adhesives and paint removal would be included in this subcategory; and subject to the proposed prohibition of chlorinated solvents.

Although survey data exist for only aerosol products, we are also aware of the existence of foaming products. The pressure and force from the aerosol provides a penetrative quality that aids in the swelling and softening of the adhesive. Once sprayed, the product is allowed to sit for 5-10 minutes, then are scraped off with a putty knife or spatula for the removal of gaskets. Once the product softens the threadlocking adhesive on cylindrical parts, the bolt, etc., can be loosened. For difficult to remove adhesive, more than one application may be required. Once the adhesive has been removed, these products suggest that the parts be thoroughly cleaned with a water rinse or damp cloth, and dried before assembly.

It should be mentioned that we are aware that many gasket or thread locking adhesives are "reactive," and form polymerized bonds. For this reason, some may believe that these products belong in the "Specialty Adhesive Remover" subcategory, therefore subject to the 70 percent VOC limit. We believe that products that remove gaskets or thread locking adhesives do not require a higher VOC limit than what we are proposing. Products in this category remove all types of gaskets, including gaskets that are not reactive, such as preformed gaskets made from cork, cardboard, or rubber. Products in this category also contain solvents such as methylene chloride, and are intended to only "soften" the adhesive enough allowing for the adhesive to be mechanically scraped away. On the other hand, products in the "Specialty Adhesive Remover" may be used on more sensitive substrates where mechanical scraping may harm the substrate, especially if the substrate is painted.

Product Formulation:

Adhesive removers are formulated in both aerosol and non-aerosol forms, and can be based upon VOC or non-VOC technologies. There are hundreds of types of

adhesives being manufactured and there are just as many products available to remove the adhesives. Below, are examples of common ingredients found in each of the four adhesive remover subcategories.

Floor or Wall Covering Adhesive Remover

Products in this subcategory are formulated using both VOC and non-VOC technology. Hydrocarbon propellants are used for aerosol removers. Low VOC products achieve adhesive removal by formulating with methylene chloride, dibasic esters, soy methyl esters, LVP-glycol ethers, water, and inorganic or surfactant ingredients. Higher VOC products use hydrocarbon solvents, 2-butoxyethanol, d'limonene, and glycol ethers (ARB, 2001).

General Purpose Adhesive Remover

Products in this subcategory are formulated using VOC technology, although there is limited use of LVP-VOC and exempt ingredients such as dibasic esters and acetone. Typical ingredients found in this subcategory include hydrocarbon solvents, d'limonene, isopropyl alcohol, 2-butoxyethanol, xylenes, glycol ethers, and hydrocarbon propellants for aerosols (ARB, 2001).

Specialty Adhesive Remover

Products in this subcategory utilize traditional VOC solvent ingredients such as methyl ethyl ketone, hydrocarbon solvents, xylenes, toluene, and the aerosols use hydrocarbon propellants (ARB, 2001).

Gasket or Thread Locking Adhesive Remover

Products in this subcategory use dimethyl ether or hydrocarbon propellant systems. Non-propellant ingredients for this subcategory include: n-Methyl-2-pyrrolidone, xylenes, methylene chloride, hydrocarbon solvents, methanol, monoethanolamine, water, and alcohol (ARB, 2001).

Proposed VOC Limit and Compliance:

The proposed VOC limits for Adhesive Removers are listed by subcategory, and are shown in Table VI-2, below, effective December 31, 2006. As shown in Table VI-2, using adjusted 2001 emissions, the proposed limit will result in a total estimated emission reduction of 1854 pounds per day or 0.0025 tons per day. As footnoted in Table VI-2, a negative VOC reduction is anticipated as "Gasket or Thread Locking Adhesive Removers" reformulate without the use of chlorinated solvents such as methylene chloride.

Table VI-2
Adhesive Remover Proposal*

Product Subcategory	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Floor or Wall Covering Adhesive Remover	5	9	42	1150
General Purpose Adhesive Remover	20	4	11	472
Specialty Adhesive Remover	70	3	6	252
Gasket or Thread Locking Adhesive Remover	50	0[1]	0[1]	(-)20[1]
Total				**1854**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for adhesive remover products was 15%; staff believes the 2001 Survey covered 85% of the market.

[1] There will be a slight VOC emissions increase due to the proposed prohibition of methylene chloride use in this category.

Reformulation Options

The proposed VOC limits for "Adhesive Removers" were established to protect public health by further reducing VOC emissions and by prohibiting the use of chlorinated Toxic Air Contaminants (TACs), such as methylene chloride. We expect that VOC limits established for this category can be met without the use of chlorinated solvents. Please see Chapter IX, Environmental Impacts for our analysis supporting the prohibition.

Reformulation options and pathways presented for this category are examples of technologies that could be used as a starting point. Staff fully expect that manufacturers and formulators will reformulate to the proposed VOC limits by making additional modifications and improvements tailored to enhance product performance and efficacy.

Based on adhesive removal claims and applications, manufacturers and formulators will be required to determine which subcategory the product belongs. Staff acknowledges that labels and adhesive removal claims for some "multi-use" adhesive removers may require appropriate modification. Staff also is aware that reformulation of products may mean that some adhesive resins or polymers may require removal using a different product. For instance, products previously formulated with methylene chloride for the purpose of general adhesive removal will likely no longer effectively remove the entire range of adhesives as before reformulation. However, consumer

needs will still be met by products formulated and marketed for the removal of specific adhesives.

To meet the proposed VOC limits, manufacturers will likely increase the use of LVP-VOC solvents. Aside from petroleum distillation, LVP-VOCs can be produced through the esterification of certain acids such adipic, or glutaric to make dibasic esters (DuPont), or oils such as soybean oil to make soy methyl esters (Vertec). Proposed VOC limits for adhesive removers will promote the use of LVP-VOCs and water emulsion formulations. Products already exist in the market that suggest the proposed VOC limits will continue to allow for the formulation of adhesive remover products to meet consumer needs. With the exception of the "Gasket or Thread Locking Adhesive Remover" category, one or more products exist that suggest the proposed VOC limits are feasible. However, industry representatives have indicated they can reformulate to meet the proposed limit.

LVP-VOCs can be used for a variety of applications. They are miscible with many organic solvents and have good solvency for a wide range of resins (USB). A concern of manufacturers is that LVP-VOCs have a dry time that is too slow, therefore leaving a slight oily residue. However, there are products on the market that meet the proposed VOC limits using LVP-VOC solvents. We also believe that the residue issue is not insurmountable. Blending solvents or the addition of surfactants greatly enhances rinseability and accelerates evaporation of LVP-VOCs; thereby lessening the residue potential. Any film or residue is easily wiped clean with a damp cloth (Soy Solv).

Biobased solvents like ethyl lactate and soy methyl esters are increasingly becoming viable alternatives to petroleum solvents, both in cost and utility (IP&P). Ethyl lactate is well suited for a variety of solvent replacement applications, including methylene chloride. It dissolves a wide range of polyurethane resins and epoxies (Paint). Soy methyl esters also show great promise for adhesive removal applications. They have high solvency power for resins and polymers, and offer great penetration characteristics (Vertec). Blending soy methyl esters with ethyl lactate increases the water rinseability of soy methyl esters and a 50/50 blend is said to equal the characteristics of methylene chloride (Industrial Paint and Powder Magazine). Bio solvents such as these are increasingly becoming competitive in the market. Supply of solvents such as these, grown from renewable resources, is more than adequate to meet increased industry use (Soy Solv), and we anticipate that as their use increases, the price of bio-solvents will likely decline.

Ethyl lactate and soy methyl esters are compatible with dimethyl ether, carbon dioxide, and traditional hydrocarbon propellants. They can often be used as a drop in replacement for many traditional solvents (Soy Solv).

Another option is to use acetone, a VOC exempt solvent. Manufacturers have reported that they do not like to use acetone in some cases because of its flammability, potential damage to plastics and painted surfaces, strong odor, and fast evaporation. However, there are currently adhesive removers that contain acetone and are used on

sensitive, painted substrates. We believe that acetone is a viable solvent for many types of adhesive remover products, especially those that remove polyester, epoxy, or cyanoacrylate adhesives, as well as some contact cements.

In products that use methylene chloride, manufacturers may use a combination of ethyl lactate, methyl esters, and LVP-VOC hydrocarbon solvents to meet the proposed limits. Product performance can be enhanced with the addition of inorganic ingredients like potassium hydroxide or formic acid (Dishart and McKim, 2003).

Products that do not contain methylene chloride may use any combination of previously discussed reformulation options, as well as increasing the use of water emulsions, surfactants, etc.

Subcategory Reformulation Options

Floor or Wall Covering Adhesive Remover

We expect products in this category to reformulate using water emulsions, as well as a variety of LVP-VOC solvents in combination with exempt or inorganic ingredients. We anticipate many products in this category will increase the water or acetone content in their formulations because this approach is relatively inexpensive. Other options include substituting an LVP-VOC hydrocarbon solvent such as Isopar M, or and LVP-VOC glycol ether for much of the VOC content. Other LVP-VOC reformulation options include using soy methyl esters and dibasic esters. These two solvents show great promise in adhesive removal applications. They tend to be more expensive than other solvents, but have a price lower than d'limonene, which is a common ingredient in these products. For the VOC content in these products, we expect formulators to use solvents like d'limonene; 2-butoxyethanol; glycol ethers; or possibly an aromatic hydrocarbon solvent. The addition of inorganic ingredients like wax; formic acid; or potassium hydroxide may be needed to aid in product penetration or lifting of the adhesive. Aerosol products may reformulate using carbon dioxide.

General Purpose Adhesive Remover

Products in this category are expected to formulate up to 20 percent of their product using VOC hydrocarbon solvents, glycol ethers, 2-butoxyethanol, or the slightly more expensive bio-solvents such as d'limonene or ethyl lactate. Blending LVP-VOCs such as dibasic esters; soy methyl esters; LVP-glycol ethers; LVP-hydrocarbon solvents such as Isopar M, or water emulsions may be used to complete the balance of the product. As with many adhesive remover reformulations, inorganic ingredients or surfactants may be required to enhance product performance. In products using aerosol delivery systems, carbon dioxide or hydrocarbon propellants may be used.

Special Purpose Adhesive Remover

Reformulation of products in this category may present the greatest challenge to manufacturers due to continually evolving adhesive technology and hybridization of disparate resin and polymer systems. A primary concern of some formulators is to completely remove difficult adhesives without damaging painted surfaces of vehicles. Commonly used ingredients to lower VOC content in products have been said to damage vehicle surfaces. However, dibasic esters (ARB, 1997), LVP-VOC solvents, acetone (ARB, 2001) and small concentrations of inorganics can be used on painted surfaces without causing damage.

As with many of the reformulation options previously discussed, VOC ingredients like ethyl lactate; xylenes; toluene; d'limonene; glycol ethers; and hydrocarbon solvents will likely continue to comprise most of the product formulation. However, we believe there are opportunities to blend many of these products with LVP-VOCs, or exempt ingredients. Many ingredients proposed as reformulation pathways blend well with traditional solvents, and are increasingly being marketed as pathways toward VOC reduction.

Acetone works well at removing many epoxy and poylester resin adhesives. Ingredients such as soy methyl esters; dibasic esters; and Isopar M are becoming recognized as reformulation options. In light of the proposed prohibition on the use of chlorinated solvents like methylene chloride, blending ethyl lactate and soy methyl esters is becoming a viable and likely pathway toward reformulation.

We do not foresee greater use of water in many product reformulations because adhesives, such as urethanes and some silicones, cure when exposed to water. However, water may be a viable option for some formulators.

Gasket or Thread Locking Adhesive Remover

Due to the proposed prohibition of chlorinated solvents, we expect many formulators to use xylenes, or similar aromatics, as well as using the slightly more expensive blends of ethyl lactate and soy methyl esters because of the similarity to methylene chloride. Aerosol products may choose to use carbon dioxide or dimethyl ether as a propellant, however, we believe they will likely continue to use a hydrocarbon propellant system as a means of product delivery. Hydrocarbon propellants are favorable because of the range of pressures to which they can be formulated. Products in this category partly rely on the force of the aerosol delivery to aid in product penetration into the adhesive.

Other ingredients likely to be chosen for use in this category include dibasic esters, LVP-VOC hydrocarbon solvents such as Isopar M, acetone, along with exempt ingredients such as wax, formic acid, and potassium hydroxide or similar surfactant.

Prohibition of use of Perchloroethylene, Methylene Chloride, and Trichloroethylene

Staff is proposing to prohibit the use of the chlorinated Toxic Air Contaminant solvents perchloroethylene, methylene chloride, and trichloroethylene in all categories of Adhesives Removers. As documented in Chapter IX, Environmental Impacts, staff has determined that use of these solvents constitutes an unnecessary health hazard. In each subcategory, except Gasket or Thread Locking Adhesive Remover, numerous alternatives products exist that perform the same function. However, data as well as consultation with industry, suggest that the proposed limit for "Gasket or Thread Locking Adhesive Remover" is feasible without the use of these TAC solvents. While only methylene chloride is presently used in Adhesive Removers, to prevent the use of perchloroethylene and trichloroethylene, staff is also proposing to prohibit their use as well.

Additional Labeling

Increasingly ambiguous product labels for multi-function products warrants the need for proposing additional labeling requirements for adhesive remover products. Therefore, staff is proposing to require the manufacturer and responsible party for each adhesive remover product to clearly display the adhesive remover subcategory name and applicable VOC limit to which the product belongs, as defined in section 94512(d) of the Consumer Products Regulation. These requirements are already in place for aerosol adhesives and are intended to clarify to ARB staff and the consumer, how the product is categorized and which VOC limit applies.

Issues:

The following summarizes the primary issues raised during the development of the proposed adhesive remover limits and presents staff's response.

1. Issue: The proposed VOC limit for Adhesive Removers may encourage manufacturers to reformulate their products using perchloroethylene or methylene chloride.

Response: The VOC limits are designed to allow for the reformulation of products without the use of chlorinated compounds. Nevertheless, to ensure that reformulation with chlorinated ingredients does not take place, the ARB is proposing to prohibit the use chlorinated solvents in this category.

2. Issue: ARB staff should propose Maximum Incremental Reactivity (MIR) standards for these categories because the VOC limits proposed are not technologically feasible.

Response: ARB staff believes that the propose mass limits for these categories are technologically and commercially feasible. Staff evaluated proposing MIR limits and found that to achieve the same air quality benefit as the proposed mass limits would

require MIR limits that were not commercially and technologically feasible (i.e. low product-weighted reactivity limits).

3. Issue: ARB staff should subcategorize products that remover "Stickers and Labels" from the "General Purpose Adhesive Remover" subcategory, and regulate them using a reactivity limit instead of a VOC limit.

Response: Although the proposed VOC limit for these products will be challenging, there are low VOC adhesive remover products as well as products from other consumer product categories on the market that claim to remove stickers and labels. In addition, several industry associations whose membership produce products that would be subject to this limit expressed to ARB staff that the proposed limit is technologically and commercially feasible, and have endorsed the proposal. Based on this support, analysis of survey data, and reformulation options, ARB staff concluded that the proposed VOC limit is both technologically and commercially feasible.

4. Issue: ARB staff should exempt products designed to remove adhesive from automotive surfaces due to the sensitivity of automotive paint substrates.

Response: ARB staff acknowledges concerns over the sensitivity of automotive substrates; however, staff believes the VOC limit for these adhesive removers is technologically and commercially feasible. We are aware of automotive products that are able to use exempt solvents to lower their VOC content.

5. Issue: There are not currently products that meet the proposed 50 percent VOC limit for Gasket or Thread Locking Adhesive Removers without the use of chlorinated ingredients.

Response: Lab demonstrations sponsored by industry associations demonstrated that this limit is technologically feasible.

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B. Anti-Static Product

Product Category Description:

Anti-Static Products are designed and labeled to eliminate, prevent, or inhibit the accumulation of static electricity that can occur on hard surfaces, such as floors and countertops, and fabrics. These products are commonly used to release static cling from clothing and are also used in commercial and institutional settings to dissipate static charge from floors and/or fabric. Many products also leave a protective film or coating on the surface to suppress static accumulation. (Alberto, 2004)

Anti-Static products do not include electronic cleaners or electrical cleaners, which are proposed for regulation as separate categories, or floor polish or wax, which is already regulated. Anti-Static products also do not include floor coatings, or any coatings subject to the aerosol or architectural coatings regulations. Anti-Static products do not include dusting aids or General Purpose Cleaners that may impart some anti-static properties.

Table VI-3 below summarizes the sales and emissions from anti-static products based on the results of the ARB's 2001 Consumer and Commercial Products Survey

(ARB, 2001). As shown in Table VI-3, Anti-Static Products are sold in both aerosol and non-aerosol forms, with the aerosol form dominating the market. VOC emissions from this category are approximately 0.278 tons per day (556 pounds per day) in California with almost 99 percent of the emissions coming from the aerosol form.

Table VI-3
Anti-Static Product*

Product Form	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Aerosol	8	562	550
Non-aerosol	13	184	6
Total	**21**	**746**	**556**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)
****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for anti-static products was 15%; staff believes the 2001 Survey covered 85% of the market.

The survey data also show that the aerosol and non-aerosol products are formulated very differently and have different uses. The aerosol products in this category had a sales-weighted average VOC (SWA-VOC) content of 97.7 percent, by weight, with a SWA-MIR (Maximum Incremental Reactivity) value of 1.55 tons ozone per ton product. The Ozone Forming Potential (OFP) of these aerosols was 159.4 tons ozone per year. On the other hand, the non-aerosol anti-static products had an SWA-VOC of 3.72 percent, an SWA-MIR of 0.12 tons ozone per ton product, and an OFP of 3.97 tons ozone per year.

Product Use and Marketing:

Anti-Static products are used by household, industrial, and institutional customers. Aerosol products are designed, and labeled, for usage on a variety of surfaces including machinery, draperies, floors, and clothing. By far, the household products represent the majority of the emissions in this category. The majority of the non-aerosol products are for use on hard floors in sensitive equipment work areas, but some products are also designed for use on carpeting and other fabric as well. However, all products are to be used on clean surfaces. (Hanson-Loran Co., 2003)

Aerosol anti-static products must eliminate static electricity from a wide variety of surfaces, must dry quickly, and must not be susceptible to static ignition. (Alberto, 2004) These products are generally designed for household use. Aerosols can be sprayed on clothing or other fabrics, like drapes, to relieve static cling. These products are also designed for usage on carpeting around the computer, or other form of home electronic equipment, as well as on upholstery. (Penn Champ, 2003) Most products also can be sprayed directly onto a hard surface or onto a piece of cloth and wiped on a hard

surface such as a computer monitor or other form of electronic equipment, leaving a protective coating as the solvent evaporates.

Non-aerosol anti-static products are designed mainly for industrial and institutional use. The majority of these products are used on floors to provide a protective coating from triboelectric charge, which is a charge that is generated by rubbing or friction. Non-aerosol anti-static products are applied only on clean, dry floors. However, there are a few products that are designed specifically for use on carpeting and other fabrics. (Hillyard, 2003) Some products may be buffed after use to restore the original luster and can be diluted for use in a spray and buff application. Some of these products are similar to floor polish/waxes because they provide a protective coating to flooring. Although the function of the anti-static product is to provide triboelectric protection, the most restrictive limit provision may be applicable.

Non-aerosol anti-static products are sold primarily in janitorial supply stores, however, aerosols are mainly found in supermarkets, office supply or electronics stores, and convenience stores.

Product Formulation:

Anti-Static product formulations vary by product form. Aerosol products are typically formulated with a higher VOC content than non-aerosol products. These aerosols consist mainly of alcohol to promote fast evaporation, a propellant, and a VOC exempt, or an inorganic compound, as an active ingredient. The non-aerosol products are normally water-based formulations containing no or small amounts of VOC. (ARB, 2001)

In the aerosol formulations, dry time is an issue. These products need to dry fast enough to prevent staining and mildew. For this reason, hydrocarbon gas combined with an alcohol, usually ethanol, are used in the majority of these formulations. The active ingredient in these formulations is usually a quaternary ammonium compound such as Dimethyl Ditallow Ammonium Chloride. (Alberto, 2004) The primary function of this compound is static electricity conduction and dissipation. An important side benefit is the lubricity it confers to the fabric, reducing triboelectric buildup. (MadSci Network)

Non-aerosol anti-static products are normally used as a protective finish after the floor has been cleaned and is dry. These products are composed of primarily water with either a VOC exempt compound or an inorganic compound as the active ingredient.

Proposed VOC Limit and Compliance:

The proposed VOC limits for Anti-Static Product, are 80 percent by weight for aerosol, effective December 31, 2008, and 11 percent by weight for non-aerosol, effective December 31, 2006. As shown in Table VI-4, using adjusted 2001 emissions,

the proposed limits will result in an estimated emission reduction of 102 pounds per day or 0.051 tons per day. (SOUTH COAST)

Table VI-4 also shows that there are 3 current products complying with the proposed 80 percent VOC limit (aerosol). All non-aerosol products are complying with the proposed limit of 11 percent by weight.

Table VI-4
Anti-Static Product Proposal*

Product Form	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Aerosol	80	3	2	102
Non-aerosol	11	13	100	0
Total				**102**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for anti-static products was 15%; staff believes the 2001 Survey covered 85% of the market.

The proposed 11 percent VOC limit is designed to cap the non-aerosol form of this category since there is little opportunity for emission reductions. Therefore, no reformulation is necessary. Non-aerosol formulations are able to use such low VOC formulations because they are typically not used on clothing, which not only needs a fast dry time but needs to be non-staining to be effective.

Reformulation strategies that could be used by manufacturers to meet the proposed 80 percent, by weight, VOC limit for aerosols includes using more water as well as an alternative non-VOC propellant. While an 80 percent limit may not appear to be technologically challenging, balancing the numerous issues, including dry time, non-staining, and static charge prevention, presents a challenge. The addition of water to these products could affect the drying time of the products, the amount and types of surfaces the products can be used on, the effectiveness of the product, as well as the shelf-life of the product. (Penn Champ, 2004) However, the use of a higher pressure propellant blend and/or the use of HFC-152a blended with their current propellant could offset many of these issues. The use of corrosion inhibitors may also be instituted. The use of VOC exempts, such as acetone, is limited because of possible damage to fabrics as well as other surfaces and LVP-VOC substitution may also be difficult because of slow dry times, odor, and possible residue issues. (Exxon, 2004)

These issues will make reformulating to 80 percent a challenge; therefore, staff is proposing that aerosol products in this category be given until December 31, 2008 to comply.

Issues:

1. Issue: Industry has indicated that some products may be strictly consumer, or household use, vs. other products that are strictly for industrial, or commercial use, and has asked for different VOC limits to represent this difference. (CSPA)

Response: Staff disagrees with a need for further sub-categorization of this category into consumer and commercial use because upon review of the product labels and directions for use, there doesn't appear to be a difference in need, or use, that would warrant a different VOC limit.

2. Issue: Industry has stated that there should be no limit set for non-aerosol forms because there are no reductions to be gained. (CSPA)

Response: Staff does not believe we should drop this category from this regulatory effort. Because there are no reductions to be gained from the non-aerosol form, staff has decided to "cap" these forms of the category at a VOC limit of 11 percent by weight. This limit should not cause existing products to reformulate and will prevent products from using an unnecessary amount of VOC ingredients in the future.

3. Issue: According to the most restrictive limit provision, non-aerosol products that make cleaning and anti-static claims will be forced to reformulate to the proposed 11 percent limit, which is not feasible. Reformulations should not be required in instances where no reduction is to be achieved. (Sara Lee)

Response: Staff disagrees that the proposed limit is not feasible. If the product in question were categorized as a non-aerosol anti-static product, there would still be 13 out of 14 products complying. However, according to the most restrictive limit provision, products with cleaning claims are characterized as general purpose cleaners, and not an anti-static product. Anti-static products are designed solely to provide anti-static protection to surfaces that have been cleaned, or are otherwise clean. The "General Purpose Cleaner" limit for non-aerosols will be 4 percent as of December 31, 2004. Staff does not believe the products subject to the proposed limit for non-aerosol anti-static products will require reformulation.

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C. Contact Adhesive

Product Category Description:

We are proposing to separate the existing Contact Adhesive subcategory into Contact Adhesive - General Purpose and Contact Adhesive – Special Purpose. We are proposing to define Contact Adhesive - General Purpose as a contact adhesive that is not a Contact Adhesive – Special Purpose. Therefore, if a contact adhesive were determined not to be a Contact Adhesive – Special Purpose, it would be a Contact Adhesive - General Purpose.

In the Consumer Products Regulation, a contact adhesive is defined as an adhesive that is applied to two surfaces, allowed to dry, and which provides an instant and permanent bond when proper pressure is used. Adhesive does not include units of product, less packaging, which weigh more than one pound and consist of more than 16

fluid ounces. Additionally, an exemption applies to adhesives sold containers of 1 fluid ounce or less. We are proposing to define Contact Adhesive – Special Purpose as a contact adhesive that: (A) is used to bond melamine-covered board, unprimed metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber, high pressure laminate or wood veneer 1/16 inch or less in thickness to any porous or nonporous surface, and is sold in units of product, less packaging, that contain more than eight fluid ounces, or (B) is used in automotive applications that are (1.) automotive under-the-hood applications requiring heat, oil or gasoline resistance, or (2.) body-side molding, automotive weatherstrip or decorative trim. Therefore, a contact adhesive that is a “Contact Adhesive - General Purpose" would typically be sold in units of product, less packaging, that contain no more than eight fluid ounces and would not be a product used for automotive applications.

VOC limits and the size requirements were first introduced for consumer adhesives during the development of the “Phase II” Consumer Products Regulation. "Household Adhesives" and two subcategories, “Aerosols” and “All Others (General Purpose),” were described in the “Phase II” staff report, technical support document, and appendices (ARB, 1991a, 1991b, 1991c). Prior to the “Phase II” Board hearing on January 9, 1992, two additional adhesive subcategories, “Construction and Panel Adhesive” and “Contact Adhesive” were added to the list of “Phase II” categories for regulation. The category definition for "Household Adhesives" was modified in order to clarify the language of the regulation and more accurately define the scope of the category. Definitions were added for the terms "Contact Adhesives", and "General Purpose Adhesives." At that time, the "Contact Adhesives" subcategory was given an 80 percent VOC limit effective on January 1, 1995. (ARB, 1992; FSOR)

Contact adhesives require application to both substrate surfaces to achieve a bond, whereas general purpose adhesives only require application to one of the substrate surfaces to achieve a bond. Contact adhesives are ideal when it is awkward to clamp, or when you have large surface area. Contact adhesives are used in many applications to bond a variety of substrates. They are used extensively in the woodworking industry to bond decorative high-pressure laminates to particle board and plywood. Contact adhesives can be used for furniture; kitchen cabinets; custom display cabinets; interior and exterior panels and partitions; footwear; automotive trim; roofing membrane attachment; and a wide variety of related applications where quick, high strength permanent bonds are needed.

The local air pollution control districts in California regulate the use of the larger size contact adhesives (units of product, less packaging, which weigh more that one pound and consist of more than 16 fluid ounces) and industrial-use adhesives. There are a number of district adhesive or adhesives and sealants regulations with contact adhesive requirements. Larger districts such as the Bay Area Air Quality Management District (AQMD), the San Diego County Air Pollution Control District (APCD), and the South Coast AQMD also have requirements specific to special purpose contact

adhesives. Currently, the following districts have adhesives or adhesives and sealants regulations:

- Bay Area AQMD, Rule 8-51, Adhesives and Sealant Products;
- El Dorado County APCD, Rule 236, Adhesives;
- Placer County APCD, Rule 253, Adhesives;
- Sacramento Metropolitan AQMD, Rule 460, Adhesives and Sealants;
- San Diego County APCD, Rule 67.21, Adhesive Materials Application Operations;
- San Joaquin Valley Unified APCD, Rule 4653, Adhesives;
- Santa Barbara County APCD, Rule 353, Adhesives and Sealants;
- Shasta County APCD, Rule 3-32, Adhesives and Sealants;
- South Coast AQMD, Rule 1168, Adhesive and Sealant Applications;
- Tehama County APCD, Rule 4-40, Adhesives and Sealants;
- Yolo-Solano AQMD, Rule 2-33, Adhesive Operations; and
- Ventura County APCD, Rule 74.20, Adhesives and Sealants.

In December 1998, the ARB published the document titled "Determination of Reasonably Available Control Technology (RACT) and Best Available Retrofit Control Technology (BARCT) for Adhesives and Sealants" (RACT/BARCT) (ARB, 1998). The members of the California Air Pollution Control Officers Association's Adhesives Committee (which includes ARB staff) developed the RACT/BARCT for the purpose of meeting California Clean Air Act requirements and to provide consistency between district rules. The RACT/BARCT contains suggested VOC limits for the larger-size adhesives and sealants used in commercial and manufacturing processes that are regulated by the districts. The VOC limits in the RACT/BARCT were largely based on limits adopted in existing district adhesive and sealant rules. The district and RACT/BARCT limits were established on the basis of grams VOC per liter [g/l], less water and exempt solvents. (ARB, 1999)

In the ARB's 2001 Consumer and Commercial Products Survey, contact adhesives were reported as a single survey category. However, for this proposed regulatory action, we are proposing two separate categories: Contact Adhesive - General Purpose and Contact Adhesive – Special Purpose. We believe this is appropriate because at this time we are only proposing a new VOC limit for contact adhesives that are Contact Adhesive - General Purpose. We are proposing to retain the existing 80 percent VOC limit for contact adhesives that are Contact Adhesive – Special Purpose.

Table VI-5 below summarizes the sales and emissions from the Contact Adhesive category, based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001).

Table VI-5
Contact Adhesive*

Product Subcategory	Number of Products/ Product Groups	Category Sales (lbs/yr)	Adjusted VOC Emissions (lbs/day)**
Contact Adhesive – General Purpose	13	98,327	154
Contact Adhesive – Special Purpose	12	92,603	166
Total	**25**	**190,930**	**320**

* Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for contact adhesive products was 10%; staff believes the 2001 Survey covered 90% of the market.

Product Use and Marketing:

Contact adhesives that are Contact Adhesive - General Purpose are typically used by “do-it-yourself” retail customers, hobbyists, and professionals for minor repairs and small projects. These products are sold in stores that cater to both the retail and professional customers. While frequently marketed for multipurpose or general use, these products are also marketed for specific applications such as household, plumbing, and shoe repair. Contact adhesives are typically packaged in squeeze tubes, small glass bottles, or metal containers.

Products that are Contact Adhesive - General Purpose can suitable for joining a wide variety of substrates, including plastic laminates; linoleum; metal; china; wood; masonry; leather; decorative laminates; veneer; foam; cloth; paper; cork; rubber; wood particle board; plywood; and drywall. A contact adhesive is an adhesive having the property of “autohesion” which is the bonding of two adhesive surfaces to each other. In contrast, other glues primarily function by forming bonds between the adhesive surface and the substrate to be joined, which might be wood or ceramic. A contact adhesive’s ability to bond strongly to itself makes it very useful for joining non-porous surfaces, such as counter tops, floor tiles, and other decorative laminates, to which as strong bond is difficult to establish. In order for autohesion to occur, the adhesive is spread evenly on both surfaces and allowed to dry before the surfaces are joined so that most of the solvent can evaporate. Then the surfaces are brought together and bonding occurs instantly without the need for sustained pressure or clamping. Consequently, contact adhesive are also effective in joining hard-to-glue surfaces and areas such as curved surfaces, where clamping is impractical and irregular surfaces.

The product labels submitted with the 2001 Survey contain instructions to use the products: 1) in well-ventilated areas; 2) start with a clean, dry surface; 3) apply a uniform coat of adhesive product to both surfaces to be bonded; and, 4) allow the adhesive to become "tacky." "Tacky" describes the initial grab or stickiness between the adhesive and the product before applying pressure. Once the adhesives become

"tacky," both surfaces are to be joined together, making sure they are aligned because once bonded the surfaces cannot be moved. Momentary pressure applied by hand or with a roller may be recommended for some applications. Some product labels also recommend roughing up the surface before use, for the best adhesion.

Product Formulation:

Contact adhesives are composed of an elastomeric polymer, which may be natural or synthetic rubber, carried in a solvent solution or in water as a latex emulsion. The earliest contact adhesives were based on isoprene, natural rubber, dissolved in solvent blends. Currently, synthetic polymers such as polychloroprene are widely used in both solvent-based and water-based contact adhesives. The typical solvent-based contact adhesive is composed of polychloroprene; t-butyl phenolic resin; magnesium oxide; zinc oxide; antioxidants; fillers; curing agents; and a mixture of solvents. Among the more common types of solvent are aliphatic hydrocarbons (hexane, heptane); ketones (acetone and methyl ethyl ketone); alcohol; and aromatics (xylene and toluene). The use of chlorinated solvents such has methylene chloride has decreased due to toxicity concerns and use prohibitions. More commonly used in industrial applications, water-based contact adhesives are typically composed of polychoroprene latex; terpene phenolic resin; zinc oxide; antioxidants; fillers; curing agents;and water.

Consumer contact adhesives are subject to the flammability requirements in the Federal Hazardous Substances Act as codified in 16 CFR Section 1302, “Ban on Extremely Flammable Contact Adhesives” (FHSA). Contact adhesives that are labeled as, marketed, and sold solely for industrial or professional use are not within the scope of this ban. Contact adhesives subject to the ban have specified product characteristics that include: 1) show a flash point at or below 20 degrees Fahrenheit; 2) are composed of a high percentage (70-90 percent by weight) of solvents and a low percent of solids (10-30 percent by weight); and 3) are packaged in containers of more than on-half (equivalent to eight fluid ounces).

Low VOC solvent based contact adhesives would typically contain more exempt solvents such as acetone or chlorinated solvents. Acetone is an exempt VOC, as a negligibly reactive VOC. However, the use of acetone can harm some substrates and can lower a product’s flash point below the FHSA requirements. Because some chlorinated solvents such as methylene chloride are exempt VOCs and also has desirable solvent qualities, their use could potentially increase as products are reformulated to meet the new low VOC limits. However, use of methylene chloride in consumer products has decreased due to toxicity concerns. Methylene chloride has been identified as a Toxic Air Contaminant (TAC) by the ARB. Additionally, South Coast AQMD Rule 1168 “Adhesive and Sealant Applications” prohibits the sale for methylene chloride-based adhesives (adhesives containing one percent or more of methylene chloride) starting January 2004, with a one year sell through provision.

Because there are viable nontoxic alternatives available and complying products exist, we are proposing a TAC prohibition for contact adhesives, along with six other categories, to ensure that chlorinated solvents are not used in reformulation of products. In addition, the 2001 Survey shows that toxic compounds are used very little in adhesives anymore, and that manufacturers have formulated with safer alternative products.

Reformulation without exempt solvents is currently limited to water-based technology. Water-based contact adhesives would comply with FHSA flammability requirements. However, several manufacturers have indicated that water-based contact adhesives, while prevalent in industrial applications, do not meet the needs of typical retail customers. The manufacturers have expressed concern, and, in one case, provided supporting complaint statistics, that the typical retail user lacks the knowledge and equipment necessary to successfully apply these products with satisfactory results. Problems that could arise due to retail users lacking familiarity with the longer drying times of these products include joining the two surfaces before the "tacky" point is reached and prematurely testing the bond before full bond strength is attained. Water based contact adhesives also may not be as suitable as solvent-based products due to wetting problems and corrosion for certain substrates: 1) certain plastics, including melamine; 2) rubber; 3) flexible vinyl, and 4) possibly metals (BAAQMD 1997).

Proposed VOC Limit and Compliance:

The proposed VOC limit for Contact Adhesive - General Purpose is 55 percent by weight, effective December 31, 2006. We are not proposing a new VOC limit for Contact Adhesive – Special Purpose. The VOC limit that for Contact Adhesive – Special Purpose will remain 80 percent VOC, the current limit for contact adhesives.

As shown in Table VI-6, using adjusted 2001 emissions, the proposed limit for Contact Adhesive - General Purpose will result in an estimated emissions reduction of six pounds per day or 0.003 tons per day. Table VI-6 also shows that 80 percent of the products in the market currently comply with the proposed 55 percent VOC limit. The sales weighted average VOC content is 57.2 percent. We expect minor or no reformulation will be required for the majority of the products. The most common reformulation option that could be used by manufacturers to meet the proposed limit will be solvent substitution with an exempt solvent, such as acetone.

Table VI-6
Contact Adhesive Proposal*

Subcategory	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Contact Adhesive – General Purpose	55	5	80	6
Contact Adhesive – Special Purpose	80	12	100	0
Total				**6**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for contact adhesive products was 10%; staff believes the 2001 Survey covered 90% of the market.

The 55 percent VOC limit for Contact Adhesive - General Purpose is being proposed to provide a cap on VOC content and establish a VOC limit approaching closer to the lower limits in the District rules for adhesives and sealants. Most of the large Districts currently have limits for general contact adhesives and for special substrates. Most of these Districts have a current VOC limit of 250 g/l (roughly equivalent to 30% VOC by weight) for special purpose contact adhesives. We do not believe that a 30% by weight VOC limit is feasible for the Contact Adhesive - General Purpose subcategory at this time without the use of chlorinated solvents.

Staff is proposing a 55 percent VOC limit for the general purpose subcategory. Based on information provided by manufacturers, staff believes that manufacturers need additional time to develop water-based resins suitable for household applications before the VOC limit can be lowered. Our 2001 Survey shows that products reporting a low-VOC do not recommend using the product on metal and other non-porous substrates. The only product that had a low-VOC level that recommends use on metal, had methylene chloride in its formula. With a 55 percent VOC limit, a few products may need to be reformulated, most likely with acetone, and possibly repackaged in units of eight fluid ounces or less be excluded from the federal extremely flammable ban.

We recognize that manufacturers need more time to develop new or more effective water-based resins that can be used by consumers without industrial-type application and drying equipment. Complying solvent-based industrial contact adhesives use exempt acetone solvent-based technologies but are not subject to the FHSA ban on extremely flammable contact adhesives. South Coast AQMD has also recognized the reformulation challenges for automotive contact adhesives, has extended the effective date of its limit for these products, and is currently conducting a technology review of this category (SCAQMD 2002, SCAQMD 2004). Staff has also been provided data indicating that at or below 50 percent VOC, some solvent-based technologies will be adversely effected in terms of the viscosity or “spreadability.”

However, staff believes that VOC content can be capped at the proposed 55 percent VOC limit for general purpose products not subject to the FHSA ban that applies only to product packaged in units greater than one-half pint (equivalent to eight fluid ounces). However, we intend to revisit this category in subsequent rule makings to determine if there are new technologies that would enable further VOC reductions for both contact adhesive subcategories.

Prohibition of Use of Perchloroethylene, Methylene Chloride, and Trichloroethylene

Staff is proposing to prohibit the use of the chlorinated Toxic Air Contaminant solvents perchloroethylene, methylene chloride, and trichloroethylene in contact adhesives. As documented in Chapter IX, Environmental Impacts, staff has determined that use of these solvents constitutes an unnecessary health hazard. The proposed limits for contact adhesives are designed to be feasible without the use of perchloroethylene, methylene chloride, and trichloroethylene. In each subcategory, numerous alternative products exist. While methylene chloride use was reported in the 2001 Survey, staff is not aware of any methylene chloride containing products currently on the market. Although, perchloroethylene and trichloroethylene containing products were not reported in the 2001 Survey, staff is also proposing to prohibit their use as well.

Additional Labeling

Due to difficulty in distinguishing between the subcategories, we are proposing contact adhesives would be subject to additional labeling requirements as defined in Section 94512(d) of the Consumer Products Regulation. These additional requirements will ensure that all products clearly display the name of the subcategory as specified in Section 94509(a) and the applicable VOC standard of the product, in percent by weight. This information shall be displayed on the product container such that it is readily observable without removing or disassembling any portion of the product container or packaging and may be displayed on the bottom of a container as long as it is clearly legible without removing any product packaging

Issues:

1. Issue: Industry requests that the category be divided into three subcategories with VOC limits to take into account the unique requirements of these subcategories' applications. Industry proposes the following three subcategories and respective VOC limits: Contact Adhesive – General Purpose, 45% VOC; Contact Adhesive – Special Purpose, 80%; VOC Contact Adhesive – Special Purpose - Automotive, 70% VOC.

Response: Staff proposes that the category be divided into two categories: "Contact Adhesive - Special Purpose" (80%) and Contact Adhesive - General Purpose (55%). Many district rules have a specialty contact adhesive subcateorgy which is typically defined as a contact adhesive that is used to bond unsupported vinyl melamine covered board, metal, Teflon, ultra-high molecular weight polyethylene, rubber, or wood

veneer 1/16 inch or less in thickness to any porous or nonporous surface [South Coast AQMD (250 g/l), Ventura County (250 g/l), Sacramento Metropolitan AQMD (250 g/l), Bay Area AQMD (400 g/l), San Diego County APCD (400 g/l)]. District rules also recognize an automotive applications subcategory. Staff is proposing a single special purpose subcategory (see proposed definition) to include these products and to maintain the existing 80% VOC limit.

Most of the District rules are already in effect or will soon come into effect with new future VOC limits. However, the complying water-based industrial contact adhesives rely on specialized application and drying equipment and methods not available to household users and the acetone solvent-based products are not subject to the FHSA ban. Based on information provided by manufacturers and South Coast AQMD, staff believes that manufacturers of special purpose adhesives packed in units greater than eight fluid ounces and all unit sizes of products used in automotive applications need additional time to transfer industrial technologies or develop new water-based resins suitable for non-industrial users.

2. Issue: One company requested a Contact Adhesive - Automotive category. The company maintains that the adhesives used in automotive applications must bond to non-porous surfaces while maintaining adhesive performance under extremes of both hot and cold temperatures and chemical exposure such as engine oil and gasoline. The company, with products specific for automotive needs, have already reformulated to a lower VOC level depending on the specific product requirements. The company believes that since they are one of a few companies reporting contact adhesives for automotive applications, maintaining this specific use at the current VOC limit would have a negligible impact on VOC emissions.

Response: Since we are proposing that the automotive products be included in the Contact Adhesive -Special Purpose, at the current 80% VOC limit, it will not be necessary to create an additional category.

3. Issue: Industry requested that we add the non-porous substrate of high pressure laminate to our proposed definition for Contact Adhesive - Special Purpose.

Response: Staff has added high pressure laminate to the definition.

4. Issue: Two manufacturers of contact adhesives have told ARB that they are committed to continuing their research into low-VOC or water-based resins.

Response: Comment noted and appreciated.

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D. Electronic and Electrical Cleaner

Product Category Description:

Electronic and Electrical Cleaner were originally surveyed for under the category "Electronic Cleaner," which was defined as "a product designed for the removal of

contaminants such as dirt, grease, grime, moisture, dust, flux, light oil, and/or oxides from electrical components" (ARB, 2001). However, based on function and end-use variation among the products submitted in this category, as well as input from stakeholders, we are proposing to divide these products into two categories, Electronic Cleaner and Electrical Cleaner. Additionally, we are proposing that Electrical Cleaner be further subcategorized to distinguish cleaners that must be used on live (energized) equipment. Such cleaners would fall into the subcategory of "Energized Electrical Cleaner."

Electronic Cleaner

"Electronic Cleaner" products are designed to remove dirt, moisture, dust, flux, and oxides from electronic or precision equipment such as circuit boards and the internal components of radios, compact disc (CD) and/or digital video disc (DVD) players, computers, and any other sensitive, precision electronic instruments. These products are normally used in applications where the substrate is delicate, such as plastic, and can be harmed by the use of aggressive solvents or residue. Electronic Cleaner does not include products that are designed to clean casings or housings of any electronic equipment. Electronic Cleaners are not designed for use on energized equipment.

Electrical Cleaner

"Electrical Cleaner" products are designed to remove heavy soils such as grease, heavy oil or grime from electrical equipment such as electric motors, armatures, relays, electric panels, generators and/or any other electrical equipment. These products normally use aggressive solvents in order to clean heavier soils off of electrical equipment. Electrical cleaner does not include products that are designed to clean casings or housings of any electrical equipment. In electrical cleaning applications, there are situations where there is a need for non-flammable solvent. These situations occur when equipment must be cleaned while current is running through it, thus creating a spark, or flammability hazard. To address this flammability concern, and the subsequent need for special solvent in these applications, we are also proposing a category for "Energized Electrical Cleaner."

Energized Electrical Cleaner

"Energized Electrical Cleaner" products are proposed as a subcategory of Electrical Cleaner and are designed to remove heavy dirt, grease, moisture, heavy oil or grime from electrical equipment that must be cleaned while current is running through it, or when residual current exists. Typical situations, where cleaning is done while equipment is energized, would be in applications where the equipment to be cleaned is operated on alternating current (AC). An example of which is a city transformer that must remain on to provide electricity to the city. In instances where low voltage direct current (DC) is used as a power source, such as in motorized vehicles, use of an Energized Electrical Cleaner is not warranted.

Energized Electrical Cleaner products are used in applications that require nonflammable solvent and high dielectric strength. Dielectric strength is defined as the maximum voltage required to produce a dielectric breakdown through the material and is expressed as volts per unit thickness. "Breakdown is when an electrical burn-through punctures the material, or decomposition occurs. The higher the dielectric strength of a material, the better its quality as an insulator" (PTLI, 2004). "The dielectric strength cutoff for cleaners that can be used on energized equipment is generally 30 kV" (IRTA, 2003). As mentioned above, a typical application would be on AC-powered equipment that cannot be shut down before cleaning.

Electronic, Electrical, and Energized Electrical Cleaners do not include "General Purpose Cleaner," "General Purpose Degreaser," "Dusting Aid," "Engine Degreaser," "Pressurized Gas Duster," and "Anti-static product." As previously mentioned, Electronic and Electrical Cleaners do not include products designed to clean the outer casings and housings of electrical equipment.

Table VI-7 below summarizes the sales and emissions from Electronic and Electrical Cleaner, based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001). As shown in Table VI-7, Electronic Cleaner has estimated VOC emissions of about 0.242 tons per day (484 pounds per day) in California. Electrical Cleaner has estimated VOC emissions of about 0.117 tons per day (234 pounds per day) in California. Note that in Table VI-7, Energized Electrical Cleaners were products that we believe would meet the criteria for use on energized equipment. This is because the products reported clearly indicated that they were also for use on energized equipment and would only need to relabel to meet the exemption. However, the impact of these types of cleaners on emissions is small because the predominant ingredients used are VOC-exempt compounds.

Table VI-7
Electronic and Electrical Cleaner*

Product Form	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Electronic Cleaner	106	934	482
Electrical Cleaner	88	884	660
Energized Electrical Cleaner	14	332	82
Total	**208**	**2,150**	**1224**

* Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for electronic and electrical cleaner products was 10%; staff believes the 2001 Survey covered 90% of the market.

The Electronic Cleaner products had a sales-weighted average VOC (SWA-VOC) content of 52.2 percent, by weight, with a SWA-MIR (Maximum Incremental Reactivity) value of 0.71 tons ozone per ton product. The Ozone Forming Potential (OFP) of these aerosols was 119.4 tons ozone per year. The Electrical Cleaner products had a SWA-VOC of 51.2 percent, an SWA-MIR of 0.462 tons ozone per ton product, and an OFP of 108.6 tons ozone per year. The Energized Electrical Cleaner products had an SWA-VOC of 25 percent, an SWA-MIR of 0.147 tons ozone per ton product, and an OFP of 0.89 tons ozone per year. The SWA-MIRs for these categories are low due to the use of hydrochlorofluorocarbon-141b (HCFC-141b) and perchloroethylene.

Product Use and Marketing:

Electronic Cleaner

Electronic Cleaners are used by "do-it-yourself" consumers, technicians, and professional engineers in applications such as cleaning circuit boards and other internal workings of complex instruments that are easily damaged by aggressive solvents such as acetone or perchloroethylene. These types of cleaners are to be sprayed until the soil has run off the equipment, must have a rapid dry-time, and must not leave a residue. They are often marketed as light soil removing and safe on plastics.

Electrical Cleaner

Electrical Cleaners are also used by "do-it-yourself" consumers, technicians, and professional engineers, but in applications where the substrate to be cleaned tolerates aggressive solvents and the removal of heavy soils is required. These products are used on equipment such as relays, switches, and electric motors where there is a need for more aggressive solvents. They are also conductive and some product labels specify that the products have dielectric strengths ranging from 10,000 to 30,000 volts per meter. The cleaner is sprayed on the equipment and wiped off with a cloth. These products are marketed for heavier degreasing applications.

Energized Electrical Cleaner

Energized Electrical Cleaners are for use on equipment that cannot be shut off or unplugged before being cleaned or in applications that require non-flammability. An example of such an application would be a situation in which there could be residual current, even if shutdown, such as in a capacitor. These products are used exclusively in situations where the technician or engineer must clean a piece of equipment that is either active with live current or when there is a residual electrical potential. The phase-out of ozone depleting compounds such as HCFC-141b limits the availability of solvents that can be used to clean in these applications. Electronic and electrical cleaning products are sold primarily in automotive, hardware, and convenience stores.

Product Formulation:

Electronic and Electrical Cleaners are typically composed of a variety of VOC and chlorinated solvents. The most prevalent ingredient in these products is HCFC-141b (1, 1-dichloro-1-fluoroethane), which is a stratospheric ozone depleting substance. In accordance with the Montreal Protocol, HCFC-141b is being phased out. As of January 2003, HCFC-141b can no longer be produced or imported. However, electronic cleaning applications obtained an exemption from the non-essential use ban from the United States Environmental Protection Agency, such that in these applications HCFC-141b can continue to be used.

However, when existing stores are depleted, reformulated products may result in an increase in VOC emissions as well as global warming emissions, as explained in the Chapter IX, Environmental Impacts.

Electronic Cleaner

For the most part, Electronic Cleaners using VOC ingredients, contain high amounts of alkanes and/or alcohols in order to provide quick cleaning and quick drying without leaving a residue. As the survey data show, the SWA-VOC is about 25 percent by weight. However this low percentage reflects the use of HCFC-141b, which is an exempt VOC. Even though some in the industry have suggested that HCFC-141b is not safe on plastics, there are a number of aerosol and non-aerosol products using HCFC-141b. Other products are beginning to use combinations of different hydrofluorocarbons (HFC), hydrochlorofluorocarbons (HCFC), and hydrofluoroethers (HFE) in an effort to replace HCFC-141b. Each of these alternatives is available for use in both aerosol, and non-aerosol forms. These fluorinated compounds have been exempted from the United States Environmental Protection Agency's VOC definition but not from ARB's. Hence, reformulations using these compounds result in higher VOC content. A number of the aerosols in this category use carbon dioxide as their propellant in the formulations that include HCFC-141b, but the higher VOC formulas normally use a hydrocarbon propellant. It is also not uncommon to see HFC-134a used as a propellant because it is non-flammable.

Electrical Cleaner

Electrical Cleaner products are normally composed of aggressive solvents such as xylene, toluene, acetone, and 1-bromopropane. There are also products containing HCFC-141b as well as a number of products with perchloroethylene, methylene chloride, or trichloroethylene solvents. Ingredients in these products need to be able to cut grease and heavier soils in applications where the substrate to be cleaned is not easily damaged by solvent action. Aerosol electrical cleaners also tend to use carbon dioxide as the propellant, especially when chlorinated solvents are used. Most of the products in the category are aerosol.

Energized Electrical Cleaner

Electrical cleaners to be used on energized equipment, where flammability is a concern, are generally formulated with exempt chlorinated solvents, such as perchloroethylene or HCFC-141b, in aerosol and non-aerosol forms. Trichloroethylene, a VOC is also used. Carbon Dioxide is the propellant of choice because it is also non-flammable.

Proposed VOC Limit and Compliance:

The proposed VOC limit for Electronic Cleaner is 75 percent by weight, effective December 31, 2006. As shown in Table VI-8 using adjusted 2001 emissions, the proposed limit will result in an estimated emission reduction of 90 pounds per day or 0.045 tons per day. Table VI-8 also shows that 52 percent of the market currently complies with the proposed 75 percent VOC limit.

The proposed VOC limit for Electrical Cleaner is 45 percent by weight, effective December 31, 2006. As shown in Table VI-8 using adjusted 2001 emissions, the proposed limit will result in an estimated emission reduction of 128 pounds per day or 0.064 tons per day. Table VI-8 also shows that 6.5 percent of the market currently complies with the proposed 45 percent VOC limit, mostly due to the use of HCFC-141b. Products that met the limit with the use of perchloroethylene and other exempt chlorinated solvents were not included in the number of complying products or the complying market share. The "Energized Electrical Cleaner" category consists of 14 products that are likely to relabel in order to qualify for the energized exemption, all of which complying because we are not proposing a VOC limit.

Table VI-8
Electronic and Electrical Cleaner Proposal*

Product Category	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Electronic Cleaner	75	47	52	90
Electrical Cleaner	45	22***	6.5***	128
Energized Electrical Cleaner	n/a	14	100	n/a

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)
****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for electronic and electrical cleaner products was 10%; staff believes the 2001 Survey covered 90% of the market.
******* Does not include products that meet the limit using exempt chlorinated solvents.

Electronic Cleaner

The proposed 75 percent VOC limit for Electronic Cleaner is designed to allow for continued use of alcohol in this category. The high complying market share reflects products using exempt solvents such as HCFC-141b. Because this compound is being phased out, the proposed limit is also designed to allow for the use of other technologies as it is replaced. Besides using an alcohol, there are very few viable alternatives to VOCs that could be used to meet the requirements for this category to dry rapidly without leaving a residue or damaging the substrate to be cleaned. Even HCFC-141b is not always used because it may damage certain plastics. It is important to note that chlorinated solvents are also not used in this category, in large part, due to their propensity to damage sensitive substrates.

Electrical Cleaner

The proposed 45 percent VOC limit for Electrical Cleaners is designed to be consistent with that of "General Purpose Degreaser" (aerosol) as well as "Engine Degreaser." Because these products are used in applications that are similar, the limit reflects this. Reformulation options for Electrical Cleaner that could be used by manufacturers to meet the proposed limit include using water, acetone, other exempt VOCs, and LVP-VOCs. Alternative propellants remain an option for use as well. LVP-VOC substitution is an option for Electrical Cleaners.

The proposed limits for these categories are designed to be feasible without the use of perchloroethylene (Perc), methylene chloride (MeCl), and trichloroethylene (TCE). Under the staff's proposal, we are proposing to prohibit the use of these compounds in "Electronic Cleaner" and "Electrical Cleaner."

Energized Electrical Cleaner

Comments have been received which express concern that usage of the chlorinated solvents in Electrical Cleaners is necessary--especially in areas where cleaning is performed while the equipment is energized, or when cleaning may occur near flame, heat, or other ignition sources. Staff agrees and is proposing a separate category for "Energized Electrical Cleaner." Staff further agrees that there is a need for use of non-flammable Toxic Air Contaminant (TAC) solvents such as Perc, MeCl, and TCE, in this category, especially as the use of HCFC-141b is being phased out. Very few viable alternatives exist today.

Therefore, while we are proposing to prohibit Perc, MeCl and TCE in Electrical and Electronic Cleaners because of toxicity concerns, we are proposing that Energized Electrical Cleaners would be able to continue to contain Perc, MeCl, and TCE. Cleaning of energized equipment does pose a risk, but flammability is a lesser concern in other applications. It should also be noted that many of the existing products with a chlorinated ingredient still pose a fire hazard and have warning and cautionary

statements on the product labels indicating that the product is not to be used on energized equipment.

To account for these specialized uses, but to restrict the use of TACs to the extent feasible, we are proposing that to qualify as an "Energized Electrical Cleaner" products would need to meet very specific criteria to be able to use Perc, MeCl, and TCE. As proposed, "Energized Electrical Cleaner" products would need to meet both of the following criteria:

1) the product is labeled to clean and/or degrease electrical equipment, where cleaning and/or degreasing is accomplished when electrical current exists, or when there is a residual electrical potential from a component, such as a capacitor;

2) the product label clearly displays the statements: "Energized Equipment use only. Not to be used for motorized vehicle maintenance, or their parts."

"Energized Electrical Cleaner" products would have to clearly include a statement on the product label explaining that the product was only for use in applications where equipment is energized. The label must also clearly state that the product is not to be used for motorized vehicle maintenance, or for cleaning vehicle parts. These statements are designed to ensure that chlorinated products are only used when appropriate and prevents their use for motorized vehicle maintenance and for cleaning of motorized vehicle parts, for example, in the work performed by the approximately 35,000 Automotive Maintenance and Repair facilities in California. As always, when using these Energized Electrical Cleaner products, manufacturer specified safety precautions and good work practices should be adhered to.

Prohibiting the use of Perc, MeCl, and TCE in motorized vehicle applications would be consistent with the Airborne Toxics Control Measure for Automotive Maintenance and Repair Activities (AMR ATCM). In 2000, the ARB prohibited the use of the chlorinated solvents, Perc, MeCl, and TCE in products designed for use in AMR facilities, which included the product categories Automotive Brake Cleaner, Carburetor & Choke Cleaner, Engine Degreaser, and General Purpose Degreaser (automotive use). These products are used in similar applications as electrical cleaners that would have automotive end-uses, which includes "under-the-hood use." In adopting the AMR ATCM, the ARB determined that there was not a flammability issue with these uses because of "the use of good operating practices on the part of facility owners, mechanics, and technicians. Staff also concluded, during development of the ATCM, that the majority of aerosol products available on the market consisted of VOC-based degreasers. (ARB, 2000).

We note that when the ATCM for AMR facilities was developed, staff could find no evidence, of reports of fires, injuries, or other incidents related to the use of non-chlorinated products in AMR facilities. This conclusion was arrived at by conducting a search of statewide and national databases, as well as by making inquiries to fire departments and associations across the State. Additionally, the California State

Fire Marshal's office indicated that the combustion of gasoline, such as from a leaking fuel line, poses a significantly greater flammability concern than the use of potentially flammable aerosol products. (ARB, 2000) It is also important to note that a few facilities expressed concerns about the health and safety impacts of "poison gas" formation (referring to phosgene and other gases) when chlorinated aerosols are used near heat and flame sources (ARB, 2000).

We believe common safety precautions, as well as, good operating practices, in combination with allowing Perc, MeCl, and TCE-containing products to continue to be used to clean energized electrical equipment, addresses the issue of flammability. Moreover, the product labels submitted under the survey definition of Electronic Cleaner (which included both electrical and electronic cleaners) show that VOC-containing products had the same uses and precautions as those containing a chlorinated solvent. For these reasons, the chlorinated solvents, Perc, MeCl, and TCE would be prohibited from use in the categories "Electronic Cleaner" and "Electrical Cleaner."

We do not believe it is feasible to set a VOC limit for Energized Electrical Cleaners at this time. Solvents typically used in this type product are often VOC-exempt. The solvent of choice is HCFC-141b or another chlorinated solvent. However, use of HCFC-141b is being phased out.

Also, because of provisions already in place in the Regulation (see section 94509(e)) products not using HCFC-141b at the present time, would not be allowed to begin using it to meet a VOC limit. With the ongoing phase-out of HCFC-141b, the only solvents that seem to sufficiently fill this need are the chlorinated solvents. However, compounds that could be suitable as replacements for the chlorinated TACs and/or HCFC-141b, such as HFC-245fa and the hydrofluoroethers, are considered VOCs in California. Thus, because a low VOC limit precludes the use of alternatives to TACs, and a high VOC limit (near 100 percent) would result in no emission reductions, staff is also proposing to exclude Energized Electrical Cleaners from VOC limitations at this time.

However, progress is being made through technology and research to develop suitable non-chlorinated alternatives. We will continue to follow advances and will reevaluate this category in the future to determine if use of Perc, MeCl, and TCE is warranted.

Labeling

Due to difficulty in distinguishing between the types of products, we are proposing that each category would be subject to additional labeling requirements as defined in section 94512(d) of the Consumer Products Regulation. These labeling requirements already apply to aerosol adhesives. These proposed additional requirements will ensure that all products clearly display the name of the category as specified in section 94509(a) and the applicable VOC standard of the product, in percent by weight. This information would be required to be displayed on the product

container such that it is readily observable without removing or disassembling any portion of the product container or packaging.

Reporting Requirement

Although we are proposing to allow continued use of Perc, MeCl, and TCE in the subcategory "Energized Electronic Cleaner," we are proposing that the category would be subject to section 94513(e) of the Consumer Products Regulation. This section requires all responsible parties for consumer products that are subject to section 94509(a) and contain Perc and MeCl to report the product name, product form, the weight percent of Perc and MeCl in the product, and pounds of product sold. This annual report is to be submitted by March 1 until the year 2011. For this category, we are proposing that even though "Energized Electronic Cleaner," would not be subject to section 94509(a), in order to monitor the amount of chlorinated solvents used, reporting of usage of Perc and MeCl would be required.

Issues:

1. Issue: The proposed VOC limits for Electrical Cleaner and Electronic Cleaner may encourage manufacturers to reformulate their products using perchloroethylene or methylene chloride.

Response: As explained in the "Proposed VOC Limit and Compliance" section above, the category was subcategorized and the respective VOC limits are designed to allow manufacturers to reformulate their products without using perchloroethylene or methylene chloride. Different VOC limits are given because the technical feasibility of using non-chlorinated solvents is application-specific. However, "Energized Electrical Cleaner" would be allowed to use chlorinated solvent due to flammability issues that can occur during cleaning active equipment.

2. Issue: Electrical Cleaners should not have a restriction for usage of chlorinated solvents. Nonflammable solvents are often needed for use in Electrical Cleaner because of use on equipment with live or residual charges, and therefore need to have low conductivity and/or low flammability. These needs cannot be met by water because it is conductive and slow to evaporate. Because of the phase-out of HCFC-141b, chlorinated solvents must be allowed for use. (CSPA)

Response: Staff agrees that non-flammable solvent is needed in certain instances of electrical cleaning because of flammability issues. Since HCFC-141b is being phased out, staff has agreed to allow the use of chlorinated solvents in situations where use on live equipment cannot be avoided. The category "Energized Electrical Cleaner" has been proposed for these situations and it must be very clear on the label that products in this category are to be used exclusively in situations where the equipment cannot be shut down and/or unplugged before cleaning, or when there is a residual electrical potential from a component. However, Perc, MeCl, and TCE would be prohibited from use in "Electronic Cleaner" and "Electrical Cleaner."

3. Issue: ARB should develop a reactivity strategy for meeting this limit. (CSPA, Hydrosol)

Response: Staff has maintained that a mass-based VOC strategy would be the primary focus of this regulatory effort and that a reactivity strategy would only be employed if the mass-based strategies did not provide the necessary reductions. Staff evaluated a reactivity-based control strategy and found, that to achieve similar reductions as those from the proposed mass limits, would require a reactivity limit that would not be feasible. We believe the proposed mass-based limits are feasible and proposing an MIR strategy would not yield additional air quality benefits.

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E. Fabric Refresher

Product Category Description:

Fabric refresher products are designed to neutralize or eliminate odor on fabric. They do not include carpet and upholstery cleaner, footwear or leather care product, spot remover, disinfectant, or products labeled for application to both fabric and human skin.

According to the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001), VOC emissions from all forms of fabric refreshers are about 1.09 tons per day (2,180 pounds per day) in California. Table VI-9 below summarizes the sales and emissions from aerosol and non-aerosol fabric refreshers. Aerosol products make up 9 percent of the fabric refresher market and contribute about 39 percent of the VOC emissions from the fabric refreshers. The non-aerosol forms include pump sprays, liquids and solids. Non-aerosol products make up 91 percent of the fabric refresher market and contribute about 61 percent of the emissions from fabric refreshers.

Table VI-9
Fabric Refresher*

Product Form	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Aerosol	16	2,982	848
Non-aerosol	61	30,670	1,332
Total	**77**	**33,652**	**2,180**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for fabric refresher products was 30%; staff believes the 2001 Survey covered 70% of the market.

Product Use and Marketing:

Fabric Refreshers are used in households, automotive, institutional, and commercial settings to treat unpleasant odors on fabrics. This is accomplished by masking the odor with a pleasant scent or removing the odor. Household products are generally available through retailers, while the institutional and commercial products are sold via wholesalers through distribution channels or direct sales.

Household fabric refreshers are used to treat odors such as smoke, pet odors, kitchen odors, musty odors, odors caused by perspiration, germs, mold and mildew on fabric including, but not limited to, soft household surfaces, rugs, carpeting, draperies, bedding, automotive interiors, footwear, athletic equipment, clothing and/or household furniture or objects upholstered or covered with fabrics such as wool, cotton, nylon, or other synthetic fabrics.

Fabric refreshers used in institutional and commercial settings are used to control odors on fabric and/or furniture or objects upholstered or covered with fabric in sick rooms, nursing homes, hospitals, hotels, motels and restaurants.

Aerosol and pump spray fabric refresher products are usually sprayed on the fabric. The product penetrates the fabric, and the odor fades as the fabric dries. Solid fabric refresher products are typically sprinkled on the fabric surface, followed by vacuuming or sweeping.

Fabric refreshers control odors in a number of ways. Some products simply mask the bad odors with molecules that have a pleasant smell. Other products neutralize the odors by modifying the cause of the odor on the molecular level. Fabric refresher may also contain odor digesters with bacteria that create enzymes which seek and eliminate the odor's source (Abraham).

Product Formulation:

Aerosol fabric refresher products are typically either double-phase or single-phase. With single-phase aerosol products, the liquid components of the product are present in a single, homogeneous phase. These products contain a small amount of fragrance with the balance consisting of solvents and propellants. Most products contain some amount of inorganic compounds, which typically comprise less than 40 percent of the weight of the product. Metallic salt, which can be used as an odor control agent, is one of the examples of inorganic compounds that can be present in the formulation (*US Patent 6,077,318*). These aerosol products usually have a high VOC content.

Double-phase aerosols make up a greater majority of the aerosol market and usually have a lower VOC content than the single-phase aerosol products. The double-phase products contain two liquid phases and a propellant. The liquid phases consist of a larger water phase and a smaller organic phase(s), which contains a small amount of fragrance. These products must be shaken before use to mix the phases into a homogeneous emulsion. The organic phase is generally made up of liquefied hydrocarbon propellant, emulsifiers, and fragrance (ARB 1999).

The propellants used in single-phase and double-phase aerosol products are typically blends of butanes and propane, or dimethyl ether. Propellants generally constitute 15 to 90 percent of the weight of the product for single-phase aerosols, and 5 to 30 percent of the weight of the product for double-phase aerosols.

Pump spray fabric refresher products are typically composed of water, a small amount of fragrance and surfactants, and alcohol. As reported in a 2001 Survey, the amount of alcohol in the formulation varies from trace amounts to as high as 99 percent of the weight of the product. Alcohol is the main VOC found in this product form. Alcohol serves as a solvent for the fragrance compounds, stabilizing the formula. Alcohol also

controls the particle size and decreases the drying time of the fabric after product application (Procter & Gamble).

Emulsifiers are used in the product formulation to aid mixing of the fragrance compounds in the water phase by creating a homogeneous liquid that can be sprayed. Typically, the emulsifiers in the product are less than 10 percent of the weight of the product (2001 Survey).

Liquid fabric refresher products are very similar in their formulation to pump spray products, usually containing water, small amount of surfactants and slightly higher amount of fragrance on average than in pump sprays.

Solid fabric refresher products typically consist of inorganic compounds, which range from about 20 percent to about 95 percent of the weight of the product, and a small amount of fragrance. Inorganic compounds in solid fabric refreshers may serve as odor removers, moisture absorbents, desiccants and fillers (*US Patent 5,716,938; US Patent 6,703,010*).

Proposed VOC Limit and Compliance:

The proposed VOC limits for aerosol and non-aerosol fabric refresher are 15 and 6 percent VOC by weight, respectively. Staff could not propose a lower than 6 percent VOC limit for non-aerosol products due to the existing patent that Procter & Gamble holds (*US Patent 6,077,318*, Method of using a composition for reducing malodor impression, June 20, 2000). The proposed limits would be effective by December 31, 2006. As shown in Table VI-20, using adjusted 2001 emissions, proposed limits will result in an estimated emission reduction of 806 pounds per day or 0.403 tons per day.

Table VI-10 also shows that 1 percent of the aerosol market currently complies with the proposed 15 percent VOC limit, and 97 percent of the non-aerosol market complies with the proposed 6 percent VOC limit.

Table VI-10
Fabric Refresher Proposal*

Product Form	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Aerosol	15	2	1	404
Non-aerosol	6	47	97	402
Total				**806**

* Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for fabric refresher products was 30%; staff believes the 2001 Survey covered 70% of the market.

As described above, the main ingredients in typical aerosol fabric refreshers are water, fragrance, emulsifiers, hydrocarbon propellants and inorganic compounds. Usually the emulsifiers used are LVP-VOCs. The most likely VOC ingredient to be reduced in the formulation is the hydrocarbon propellant.

One possible method of reformulation would be to replace a portion of the hydrocarbon propellant with a non-VOC propellant such as hydrofuorocarbon-152a (HF-152a). A propellant blend of HFC-152a and hydrocarbon propellant can be used. If the product's water content must be increased, it could lead to decreased miscibility of fragrance and other organic compounds in the water phase. This effect could be mitigated by adding blends of surfactants and emulsifiers to the product. Surfactants aid in the mixing of the organic and water phases in the product to produce oil-in-water emulsions. Emulsion is necessary to allow the fragrance molecules to be discharged along with the water from the can. A manufacturer may also consider reformulating double-phase aerosol product through the use of high vapor pressure propellant and exempt VOC solvent (ARB 1999).

For non-aerosol products, we expect manufacturers of noncompliant products to formulate products similar to the compliant products, which comprise 97 percent of the market. Since alcohol is the main and often only VOC contributor in pump spray and a number of liquid fabric refreshers, it seems to be the logical target for modification in reformulations. In general, reformulation would require increasing the water content while reducing or replacing the alcohol in the products. The 6 percent VOC limit would allow an adequate level of VOC's to be present for effective solubilization of the fragrance compounds and satisfactory drying time.

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F. Footwear or Leather Care Product

Product Category Description:

Footwear or leather care products are applied to footwear and leather articles, to maintain, enhance, clean, protect, or modify the appearance, durability, fit, or flexibility of footwear or leather. Leather substrates include smooth leather and rough leather, such as suede, nubuck, and roughout. Footwear substrates include leather and non-leather material, such as fabric. The current proposal considers products in three sub-categories according to product form -- aerosols, solids, and "all other forms."

The footwear or leather care products category is new; the products have not been previously regulated in the Consumer Products Regulation. However, some products are closely related to products already regulated in the Consumer Products Regulation, or to products in other categories concurrently being proposed. More specifically, footwear or leather care products do not include products defined as "Fabric Protectant," "General Purpose Adhesive," "Contact Adhesive," "Rubber and Vinyl Protectant," "Fabric Refresher," or "Vinyl/Fabric/Leather/Polycarbonate Coating." This last category is currently regulated under the ARB's "Aerosol Coating Products Regulation" (ARB, 2001a), and pertains to aerosol products that apply resin or pigments to leather or fabric substrates. However, the "Vinyl/Fabric/Leather/Polycarbonate Coating" category does not include products for preserving or cleaning leather.

Table VI-11 below summarizes the sales and emissions from footwear or leather care products based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001b). As shown in Table VI-11, footwear or leather care products contribute estimated VOC emissions of about 0.318 tons per day (637 pounds per day) in California.

Table VI-11
Footwear or Leather Care Product*

Product Form	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Aerosol	17	310	101
Solid	25	726	348
All Other Forms	162	2,592	188
Total	**204**	**3,628**	**637**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001b)
****** Survey emissions adjusted for complete market coverage (see Chapter IV,

Emissions). The market coverage adjustment for footwear or leather care products was 10%; staff believes the 2001 Survey covered 90% of the market.

Product Use and Marketing:

The footwear or leather care products category is a group of products with a variety of functions. Examples include products to shine and protect footwear ("shoe polish"), to clean footwear and leather articles ("cleaners"), and to soften and preserve leather ("conditioners"). Examples of more specialized products include products to stretch tight-fitting footwear to loosen them for a better fit, dedicated dye products for leather and associated dye reducers used for permanent coloring, products to "dress" the edges of soles and heels of footwear, and products to remove scuff marks from footwear. As previously discussed, resin-containing aerosol products for leather substrates, such as "protectant" products that form a sometimes invisible film, and "color renew" products that replace the lost color in older leather, are considered separately as "Vinyl/Fabric/Leather/Polycarbonate Coatings," and are already regulated as "aerosol coating products."

Footwear or leather care products are used by household consumers, working professionals, outdoor enthusiasts, workers in commercial establishments, and others. Working professionals may include farmer; rancher; construction worker; security guard; law enforcement official; hospital nurse (white shoes); and military personnel ("spit shine"). Outdoor enthusiasts may include athlete; hiker; camper; hunter; equestrian rider; and leather hobbyist. These people use products for their own clothing and other leather goods. Products may also be used for commercial purposes by shoe repair shop; saddler and stable operator; automotive "detailing" shop for leather seat; leather specialty shop; and -- although less common these days -- shoe-shine-stand operator.

How products are used depend on product function and form. For example, suede and nubuck cleaners are generally aerosols to be applied to suede or nubuck footwear and to other articles with these substrates. The suede or nubuck item is then wiped clean with a dry cloth and brushed to reset the nap. Hard-paste shoe polish, a solid, is applied to footwear by brush or cloth applicator and allowed to dry to a haze. A clean cloth is then used to buff the haze to reveal a shiny wax coating. "Conditioner" products are usually liquid products applied to leather. The product is allowed to penetrate the surface to replace lost oil in the leather. For other products, use instructions may differ substantially because of the variety of products.

Footwear or leather care products may be marketed by general and specialized sales outlets. Examples include mass-market variety store; supermarket; drug store; department store; men's and women's clothing store; sporting goods store; outdoor recreation store; shoe store; shoe repair shop; uniform clothing store; saddle shop; hunting and gun shop; leather specialty shop; auto parts and supply store; and car dealership.

Product Formulation:

Footwear or leather care products include various formulas and ingredients that serve different functions or combination of functions. Active ingredients may range from hard or protective substances -- such as carnauba wax; paraffin wax; microcrystalline wax; beeswax; shellac wax; and resins (except aerosol products, since these are "aerosol coating products"), to mild substances -- such as glycerin cleaners; lanolin; and other ingredients similar to those used in lotions for human skin. Other active ingredients may include neatsfoot oil (derived from animal bones); petrolatum (petroleum jelly); mink oil; petroleum oils; solvent or pigment dyes; and organic or hydrocarbon cleaning solvents. Carriers and other ingredients may include organic and hydrocarbon solvents; water; emulsifiers; plasticizers; and propellants for aerosols.

Although generally not evident according to product labels, product use may vary greatly -- from protection of heavy-duty outdoor footwear or leather, to the other extreme -- for gentle cleaning or preservation of fine or indoor leather. For some products, there may be numerous label claims. For example, a product containing oil and wax may claim a combination of functions for “softening or conditioning;” “nurturing or moisturizing;” “dressing leather;” “preserving;” “revitalizing;” “protecting;” “shining;” “repelling dirt and stains;” or “repelling water” Some products claim to be both “cleaner and conditioner.” For still other products, there may essentially be no label claim. For example, a product named “Boot Oil” and another named “Leather Lotion” may have absolutely no explanation on the labels regarding the function of the “oil” or the function of the “lotion.”

The types and amounts of solvents needed to deliver the various ingredients, as well as the types and amounts of solvents used in cleaning products, vary considerably. Therefore, when products are considered as a category or by product form, VOC contents also vary considerably.

Aerosols

Aerosol products include cleaners for suede and nubuck, cleaners for athletic shoes, and miscellaneous products. As previously noted, aerosol products containing resin or pigments, such as "protectants" and "color-renew," are not in this category.

The VOC content of aerosol cleaners for suede and nubuck varies from 85 percent to 100 percent (survey data, ARB, 2001b). Current formulations contain predominantly hydrocarbon solvents, along with organic solvents, and hydrocarbon or carbon dioxide propellant. Hydrocarbon solvents include heptane (30% to over 95%), petroleum distillates such as mineral spirits or aliphatic petroleum distillates, and toluene (2 to 15%). Organic solvents include compounds such as butyl acetate, ethyl acetate, or isopropyl alcohol (2 to 10% each). The propellants include either hydrocarbons (butane-isobutane-propane blends, approximately 25%), or carbon dioxide (approximately 2%). Perchloroethylene, a chlorinated solvent cleaner, is used to a very limited extent in this category (survey data, ARB, 2001b). Since

perchloroethylene is a toxic air contaminant, it will be prohibited as an ingredient in the proposal for this category. We do not expect that this prohibition will create any technical hurdles in reformulating products to meet the proposed standard.

The VOC content of aerosol cleaners for athletic shoes varies from 10 to 20 percent (survey data, ARB, 2001b), and would generally comply with the proposed VOC standard of 75 percent by weight for aerosol products. Current formulations are water-based (75 to 90% water). The cleaning agents may be glycol ethers, alcohols, d-limonene, or a combination of these (1 to 10% each). The propellant may be hydrocarbons (butane-isobutane-propane blends) (5 to 10%).

The VOC content of other aerosol products varies from 0 to 45 percent VOC (survey data, ARB, 2001b), and would generally comply with the proposed VOC standard of 75 percent by weight for aerosol products. Example products include "shoe stretch" aerosols, and smooth-leather aerosol cleaners, polishes, and oil "conditioners" (water-based or high-content LVP-VOC).

Solids

The VOC content of traditional hard-paste shoe polish varies from 60 to 75 percent (survey data, ARB, 2001b). Essentially all of the VOC consists of the petroleum distillate solvents used, such as mineral spirits, aliphatic hydrocarbons, or stoddard solvent. These solvents enable the main ingredient waxes to be softened and formed into paste with the correct consistency, stability, and performance characteristics. The product must be readily packaged and stored in paste polish form, easily applied to shoe surfaces, sets up quickly and properly to form a dry haze, and easily buffed to a shiny wax coating. Various waxes and wax blends may be used, including hard waxes such as carnauba wax. A shoe polish product line may include many colors, with each colored-product using a different dye.

The VOC content of other solid products varies from 0 to 25 percent (survey data, ARB, 2001b), and would generally comply with the proposed VOC standard of 55 percent by weight for solid products. Example products include "conditioning" products in paste form and solid cleaners such as "saddle soap." Solid cleaners may use LVP-VOC cleaners such as glycerin. Some paste "conditioners" for applying oil or wax to heavier-duty leather may actually be "semi-solids" rather than "solids," since the 2001 survey instructions did not ask for reporting products as "semi-solids." The same situation may exist for "shoe creams," some of which may have been reported as "solid," since "semi-solid" was not a reporting option at the time of the survey. Products that are "semi-solids," including "shoe creams" that meet the definition of the form, would be in the "all other forms" subcategory. The proposed VOC standard for "all other forms" is 15 percent by weight (see next section).

All Other Forms

In terms of sales, the dominant "all other form" products are liquids which comprise 92 percent of "all other forms." Liquid products vary from 100 percent VOC ethanol-based dyes and dye reducers for coloring leather, to 0 percent VOC water-based products for cleaning or preserving fine leather, such as automotive leather. Other products include liquid "protectants" containing resin, liquid polish, "dressings," "lotions," and products to remove scuff marks from shoes. The sale of liquid cleaners and conditioners for automotive leather is substantial; however, these products are low-VOC (0 to 2% VOC), and would generally comply with the proposed VOC standard of 15 percent by weight for "all other forms." There are far fewer products in "pump spray" form. Some of these products are similar to liquids, but packaged with a pump spray.

"Semi-solids" include "shoe creams" with 10 to 30 percent VOC content, mainly due to the petroleum distillate solvents used. These products are related to the hard-paste shoe polishes (solids), except "shoe creams" are generally emulsions with 30 to 50 percent water content, making them softer and easier to apply than hard-paste polish. Other cream products may have a high content of LVP-VOCs, rather than containing water, so that VOC contents are similar to the emulsion creams.

Proposed VOC Limits and Compliance:

The proposed VOC standards for footwear or leather care products, are 75 percent by weight for "aerosol" products, 55 percent by weight for "solid" products, and 15 percent by weight for "all other forms." The proposed effective date is December 31**,** 2006. As shown in Table VI-12, using adjusted 2001 emissions, the proposed standards will result in an estimated emission reduction of 190 pounds per day or 0.097 tons per day in California.

Table VI-12
Footwear or Leather Care Product Proposal*

Product Form	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Aerosol	75	11	82	13.3
Solid	55	19	39	71.1
All Other Forms	15	113	87	109.5
Total				**193.9**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001b)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for footwear or leather care products was 10%; staff believes the 2001 Survey covered 90% of the market.

Aerosols

The proposed VOC standard of 75 percent by weight for aerosol products is expected to mainly affect cleaners for suede and nubuck. Reformulation options include substitution of hydrocarbon propellants with exempt (or fractionally-exempt) propellants, such as HFC-152a or blends of HFC-152a with traditional hydrocarbon propellants (butane-isobutane-propane). Other options include substitution or partial substitution of current hydrocarbon solvents (mainly heptane and to a lesser extent various petroleum distillates) with exempt solvents. Acetone and volatile methylated siloxanes (VMS) are two exempt solvents available. Acetone is an aggressive solvent for some materials; however, acetone may be suitable for suede and nubuck since rough leather does not have a smooth surface finish to be damaged. Also, the VMS option provides an alternative and less aggressive substitute solvent, compared with acetone. Various combinations of these options are also available and provide further flexibility for reformulation.

When carbon dioxide propellant is used in a current formulation or as a substitute propellant in the future, the VOC content may still be on the order of 98 percent since the carbon dioxide content may contribute only about 2 percent of the product weight. Therefore, reformulation or further reformulation is still needed, such as with the options described above for solvent substitution, to comply with the 75 percent VOC standard for aerosol products.

As previously discussed, other aerosol products generally contain VOC below 75 percent, and would be minimally affected by the current proposal. However, these products may be reevaluated in the future, depending on the need and priorities for further emission reductions.

Solids

The proposed VOC standard of 55 percent by weight for solid products is expected to mainly affect the hard-paste shoe polishes. Reformulation options include solvent substitution of the current petroleum distillate solvents with LVP-VOC solvents, with exempt solvents such as parachlorobenzotriflouride (OXSOL 100®) or VMS solvents, or with various combinations. Reformulation would require that complying products use substitute solvents totaling approximately 5 to 20 percent by weight of the product. Since shoe polish may be marketed with a variety of colors (dyes), reformulation efforts may be considerable since each colored product may need individual reformulation (Sara Lee, 2004).

As previously discussed, other solid products generally have VOC content below 55 percent, and would be minimally affected by the current proposal. However, these products may be reevaluated in the future, depending on the need and priorities for further emission reductions. For "shoe cream" and "semi-solids," see the next section for "all other forms."

All Other Forms

For high-VOC liquid products, such as dye products, the main VOC ingredient may be alcohol, such as ethanol or isopropanol, with lesser amounts of hydrocarbon or other organic solvents. One reformulation approach is to convert to water-based or pigment dye formulations. Another approach is solvent substitution with an exempt solvent such as parachlorobenzotriflouride (OXSOL 100®).

For "shoe creams" in the form of “semi-solids,” reformulation options include substitution of petroleum distillate solvents, with LVP-VOC solvents, with exempt solvents such as parachlorobenzotriflouride (OXSOL 100®) or VMS solvents, or with various combinations. Reformulation would require that complying products use substitute solvents totaling approximately 5 to 15 percent by weight of the product. Since "shoe cream" may be marketed with a variety of colors (dyes), reformulation efforts may be considerable since each colored product may need individual reformulation.

Some products in the “all other forms” subcategory already comply with the proposed VOC standard of 15 percent, and would be minimally affected by the current proposal. However, these products may be reevaluated in the future, depending on the need and priorities for further emission reductions.

Issues:

1. Issue: Footwear care products have changed substantially since survey year 2001 (e.g. proliferation of impregnated wipes -- that clean, protect, and shine in a single step, reducing emissions by reducing steps (reducing separate product applications)). Re-survey of products to obtain data for sales year 2003 is recommended.

Response: We have not seen information which suggests the need for a higher VOC level for products with multiple claims, such as these “combination wipe” products. As previously discussed, there are already many products with multiple label claims.

2. Issue: The category should be subcategorized. Product uses are evident from the product names on the labels.

Response: We disagree. Product names may not be consistent with product claims. The entire label, front and back -- needs to be reviewed. Even then, it would be extremely difficult to translate the claims to product functions and subcategories.

3. Issue: The reformulation task is greater than evident from the survey data, since the grouping of products decreases the apparent number of reformulations needed. For example, some products are made with a considerable number of different colors and formulations, but the products were lumped together as one group for the survey.

Response: We understand. State law requires us to consider technological and commercial feasibility and we believe that this proposal meets this requirement. As we proceed to develop future VOC standards, we will need greater efforts for smaller reductions, as finding reductions become increasingly more difficult. We may need to go beyond the approaches used in the past.

4. Issue: Footwear care products should not be combined with leather care products. Footwear care products are for different substrates, including leather and other substrates, while leather care products are not always appropriate for non-leather substrates.

Response: We disagree. Many product labels do not distinguish between footwear and leather use. Even if we separate footwear care from leather care, we will still require the most restrictive limit to apply when a product meets both definitions. The net effect would be the same as combining footwear care and leather care into one category, as we are presently proposing. The proposed VOC standards take into account both types of products.

5. Issue: Several products appear miscategorized between solid and semi-solid splits. Creation of "semi-solid" as a new product form will create uncertainty and the need to test each product in order to be classified.

Response: Since "semi-solid" was not a separate form for reporting in the survey, some products were reported as "gel" while other products were reported as "solid" or "other." We agree that certain data in the database should to be adjusted to more accurately address "semi-solid" products, and have done so. We have proposed modifications to the regulation that clarifies the definition of the "semi-solid" form.

6. Issue: Contact adhesives are excluded from the category but sealants are not. While shoe adhesive is sold as a shoe repair product, it is also used as a protective, and sometimes sacrificial coating, as well as a high endurance sealant for footwear. The proposed VOC standard should be raised to 55 percent, or the proposal should exclude sealants as well as contact adhesives.

Response: It was our intent to exclude shoe adhesive products, but did not realize such products may also be considered as sealants, which were not excluded in the original proposal. To clarify the definition, we have added wording, in accordance with the second recommendation, to also exclude "sealant products with adhesive properties used to create external protective layers greater than 2 millimeters thick."

7. Issue: ARB should exempt or provide separate VOC standards for footwear care products used by the military.

Response: Since we will have no way to quantify emissions and emission reductions relating to military use in California, we can not justify an exemption or

separate VOC standards when seeking United States Environmental Protection Agency approval of our revisions to Consumer Products Regulation.

8. **Issue:** Aerosols cover a diverse range of products, including "protectors," cleaners, waterproofers, and stretchers. Exempt VOCs and LVP-VOCs can not be substituted for traditional solvents. Acetone and methyl acetate "fog" leather and may damage leather. Non-VOC solvents and water-based products discolor leather. Dry times are too long.

Response: As previously discussed, some aerosol products containing resin, such as "protectants" and waterproofers, have been excluded from this category since the products are “aerosol coating products.” We have considered the technological and commercial feasibility of various reformulation options. We have considered the feasibility of acetone, other substitute solvents, and various VOC standards for different leather substrates, different leather finishes, and different product functions.

9. **Issue:** The four "complying" aerosol products from the survey may have narrower performance characteristics.

Response: The four "complying" aerosol products include one water-based smooth leather cleaner, two oil products (with hydrocarbon propellant), and a water-based leather protectant that we have removed because it also appears to be a vinyl protectant (already regulated). It is not possible to define “narrow” or “broad” performance characteristics and make such determinations from product labels.

10. **Issue:** Aerosol products that have recently been determined to be “aerosol coating products” should be granted temporary waivers for 12 months, to allow time to implement the labeling requirements of California Code of Regulations, Title 17, section 94524(b), for these products.

Response: These aerosol coating products in this category appear to currently comply with the reactivity standard of 1.55 g O3 / g product, applicable to "Vinyl/Fabric/Leather/Polycarbonate Coatings" since January, 1, 2003. Regarding the labeling requirements, we will evaluate the need for developing an enforcement advisory which would notify affected industry and allow a timeframe for re-labeling to comply with the Aerosol Coating Products Regulation.

11. **Issue:** Products that are currently low-VOC are not expected to have higher VOC levels after a VOC standard is adopted that allows for higher levels. It is not appropriate to apply any VOC standard to “all other forms.” An emission “cap” should not be proposed for “all other forms.”

Response: When adopting any VOC standard, we must be aware of possible market shifts by the products. For example, if solid products need to be reformulated, changing to a semi-solid form may be a future option and a product shift in that

direction. Therefore, we need limits for various forms, such as “all other forms,” to avoid possible new products that may be detrimental to air quality.

12. Issue: Some footwear care products and leather care products overlap. The two categories should be combined into a single category called “footwear or leather care products.”

Response: We agree and have combined the two for the current proposal.

REFERENCES

Air Resources Board. Aerosol Coating Products. Title 17, California Code of Regulations, sections 94700-94701. (ARB, 2001a)

Air Resources Board. 2001 Consumer and Commercial Products Survey. September 24, 2002. (ARB, 2001b)

Camp, William, and Steve Hahn. Sara Lee Household and Body Care (Kiwi Brands). Communication with ARB staff. January 6, 2004. (Sara Lee, 2004)

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G. Graffiti Remover

Product Category Description:

Graffiti Remover products are designed to remove spray paint; ink; marker; crayon; lipstick; nail polish; or shoe polish from a variety of non-cloth or non-fabric substrates. This category includes products that are marketed for indoor as well as outdoor use. Products in this category work by penetrating and dissolving unwanted graffiti and/or markings, while doing little to no damage to the painted surface underneath. Graffiti Remover products do not include “Paint Remover or Stripper,” “Nail Polish Remover,” or “Spot Remover.”

Table VI-13 below summarizes the sales and emissions from Graffiti Remover based on the results of the ARB’s 2001 Consumer and Commercial Products Survey (ARB, 2001). Graffiti Removers have estimated VOC emissions of about 0.195 tons per day (390 pounds per day) in California.

Table VI-13
Graffiti Remover*

Product Form	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Aerosol	35	300	170
Non-aerosol	30	312	220
Total	**65**	**612**	**390**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for graffiti remover products was 15%; staff believes the 2001 Survey covered 85% of the market.

The aerosol products in this category had a sales-weighted average VOC (SWA-VOC) content of 25.7 percent, by weight, with a SWA-MIR (Maximum Incremental Reactivity) value of 0.29 tons ozone per ton product. The Ozone Forming Potential (OFP) of these aerosols was 22.3 tons ozone per year. The non-aerosols had an SWA-VOC of 9.1 percent, an SWA-MIR of 0.165 tons ozone per ton product, and an OFP of 151.4 tons ozone per year.

Product Use and Marketing:

Graffiti Remover products are used in both household and institutional settings to remove unwanted markings or to remove vandalism-related markings from a variety of surfaces. Products sold as paint strippers will remove graffiti as well. Some products are labeled as both paint removers and graffiti removers. However, Graffiti Remover products are distinguished from products in the “Paint Remover or Stripper” category, in that the underlying paint substrate is typically not damaged. They normally do not contain chlorinated solvents.

Graffiti Removers are typically sprayed on a surface and allowed to sit for a short period of time. Depending on the surface, the sprayed area is then either rubbed off with a cloth or an abrasive sponge. Some products are also to be used with a pressure wash system. The directions for use of these products depend on the type of soil to be removed and the surface it is to be removed from. Products are often marketed for use on any surface to remove any type of graffiti, ranging from lipstick, marker, and crayon to paint.

Graffiti removers are sold primarily in janitorial supply stores. Some products may also be found in paint supply stores.

Product Formulation:

Aerosol and non-aerosol Graffiti Removers are typically composed of a variety of solvents such as D-limonene, alcohol, xylene, and n-methyl-2-pyrrolidone (NMP).

However, there are a number of non-aerosol products that are water-based. Depending on the surface to be treated, these non-aerosol products can be used in a pressure wash system, which aids in the removal. Aerosol and non-aerosol graffiti removers usually contain an aromatic hydrocarbon solvent in order to adhere to the "like dissolves like" principle. There were some non-aerosol products reported in the survey that used dibasic ester mixtures as well as a few that contained glycol ethers. These compounds were normally used in water-based formulations. There were no non-aerosol products that contained a chlorinated solvent.

The aerosol products are high in VOC content because of the use of aromatic hydrocarbon solvents, hydrocarbon propellant, as well as alcohols, such as ethanol or isopropyl alcohol (Survey, 2001). The alcohols are useful in cutting, or dissolving, other markings like crayon, ink, or lipstick without damaging the underlying painted surface. Only a few aerosol products still use methylene chloride, which may not always be favorable for this category because the consumer will often want to preserve the underlying painted surface.

Proposed VOC Limit and Compliance:

The proposed VOC limits for Graffiti Remover are 50 percent by weight for aerosols and 30 percent by weight for non-aerosols, effective December 31, 2006. As shown in Table VI-14, using adjusted 2001 emissions, the proposed limits will result in an estimated emission reduction of 156 pounds per day or 0.078 tons per day.

Table VI-14 also shows that 39 percent of the market currently complies with the proposed 50 percent VOC limit for aerosols, while 11 percent of the market currently complies with the 30 percent VOC limit for non-aerosols. The aerosol products that comply do so through the use of chlorinated solvents. The complying non-aerosol products use more water as well as low-VOC alternatives, including dibasic ester mixtures. Staff is proposing that aerosols be given a higher VOC limit to allow for the use of propellant as well as the use of more solvent to make up for the inability to use ancillary equipment, i.e. a pressure washer, to aid in the cleaning.

Table VI-14
Graffiti Remover Proposal*

Product Form	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Aerosol	50	3	39	26
Liquid	30	4	11	130
Total				**156**

* Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for graffiti remover products was 15%; staff believes the 2001 Survey covered 85% of the market.

To comply with the proposed 50 percent VOC limit for aerosols, and 30 percent VOC limit for non-aerosols, staff believes LVP-VOC alternatives including LVP dibasic ester, LVP-VOC, glycol ether, and soy methyl esters, which are all compatible with water, to a certain degree will be used. Use of exempt VOCs such as acetone may also be viable. Each of these ingredients is effective in removing unwanted markings in an acceptable amount of time without leaving a significant residue. In the cases where there is residue, consumers are instructed, on the label, to simply rinse the surface with water.

Recent research, conducted by the City of Portland, has shown that non-toxic, VOC alternatives are as effective as commonly used VOC products in removing graffiti from a variety of surfaces, including concrete and stop signs. This study compared a wide range of graffiti removers with different ingredients ranging from dibasic ester-based products, acetone-based products, and glycol ether-based products. In reference to the use of hazardous ingredients, as opposed to non-toxic ingredients, the study, entitled "Graffiti Remover Research and Field Test Report: The Search for Safer Products," concluded that "the effectiveness of the product is not related to the inherent hazard. Many of the less hazardous graffiti removal products perform as well as, or better than, the more hazardous products." (CNAD, 2003)

As described in Chapter IX, Environmental Impacts, staff is proposing that Graffiti Remover products will not be allowed to contain chlorinated solvents. Many alternatives exist that do not use perchloroethylene, methylene chloride, or trichloroethylene. Staff is also proposing that products that are labeled to remove both paint and graffiti are Graffiti Removers.

Issues:

1. **Issue:** The proposed VOC limit for category name may encourage manufacturers to reformulate their products using perchloroethylene or methylene chloride.

Response: As explained in the "Proposed VOC Limit and Compliance" section above, the VOC limit is designed to allow manufacturers to reformulate their products without using perchloroethylene or methylene chloride. Manufacturers are unlikely to add chlorinated compounds to their nonchlorinated formulations because: (1) this would eliminate the benefits of a nonchlorinated product; (2) they can readily reformulate with acetone or other exempt compounds; and (3) the recognition of the potential health effects associated with perchloroethylene and methylene chloride.

2. **Issue:** ARB should develop an MIR strategy for meeting this limit. (CSPA, Florida Chemical Company, Hydrosol)

Response: The proposed mass-based limits are feasible and proposing an MIR strategy would not yield the maximum feasible emission reduction.

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Air Resources Board. 2001 Consumer and Commercial Products Survey. September 24, 2002. (ARB, 2001)

Center for a New American Dream in cooperation with the City of Portland Office of Sustainable Development. Graffiti Remover Research and Field Test Report: The Search for Safer Products. October 2003. (CNAD, 2003)

Florida Chemical Company, Inc. Comments on ARB's Proposals for VOC Standards and Regulatory Changes and Definitions. January 7, 2004. (Florida Chemical Company, 2004)

Hydrosol, Inc. Comments to Initial Staff Proposals for VOC Standards for Changes to the Consumer Products Regulation. February 7, 2004. (Hydrosol, 2004)

H. Hair Styling Product

Product Category Description:

Hair styling products are designed to be applied to wet, damp or dry hair and aid in defining, shaping, lifting, styling and/or sculpting of the hair. Hair styling is the act of manipulating the hair to modify or temporarily alter the hair's shape. A hair styling product is a product that is applied prior to and/or during the styling process to aid in achieving a hair style. A finishing product (hairspray) may then be applied after styling to lock the style in place for a period of time**.** The Hair Styling Product category does not include products meeting the new definition of Hairspray or Hair Mousse. However, the Hair Styling Product category may include some products such as styling sprays and spritzes that previously fell under the original definition of hairspray.

The Hair Styling Product category includes the previously regulated category of hair styling gels. Hair styling gels were regulated under "Phase I" of the consumer products regulation adopted in August 1990, and a description of these products is also included in the staff report for that item (ARB, 1990a). At that time, the Board adopted a 6 percent VOC limit for these products which was effective on January 1, 1994.

The Hair Styling Product category does not include the product form of "foam" since this would be the same as the product category of Hair Mousse in the Consumer Products Regulation. Hair mousses were regulated under "Phase I" of the consumer products regulation (ARB, 1990a). The VOC limit for hair mousses was lowered with the amendments to Consumer Products Regulation adopted in October 1999 (ARB, 1999). At that time, the Board adopted a 6 percent VOC limit for these products which was effective on December 31, 2002. In addition, the description of hair mousse in the staff report described hair mousses as foaming aerosol hair care products (ARB, 1999).

The Consumer Products Regulation will retain the current definition of Hair Mousse and Hair Mousse will be excluded from the Hair Styling Product category.

Although hair mousses are excluded from the Hair Styling Product category there are non-aerosol, pump-actuated, foaming hair styling products currently available in the market. Being non-aerosol products, they do not fit under the hair mousse definition. However, these products would meet the definition of a hair styling product, and would be subject to the proposed 6 percent hair styling product limit, specific to the pump form.

Table VI-15 below summarizes the sales and emissions from hair styling products based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001). As shown in Table VI-15, hair styling products are sold in aerosol, liquid, pump spray, semi-solid and solid forms, with the semi-solid form dominating the market. The product form of foam is not included here since that would be covered under the current definition of hair mousse. Hair styling products have estimated VOC emissions of about 0.66 tons per day (1,316 pounds per day) in California. Care was taken to ensure that there was a clear distinction made between hair styling products and hairspray. Please see Chapter V, Page 6 for a discussion of the process staff used to analyze all hair care products.

Table VI-15
Hair Styling Product*

Product Form	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Liquid	113	3,846	242
Pump Spray and Aerosol***	127	7,228	936
Semi-solid	390	41,024	138
Solid	67	510	2
Total	**697**	**52,608**	**1,318**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for hair styling products was 15%; staff believes the 2001 Survey covered 85% of the market.

******* Values for Aerosol and Pump Spray are combined to protect the confidentiality of the one aerosol product reported in the 2001 Consumer and Commercial Products Survey (ARB, 2001).

Product Use and Marketing:

Hair styling products are available for personal use in the home, and are also used in commercial establishments such as hair styling salons. Hair styling products are sold in discount, department, drug, and grocery stores and are available for

purchase on the Internet. They can also be purchased in hair styling salons and beauty supply stores.

Depending on the hair styling product's form, a hair styling product is applied to the hair prior to styling or during the styling process. A hair styling product is a leave-in product applied to aid in the styling process and is not rinsed from the hair prior to styling.

Product Formulation:

Hair styling product formulations are dependant on the product form, and the type of hold and/or styling capabilities of the product. Due to the wide array of products on the market and uses for each, there is no exact and/or typical formula for the category. Hair styling products may contain a variety of fixatives and/or styling polymers (resins), to provide hold, form films, and/or condition. Besides resins, some products may contain starches, waxes and/or other types of compounds to impart hold or help retain the hairstyle. The majority of products also contain water with other possible ingredients being plasticizers, silicones, lanolin derivatives, various oils and waxes, proteins, plant and/or fruit extracts, fragrance, vitamins, preservatives, pH adjusters, neutralizers, propylene glycol, glycol ethers, and humectants. Aerosol products would also contain a propellant such as HFC-152a or a hydrocarbon propellant such as butane, dimethyl ether, isobutene, isopentane or pentane.

The predominant VOCs in hair styling products are ethanol and fragrance with most products having fragrance levels below the 2 percent exemption level, per the provision specified in the Consumer Products regulation. Ethanol is used in some hairstyling products as a solvent for a resin and/or to decrease product drying time.

The resins used in hair styling products may be either water or alcohol soluble and may be supplied to the manufacturer in either an aqueous or alcohol solution. Currently, aqueous based resins are widely used in hair styling products. Hair gels in particular employ aqueous based resins. Industry representatives state that aqueous based resins are beneficial in hair gel formulations in that they act as a thickener and can increase a product's viscosity. However, we also have been told by manufacturers that there are still products on the market that use alcohol based resins and that there is no acceptable aqueous based resin substitutes available. Industry representatives report there are still performance differences between aqueous and alcohol based resins, and that many of the "high hold" resins continue to be alcohol based. Also, different types of resins can impart a particular appearance to a product and that switching resins could affect product marketability. Another issue for some products that was raised by manufacturers was that currently, it takes more aqueous based resin than alcohol based resin in the product to provide the same degree of hold, which could cause viscosity problems in some products. For many of the products using alcohol based resins, the VOC in the product comes from the amount of alcohol needed to keep the resin in solution, or from the resin solution as it is provided from the supplier prior to

formulating the product. For these products, reducing the VOC would be difficult since an aqueous based resin must be used or the product must be discontinued.

Products that use additional alcohol other than to keep resins in solution use the alcohol for the product to dry quickly on the hair. Alcohol based styling products, like hairspray, deliver styling product to the hair as a mixture of styling product and alcohol. Alcohol based hair styling products are commonly used to finish a hairstyle because they do not rewet the hair and/or they seal off the hair from external moisture and humidity. Hair styling products that make both styling and finishing claims would be considered a hairspray and would be subject to the 55 percent VOC limit to accommodate the necessary alcohol.

Proposed VOC Limit and Compliance:

The proposed VOC limit for hair styling products is 6 percent by weight for aerosols and pump sprays and 2 percent for all other forms, effective December 31, 2006. As shown in Table VI-16, using adjusted 2001 emissions, the proposed limit will result in an estimated emission reduction of 1,032 pounds per day or 0.52 tons per day.

Table VI-16 also shows that 62 percent of the market currently complies with the pump spray proposed 6 percent VOC limit and 93 percent of the market currently complies with the 2 percent all other forms limit. Although there was only one aerosol hairstyling product without finishing claims to report in the 2001 Survey, store shelf surveys show there may be additional aerosol styling products available on the market. A 6 percent VOC limit is proposed for these products in keeping with the current 6% hair mousse limit in the regulation.

Table VI-16
Hair Styling Product Proposal*

Product Form	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Aerosol/ Pump Spray***	6	92	62	736
All Other Forms	2	490	93	296
Total				**1,032**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for hair styling products was 15%; staff believes the 2001 Survey covered 85% of the market.

******* Values for Aerosol and Pump Spray are combined to protect the confidentiality of the one aerosol product reported in the 2001 Consumer and Commercial Products Survey (ARB, 2001).

Based on the 2001 Consumer and Commercial Products Survey. (ARB, 2001) and industry representatives, the recommended standards are feasible within the timeframe proposed in the regulation. The proposed 6 percent aerosol and pump spray and the 2 percent all other form limits should allow enough flexibility to industry to address resin solubility issues and to be able to use all resins currently on the market, including those supplied as an alcohol solution.

Industry representatives state that besides the alcohol needed to keep alcohol based resins in solution, additional alcohol for drying should not be necessary in styling products used on wet or damp hair prior to styling. Many products used on dry hair are combination styling and finishing products and would be subject to the 55 percent hairspray limit. In reviewing products that did contain higher amounts of alcohol, the directions for use and label claims were the same as for products currently on the market that comply with the proposed limits. Currently, 62 percent of the pump spray products and 93 percent of all other forms other than aerosol currently meet the proposed limits. These products contain the same marketing language, directions and claims as the products with higher VOC amounts. Although there was only one aerosol hair styling product reported in the survey, the proposed 6 percent aerosol hairstyling product limit is the same as that for aerosol hair mousses which had an effective date of December 31, 2002. Therefore, we believe this limit is feasible and that technology transferred from hair mousses is a compliance option.

Issues:

1. Issue: A concern exists with the change of "Gel" to "Semi-solid" – it will result in arbitrarily moving products subject to existing standards that have been adopted according to established ARB procedures under new standards without the benefit of appropriate analysis and opportunity to comment. For example, what will be the impact on "hair styling gels", a currently regulated category?

Response: To date, products currently on the market labeled as "Gel" do not fall neatly under the regulatory definition of hair gels as being "a high viscosity, often gelatinous, product". There are products currently on the market labeled as spray gels, liquid gels, gel mousse, gel pomades, etc. with various ranges in viscosity from liquids and pump sprays to semi-solid and solids or the products have creative and/or innovative names that make it more difficult to determine which category and form they may fall into. This also made the current definition of "Hair Styling Gel" difficult to enforce. To address this problem, the current hairstyling product definition was crafted to regulate products by form instead of by name. Therefore, all gels except for spray gels would be regulated as a hairstyling product – all other forms, regardless of the product's name. This is in accordance with previous ARB policies of updating regulatory definitions to reflect current market trends.

2. Issue: Retain the current hair gel definition that is in the existing Consumer Products rule with a new limit of 3 percent from the current VOC by weight limit of 6 percent.

Response: There are many products on the market labeled as “Gels”. It is very difficult to determine if they meet the current definition requirement of “Highly Viscous”. Staff has determined that a more enforceable option would be to regulate by product form instead of by name. In addition, some of the top selling hair gels currently on the market can easily comply with the proposed 2 percent VOC limit. A 2 percent limit is being proposed to allow products the option of continuing to use alcohol based resins where a substitute resin may not available.

3. Issue: Include a new Hair Styling Product category of Hair Volumizers with a VOC limit of 55 percent. Include hair volumizers, hair lifters and root lifters into this new category.

Response: The proposed definition is too vague, confusing and broad to be included. In searching current products in the database, there were products reported under hairspray, mousse, shampoo, conditioner, gel, serum etc. that had volumizing claims on their label or names. Many classes of products could fall under this category which were not meant to be included. In addition, there were products with formulas containing less than 2 percent VOC (after 2% fragrance exemption) that claimed to be volumizing, or to be root or hair lifters. In doing a rough analysis of the data currently in the proposed hair styling category that make volumizing, root lifting or hair lifting claims in their names, approximately 67 percent of the aerosol/pump spray products currently meet the proposed 6 percent VOC limit and 85 percent of all other form products currently meet the proposed 2 percent limit.

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I. Shaving Gel

Product Category Description:

The Shaving Gel category consists of products which dispense a post-foaming semi-solid designed to be used with a blade, cartridge razor, or other shaving system in the removal of facial or other bodily hair. Shaving gels facilitate the shaving of facial and other bodily hair by providing lubricity, while also protecting and moisturizing the skin. Shaving gels are aerosol products by definition, although they differ from typical aerosol products (product and driving propellant are mixed) in that the majority of shaving gels on the market utilize barrier pack (compartmentalized) systems in which the semi-solid (gel) is separated from the driving propellant. The shaving gel category does not include shaving creams, which are currently subject to the Consumer Products Regulation. In contrast to shaving gels that dispense post-foaming semi-solids, the shaving cream concentrate is mixed with the driving propellant and thus is expelled from the container as a foam lather.

Table VI-17 below summarizes the sales and emissions from shaving gels based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001). As indicated, 27 shaving gels were sold in California in 2001, which was by 10 companies. Please note that the actual number of products reported is greater than 27; several companies grouped products with up to 2 percent variation in VOC due to differences in fragrances used. Shaving gel VOC emissions are about 1.03 tons per day (2,060 pounds per day) in California.

Table VI-17
Shaving Gel*

Product Form	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Aerosol	27	26,800	2,060

* Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for shaving gel products was 15%; staff believes the 2001 Survey covered 85% of the market.

Product Use and Marketing:

Shaving gels are used to aid in the removal of facial or other bodily hair. Typically after wetting the skin, the shaving gel is dispensed into the hand, onto the fingertips, or directly to the area to be shaved. The product is then rubbed or massaged over the skin surface. A shaving system such as a razor blade is then used to remove the hair. After hair removal, the remaining product is removed, usually by rinsing with water.

Shaving gels are sold in a variety of retail outlets including grocery stores; drug stores; beauty supply stores; discount stores; and department stores. Shaving gels are also available for purchase over the Internet. The most common shaving gel product size is 7 weight ounces, although some companies offer smaller (i.e. travel size) and larger sizes.

Product Formulation and Packaging:

The VOC content of products in this category ranges from 2.7 to 13.3 percent by weight, with a sales weighted average of 7.7 percent by weight. Shaving gels employ compartmentalized packaging systems, most commonly the bag-in-can and piston-type barrier-pack systems, in which the blowing agents (also called post-foaming agents) and driving propellants are contained in separate chambers or compartments (SanGiovanni). The VOC content of shaving gels is attributable to these two propellants.

Blowing agents are a component of the shaving gel concentrate and provide the post-foaming effect of shaving gels. Once the gel is dispensed and spread, the blowing agent changes from an initial liquid phase to a gas phase, which causes the product to foam. The gel concentrate is located either inside an inner container or bag (in the case of bag-in-can barrier pack systems), or located in the can above the piston (in the case of piston-type barrier pack systems). Shaving gel blowing agents reported for the 2001 Survey include pentane, isopentane, and isobutane, with the most common being isopentane/isobutane blends. No products were reported in the 2001 Survey that used blowing agents other than hydrocarbon VOCs.

Driving propellants are used to expel shaving gels from the container. Shaving gel driving propellants differ from standard aerosol propellants in that they are physically separated from the gel product, rather than being mixed with the product as typical aerosols. Driving propellants are contained outside of the bag in bag-in-can systems, or below the piston in piston-type barrier pack systems. Shaving gel driving propellants reported for the 2001 Survey include compressed air, butane, isobutane, and propane, with the most common being isobutane and propane/isobutane blends.

The balance of shaving gel ingredients includes emollients such as stearic and palmitic acid; surfactants such as triethanolamine and polyethylene glycols; thickeners such as cocamide DEA, hydroxyethylcellulose, and PVP (Polyvinylpyrrolidone); preservatives such as methyl and propyl paraben; moisturizers such as aloe vera gel; and neutralizers such as triethanolamine. Water is the solvent used for shaving gels. In addition, most shaving gels also contain fragrance and colorants.

As previously mentioned, shaving gels employ compartmentalized packaging technologies, in which the blowing agents and driving propellants are contained in separate chambers or compartments. The development of compartmentalized aerosol packaging technologies (barrier-pack systems) has advanced greatly since the first barrier packs were developed in the 1950s and 1960s (Johnsen, October 2001). In addition to providing a method for separating driving propellants from product concentrates, additional benefits of barrier packs include use in any orientation (many conventional aerosols lose propellant when inverted), and being quiet during use (don't produce the typical hiss associated with aerosols) (SanGiovanni). Today there are numerous material and packaging options for shaving gel manufacturers using barrier packs including various can types and sizes, bags/pouches/inner containers, piston materials, actuators/valve systems, and use with both liquefied and compressed gas/air propellants.

Concerning bag-in-can technologies specifically, there are generally two types. In the first, the bag or pouch is attached to the can at the can curl, and in the second, the bag is attached to the valve (referred to as "bag-on-valve" technology). In the first type, the product is injected into the open bag/pouch prior to valve attachment, then the bag is hermetically sealed during the crimping process. The driving propellant (typically hydrocarbon) is then injected through a hole in the bottom of the can. This type of system can be immediately identified by the presence of a bottom plug (grommet) which is used to contain the propellant (Johnsen, February 2002) (SanGiovanni). In the second type of system in which the bag is attached to the valve, an under-the-cap gasser is used to add the driving propellant (typically nitrogen or compressed air) before the crimp is made. The gel is forced into the bag, via the valve, and the exo-space gas is compressed. Bottom plugs/grommets are absent with this system (Johnsen, October 2001).

Piston-type barrier-pack systems consist of a can, open at the bottom, into which a piston is inserted. The bottom, which is perforated with a central hole, is then seamed on. Product filling takes place through the valve opening prior to insertion of the valve.

Because the can bottom has a hole, when the piston is displaced by the product upon filling, any air below the piston is expelled. After the valve is attached, the package is bottom-gassed with propellant and the bottom hole plugged with a grommet (SanGiovanni).

An additional packaging technology has been available and used for several years by various consumer products companies, including shaving gel manufacturers. The ATMOS system made by Exxel Container, Inc. utilizes a self-pressurized dispensing system, without the use of a driving propellant. The ATMOS system consists of a plastic bottle that is inserted into a rubber tube (sleeve). When the product is filled into the bottle, the rubber sleeve expands. The sleeve's natural tendency to return to original size provides the propelling power for the system. The system is available in sizes typically used for shaving gels, and in addition to being absent of a driving propellant, the ATMOS system utilizes plastic containers which are beneficial in wet-shaving environments (Exxel). Because no driving propellant is used in the ATMOS system, it is a low-VOC technology.

Proposed VOC Limit and Compliance:

As shown in Table VI-18 below, we are proposing a two-tiered VOC limit for shaving gels. The proposed Tier 1 VOC limit is 7 percent by weight, effective December 31, 2006. The proposed Tier 2 VOC limit is 4 percent by weight, effective December 31, 2009. Using adjusted 2001 emissions, the proposed limits will result in an estimated emission reduction of 226 pounds per day or 0.113 tons per day for Tier 1, and 762 pounds per day or 0.381 tons per day for Tier 2.

Table VI-18
Shaving Gel Proposal*

	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emission Reductions (lbs/day)**
Tier I	7	15	34	226
Tier II	4	1	< 0.1	762

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for shaving gel products was 15%; staff believes the 2001 Survey covered 85% of the market.

As shown in Table VI-36, at the time of the 2001 Survey over a third of the market complied with the proposed Tier I limit of 7 percent by weight. Most of these products comply by using slightly lower amounts of hydrocarbon propellants. Also shown in the table, at the time of the 2001 Survey a very low percentage of the market complied with the proposed Tier II limit of 4 percent by weight. However, one product did comply and as described in subsequent paragraphs, we are aware of several other Tier II compliant products that have appeared on the shaving gel market since the 2001

Survey was performed. For both limits, we believe manufacturers will be able to comply by using the same ingredients and packaging technologies as are used today.

Although we believe the Tier II limit is technically feasible in the nearer term, we recognize that for some manufacturers, significant changes to the manufacturing process will be necessary. Therefore we are proposing to provide additional time to comply with the Tier II limit. In recognition of the reformulation and production challenges, staff is committing to conduct a technical review in advance of the Tier II effective date.

Compliance with the proposed limits will likely focus on reducing levels of the VOC propellants (blowing agents and driving propellants) used in shaving gels. Other options include use of compressed gas or compressed air driving propellants, use of VOC/non-VOC propellant blends, use of self-pressurized containers that eliminate the need for driving propellants, or a combination of these options.

Reduction in Hydrocarbon Driving Propellants and Blowing Agents

In the 2001 Survey, a wide range of driving propellant and blowing agent weight percentages were reported. The range for driving propellants reported was 0-10 percent by weight. The range for blowing agents reported was 2-5 percent by weight. Shaving gel patents for several companies support this blowing agent range, listing the preferred level of blowing agent in post-foaming shaving gel concentrates to be 2-5 percent (Procter & Gamble, Pfizer, S. C. Johnson, Gillette). In order to comply with the proposed standards, some manufacturers may only need to reduce the amount of driving propellant and/or blowing agent used.

Shaving gel manufacturers indicated that one reason for use of higher levels of driving propellant was to account for propellant leakage through the bottom plug/grommet. We are also aware of driving propellant bag permeation issues specific to some bag-in-can systems. In cases such as these, additional overfill of driving propellant is used to ensure there is enough propellant to empty the container. In order to comply with the proposed standard, some manufacturers may choose to reduce overfill of driving propellants through use of alternative grommet styles that minimize leakage, or even through elimination of the grommet all together by using top-filling, bag-in-can technologies.

Compressed Gas/Compressed Air Driving Propellants

According to the Survey, compressed gases, as well as hydrocarbons, are currently employed as driving propellants in shaving gel barrier-pack systems. Bag-in-can and piston-type barrier packs may be used with non-VOC driving propellants, such as compressed air or nitrogen (Johnsen, Oct 2001). Several companies (see partial list below) manufacture bag-in-can barrier pack systems which are designed for use with compressed gas and compressed air driving propellants (Spray).

Some companies that provide compressed gas and/or compressed air bag-in-can systems for shaving gels:

EP Spray System
Lindal Group
Lechner, USA Ltd.
CCL Industries, Inc.
Aerosol-Service AG (ASM)

EP Spray System has representatives in Europe, USA/Canada and Asia, and supply a bag-in-can, valve/actuator system for use with compressed air or nitrogen driving propellants (EP, internet). Lindal Group is one of the main suppliers for the Nivea compressed air shaving gel, supplying a bag-on-valve system and the shaving gel actuator to Beiersdorf AG (Lindal). Lechner, USA Ltd. developed a unique "sprayed-in" bag or pouch that works very well with compressed gases (Johnsen, January 2002). CCL Industries Inc. also produces a bag-in-can system and states that discharge rates using nitrogen propellants are satisfactory for many applications, especially high-viscosity products such as gels. In addition, CCL states that use of Nitrogen minimizes flammability and VOC concerns (CCL). Aerosol-Service AG manufacturers their own bag-on-valve system for use with compressed air, and fills products for several other companies that utilize compressed air, bag-on-valve systems (ASM). In addition, there are several European bag-in-can systems in which pressurization with either nitrogen or compressed air is preferred (Johnsen, October 2001). In general, we are also aware that the bag-on-valve system, using compressed air, is well known and accepted in Europe (ASM).

Concerning piston systems specifically, piston technologies are quite developed and there are over 30 different pistons and designs available, in at least four can diameters, using at least three plastics (Johnsen, October 2001). Taller pistons are available for taller cans where the preferred propellant is nitrogen or compressed air (Johnsen, November 2001).

Manufacturers have expressed concerns that using compressed gases as driving propellants results in a pressure drop in the barrier pack over the life of the shaving gel. However, it has been reported that the pressure drop can be minimized by using oversized valve body and stems (Johnsen, February 2002), and by using actuators to control the flow and volume of the dispensed shaving gel, which helps compensate for the pressure drop associated with the systems (EP, conversation). Also to offset the pressure drop, for piston-type systems, expanding the percentage of the can capacity consigned to the exo-space can be done by increasing piston height, or by using a smaller piston-type can. For the bag-in-can options, there may be some flexibility in bag capacities, or the can may be made longer (Johnsen, January 2002). One manufacturer indicated that even though there is a pressure difference as the compressed air shaving gels are dispensed (also occurs in hydrocarbon-driven shaving gels to a lesser extent), because the product is dispensed in such a small amount per use, they do not consider this a consumer-distinguished trait (EP, conversation).

Blends of Driving Propellants

Manufacturers may want to investigate the use of various driving propellant blends, including hydrocarbon/HFC-152a blends. The addition of the non-VOC propellant HFC-152a to the driving propellant system alone, or more likely as a blend, may provide the decrease in VOC levels necessary for compliance.

Self-pressurized Containers

Several shaving gels have been and are currently available on the market that use the self-pressurized dispensing ATMOS system from Exxel Container, Inc. No driving propellant is required to dispense the product (Exxel). Companies that choose to use the ATMOS system or other self-pressurized systems would be able to reserve the VOC in their product for the blowing agent portion of their product.

Issues:

1. Issue: Because driving propellants are not mixed with the gel concentrate itself, and not expelled from the can during consumer use, the VOCs attributable to driving propellants should not be included in the total VOC content of shaving gels.

Response: As clarified in ARB's Enforcement Division Advisory Number 300, for compartmentalized aerosol products like shaving gels, the total weight of VOC for a product includes the VOC contained in the driving propellant (ARB Advisory 300). For both the 1997 and 2001 ARB Consumer and Commercial Product Surveys, several companies did not at first report driving propellants due to the misconception that because driving propellants are not mixed with the gel product itself, they are, therefore, not part of the reportable formula. For both the 1997 and 2001 Surveys, the companies were asked by ARB staff to submit complete formulation data, and the survey data were updated accordingly.

2. Issue: There is not total evacuation with compressed air and nitrogen systems.

Response: There are bag-in-can barrier packs available today using compressed air and nitrogen that yield over 98 percent evacuation rate, which is comparable to shaving gels using hydrocarbon driving propellants (EP, conversation). With any barrier pack system, there will be residue left in the container.

3. Issue: Special cans will be required when non-VOC propellants are used.

Response: Staff has information that suggests this may not be true. For example the EP Spray System fits standard aerosol cans, either aluminum or tin plate, with a 1" opening. No special inner coating is required. The system can be filled with traditional aerosol filling equipment such as: Pamasol, KP-Aerofill, Terco, Coster, with only minor adaptation to the filling heads (EP, filling).

4. **Issue:** The cost will be too high to convert our piston filling lines to bag-in-can systems in order to use compressed air for a driving propellant.

Response: Staff agrees that converting from a piston system to a bag-in-can system would be costly, although information suggests that piston-systems are able to be used with compressed gases. Recognizing the challenge, however, staff is proposing to provide additional time to comply with the Tier II limit (December 31, 2009) to give manufacturers time to find the most cost effective means to comply.

5. **Issue:** The cost of the ATMOS system is too high.

Response: The Manufacturer of the ATMOS system has indicated that when purchasing in larger quantities, the cost of using ATMOS systems is comparable to standard bag-in-can systems (Exxel).

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J. Toilet/Urinal Care Product and Solid/Gel Room Air Freshener

This section provides information on two proposals that are related, one for the proposed category of "Toilet/Urinal Care Product," and another for revising an existing category, "Air Fresheners - Solid/Gel." This Section focuses primarily on the VOC benefits that would be realized as a result of the “Health Risk and Needs Assessment for Prohibiting the Use of Para-dichlorobenzene (PDCB) in Solid Air Fresheners and Toilet/Urinal Care Products Used in Toilet/Urinal Care Products and Solid/Gel Room Air Fresheners.” For a more detailed discussion of the toxics considerations of the proposal, the reader is referred to Chapter VII, Health Risk and Needs Assessment for the Airborne Toxic Control Measure for Para-dichlorobenzene Solid Air Fresheners and Toilet/Urinal Care Products.

Background

In 1991, the ARB in their Phase I Consumer Products Regulation established a VOC limit for the solid/gel air freshener category. Toilet/urinal deodorizing products

(that are not primarily considered as cleaners) were included within the definition of "air freshener," and were required to meet the 3 percent VOC by weight limit. The exception to this is that the Regulation specifically exempted products containing at least 98 percent para-dichlorobenzene (PDCB), and products comprised entirely of fragrance. At the time staff determined that PDCB toilet blocks filled a unique niche with very few viable competing products. This exemption was granted with the intention of following the health effects evidence in the future as well as the use trends in the category and the availability of non-toxic or non-carcinogenic alternatives.

Product Category Descriptions:

Toilet/Urinal Care Products

“Toilet/Urinal Care Products,” as proposed, are products designed specifically to deodorize, clean, or both deodorize and clean, toilet bowls, toilet tanks, and/or urinals. The category would also include products used for portable toilets and urinals at temporary sites, including recreational motor homes, boats, and aircraft, etc.

Cleaning products for dedicated toilet/urinal use are not currently regulated. The existing category, "Bathroom and Tile Cleaner," applies to products for cleaning tile or surfaces in bathrooms, but not to products specifically designed to clean toilet bowls, toilet tanks, or urinals. The proposed new category for "Toilet/Urinal Care Product" will include these toilet/urinal cleaning products.

Solid/Gel Room Air Fresheners

Room air fresheners are designed to mask odors, or to freshen, clean, scent, or deodorize the air in a bathroom, kitchen, or other space. Currently, solid/gel room "air fresheners" are subject to the 3 percent by weight VOC standard, except for products meeting the exemption for products containing at least 98 percent para-dichlorobenzene, and products comprised entirely of fragrance. The current proposal would eliminate the para-dichlorobenzene exemption contained in section 94510(g). Effectively, this proposal would prohibit the sale of para-dichlorobenzene room "air fresheners," because we are not aware that these products can meet the 3 percent VOC standard for solids and gels. However, to ensure that there is no unnecessary exposure to PDCB emissions, we are proposing a specific prohibition on the use of PDCB in both Air Fresheners and Toilet/Urinal Care Products to ensure that no PDCB can be used. See Chapter VII for a discussion of the ATCM.

However, since the exemption was put in place, in recognition that no alternatives existed, today we find that the market has changed substantially, and many competing products now not only deodorize but also clean. These products are popular with consumers, despite their somewhat higher average price, as discussed below regarding product use and marketing. We also note that from ARB 2001 survey data, no 100 percent fragrance air fresheners were reported for toilet or urinal use. In

addition, no 100 percent solid air fresheners were reported in the 1997 Consumer Products Survey.

Because of the variety of products available today and because of similar uses, under the staff's proposal, we would realign the solid/gel air fresheners for use in toilets and urinals, and including them in the newly proposed category of "toilet/urinal care products."

The remaining information is presented in three parts, first, data and information on Toilet/Urinal Care Products will be presented, followed by information on Solid/Gel Air Fresheners. These descriptions will be followed by a discussion of the combined emission reduction benefits from the staff's proposal.

TOILET/URINAL CARE PRODUCTS

Sales and Emissions

Table VI-19 below summarizes the sales and emissions from the category "Toilet/Urinal Care Products," based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001b). As shown in Table VI-19, VOC emissions from "Toilet/Urinal Care Products" were about 2.66 tons per day (tpd) (5,318 pounds per day) in California. Included within this total are PDCB products which contributed estimated VOC emissions of 2.48 tpd (4,964 lb/day), approximately 93 percent of the category emissions.

Table VI-19
Toilet/Urinal Care Product*

Product Form	Number of Products/Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
All	266	56,578	5,318

* Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001b)

** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for toilet/urinal care products was 10%; staff believes the 2001 Survey covered 90% of the market.

Toilet/Urinal Care Products

Toilet/Urinal Care Products function in several ways. Some products are mounted in or connected to the bathroom fixtures and work automatically, while others are designed for periodic manual application to the fixtures. Some are cleaners that provide deodorizing benefits, while others are solely deodorizers with no cleaning function. Products are marketed in solid/gel, liquid, and to a very limited extent, aerosol, and pump spray forms.

"Blocks"

For use as automatic deodorizers and deodorizer/cleaners, Toilet/Urinal Care Products are mainly marketed in solid (block) form. Solid products used to mask restroom odors are packaged in a variety of ways. Blocks are available in both PDCB and non-PDCB formulations. These blocks are also available enclosed in a rubber or plastic screen.

PDCB and non-PDCB solid products are used interchangeably to primarily mask unpleasant odors in restrooms. PDCB blocks have been used worldwide for decades, and find use in all manner of restroom facilities including schools, offices, homes, outhouses and even aircraft lavatories.

PDCB is the main ingredient in many of the deodorizing blocks for toilet bowls and urinals. They provide a characteristic aroma that serves to mask unpleasant bathroom odors, but provide no cleaning function. A typical urinal block is simply placed in the urinal basin, where it sublimes and provides a masking odor. Subliming refers to a process where a substance converts directly from a solid to a gas phase, without going through a liquid phase. Screens are sometimes used to encase the block to minimize splash, trap debris that may clog drains, and may themselves be impregnated with fragrance. In fact, fragrance-impregnated screens without a block are sold as competitors to urinal blocks.

Toilet bowl deodorizers, as opposed to urinal deodorizers, are sold in a rim hanger cage. As with urinal deodorizers, solid toilet rim hanging deodorants come in PDCB and non-PDCB formulations.

Non-PDCB blocks generally provide some cleaning capability as well as masking odors. These products have gained substantial marketshare over the last decade, and are frequently advertised as environmentally friendly. Retailers frequently market both PDCB and non-PDCB blocks side by side. Sometimes products are dye color-coded to easily distinguish between the two. Red is typically the color-code for PDCB products, and blue typically for non-PDCB products. Marketers also refer to products as "para" and "non-para."

Non-PDCB toilet/urinal blocks are increasingly being viewed as more environmentally friendly than their PDCB competitors. As detailed in Chapter VII, PDCB is a potential human carcinogen, and as, such, the ARB is enacting an ATCM to prohibit the use of PDCB in toilet/urinal care products and air fresheners.

The ARB is not acting alone to prohibit use of PDCB. The City of Seattle prohibits the use of PDCB blocks in city owned and leased buildings, and purchases non-PDCB blocks as well as other "environmentally friendly" cleaning agents to protect their janitorial workers (Seattle 2004). Retailers advertise these products as "non-toxic," and "biodegradeable," while also touting their cleaning attributes such as removal of

hard water scale, uric acid and mineral deposits, and "keeps drain clean." (Central Stores, 2004).

Addressing health concerns regarding the use of PDCB in air fresheners, the New York State Assembly is presently considering approval of bill A09485, which bans the use of PDCB in restrooms accessible to the public. A retail janitorial supplier in New York reported that while five years ago PDCB blocks were the only urinal deodorizers sold, where now these blocks account for only about 20 percent of their sales (NY Post, 2003).

The City of Santa Monica has followed a similar path as New York and Seattle. Investigating complaints regarding odor in a public restroom, city staff concluded that PDCB toilet blocks are not effective in reducing odor. They felt the best solution was the use of enzyme cleaners paired with frequent, proper cleaning, especially for restrooms in high pedestrian traffic areas. Besides general odor complaints, the City received complaints specifically regarding the odor from the PDCB toilet blocks.

Moreover, California Proposition 65 requires that PDCB blocks sold for use in California confirm the warning: "This product contains a chemical that is known by the State of California to cause cancer." Online marketers frequently if not usually advertise both the PDCB blocks and non-PDCB blocks side by side, with both getting fairly equal advertisement space and clearly competing with each other.

The PDCB blocks generally cost less than their non-PDCB counterparts, as little as half as much, but substantial overlap in price was seen, especially when the blocks were sold contained within a urinal screen. A review of online retailers reveal a typical PDCB 12 pack of four ounce blocks, each which will last for 30 days, with prices in the $5 to $8 range. Comparable prices for the non-PDCB block, albeit with screen included, average $17 for a 12 pack with each individual block also lasting for about 30 days.

Rim hanging blocks showed similar prices differentials, with a PDCB 12 pack selling for about $9 and a non-PDCB 12 pack selling for about $18. The price for non-PDCB blocks, though, is not always higher, with some manufacturers selling PDCB blocks saturated with an alternate fragrance such as cherry and contained within a screen in the $20 range for a 12 pack. Enzyme-containing non-PDCB blocks tend to be the most expensive, with prices running in the $25 range for a 12 pack.
(Total Office Supply, 2004, Twin Supply, 2004, Keysan, 2004, CJMS, 2004, Business Supply, 2004, Shoplet, 2004).

“Other Products”

Another type of automatic product is used inside the toilet's water tank. These products are generally placed on the bottom right side of the tank (away from the water valve mechanisms generally at the left), and provide cleaning chemicals and other ingredients as flush water travels from the tank to the bowl below. Most of the "in-toilet-

tank" products are sold as solids. Liquid products use bottle dispensers that are hung to the tank. Though different, "in-toilet-tank" products may be viewed as indirect alternatives to the block products used in toilet bowls. Products that clean inherently provide deodorizing benefits.

The main type of manual product is the familiar plastic squeeze bottle containing liquid cleaner. The product is dispensed by inverting the bottle, so the bottle tip can access and dispense liquid (or thick liquid) to underneath the toilet bowl rim and to other bowl areas to be cleaned. The liquid may be left with the contents of the bowl for several minutes. A manual brush, small mop, or other device is then used to scrub the bowl. The last step is to drain the contents of the bowl by flushing the toilet. For urinals, manual products are used in a similar way. Although very different, the manual cleaning products may be viewed as indirect alternatives to the block products. Products that clean inherently provide deodorizing benefits.

Miscellaneous products include sophisticated automatic dispensing systems used in high-traffic public or commercial restrooms, and products for portable toilets and urinals. The automatic dispensing systems may include an external container and liquid-product delivery tube, either to the bowl of the toilet or urinal, or into plumbing that provides flush water. The most advanced systems use infra-red sensors for "touchless" automatic flushing and product dispensing, as toilet/urinal users depart. Automatic flushing devices help alleviate odors from the fixtures caused by otherwise "no-flush" users. (Jolicoeur, 1999).

Products for portable toilets and urinals are sold in concentrated liquid form. The products are added to and diluted by water in the holding tank, to the recommended dilution ratio.

Toilet/urinal care products are available at stores for general consumers and for janitorial supplies.

Product Formulation:

Automatic Products -- In-Toilet-Bowl and In-Urinal

PDCB products are traditionally comprised of over 98 percent PDCB. Small amounts of colorant and other fragrances are frequently added, making up the remaining one to two percent. PDCB dominated the market in this category for years. PDCB is a subliming solid at room temperature (converts directly from a solid to a gas phase, without going through a liquid phase). It is easily packaged into cakes, and sublimes with a characteristic sweet odor such that a four ounce block will typically last about 30 days. It is nearly insoluble in water, which prevents it from rapidly dissolving in the waste stream. However, we have determined that approximately 20 percent of the mass of PDCB toilet blocks has a waste water fate, and is found in influent levels at Publicly Owned Treatment Works (see Chapter VII, section 4). The compound is the product, so little money is required to formulate or manufacture the blocks.

The alternative, non-PDCB toilet/urinal blocks require additional formulation while their PDCB counterparts do not. This in part explains their higher cost. A typical non-PDCB block is a mixture of an inorganic surfactant/salt, i.e. sodium sulfate, borax, along with a gelling agent such as high molecular weight polyethylene glycol to mix with the inorganic and form a block. These high molecular weight hydrophilic compounds are slow to dissolve, so bowl residence time is about the same for both PDCB and non-PDCB blocks. Into this matrix, both non-ionic and ionic surfactants may be added to provide cleaning. In this capacity, cleaning is synergistic with odor combating, since residues that build up in the basins are responsible for much of the malodors. Fragrances are also added, as are dyes to provide pleasing counter-aromas and color.

These competing products, being surfactant/gel based, have much lower emissions and yet these products fulfill the same deodorizing function. A four ounce non-paradichlorobenezene toilet block is also advertised to similarly last about 30 days, but along with providing a masking aroma, also adds cleaning ability.

More advanced cleaning and odor-fighting ability may be added to non-PDCB blocks by adding enzymes that break down residues, or live bacterial suspensions that actively do the same. These products tend to be more expensive than simpler formulations.

The "in-toilet-bowl" products also include several liquid products. These typically include a small liquid container/dispensing unit and a hanger. The products are mounted on the toilet bowl rim the same way the blocks are used. For automatic cleaning and deodorizing, liquid product is gradually dispensed into the bowl, based on water flow from the flushing action.

Automatic Products -- In-Toilet-Tank

Typical ingredients used include surfactants, sodium sulfate, baking soda, carbamide, bleach, dye, and fragrance. The majority of in-toilet-tank products are low-VOC (2.1 percent VOC sales-weighted-average) and generally comply with the proposed 3 percent VOC standard for non-aerosol products. Products needing reformulation have the option of reducing the level of fragrance.

Manual Products

The manual products are generally cleaners with low levels of fragrance. Hydrogen chloride is a common active ingredient. Some products are formulated as disinfectants with quaternary ammonium compounds. The vast majority of non-aerosol manual products are low VOC (0.04 percent VOC sales-weighted-average) and generally comply with the proposed 3 percent VOC standard for non-aerosol products. The very few products needing formulation have the options of reducing VOC ingredients, such as alcohol, glycol ether, or fragrance, or converting to a formulation similar to the complying products.

Other Products

The external dispenser products contain ingredients to counteract odor causing substances in toilets and urinals, and are generally low-VOC (1.1 percent VOC sales-weighted-average). Most products already comply with the proposed 3 percent VOC standard for non-aerosol products, but a limited number of products would need to reformulate. Reformulation options include decreasing the use of alcohol, glycol ethers, or fragrance, or converting to a formulation similar to one of the complying products.

The concentrate liquid products for portable toilets use various ingredients to counteract odor. Some use biologically active ingredients (friendly bacteria, enzymes). Alcohol is used to a limited extent. Some products contain fragrance. The strength of the fragrance may be varied by the dilution ratio. When diluted, the products generally comply with the proposed VOC standard of 3 percent for non-aerosol products.

Proposed VOC Limit and Compliance:

Toilet/Urinal Care Product

The proposed VOC standards for "toilet/urinal care products" are 10 percent by weight for "aerosol" products, and 3 percent by weight for "non-aerosol" products. The proposed effective date is December 31, 2006. As shown in Table VI-20, using adjusted 2001 emissions, the proposed standards for "toilet/urinal care products" will result in an estimated emission reduction of 4,951 pounds per day or 2.48 tons per day.

Table VI-20
Toilet/Urinal Care Product Proposal *

Product Form	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Aerosol	10	Protected Data	Protected Data	Protected Data
Non-Aerosol	3	202	88	4,951

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001b)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for toilet/urinal care products was 10%; staff believes the 2001 Survey covered 90% of the market.

Compliance with the proposal will not be difficult. Numerous non-PDCB Toilet/Urinal Care Products are already available and well accepted by consumers. In fact, survey data show that 88 percent of the market already complies with the proposed 3 percent limit for non-aerosol forms of Toilet/Urinal Care Products. Non-complying toilet/urinal will need to follow the alternative non-PDCB formulation strategies described above under Product Formulations. Aerosol products are in compliance with the proposed limit of 10 percent VOC by weight.

SOLID/GEL ROOM AIR FRESHENERS

Sales and Emissions

The 2001 Survey did not cover the entirety of the solid air freshener category. Emissions from solid/gel air fresheners not used in toilet/urinal care were not included. Thus to estimate VOC emissions, staff used the following data: the 1990 U.S. EPA Survey (U.S. EPA Report to Congress); the 1997 Consumer and Commercial Products Survey; the 2001 Consumer and Commercial Products Survey; and the Chemical Market Reporter, 1999. By estimating VOC emissions based on these data, staff is able to quantify the ancillary VOC reduction benefit resulting from the proposal to prohibit use of PDCB in air fresheners.

A. 1990 U.S.EPA Consumer and Commercial Products Survey

Data from the 1990 U.S. EPA survey showed total California emissions of solid air fresheners containing PDCB at 3.0 tpd, as shown below.

Non-Toilet/Urinal Solid Air Freshener PBD Emissions	0.5 tpd
Toilet/Urinal Deodorant Block PDCB Emissions	2.3 tpd
Market Coverage Estimate	90 percent
1990 Total Estimated California Solid Air Freshener PDCB	**3.0 tpd**

B. 1997 ARB Consumer and Commercial Products Survey

Although market coverage was low, the 1997 ARB survey showed emissions of 1.9 tpd for solid air fresheners containing PDCB (see below).

Solid Air Freshener PDCB Emissions	**1.9** tpd
Solid Air Freshener Total Emissions	2.6 tpd

(poor market coverage in this category)

C. 2001 ARB Consumer and Commercial Products Survey

Our 2001 ARB survey covered a portion of the solid air fresheners containing PDCB market that were included in toilet/urinal care product emissions. Total Toilet/Urinal Care Products PDCB Emissions were 2.5 tpd.

D. Manufacturing estimates presented in the *Chemical Market Reporter, 1999*.

These survey data are supplemented by the *Chemical Market Reporter, 1999*. In this journal room deodorants represented 25 percent of the use of all PDCB manufactured. Total U.S. demand for PDCB in 1999 was 93 million pounds. Correcting for import/export using ratios from 2000 (7.4 million imported, 27.1 million exported, ITA, 2001), PDCB use for room air fresheners in California is 3.1 tons per day for 1999.

As shown above, approximately 0.6 tons per day of PDCB was used for non-toilet air freshening using 3.1 tpd of total emissions (Chemical Market Reporter) and 2.5 tpd from the 2001 Survey, and assuming fairly stable market. This ratio, 0.6/3.1, for current non-toilet PDCB use is consistent with the ratio shown from the 1990 U.S. EPA data of 0.5/3.0.

Staff concludes based on the foregoing, that VOC emissions from PDCB-based solid/gel air fresheners not used in toilet/urinal care, are 0.6 tpd.

Product Use and Marketing:

Although the size, shape, and mounting methods may differ, the current PDCB room "air fresheners" used as space deodorizers are otherwise very similar to the PDCB toilet/urinal blocks, with essentially the same chemical composition. The PDCB room "air fresheners" include blocks mounted on walls and blocks placed at counters. The PDCB products compete with traditional room air fresheners such as metered dose products, gels, fragrance pearls and potpourri. Some of the non-PDCB products are used in essentially the same way as the PDCB products. Solid/gel room air fresheners are available at stores for general consumers and for janitorial supplies.

Product Formulation

As previously discussed, the PDCB room "air fresheners" are formulated essentially the same as the PDCB blocks for toilets and urinals. PDCB products are traditionally comprised of over 98 percent PDCB. Small amounts of colorant and other fragrances are frequently added, making up the remaining one to two percent.

The non-PDCB "air fresheners" are not affected by the proposal, other than being viewed as potential alternative products with considerably lower VOC emissions.

Proposal and Compliance for Solid/Gel Room Air Fresheners

Staff is proposing to remove two previously provided exemptions contained in the Regulation. The first provision described in section 94510(g), exempted air fresheners containing at least 98 percent PDCB from compliance with the VOC limit contained in section 94509(a). The second provision, section 94510(f), excluded air fresheners comprised entirely of fragrance and/or compounds not defined as VOCs from compliance with the VOC limits, as well.

Removal of these exemptions, and specifically prohibiting the use of PDCB in air fresheners (through the ATCM, see Chapter VII) or as a fragrance, would eliminate PDCB air fresheners from the California market. The market will need to use non-PDCB products that meet the current VOC limit of 3 percent by weight. As detailed above, as a result of the proposed ATCM, staff estimates a VOC emission reduction benefit from solid air fresheners (not used in toilets and urinals), would be about 0.57 tons per day.

Compliance Methods

Numerous non-PDCB room Air Fresheners have been complying with a 3 percent by weight limit since January 1, 1993. Thus, the only solid/gel Air Fresheners that would not comply are those comprised of PDCB. Because the proposed ATCM will prohibit use of air fresheners containing PDCB, these products will be replaced by other non PDCB air fresheners.

EFFECT OF COMBINED PROPOSALS

In this chapter we have described the ancillary VOC emission reduction benefits that would be achieved from implementation of the proposed ATCM for PDCB. In addition to the predicted reduction in excess cancers (9 excess chances per million persons) that would be achieved through adoption of the proposed ATCM, the ATCM will also result in VOC reductions from the toilet/urinal care products of about 2.7 tpd, about 2.3 tpd of which are PDCB and 0.4 tpd of other VOCs. A further VOC reduction of about 0.4 tons per day would be achieved from the solid/gel room air fresheners, all of which is PDCB. In total, a VOC reduction of about 3.1 tpd would be achieved, 2.7 tpd of which would be PDCB.

Issues:

1. Issue: Some manufacturers of PDCB toilet blocks argue that given the low reactivity of PDCB, replacement fragrances from the non-PDCB products may actually form more ground level ozone given their higher reactivity. Thus, while generating an environmental benefit by reducing direct human exposure to PDCB, ARB is worsening the ozone problem and should not be claiming VOC reduction benefits.

Response: See discussion in Chapter IX, section D.

2. Issue: The amount of fragrance provided by PDCB air fresheners can not be matched by alternative products, resulting in ineffective odor masking.

Response: The ARB is claiming reductions of 0.4 tpd from the non-toilet/urinal air fresheners. We justify this claim based on the VOC content of competing products as well as the very high odor threshold of para-dichlorobenzene. The odor threshold for para-dichlorobenzene is about 90 mg/m3. Common indoor air fresheners such as limonene has an odor threshold of 0.01 – 0.05 mg/m3. Terpenes such as a-pinene, the fragrance of pine, has an odor threshold of 0.84 mg/m3. Aldehyde, active moieties on many fragrant compounds, frequently have odor potencies less than 1 mg/m3. In other words, common fragrances are potent at significantly lower atmospheric concentrations. For this reason, a 5 percent VOC (fragrance exemption applied) non-PDCB air freshener can compete directly with a PDCB product in terms of odor masking ability. We expect the PDCB eliminated from air fresheners to be replaced by more reactive fragrances, but used at significantly lower atmospheric concentrations, leading to net ozone reductions.

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K. Wood Cleaner

Product Category Description:

Wood Cleaners are specialty cleaning products designed and labeled exclusively to clean wooden materials including but not limited to decking, fences, flooring, logs, cabinetry, and furniture. Non-aerosol products are usually designated for either indoor or outdoor use while the aerosols are primarily used indoors. Wood Cleaners do not "clean and polish" or leave any protective finish on the surface. Products with these attributes are already regulated as "Furniture Maintenance Products." In fact, home-use products are often designed to remove waxy buildup due to repeated furniture polishing. Wood Cleaner products also do not include dusting aids, which are also regulated as a separate category. Wood Cleaners are mainly found in liquid form but can also be purchased as an aerosol or solid.

Table VI-21 below summarizes the sales and emissions from Wood Cleaners based on the results of the ARB's 2001 Consumer and Commercial Products Survey (ARB, 2001). As shown in Table VI-21, Wood Cleaners are sold in both the aerosol and non-aerosol forms, with the non-aerosols dominating the market, with over 92 percent of the reported sales. Wood Cleaners have an estimated VOC emission of about 0.279 tons per day (558 pounds per day) in California.

Table VI-21
Wood Cleaner*

Product Form	Number of Products/ Product Groups	Category Sales (lbs/day)	Adjusted VOC Emissions (lbs/day)**
Aerosol	4	424	106
Non-aerosol	40	5,014	452
Total	**44**	**5,438**	**558**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)
****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for wood cleaner products was 10%; staff believes the 2001 Survey covered 90% of the market.

The aerosol products in this category had a sales-weighted average VOC (SWA-VOC) content of 25.7 percent, by weight, with a SWA-MIR (Maximum Incremental Reactivity) value of 0.29 tons ozone per ton product. The Ozone Forming Potential (OFP) of these aerosols was 22.3 tons ozone per year. The non-aerosols had an SWA-VOC of 9.1 percent, an SWA-MIR of 0.165 tons ozone per ton product, and an OFP of 151.4 tons ozone per year.

Product Use and Marketing:

The wood cleaner category consists of aerosol and non-aerosol cleaning products that are designed for cleaning surfaces made of wood. Non-aerosol products are most commonly used on floors, patios, and decks while aerosol products are used on all surfaces made of wood, usually furniture and cabinetry.

Non-aerosol wood cleaners are designed for use on either exterior or interior surfaces. The product is normally diluted, applied to a soiled surface and allowed to set for a few minutes. The surface is then cleaned off with a cloth, mop, abrasive sponge, or rinsed off and allowed to dry. The use of a cloth or abrasive sponge normally depends on the severity of the soil to be removed. Non-aerosol deck washes are added with a mechanical sprayer or water hose, allowed to set, then rinsed off. (Procter, 2003) Aerosol wood cleaners are used similarly but appear to be tailored to indoor use.

Wood Cleaners are sold to household consumers, commercial, and industrial establishments in both aerosol and non-aerosol forms. Non-aerosol products can be found at janitorial, convenience stores, warehouse, supermarkets, and hardware stores. Aerosol products are likely to be found at supermarkets and convenience stores.

Product Formulation:

Non-aerosol wood cleaners are primarily near zero water-based formulations. A typical formulation includes water with a small amount of an exempt and/or an inorganic compound. Various glycol ethers are also used. Solvent-based non-aerosol

formulations normally consist of hydrocarbon solvent and exempt compounds. Aerosol wood cleaners consisted mainly of mineral spirits, hydrocarbon propellant, and sometimes water. (Survey, 2001)

Proposed VOC Limit and Compliance:

The proposed VOC limit for Wood Cleaner is 17 percent by weight (aerosol) and 4 percent by weight (non-aerosol), effective December 31, 2006. As shown in Table VI-22, using adjusted 2001 emissions, the proposed limit will result in an estimated emission reduction of 458 pounds per day or 0.23 tons per day.

Table VI-21also shows that 90 percent of the market currently complies with the proposed 4 percent VOC limit. This category is dominated by deck washes and similar exterior wood surface cleaners. Because these products are near zero, if not zero VOC, there is a high complying marketshare at any limit. However, products to be used indoors have a higher VOC content and need to have a small amount of VOC to be effective. (Procter, 2004) It is also important to note that the mechanical force of the spray when using a sprayer or water hose aids in the effectiveness of some of these outdoor use products. There are no complying aerosol products.

Table VI-22
Wood Cleaner Proposal*

Product Form	Proposed VOC Limit (wt. %)	Complying Products/ Product Groups	Complying Market Share (%)	Emissions Reductions (lbs/day)**
Aerosol	17	0	0	34
Liquid	4	32	90	424
Total				**458**

***** Based on 2001 Consumer and Commercial Products Survey. (ARB, 2001)

****** Survey emissions adjusted for complete market coverage (see Chapter IV, Emissions). The market coverage adjustment for wood cleaner products was 10%; staff believes the 2001 Survey covered 90% of the market.

The proposed 17 percent VOC limit for aerosol, and 4 percent VOC limit for non-aerosol are designed to make the Regulation consistent with previously regulated categories. The aerosol limit for this category is consistent to that of the Furniture Maintenance Product, which contains similar products while the non-aerosol limit is consistent to that of a General Purpose Cleaner.

Reformulation options that can be used by manufacturers to meet the proposed limit include the use of water, LVP-VOC hydrocarbon solvents, glycol ethers, as well as dibasic esters. Each of these alternatives provides the solvency necessary to allow for substitution, since dry time is not an issue. Because the product is normally wiped with some form of cloth or sponge or rinsed with water after usage, slow evaporation and slight residue should not be an issue in this category. Reformulating to the proposed

limits is technically feasible. The majority of the products in this category are already water-based, and there are many viable non-VOC alternatives available for substitution.

Issues: There were so significant issues with this category.

REFERENCES

Air Resources Board. 2001 Consumer and Commercial Products Survey. September 24, 2002. (ARB, 2001)

Procter & Gamble. ARB presentation. February 11, 2004 (Procter, 2004)

Procter & Gamble. Product Label. August 20, 2003 (Procter, 2003)

SC Johnson. Product Label. August 20, 2003 (SC Johnson, 2003)