

IX.

ENVIRONMENTAL IMPACTS

A. SUMMARY OF ENVIRONMENTAL IMPACTS

In this rulemaking, staff is proposing to amend the Consumer Products Regulation (Regulation) by establishing volatile organic compound (VOC) limits for 15 categories of consumer products. The intent of these proposed amendments is to protect the public's health by reducing their exposure to ground level ozone. Other amendments, designed to clarify various aspects of the Regulation, are also proposed. Minor amendments to the Antiperspirants and Deodorants Regulation, and the Aerosol Coating Products Regulation are also proposed. Amendments to Air Resources Board (ARB) Method 310, which is used to determine compliance with VOC limits, are also proposed.

Staff is also proposing measures to reduce the amounts of Toxic Air Contaminants (TACs) used in seven categories, including the previously regulated category of General Purpose Degreasers.

Finally, within this rulemaking staff is proposing an Airborne Toxic Control Measure (ATCM) which would prohibit the use of the TAC Para-dichlorobenzene (PDCB) in solid air fresheners and toilet/urinal care products.

As part of this rulemaking ARB staff has investigated the potential environmental impacts of the proposed amendments to the Consumer Products Regulation, the Antiperspirant and Deodorant Regulation, the Aerosol Coatings Regulation, ARB Method 310, and the proposed ATCM. Overall, staff has determined that the proposed amendments would have a positive environmental impact by reducing the amount of ground level ozone formed from consumer product VOC emissions. A VOC emission reduction of about 6.0 tons per day (tpd) is expected beginning December 31, 2006. By December 31, 2009, emission reduction benefits grow to 6.8 tpd. In 2010, the reduction equates to about 6.9 tpd statewide, and a 2.9 tpd reduction in the South Coast Air Quality Management District (SCAQMD). These ozone precursor reductions include the ancillary VOC reductions achieved by eliminating the use of PDCB, a VOC, in air fresheners and toilet and urinal care products. Reductions in particulate matter (secondary organic aerosols) are also expected.

Another environmental benefit of the proposal is elimination of emissions of the TACs Para-dichlorobenzene (PDCB), perchloroethylene (Perc), methylene chloride (MeCl), and trichloroethylene (TCE) in the categories containing these compounds. In total, based on the 2001 Survey data, we expect to eliminate over one million pounds (510 tons) per year of Perc, MeCl, and TCE emissions. In 2006 this reduction would become 559 tons per year. As a consequence of proposing an ATCM prohibiting the use of PDCB in solid toilet/urinal care products, and solid air fresheners, an emission reduction of about 2.4 million pounds (1,219 tons) per year of this TAC, would be

achieved in 2006. In total, toxic emission would be reduced by 1,778 tons per year in 2006. As explained in further detail below, many alternative effective products already exist in each of these categories.

However, due to the staff's proposal to prohibit the use of Perc, MeCl, and TCE, there could be a slight increase in VOC emissions in Gasket or Thread Locking Adhesive Removers, because it is expected that manufacturers will replace their chlorinated solvent content with VOC ingredients. In the case of the proposed ATCM for PDCB, no VOC emission increases are expected.

ARB staff has also determined that no significant adverse environmental impacts should occur as a result of the proposed amendments relating to establishing VOC limits. Staff does estimate that there may be a slight increase, though not significant, in emissions of global warming compounds. We will also monitor this potential impact through future surveys.

Staff has also determined that the proposals designed to clarify other aspects of the Regulation, including changes to the "Most Restrictive Limit" provision, "Code Dating," Notification of Sell-Through, and changes to the "Reporting Requirements," will not result in any adverse environmental impacts. In fact, a positive environmental impact may result because the proposed revisions are designed to ensure that emission reductions committed to in this rulemaking, as well as previous rulemakings, are fully realized.

Minor changes are proposed to ARB Method 310, and the test methods sections in the Consumer Products, Antiperspirants and Deodorants, and Aerosol Coating Products Regulation. These changes would have no adverse environmental impact because only technical changes are proposed that will not affect the environment. A further amendment of the Antiperspirant and Deodorant Regulation would modify the definition of "Deodorant." No adverse impacts are expected due to modifying the definition. Chapter V of this report contains a complete description of these proposals.

Staff has conducted a qualitative health risk assessment that concludes that because VOCs are ozone precursors, public health is further protected by reducing VOC emissions. Staff has also determined that hundreds of potential excess cancer cases would be avoided by prohibiting the use of chlorinated solvent TACs. A detailed health impacts analysis regarding the benefits of prohibiting the use of the potential human carcinogen PDCB is included in Chapter VII of this report.

B. LEGAL REQUIREMENTS APPLICABLE TO THE ANALYSIS

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential adverse environmental impacts of proposed regulations. Because the ARB's program involving the adoption of regulations has been certified by the Secretary of Resources (see Public Resources Code section 21080.5), the CEQA environmental analysis requirements are allowed to be included in the ARB

Initial Statement of Reasons in lieu of preparing an environmental impact report or negative declaration. In addition, the ARB will respond in writing to all significant environmental points raised by the public during the public review period or at the Board hearing. These responses will be contained in the Final Statement of Reasons for the proposed amendments to the Regulation.

Public Resources Code section 21159 requires that the environmental impact analysis conducted by ARB include the following: (1) an analysis of the reasonably foreseeable environmental impacts of the methods of compliance; (2) an analysis of reasonably foreseeable feasible mitigation measures; and, (3) an analysis of reasonably foreseeable alternative means of compliance with the Regulation.

Our analysis of the reasonably foreseeable environmental impacts of the methods of compliance is presented in subsections C through J below. Regarding reasonably foreseeable mitigation measures, CEQA requires an agency to identify and adopt feasible mitigation measures that would minimize any significant adverse environmental impacts described in the environmental analysis.

C. ALTERNATIVE MEANS OF COMPLIANCE

Two alternative means of compliance with the Regulation have been developed. A current compliance alternative for manufacturers of consumer products is the Alternative Control Plan (ACP). The ACP Regulation, title 17, California Code of Regulations, sections 94540-94555, is a voluntary emissions averaging program. Under the ACP, an overall limit on the VOC content of emissions from each individual product in the ACP is determined. To be approved, an ACP must demonstrate that the total VOC emissions within the ACP would not exceed the emissions that would have resulted had the products been formulated to meet the VOC limit established for each product category. In other words, some products in the ACP could exceed the established VOC limits in the Regulation as long as those increased emissions were offset by additional products that over-comply with the established VOC limits. The ACP provides manufacturers with flexibility, but preserves the overall environmental benefits of emission reductions.

Another compliance alternative that is available for manufacturers is the Innovative Products Provision specified in title 17, California Code of Regulations, section 94511. This provision allows a manufacturer to formulate products that exceed the mass-based limit specified in the Regulation for a particular product category. The manufacturer must demonstrate that, through some characteristic of the higher VOC product, its use will result in less VOC emissions compared to a representative complying product. This alternative is also specifically designed to allow manufacturers flexibility, while preserving the emission benefits of the Regulation.

Absent use of either of these alternatives, the staff is not aware of any additional compliance means, other than direct compliance with the proposed VOC limits and proposed prohibition of the use of Perc, MeCl, and TCE in specified categories. Staff is

not aware of alternative means of compliance with the proposed ATCM for PDCB. However, we note that many alternative complying products already exist.

D. AIR QUALITY ENVIRONMENTAL IMPACTS

1. Ground level Ozone

The primary intent of the proposed amendments to the Regulation is to reduce the formation of tropospheric, or ground-level ozone by reducing VOC emissions from 15 categories of consumer products. Enhanced ground level ozone formation involves the interaction between VOCs and oxides of nitrogen (NO_x) in the presence of sunlight. For a more complete description concerning ground level ozone and health impacts related to elevated ozone concentrations, the reader is referred to Chapter IV of this report.

Reducing ozone precursor emissions, namely VOCs, would result in a positive environmental impact by lowering the concentrations of ground level ozone in the atmosphere. The proposed amendments are designed to reduce VOC emissions by 6.0 tpd, effective December 31, 2006, with reductions increasing to about 6.8 tpd by December 31, 2009. The categories proposed for regulation and the corresponding VOC emission reductions are shown in Table IX-1 below.

**Table IX-1
Proposed VOC Limits and Reductions by Product Category**

Product Category	Product Form	Proposed VOC Limit (wt%)	VOC Emission Reductions (TPD)¹
Adhesive Removers :			
Gasket or Thread Locking Adhesive Remover	All	50	-0.011 ²
Floor or Wall Covering Adhesive Remover	All	5	0.630
General Purpose Adhesive Remover	All	20	0.258
Specialty Adhesive Remover	All	70	0.138
Air Freshener ³	--	--	0.624
Anti-Static Product	Aerosol	80	0.057 (12/31/08)
	Non-aerosol	11	0.000
Contact Adhesive:			
Contact Adhesive - General Purpose	All	55	0.003
Contact Adhesive - Special Purpose	All	80	0.000 ⁴
Electrical Cleaner	All	45	0.070
Electronic Cleaner	All	75	0.049
Fabric Refresher	Aerosol	15	0.221
	Non-aerosol	6	0.220
Footwear or Leather Care Product	Aerosol	75	0.008
	Solid	55	0.039
	All Other Forms	15	0.060
Graffiti Remover	Aerosol	50	0.014
	Non-aerosol	30	0.071
Hair Styling Product	Aerosol,	6	0.404
	Pump Spray		
	All Other Forms	2	0.163
Shaving Gel	All	7	0.124
		4	0.435 (12/31/09)
Toilet/Urinal Care Product	Aerosol	10	PD ⁵
	Non-aerosol	3	2.709
Wood Cleaner	Aerosol	17	0.019
	Non-aerosol	4	0.232
Total Reductions by 2006			6.05
Total Reductions by 2008			6.28
Total Reductions by 2009			6.81

- 1 Survey emissions adjusted for market coverage as discussed in Volume II, Chapter IV; reduction on the effective date of limits which is December 31, 2006, except where otherwise noted.
- 2 VOC emission increase as result of prohibition on use of certain specified TACs.
- 3 Currently a regulated category; with elimination of the exemption for 98% para-dichlorobenzene products, additional reductions will be achieved from replacement with lower VOC air fresheners.
- 4 No reductions; Contact Adhesive was separated into two subcategories and the existing 80% VOC limit was retained for this subcategory.
- 5 PD = Protected Data; reductions omitted to protect manufacturers' confidential information.

Total emissions from these categories in 2001 were about 8.7 tpd, and would grow to 9.5 tpd in 2006, without controls. Therefore, the staff's proposal represents about a 65 percent reduction in emissions when all limits become effective in 2009.

Staff has also evaluated the potential for VOC emission increases resulting from other proposals within this rulemaking, namely the ATCM for PDCB and the elimination of Perc, MeCl, and TCE. The phaseout of a stratospheric ozone depleting compound is also assessed. Staff has found that some of these proposals may lead to a slight increase in VOC emissions, although any increases would likely be negligible. Because these proposals relate to elimination of TACs, staff believes that the small potential increase in VOC emissions is outweighed by the reduction in these potentially carcinogenic TACs. Our analyses follow.

a. Proposed Prohibition on Use of Perc, MeCl, and TCE

Staff is proposing to prohibit the use of Perc, MeCl, and TCE, in seven categories. Six are previously unregulated categories and include Adhesive Removers, Contact Adhesives, Electrical Cleaners, Electronic Cleaners, Footwear or Leather Care Product, and Graffiti Removers. Accounting for growth to 2006, these six categories, for which VOC limits are being proposed, would emit approximately 1.52 tpd of these three chlorinated solvents in California. Emissions of Perc and MeCl, in 2006, would comprise 1.28 tpd of the total of 1.52 tpd. Some products meet the proposed VOC limits because of the use of Perc and MeCl, which are VOC-exempt solvents. However, as these products are reformulated to remove these TACs, likely replacements would be VOC ingredients. This means that the VOC content of these products would increase, but only up to the proposed limit. Any VOC emission increase in these products would erode the overall VOC emission reduction from the category. We have evaluated this impact on overall VOC emission reductions from the categories after applying the proposed limits.

If Perc and MeCl would continue to be allowed for use, VOC emission reductions from all six categories would be 1.37 tpd in 2006. The effect of prohibiting the use of MeCl and Perc changes the overall VOC reduction from these six categories to 1.34 tpd, a difference of 0.03 tpd. Staff concludes this change is minimal and that reducing Perc and MeCl emissions by 1.28 tpd in these six categories offsets the small change in VOC reductions.

As for General Purpose Degreasers, a previously regulated category, a VOC limit of 4 percent by weight will become effective on December 31, 2004. Staff has found that VOC reductions would change by less than 0.06 pound per day, or less than 22 pounds per year, a negligible change.

Note that TCE is a VOC so as products are reformulated to remove it, no change in expected VOC reductions will occur, even if all TCE is replaced with other VOC ingredients.

In determining that we would achieve an additional reduction of 0.03 tpd if Perc, MeCl, and TCE were not prohibited, we have assumed a worse case scenario where all of the currently used chlorinated solvent is replaced with VOCs. Staff notes however, that there are several viable reformulation options, including use of exempt VOCs such as acetone, such that there could be little to no change in overall VOC reductions. We believe the small amount of VOC reduction lost due to prohibiting the use of these TACs outweighs the adverse impact from continued TAC use.

b. Effect of Phase-out of Hydrochlorofluorocarbon (HCFC)-141b

Another issue that may further erode the benefit of the proposed VOC limits would be the phaseout of the use of hydrochlorofluorocarbon (HCFC)-141b, under the Montreal Protocol. This compound is used extensively in Electronic and Electrical Cleaners. Production of this stratospheric ozone depleting compound has already ceased, with only the use of existing stocks allowed. However, once this option for cleaning of electronic and electrical equipment is no longer available, VOC alternatives may be used. If all HCFC-141b were to be replaced by VOCs, the VOC emission reduction benefit would be reduced by 0.22 tpd. This potential increase is not reflected in the emission reductions expected for Electrical and Electronic Cleaners because existing stores of HCFC-141b could last for a number of years. If, over the next several years, suitable non-VOC replacements are found, the impact may be lessened.

c. Proposed ATCM for PDCB

Staff has evaluated whether, as a result of prohibiting the use of PDCB in toilet/urinal blocks and air fresheners, there would be an increase in ground level ozone concentrations or VOC emissions due to use of alternative products. Staff has determined that there would be no potential adverse impact and, to the contrary finds that there would be some air quality improvement, from prohibiting the use of PDCB. Not only would emissions of a potential carcinogen be eliminated, but there would be a small reduction in ground level ozone concentrations. Our analysis follows.

1. Increased Ozone Formation

Based on the published maximum incremental value (MIR), (see title 17, CCR, section 94700), staff agrees that PDCB is a fairly low reactive VOC compound, meaning it has a low potential to react to form ozone. However, we note that it has not qualified for exemption from the VOC definition at either the Federal or State level. Thus, PDCB is a VOC. Para-dichlorobenzene in the atmosphere will photochemically react to lead to formation of ozone. While we agree that fragrances other than PDCB are usually more reactive, we disagree that we will see an increase in ozone concentrations due to the proposed ATCM.

First of all, before we step through our analysis, it should be noted that photochemical reactivity information, namely MIR values, for most fragrance components is not available. Thus, our analysis, due to lack of data, can only focus on

fragrance components where reactivity information is available. This fact does not diminish our analysis because important, typical fragrance components, those that provide pine and citrus scents, have been studied for their impact on ozone production (Carter, 2000). These terpene compounds provide the basis for our comparison of ozone forming ability of alternative products with that of PDCB products.

Secondly, it should be noted, that even though reactivity data are available for a number of compounds (over 700 VOCs), such that MIR values can be estimated, some MIR values are “uncertain” because their atmospheric reaction chemistry is not well understood. Such is the case for PDCB. According to Dr. William Carter, developer of the MIR scale used by ARB in regulatory applications, no photochemical data are available for this compound. The MIR value of 0.2 g O³/g VOC is based only on a parameterized estimate (ARB, 2003c; Carter, 2004).

Because of the uncertainty of the MIR value for PDCB, Dr. Carter recommends that the published MIR value be adjusted for regulatory applications (see Appendix F, within ARB, 2000c). The ARB staff, in recognition of Dr. Carter’s recommendations, developed a protocol to adjust MIR values based on uncertainty. In the case of PDCB, ARB staff, in regulatory applications, would adjust the published MIR value upward to help ensure an air quality benefit, if the compound were to be used. As documented in the Aerosol Coatings Regulation amendments in 2000, VOCs in Dr. Carter’s uncertainty bins 5 and 6, which would include PDCB, would be doubled (see Chapter IV, part 5). Thus, from a regulatory standpoint staff would consider the reactivity of PDCB to be 0.4 g O³/g VOC (ARB, 2000c). In this scenario, obviously the calculated ozone formation potential of PDCB would be greater.

Moreover, in instances where the chemistry of a compound is highly uncertain, calculating the “upper limit” MIR value may be more appropriate. The “upper limit” MIR is a mathematical calculation to determine the absolute maximum potential of a compound to form ozone. The procedure for the calculation is described in Appendix E of the Amendments to the Aerosol Coatings Regulation, May 5, 2000 (ARB, 2000c). Following this procedure the calculated “upper limit” MIR value for PDCB, would be 1.11 g O³/g VOC. Based on the foregoing, to put it simply, PDCB could react to form over five times more ozone than would be assumed using the published MIR value.

While it is uncertain whether there would indeed be more ground level ozone formed from emissions of PDCB, than the published MIR value would indicate, it is important to note that one should not rely on the published MIR value, in the case of PDCB, to accurately predict the ozone formation potential of this compound. On the other hand, we can more reliably predict the ozone forming ability of the common terpene fragrances because the atmospheric reactions of pine oil and limonene have been better characterized. We note that Dr. Carter does not recommend adjustment of the MIR value for these compounds to address uncertainty (Carter, 2000).

Aside from whether the MIR value for PDCB accurately reflects its ozone forming potential, let us assume, a PDCB toilet block is replaced by a non-PDCB product

containing pine oil. We believe this same analysis would be applicable to solid air fresheners, as well. A typical PDCB toilet block may be 100 percent PDCB, or may contain 1-2 percent additional fragrance, with the balance being PDCB. Using the published MIR value for PDCB of 0.20 g O³/g VOC, and considering the product as 100 percent PDCB, the product-weighted MIR (PWMIR) would also be 0.20 g O³/g product. If we consider the 1-2 percent fragrance and assume it is a highly reactive compound, the PWMIR for the PDCB product would be even higher.

However, for the purposes of our analysis we used the conservative assumptions that, 1) the MIR value for PDCB is the published value of 0.2 g O³/g VOC; 2) the toilet block is composed of 100 percent PDCB (no additional fragrance component); and 3) the VOC in alternative products is all fragrance (the most reactive component). Using the MIR value for alpha pinene (the primary component in pine oil) of 4.29 g O³/g VOC for the ingredient, and the published MIR value of PDCB, we find that pine oil, is 21 times more reactive than PDCB.

"Alternative products" include both solid and liquid units that are either hung on toilet bowl rims, placed at the drain of urinals, or hung on a wall. The Consumer Products Regulation, for determining compliance with VOC standards based on weight, does not count the weight of the fragrance, up to 2 percent, for determining compliance. However, for reactivity comparisons, let us assume we do not apply the exemption. While the vast majority of the "alternative replacement" products already comply with the proposed 3 percent VOC limit for non-aerosol toilet/urinal care products, several products will need to be reformulated. This means those few products needing to reformulate to comply with a 3 percent VOC limit would contain at the most 5 percent VOC (including fragrance).

Adjusting the 2001 survey data to bring all alternative products into compliance by adjusting their total VOC content to 5 percent, yields an overall sales-weighted average VOC content for alternative products of 2.81 percent by weight, including fragrance. Assuming the typical "alternative product" would contain all of the 2.81 percent VOC as pine oil, the PWMIR for the "alternative product" would be 0.12 g O³/g product or approximately one-half of the PWMIR for the PDCB product.

Therefore, staff concludes that prohibiting PDCB in toilet and urinal care products and air fresheners would result not only in a VOC reduction benefit but also an ozone benefit. While the difference between a 0.20 PWMIR and a 0.12 PWMIR seems small, when you consider the large amount of PDCB emissions--over 3.3 tons per day (1,219 tons)--the amount of ozone production could be reduced by over 97 tons per year in 2006 by prohibiting its use.

If we did not make the assumption that all of the VOC content of alternatives was fragrance, there would be an even greater ozone reduction benefit. The 2001 survey data show that other non-fragrance VOCs in alternative products is about 1 percent by weight. Assuming the 1 percent is ethanol, a common VOC, and assuming the balance

of the product is pine oil, the PWMIR of alternatives would be 0.1 g O³/g product. In this case, ozone production would be reduced by over 120 tons per year.

2. Increased VOC Emissions

Some comments were received claiming that “alternative products” for PDCB products would result in increased VOC emissions. Other comments claim that alternative toilet blocks or room air fresheners do not last as long and that more frequent refill requirements will lead to increased emissions from the alternative products, negating the gain of their lower VOC content.

In addressing these comments, it is important to keep in mind that PDCB is a potential human carcinogen. The alternatives are not. Any implications of increased VOC emissions from alternative products, either because they do not last as long, or that they have higher VOC emissions, would have to be balanced by the overall health benefit of reducing the public’s exposure to the TAC PDCB. However, staff has found neither of these claims regarding VOC emission increases to be true.

To address these comments, increased VOC emissions from using alternative products could result from: 1) users switching from solid products to other product forms that contain more VOCs, such as aerosols, or 2) switching to products that do not last as long. These two possibilities are linked in that the alternative switched to, even if higher in VOC content, would have to not last as long for the comments to be true. The following paragraphs explain why there would not be an emissions increase.

For a variety of reasons, most notably similar cost and convenience, the most likely scenario is that most users of PDCB products would switch to alternative products of the same product form, namely solids. Solid alternative products are readily available, and the marketshare held by these alternatives suggest they are effective, such that current users of PDCB products would not likely increase their cost by buying more expensive products. Solid air fresheners for both toilet/urinal use and air freshening have been meeting a VOC limit of 3 percent by weight since 1993. A pound of PDCB product (100 percent VOC) produces a pound of VOC. On the other hand a, pound of alternative solid air freshener yields 0.03 pound of VOC. Thus, for there to be an increase in VOC emissions, alternative solid products would have to be replaced more than once daily over the course of a month (0.03 pound X 30 days = 0.9 pound VOC) to produce a pound of VOC and effect an increase in VOC emissions.

Although not likely due to increased product and maintenance costs, even if some PDCB solid air fresheners are replaced by aerosol air fresheners, we still conclude that VOC emissions would be reduced as a result of the prohibition. An aerosol replacement would likely be a metered-dose single phase product. This type of product is considerably more expensive than a solid air freshening product and requires equipment to dispense the product. We found the cost of dispensing systems to be between \$50 and \$70, and a 12 ounce can of air freshener, claiming to be a month’s supply, to cost between \$5-\$7. Assuming that the cost of PDCB air fresheners is similar

to PDCB toilet blocks, and that 12 ounces of PDCB product provides the same deodorizing capability of the 12 ounce aerosol product, the cost of the PDCB product would be about \$2. Thus to switch from a solid product to an aerosol product would about triple the cost for product alone (not counting dispensing equipment). Consumers are not likely to triple their costs when alternative solid products are readily available at similar cost.

However, for completeness, the VOC limit for single phase aerosols is the highest among air fresheners (excluding disinfecting products) at 30 percent by weight. Thus, users would have to replace the aerosol product over three times a month to result in equivalent VOC emissions as those from the PDCB product (a 12 ounce can of single phase aerosol would yield about 0.23 pound of VOC compared to PDCB in which 12 ounces emits 0.75 pound of VOC). As discussed below, alternative products are marketed to last the same amount of time as PDCB products.

We have not found the claim that alternative air fresheners or toilet/urinal blocks do not last as long as PDCB products to be true, based upon our market research. Our review of hundreds of retailers marketing either room air fresheners or toilet/urinal blocks, found that a 30 day product life advertisement was universal. The typical 4 ounce PDCB toilet/urinal block is advertised to last about 30 days. The same retailers also typically market the competing, non-PDCB products, which are also said to last about 30 days. This was not seen with just a few marketers of these products, but with every retailer. We feel it is very unlikely that retailers would consistently market these products in this way if the claims were not founded, especially because it is the same retailers selling both PDCB and alternative products.

In addition to the toilet/urinal blocks, many air freshener products are advertised to last approximately one month. Refill canisters for metered dose air fresheners, and the non-PDCB solid and gel air fresheners intended for general room use typically advertise a 30 day product life. While specific use conditions, such as a hot, dry environment, may cause a product to evaporate more quickly, these products are intended for indoor use, where climatic conditions tend to be very stable. We have no reason to believe that manufacturer claims for alternative products are inaccurate. In summary, we disagree that the competing products are not likely to last as long as their PDCB counterparts.

Based on the foregoing staff finds the claims that VOC emissions will increase, either because alternatives contain more VOCs, or do not last as long, as PDCB products, to be groundless. Moreover, staff notes that when the limit of 3 percent was first adopted for solid air fresheners, direct replacements for PDCB toilet/urinal care products did not exist, thus, exemption was appropriate. However, today, with many replacements available, continuing the exemption for PDCB products, which are 100 percent by weight VOC, compared to alternatives at 3 percent VOC, is now an unnecessary source of excess VOC emissions amounting to over 3.3 tpd.

2. Impact on Particulate Matter (Secondary Organic Aerosols)

Overall, our analysis found that the proposed rulemaking would not likely have a significant environmental impact on formation of particulate matter (PM), i.e. secondary organic aerosols (SOA). However, as detailed below, in the absence of SOA formation data for certain ingredients, and the uncertainty associated with the reformulation approaches manufacturers will pursue, it is difficult to determine definitively the full impacts that the implementation of the proposed amendments would have on ambient PM concentrations. Hence, we will continue to monitor implementation of the Regulation and reassess the impacts as more data become available. For completeness, staff has analyzed potential reformulation options and how SOA may be impacted.

Fine PM is prevalent in the urban atmosphere (see, for example, Pandis *et al.*, 1992), and ambient PM, especially those with aerodynamic diameters less than two and a half micrometers ($PM_{2.5}$) is known to have negative impacts on human health (Schwartz *et al.*, 1996; Moolgavkar and Luebeck, 1996). Like ozone, PM can be formed via atmospheric oxidation of organic compounds (Finlayson-Pitts and Pitts, 2000). Significant advances have been made in the theoretical and the experimental studies of the formation of secondary organic aerosols (SOA) (Pankow, 1994a, 1994b; Odum *et al.*, 1996; Seinfeld and Pandis, 1998; Harner and Bildeman, 1998; Kleindienst, *et al.*, 1999; Yu *et al.*, 1999). In addition, modeling techniques to determine the amount of ozone as well as the amount of aerosol formed from a VOC have been established (Bowman *et al.*, 1994), and the concept similar to maximum incremental reactivity is being applied to quantitatively assess the aerosol formation potential of a VOC (i.e. incremental aerosol reactivity) (Griffin *et al.*, 1999). Further information on SOA is found in Chapter IV.

Based on the results of these studies, we now know that there is a mechanistic linkage between the ozone formation and SOA formation of a VOC. Because of this relationship, the proposed amendments may also affect the SOA formation potential of consumer products. The analysis of the impact on SOA formation resulting from implementing the proposed VOC limits is detailed below.

Although most organic compounds contribute to ozone formation, SOA is usually formed from photooxidation of organic compounds with carbon numbers equal to seven or more (Grosjean and Seinfeld, 1989; Wang *et al.*, 1992). It has also been shown that aromatic compounds are more likely to participate in the formation of SOA than are alkanes (Grosjean, 1992; Pandis *et al.*, 1992). In other words, only chemicals which react fast enough in the atmosphere will generate sufficient amounts of low volatility products for forming aerosols. In general terms, the potential to form SOA among commonly used classes of VOCs used in consumer products could be described by the following order, with the lower molecular weight alkanes and ketones being least likely:

Least Likely	Lower molecular weight alkanes & ketones (7 carbons or less) Higher molecular weight alkanes
More Likely	Higher molecular weight aromatics (polysubstituted benzenes) Lower molecular weight aromatics (C7 & C8 compounds)

The analysis of the potential impact on PM formation assumes that to meet the proposed limits, in 2006 terms, will require substituting 5.7 tpd of non-VOC ingredients or exempt VOC for 5.7 tpd VOCs. To meet the proposed limits, manufacturers generally have five reformulation options: use of exempt VOCs, such as acetone or methyl acetate; use of LVP-VOC solvents; use of water; increasing 'solids' content; or use of non-VOC propellants. While reducing overall VOC content to comply, some manufacturers may opt to use smaller amounts of 'stronger' VOCs to maintain the product's attributes. It is difficult to predict which reformulation path or combination of paths will be taken by manufacturers. However, substitution for VOCs with water, higher solids content, or non-VOC propellants would likely result in a small reduction in SOA formation. The most likely exempt VOC solvents to be used to comply, acetone and methyl acetate, both having three carbon atoms, have little potential to contribute to SOA formation. Indeed, it has been predicted that there would be no SOA yield from acetone (Pandis *et al.*, 1992). Hence, use of these compounds could also result in a reduction in SOA.

To the extent manufacturers may reduce overall VOC content but formulate with stronger solvents could result in increased SOA formation. This is because the commonly used stronger solvents are aromatic compounds, such as xylenes and toluene, that are known to have higher SOA potentials than other commonly used VOCs. On the other hand, if product reformulation involves the substitution of an aromatic by a non-aromatic species, the SOA formation potential of the product is likely to be reduced. If VOC aromatics are replaced with LVP-VOC aromatic compounds, a decrease in SOA potential should also occur. However, substitution of LVP-VOC alkane or aromatic compounds for smaller low molecular weight alkanes could result in a slight SOA increase (Grosjean, 1992).

Because we can not fully predict how manufacturers would choose to reformulate, we can not fully evaluate the potential for increased SOA formation. However, it is likely to be only a slight potential for increase, if any, due to the variety of reformulation options available. Additionally, any reformulations that result in increased SOA would likely be offset by reformulations resulting in lower SOA. We will continue to monitor implementation of the Regulation and reassess the impacts as more data become available.

Other proposals within this rulemaking to prohibit TACs should have no or negligible impacts on SOA formation because replacements for these TACs (alkanes or exempt compounds) are not known to have strong SOA formation potentials.

3. Impact On Global Warming

Global warming is the process whereby emissions of anthropogenic pollutants, together with other naturally-occurring gases, absorb infrared radiation in the atmosphere, leading to increases in the overall average global temperature. Compounds of concern in global warming include carbon dioxide (CO₂), methane, water vapor, nitrous oxide, fluorocarbons, VOCs, and ozone. In this rulemaking, the compounds of concern are VOCs, ozone, CO₂, and hydrofluorocarbons, such as hydrofluorocarbon (HFC)-152a and HFC-134a. Each is discussed below.

The Global Warming Potential (GWP) of a substance is a measure of the extra amount of heat that is trapped in the atmosphere when one kilogram of the substance is released instantaneously into it, relative to the case when one kilogram carbon dioxide is released. GWPs are calculated using computer models which incorporate the radiative heat balance of the atmosphere and the chemical kinetics of all the substances involved. The model is initially in a steady state. If a kilogram of a greenhouse gas is released, the temperature will increase until a new steady state is established. If a substance stayed in the atmosphere indefinitely, the new steady state would be permanent and the increase in temperature could be used as a measure of the GWP. However, organic compounds are removed from the atmosphere by various processes including photochemical reactions and wet and dry deposition. In time, the concentration of the emitted substance will decline to zero and the initial state will be restored. Consequently, a simple temperature increase cannot be used as a measure of GWP because it depends on the atmospheric persistence of the compound.

The GWP of a compound includes a direct effect and an indirect effect. As mentioned earlier, the direct effect is the warming due to the absorption of radiation by molecules of the compound in question. The indirect effect is due to the impact that the presence of the compound has on the concentration of other greenhouse gases. VOCs could contribute indirectly to global warming, insofar as they react chemically in the atmosphere in ways that increase greenhouse gas concentrations, most notably, concentrations of ozone. The indirect forcing through changes in the hydroxyl radical (OH) and ground level ozone is small for each VOC taken individually, but can be significant for the entire family (Johnson and Derwent, 1996; Wigley *et al.*, 2002). The indirect forcing of VOCs is still poorly quantified and requires the use of global three-dimensional chemical transport models. Accurate calculations of these effects are a notoriously difficult problem in atmospheric chemistry.

a. VOCs and Ozone

Almost all VOCs have the potential to contribute directly to global warming by absorbing infrared radiation from the earth's surface. In general the more complex a VOC, the greater its ability to absorb infrared radiation, however most VOCs have a very short atmospheric lifetime and are broken down by atmospheric reactions. Generally speaking the exceptions to this rule are the saturated light hydrocarbons and halogenated compounds. VOCs also contribute indirectly to global warming via their

contribution to the formation of ozone, which is a potent greenhouse gas. Because this rulemaking will reduce VOC emissions, and thereby reduce ozone concentrations, we do not expect an increase in global warming.

b. Carbon Dioxide (CO₂)

Carbon dioxide and water vapor limits the transmission of infrared radiation to space in many wavelength regions, particularly in much of the 8-20 um region. However, almost 80 percent of infrared radiation emitted by the surface of the earth escapes to space through an atmospheric, or infrared, window in the electromagnetic spectrum region of 7-13 um, where infrared absorption by CO₂ and water vapor are very weak (Godish, 1991; Graedel and Crutzen, 1993). Synthetic gases such as chlorofluorocarbons (CFC) and HFC absorb strongly in the window region and are therefore much more effective as greenhouse gases than CO₂; on a molecule-for molecule basis, they can be thousands of times more efficient in absorbing infrared energy (Godish, 1991).

CO₂ is the primary man-made greenhouse gas of concern. To a limited extent, CO₂ may replace hydrocarbon propellants in some products. The 2001 Survey data indicate that CO₂ is used in certain consumer products considered for regulation, such as Electrical and Electronic Cleaners. In these cases it is used when flammability is an issue. Although CO₂ has found some use as a replacement propellant in these consumer products, it is not considered a likely replacement for hydrocarbon propellants in other product categories. Therefore, its use in aerosols due to the proposed Regulation, would not likely increase, and any potential increase would be negligible. Therefore, no additional impact on global warming is expected. In addition, most CO₂ used as a propellant is a recycled by-product of existing processes and, therefore, does not increase global warming (ARB, 1999).

c. Hydrofluorocarbons

For some aerosol products to meet the VOC limits in the proposed amendments, manufacturers may choose to replace some or all the typical hydrocarbon propellants with HFC-152a or HFC-134a. These compounds are exempted as VOCs under the Regulation. However, HFC-152a is the chief HFC alternative for hydrocarbon propellants in consumer products due to its significantly lower global warming potential (120) compared to HFC-134a (1300) (Applegate, 1995).

Staff believes that in only in three categories under consideration for regulation, Shaving Gels, Hair Styling Products, aerosol Fabric Refreshers, and Footwear or Leather Care would HFC-152a be a potential reformulation option. Based on the results from the 2001 Survey, the total emissions of HFC-152a from Shaving Gels, if all hydrocarbon driving propellant was replaced with it to meet the future effective VOC limit of 4 percent by weight, would be 0.14 tpd. This is a worst case scenario. Staff believes usage would be considerably less due to other reformulation options available including other non-VOC propellants, such as compressed air or nitrogen, and

alternative packaging. There is a slight potential that aerosol Hair Styling Products, aerosol Fabric Refreshers, and Footwear or Leather Care Products would use HFC-152a. However, emissions in these categories, if all aerosols switched to HFC-152a, would be negligible.

Also, when cost considerations are factored in (HFC-152a is about \$1.85 per pound, versus hydrocarbon propellants at \$0.25 per pound), it is anticipated that manufacturers will use as little HFC-152a as possible, or none at all, when reformulating their aerosol products. ARB staff does not expect the price of HFC-152a to change appreciably in the near future. Therefore, staff predicts the anticipated HFC-152a emissions as a result of implementation of the Regulation will have a negligible impact on global warming.

Based on 2001 Survey data, HFC-134a is used in Electronic Cleaners as a propellant. HFC-134a is a nonflammable gas and is a good alternative for HCFC propellants, which are being phased-out due to the Montreal Protocol. We do not predict increased usage of this compound due to its higher GWP and because its use is not recommended except in certain specialized uses.

d. Phase-out of Hydrochlorofluorocarbon 141b (HCFC-141b)

Another potential increase in use of global warming compounds would occur as HCFC-141b is phased out due to its propensity to deplete stratospheric ozone. We can not predict how manufacturers of Electrical and Electronic Cleaners will reformulate, once supplies of HCFC-141b have been depleted. However, some data indicate that likely replacements may be global warming compounds such as HFC-43-10mee, HFC-245fa, HFC-365mfc, in combination with hydrofluoroethers (HFE) 7100 and/or HFE 7200. The global warming potentials of these compounds range from 55 for HFE 7200 to 1,500 for HFC-43-10mee (U.S EPA, 2002a). Again, we can not predict how manufacturers would reformulate, but if all HCFC-141b were replaced with these compounds, there would be an emission increase of 0.22 tpd. The actual increase in GWP can not be predicted, however. As always staff will monitor usage through subsequent surveys.

Staff believes that any increase in global warming compound emissions from the proposed amendments relating to VOC emissions (that can be quantified at this time) would be negligible when compared to other sources of anthropogenic global warming compounds in the atmosphere. For example, emissions of CO₂ from fossil fuel combustion represented over 75 percent of global warming-weighted greenhouse gas emissions in 2000 (U.S. EPA, 2002b). Also global warming would be reduced, although slightly, by reducing VOC emissions and, thereby, ozone concentrations.

Other proposed amendments relating to the prohibitions on use of TACs should have no or negligible impact on global warming because replacements are VOCs or exempt compounds which are not powerful global warming compounds.

4. Impact on Stratospheric Ozone Depletion

The ARB staff has determined that the proposed amendments should not have an adverse impact on stratospheric ozone depletion. As detailed below, the compounds of concern, that are currently used in some consumer products, are being phased out. This should result in a net small decrease in stratospheric ozone depletion.

The stratospheric ozone layer shields the earth from harmful ultraviolet (UV) radiation. Depletion of the earth's ozone layer allows a higher penetration of UV radiation to the earth's surface. This increase in UV radiation penetration leads to a greater incidence of skin cancer, cataracts, and impaired immune systems. Reduced crop yields and diminished ocean productivity are also anticipated. Because the chemical reactions which form ground level ozone are driven by UV radiation, it is conceivable that a reduction in stratospheric ozone may also result in an increase in the formation of photochemical smog because of the increased levels of UV radiation on the earth's surface (ARB, 2000c). The chemicals most implicated as causing stratospheric ozone depletion are chlorofluorocarbons (CFCs) and halons (U.S. EPA, 2003). Specifically, the chlorine or bromine atoms released by photolysis of the CFCs or halons react in chain reactions leading to the catalytic destruction of ozone (Finlayson-Pitts and Pitts, 2000).

Because of this climatic problem, the Montreal protocol was enacted in 1989, to phase out a number of CFCs and HCFC. As a signatory of this protocol, the United States, in the Federal Clean Air Act of 1990 established timetables for ceasing production (see part 40, Code of Federal Regulations, section 602). In general, the protocol establishes dates by which certain compounds can no longer be manufactured, however, existing stocks can continue to be used in some applications until exhausted. Of particular concern for this rulemaking is the Class II Substance HCFC-141B that is used in Electronic and Electrical Cleaners. Production of this compound is no longer allowed, but it can continue to be used in electrical cleaning applications until existing stocks are depleted.

To mitigate potential adverse impacts from compliance with the VOC limits, the Regulation already contains a provision that prohibits the use of ozone-depleting compounds in consumer products. However, products already containing an ozone depleting compound can continue to use it, as long as the amount used in the formulation does not increase [see section 94509(e), (f), and (g)]. Because of these provisions, use of HCFC-141b will not increase and will decrease over time, such that stratospheric ozone depletion will be slowed.

However, as mentioned above, the phaseout of this compound could lead to a potential adverse environmental impact because to replace the 0.33 tpd of emissions of HCFC-141b, likely options include VOC global warming compounds such as the HFCs HFC-43-10MEE, HFC-236fa, and HFC-365mfc. These HFCs could be used in conjunction with HFE such as HFE 7100 and HFE 7200. These compounds not only

are implicated as global warming compounds, but are also VOCs as defined in the Regulation.

Because it lacks chlorine, HFC-152a probably contributes only slightly to ozone depletion (Wallington, 1994). As evidence of this, HFC-152a is not included on the list of compounds that are scheduled for phase-out under the federal Clean Air Act requirements. If manufacturers choose HFC-152a as a replacement for hydrocarbon propellants, no additional decrease in stratospheric ozone is expected.

E. POTENTIAL TOXIC AIR CONTAMINANTS IMPACTS

1. Background

As part of our obligations under CEQA the ARB staff is required to evaluate and mitigate potential adverse environmental impacts resulting from regulatory proposals. Also, pursuant to Health and Safety Code section 39650 et seq., the ARB is required to identify and control toxic air contaminants (TACs). The Health and Safety Code defines a TAC as "...an air pollutant which may cause or contribute to an increase in mortality or serious illness, or which may pose a hazard to human health." Moreover, in accordance with section 39666 of the Health and Safety Code, for TACs for which no safe exposure threshold has been established, the ARB is required to "... reduce emissions to the lowest level achievable through application of best available control technology or a more effective control method...."

Several chemicals currently used in the consumer product formulations considered for regulation have been identified as TACs. An increased or continued use of TACs in any of the consumer product categories considered for regulation could lead to a potential adverse environmental impact. ARB staff has evaluated this potential and has concluded that there would be a potential adverse environmental impact of implementing the VOC limits. Therefore, staff is proposing mitigation measures designed to ensure that use of TACs will be reduced or prohibited, resulting in a positive environmental impact.

Also within this rulemaking we are proposing an ATCM to prohibit the use of PDCB in toilet/urinal care products and air fresheners. Chapter VII contains all of the information relied upon to propose this prohibition, and the health benefits that would be realized. Within the following discussion we focus on the proposal to reduce or prohibit the use of other TACs. Basic findings on the impacts of the proposed ATCM are presented here.

2. VOC Solvents

Volatile organic compound solvents commonly used in consumer products that have been identified as TACs, include xylenes, ethyl benzene, toluene, trichloroethylene, normal hexane, and methyl ethyl ketone (ARB, 2003a). Table IX-2 describes the available data on toxicological endpoints for these compounds. Note that

although TCE is a VOC solvent, its effects will be described along with the other chlorinated solvents below.

**Table IX-2
Pollutant-Specific Health Effects for Select VOC TACs of Concern**

Compound	Total Emissions TPY ¹	Toxicological Endpoints ²	
		Acute	Chronic
Xylenes	66.6	Eye, Respiratory System	Nervous System; Respiratory System
Normal Hexane	8.9	N/A	Nervous System
Methyl Ethyl Ketone	27.9	Eyes; Respiratory System	N/A
Toluene	45.6	Central Nervous System	Reproductive; Developmental
Ethyl Benzene	4.9	N/A	Liver; Kidney; Endocrine

1. 2001 Consumer Products Survey data.

2. Toxicological endpoints were obtained from the Office of Environmental Health Hazard Assessment's Acute & Chronic Reference Exposure Levels (Air Toxic Hot Spots Program Risk Assessment Guidelines)

Staff is not proposing specific mitigation measures to reduce these VOC TACs. This is because the Regulation is designed to reduce the VOC content of consumer products. Products containing these compounds will likely have to reduce the amounts of these VOCs contained in current products in order to comply with the applicable VOC limit. The proposed limits would reduce VOC emissions by about 65 percent. Although we can not quantify the reduction at present, compliance with VOC limits should lead to a reduction in the use of TACs, resulting in a positive environmental impact. As always we will continue to monitor the use of these compounds through subsequent surveys to determine usage trends.

3. Chlorinated Solvents

Staff believes that specific mitigation measures are necessary to restrict the use of three chlorinated solvents, Perc, MeCl, and TCE because of their potential to cause cancer. Two of these TACs used in some consumer products, MeCl, and Perc, are specifically exempted from the VOC definition (section 94508 of the Regulation) in recognition of their very low ozone-forming capability. Thus, the potential exists that to meet VOC limits, manufacturers could reformulate using these exempt VOC TACs leading to an adverse impact. Trichloroethylene is regulated as a VOC, such that it's use should not increase as products reformulate to meet VOC limits. However, because of its toxicity impacts we are proposing a specific mitigation measure to address its use.

Below, we provide some general information on toxicity, physical properties and the usage of Perc, MeCl, and TCE.

a. Pollutant-Specific Health Effects Values

Presented below in Table IX-3 are pollutant-specific health effects values developed for Perc, MeCl, and TCE to characterize the relationship between a person's exposure to these TACs and the incidence or occurrence of an adverse health effect. A unit risk factor (URF) or cancer potency factor is used when estimating potential cancer risks and reference exposure levels (RELs) are used to assess potential non-cancer health impacts. Also included in Table IX-3 are the non-cancer acute and chronic toxicological endpoints for Perc, MeCl, and TCE. A further discussion of the health effects that may result from exposure to Perc, MeCl, and TCE follows.

**Table IX-3
Pollutant-Specific Health Effects Values Used for Determining
Potential Health Impacts ¹**

Compound	Cancer Unit Risk Factor (ug/m3) ⁻¹	Non-cancer Reference Exposure Levels (ug/m3)		Toxicological Endpoints	
		Acute	Chronic	Acute	Chronic
Perchloroethylene (Perc)	5.9 E-6	20,000	35	central nervous system; eye & respiratory irritation	kidney; alimentary system (liver)
Methylene Chloride (MeCl)	1.0 E-6	14,000	400	central nervous system	cardiovascular system; nervous system;
Trichloroethylene (TCE)	2.0 E-6	none	600	none	nervous system; eyes

¹. Health effects values and toxicological endpoints were obtained from three sources:

- A) Office of Environmental Health Hazard Assessment, Air Toxic Hot Spots Program Risk Assessment Guidelines, Part II, Technical Support Document for Describing Available Cancer Potency Factors, December 2002.
- B) All Acute Reference Exposure Levels Developed by the Office of Environmental Health Hazard Assessment, as of May 2000.
- C) All Chronic Reference Exposure Levels Adopted by the Office of Environmental Health Hazard Assessment, as of August 2003.

A URF is defined as the estimated upper-confidence limit (usually 95 percent) probability of a person contracting cancer as a result of constant exposure to a concentration of 1ug/m³ over a 70-year lifetime. In other words, using the URF for Perc as an example, which is 5.9 x 10⁻⁶ (microgram per cubic meter)⁻¹ or (ug/m³)⁻¹, the potential excess cancer risk for a person continuously exposed over a 70-year lifetime to 1ug/m³ of Perc is estimated to be no greater than 5.9 chances in 1 million (ARB, 2000a).

A Reference Exposure Level (REL) is used as an indicator of potential non-cancer adverse health effects and is defined as a concentration level at or below which no adverse health effects are anticipated. Reference Exposure Levels are designed to protect most sensitive individuals in the population by including safety factors in their development and can be created for both acute and chronic exposures. An acute exposure is defined as one or a series of short-term exposures generally lasting less than 24 hours. Consistent with risk guidelines, a 1-hour exposure is used to determine acute non-cancer impacts. Chronic exposure is defined as long-term exposure usually lasting from one year to a lifetime. Generally, hazard indices of less than 1.0 are not considered to be a concern to public health. A hazard index is the ratio of the modeled concentration for a toxic pollutant and the reference exposure level for that pollutant (ARB, 2000a).

b. Physical Properties and Potential Health Effects of Perchloroethylene, Methylene Chloride, and Trichloroethylene

This section summarizes the physical properties, emissions, the categories where they are used, and cancer and non-cancer impacts that can result from exposure to Perc, MeCl, and TCE. Table IX-4 shows the total emissions of each solvent in the categories proposed for regulation, as well as the total emissions of these solvents.

**Table IX-4
2001 Reported Statewide Emissions of Perc, MeCl, and TCE from
Categories of Consumer Products Scheduled for Regulation***

Perc Emissions [pounds/year]	MeCl Emissions [pounds/year]	TCE Emissions [pounds/year]	Total Chlorinated [pounds/year]
146,795	708,293	165,465	1,020,533

* Includes emissions from General Purpose Degreasers

It is important to note that even though the emissions of each solvent may not seem significant, in the case of individual products containing one or more of these solvents, the weight percent can be quite high, ranging from 10 to 100 percent by weight.

I. Perchloroethylene (Perc) or Tetrachloroethylene

aa. Physical Properties of Perc

Perchloroethylene is a volatile chlorinated aliphatic hydrocarbon compound containing a double bond. At room temperature, Perc is a non-flammable, colorless, dense liquid with an ethereal odor. Although relatively insoluble in water, it is miscible in alcohol, ether, chloroform, and benzene. Perc decomposes slowly in water to yield trichloroacetic and hydrochloric acids, and is oxidized by strong oxidizing agents. The physical properties of Perc are shown below in Table IX-5.

**Table IX-5
Physical Properties of Perchloroethylene (Perc)**

CAS Number:	127-18-4
Molecular Formula:	C ₂ Cl ₄
Molecular Weight:	165.85
Boiling Point:	121 °C at 760 mm Hg
Melting Point:	-22 °C
Vapor Pressure:	18.47 mm Hg at 25 °C
Vapor Density:	5.7 (air = 1)
Density/Specific Gravity:	1.6230 at 20/4 °C
Log Octanol/Water Partition Coefficient:	3.40
Conversion Factor:	1 ppb = 6.78 ug/m ³

bb. Sources and Emissions of Perc

Perchloroethylene is used in General Purpose Degreasers (non-automotive use), Graffiti Removers, Footwear and Leather Care Products, and Electrical Cleaners. Total emissions in these categories are 160,572 pounds per year, or 0.22 tpd.

cc. Health Impacts

Exposure to Perc may result in both cancer and non-cancer health effects. The probable route of human exposure to Perc is inhalation (ARB, 1997).

i. Cancer

The Office of Environmental Health Hazard Assessment (OEHHA) staff has performed an extensive assessment of the potential health effects of Perc, reviewing available carcinogenicity data. OEHHA concluded that Perc is a potential human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified Perc as a TAC in October 1991 (ARB, 1991). The State of California under Proposition 65 listed Perc as a carcinogen in April 1988 (OEHHA, 2004). Table IX-3 presents the current health effects values that are used for determining the potential health impacts.

In 1990, the U.S. Congress listed Perc as a hazardous air pollutant (HAP) in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The U.S. EPA has classified Perc in Group B2/C, as a probable human carcinogen, on the basis of sufficient evidence for carcinogenicity in animals and inadequate evidence in humans. The International Agency for Research on Cancer (IARC) has classified Perc in Group 2A, as a probable human carcinogen, based on sufficient evidence in animals and limited evidence in humans (ARB, 1997).

Epidemiological studies have provided some indication that the use of dry cleaning solvents, primarily Perc, poses an increased risk of cancer for exposed

workers. However, investigators were unable to differentiate among exposures to various solvents, and other possible confounding factors, like smoking, were not evaluated. Perc increased the incidence of hepatocellular tumors in laboratory mice after oral and inhalation exposure and mononuclear cell leukemia and kidney tumors in rats after inhalation (ARB, 1997).

ii. Non-Cancer

Short-term (acute) and long-term (chronic) exposure to Perc may result in non-cancer health effects. Acute toxic health effects resulting from short term exposure to high levels of Perc may include headaches, dizziness, rapid heartbeat, and irritation or burns on the skin, eyes, or respiratory tract. Massive acute doses can induce central nervous system depression resulting in respiratory failure. Chronic exposure to lower Perc concentration levels may result in dizziness, impaired judgement and perception, and damage to the liver and kidneys (ARB, 2000a). Workers have shown signs of liver toxicity following chronic exposure to Perc, as well as kidney dysfunction and neurological effects. Effects on the liver, kidney, and central nervous systems from chronic inhalation exposure to Perc have been reported in animal studies (ARB, 1997).

In addition to OEHHA listing Perc as having acute and chronic non-cancer RELs (OEHHA, 2000; OEHHA, 2003), the U.S. EPA established an oral Reference Dose (RfD) for Perc of 0.01 milligrams per kilogram per day based on hepatotoxicity in mice and weight gain in rats. The U.S. EPA has not established a Reference Concentration (RfC) for Perc (ARB, 1997). Table IX-3 presents the current health effects values that are used to determine the potential health impacts.

Epidemiological studies of women working in the dry cleaning industry showed some adverse reproductive effects, such as menstrual disorders and spontaneous abortions, but study design prevented significant conclusions. Women exposed to drinking water contaminated with solvents including Perc, showed some evidence of birth defects. Inhalation exposure of pregnant rodents to 300 parts per million Perc produced maternal toxicity and fetotoxicity manifested as developmental delays and altered performance in behavioral tests in the offspring of exposed mice and rats. However, Perc is not considered to be a teratogen (ARB, 1997).

II. Methylene Chloride

aa. Physical Properties of Methylene Chloride

Methylene chloride is a volatile, nonflammable, colorless, liquid with a sweetish chloroform-like odor. It is slightly soluble in water and miscible with alcohol, ether, and dimethylformamide. In the absence of moisture, at ordinary temperatures, MeCl is relatively stable. In dry air, MeCl decomposes at temperatures exceeding 120 °C. Methylene chloride evaporates relatively quickly from water. Possible thermal breakdown products of MeCl include phosgene, chlorine, and hydrogen chloride. The physical properties of MeCl are shown below in Table IX-6.

Table IX-6
Physical Properties of Methylene Chloride (Dichloromethane)

CAS Number:	75-09-2
Molecular Formula:	CH ₂ Cl ₂
Molecular Weight:	84.94
Boiling Point:	39.75 °C at 760 mm Hg
Melting Point:	-95 °C
Vapor Pressure:	349 mm Hg at 20 °C
Vapor Density:	2.93 (air = 1)
Density/Specific Gravity:	1.3255 at 20/4 °C
Log Octanol/Water Partition Coefficient:	1.30
Conversion Factor:	1 ppm = 3.47 mg/m ³

bb. Sources and Emissions of Methylene chloride

Methylene chloride is used in Adhesive Removers, Contact Adhesives, and Electrical Cleaners. Total emissions in these categories are 745,083 pounds per year or 1.02 tpd.

cc. Health Impacts

Exposure to MeCl (also known as dichloromethane) may result in both cancer and non-cancer health effects. The probable route of human exposure to MeCl is inhalation (ARB, 1997).

i. Cancer

The OEHHA staff has performed an extensive assessment of the potential health effects of MeCl, reviewing available carcinogenicity data. The OEHHA staff agreed with U.S. EPA and IARC that MeCl is either a possible or probable human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified MeCl as a TAC in July 1989 (ARB, 1989). The State of California under Proposition 65 listed MeCl as a carcinogen in April 1988 (OEHHA, 2004). Table IX-3 presents the current health effects values that are used to determine potential health impacts.

In 1990, the U.S. Congress listed MeCl as a HAP in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The U.S. EPA has classified MeCl in Group B2, as a probable human carcinogen. The IARC has classified MeCl in Group 2B, as a possible human carcinogen (ARB, 1997).

ii. Non-Cancer

Short-term (acute) and long-term (chronic) exposure to MeCl may result in non-cancer health effects. MeCl vapor is irritating to the eyes, respiratory tract, and skin. It is also a central nervous system depressant including decreased visual and auditory functions and may cause headache, nausea, and vomiting. Acute toxic health effects resulting from short term exposure to high levels of MeCl may include pulmonary edema, cardiac arrhythmias, and loss of consciousness. Chronic exposure can lead to bone marrow, hepatic, and renal toxicity. MeCl is metabolized by the liver with resultant carboxyhemoglobin formation (ARB, 1997).

OEHHA has adopted for MeCl acute and chronic non-cancer RELs (OEHHA, 2000; OEHHA, 2003), the U.S. EPA established an oral Reference Dose (RfD) for MeCl of 0.06 milligrams per kilogram per day based on liver toxicity in rats, and is currently reviewing a Reference Concentration (RfC) (ARB, 1997). Table IX-3 presents the current health effects values that are used to determine potential health impacts.

No information on adverse reproductive effects in humans from inhalation or oral exposure has been found, but fetotoxicity was observed in pregnant rodents exposed by inhalation to high concentrations of MeCl throughout pregnancy as evidenced by reduced fetal body weight and reduced skeletal ossification (ARB, 1997).

III. Trichloroethylene

aa. Physical Properties of Trichloroethylene

Trichloroethylene is a chlorinated aliphatic hydrocarbon compound containing a double bond. It is a dense, nonflammable, volatile, colorless liquid which is only slightly soluble in water but miscible with organic solvents and other halogenated compounds. Most fixed and volatile oils are dissolved by TCE. It is lipophilic. Trichloroethylene has an odor threshold of 28 parts per million (ppm) and smells similar to ether or chloroform. The physical properties of TCE are shown below in Table IX-7.

Table IX-7
Physical Properties of Trichloroethylene (TCE)

CAS Number:	79-01-6
Molecular Formula	C ₂ HCl ₃
Molecular Weight:	130.40
Boiling Point:	86.7 °C
Melting Point:	-73 °C
Flash Point:	89.6 °C
Vapor Pressure:	100 mm Hg at 32 °C
Vapor Density:	4.53
Density:	1.4649 at 20/4 °C
Log Octanol/Water Partition Coefficient:	2.42
Conversion Factor:	1 ppb = 5.33 ug/m ³

bb. Sources and Emissions of TCE

Trichloroethylene is used in Electrical Cleaners and, and Graffiti Removers. Total emissions in these categories are 181,164 pounds per year or 0.25 tpd.

cc. Health Impacts

Exposure to TCE may result in both cancer and non-cancer health effects. The probable routes of human exposure to TCE are inhalation and ingestion (ARB, 1997).

i. Cancer

The OEHHA staff has performed an extensive assessment of the potential health effects of TCE, reviewing available carcinogenicity data. The OEHHA staff agrees with U.S. EPA and IARC that TCE is a probable human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified TCE as a TAC in October 1990 (ARB, 1990). The State of California under Proposition 65 listed TCE as a carcinogen in April, 1988 (OEHHA, 2004). Table IX-3 presents the current health effects values that are used to determine potential health impacts.

In 1990, the U.S. EPA listed TCE as a HAP pursuant to subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The U.S. EPA has classified TCE in Group B2/C, as a probable human carcinogen. The International Agency for Research on Cancer classified TCE in Group 2A, as a probable human carcinogen, based on sufficient evidence in animals and limited evidence in humans (ARB, 1997).

The U.S. EPA considers the epidemiologic data on TCE carcinogenicity in humans to be inconclusive. Increases in testicular cancer have been reported in inhalation studies in animals. Carcinogenic responses to TCE inhalation studies in animals are increased incidences of hepatocellular carcinoma and adenoma in male

mice; lung adenocarcinomas and malignant lymphomas in female mice; malignant liver tumors in B6C3F1 mice; and renal tumors in rats (ARB, 1997).

ii. Non-Cancer

Short-term (acute) and long-term (chronic) exposure to TCE may result in non-cancer health effects. TCE is a central nervous system depressant and has been used as an anesthetic. It is mildly irritating to the eyes and respiratory tract. Occupational exposure to TCE has resulted in nausea, headache, loss of appetite, weakness, dizziness, ataxia, and tremors. Acute exposures to high concentrations has caused irreversible cardiac arrhythmias, nerve and liver damage and death. Chronic exposure to TCE has also been shown to cause respiratory irritation, renal toxicity, and immune system depression. Alcohol consumption in humans increases the toxicity of TCE and causes "degreaser's flush," which are red blotches on the skin (ARB, 1997).

OEHHA has adopted a chronic non-cancer REL for TCE (OEHHA, 2003). Table IX-3 presents the current health effects values that are used to determine potential health impacts. The U.S. EPA currently is reviewing the Reference Concentration (RfC) and the oral Reference Dose (RfD) for TCE (ARB, 1997).

There is inadequate information to determine whether TCE causes reproductive toxicity in humans. One study reported increased miscarriages in nurses exposed to TCE as well as other anesthetics. An association was found between elevated levels of contaminants, including TCE, in drinking water and congenital heart disease in children. Other studies have not reported adverse reproductive effects in humans exposed to TCE in drinking water. In animal studies, an increase in abnormal sperm morphology in mice exposed by inhalation was reported. Exposure of rats and mice to TCE by inhalation causes a significant delay in fetal maturation and an increase in embryotoxicity (ARB, 1997).

IV. Proposed Mitigation Measures to Address the Use of Perc, MeCl, and TCE

In this Rulemaking staff is proposing to prohibit the use of Perc, MeCl, and TCE in Adhesive Removers (all subcategories), Contact Adhesives, Electrical and Electronic Cleaners, Footwear and Leather Care Products, and Graffiti Removers. We are also proposing to prohibit the use of these compounds in the previously regulated category of General Purpose Degreasers. This proposal is based on data suggesting that there would be potential cancer increases resulting from their use. In proposing this prohibition we are relying on previous work conducted by ARB staff.

Specifically we are relying on three previous rulemakings. To review the complete analyses relied upon to propose these prohibitions, the reader is referred to the following three documents:

1. Initial Statement of Reasons for the Proposed Airborne Toxic Control Measure for Emissions of Chlorinated Toxic Air Contaminants from Automotive Maintenance and Repair Activities, March 10, 2000. (ARB, 2000a)
2. Initial Statement of Reasons for the Proposed Amendments for the California Consumer Products Regulation Relating to Aerosol Adhesives, April 7, 2000. (ARB, 2000b)
3. Initial Statement of Reasons for the Proposed Amendments to the Regulation for Reducing Volatile Organic Compound Emissions from Aerosol Coating Products and Proposed Tables of Maximum Incremental Reactivity Values, and Proposed Amendments to Method 310, "Determination of Volatile Organic Compounds in Consumer Products," May 5, 2000. (ARB, 2000c)

In each of the above rulemakings staff found that use of these chlorinated compounds posed an unnecessary health hazard. Based on modeling results showing the potential for increased cases of cancer, and because many alternative products were available, the ARB, in 2000, prohibited the use of Perc, MeCl, and TCE in General Purpose Degreasers designed for automotive use, Engine Degreasers, Brake Cleaners, Carburetor and Fuel Injection Cleaners, aerosol adhesives, and aerosol coatings.

Below we provide a description of each category where we are proposing to further prohibit the use of Perc, MeCl, and TCE. We also provide relevant information as to emissions, availability of alternatives, and review the data relied upon to support the prohibition in each category.

The proposed prohibition on use of Perc, MeCl, and TCE in Adhesive Removers (all subcategories), Contact Adhesives, Electrical and Electronic Cleaners, Footwear and Leather Care Products, Graffiti Removers, and General Purpose Degreasers would align with State law that requires adverse impacts to be mitigated, and the use of Best Available Control Technology (BACT) in instances where no safe exposure threshold is known. Staff has determined that the proposed prohibition is necessary to mitigate potential adverse impacts that would result from implementing VOC limits for these categories, and to ensure a level playing field among all products.

a. Adhesive Removers

Adhesive Removers are products designed to remove adhesives, gaskets, caulk and other bonding materials from a variety of substrates. Of the four subcategories of Adhesive Removers proposed for regulation MeCl is used in Gasket or Thread Locking Adhesive Removers and Floor or Wall Covering Adhesive Removers. Total emissions of 39,639 and 621,825 pounds per year of MeCl were reported in the 2001 Survey for Gasket or Thread Locking Adhesive Removers and Floor or Wall Covering Adhesive

Removers, respectively. The range of MeCl reported was 61 to 88 percent by weight. Thus, a person's exposure to MeCl could present a health hazard.

i. Floor or Wall Covering Adhesive Removers

Floor or Wall Covering Adhesive Remover are products designed to remove adhesives from wall coverings, such as wallpaper, and flooring, such as vinyl. We have evaluated the potential cancer impacts from using Floor or Wall Covering Adhesive Removers containing MeCl by assuming that the "worst case" exposure scenarios developed to assess health impacts associated with using aerosol adhesives containing MeCl would be analogous. In these instances, at a distance of 20 meters, we found a potential excess cancer increase of 5.8 per million persons for aerosol adhesives. These cancer risks were based on products containing lower percentages of MeCl than were reported for Aerosol Adhesives.

Based on this comparison, we believe it is appropriate to propose a prohibition on the use of MeCl in Floor or Wall Covering Adhesive Removers. Moreover, although they are not currently used, to prevent formulating Floor or Wall Covering Adhesive Remover with Perc or TCE, we are also proposing to prohibit their use as well.

The 2001 Survey data show that there are many alternative products that do not contain MeCl. In fact, almost 60 percent of Floor or Wall Covering Adhesive Removers sold do not contain MeCl. Because alternative products exist, we believe that to adequately protect public health a prohibition on the use of Perc, MeCl, and TCE, in Floor or Wall Covering Adhesive Removers is appropriate.

ii. Gasket or Thread Locking Adhesive Remover

Gasket or Thread Locking Adhesive Remover are products designed to soften and aid in removal of gaskets of various composition from two surfaces. Gasket or Thread Locking Adhesive Remover are likely to be used in scenarios similar to those developed to assess health impacts associated with using automotive products at automotive maintenance and repair (AMR) facilities. It is very likely that the exposure scenarios developed for this ATCM would be applicable to Gasket or Thread Locking Adhesive Removers. Often times gasket removal is associated with automotive repair and they would be used similarly and in similar environments. For our purposes here, we will review a data set from the ATCM.

For this category, we summarize the modeling results from 12 actual AMR facilities using automotive products containing a combination of Perc/MeCl or Perc/TCE. In this case, using SCREEN3 modeling, default meteorology, and at a distance of 20 meters for near-source receptors, the potential excess cancers from using these products ranged from 1 to 46 chances per million persons.

The difference here for Gasket or Thread Locking Adhesive Removers would be that the products contain only MeCl. Because the cancer URF for MeCl is lowest

among the three, the potential excess cancers from using Gasket or Thread Locking Adhesive Removers would likely be less than those reported above for products containing a combination of Perc/MeCl or Perc/TCE (1 to 46 potential excess cancers per million persons). Nevertheless, staff believes the potential excess cancer risk could still be quite high.

Based on this comparison, we believe it is appropriate to prohibit the use of MeCl in Gasket or Thread Locking Adhesive Remover. Moreover, although they are not currently used, to prevent formulating Gasket or Thread Locking Adhesive Remover with Perc or TCE, we are also proposing to prohibit their use as well.

The 2001 Survey data show that there are several alternative products that do not contain MeCl. Although sales of these products are not large, we believe they are effective products and that gaskets can be successfully removed using VOC-based products reformulated to meet the proposed VOC limit. Because alternative products exist, we believe that to adequately protect public health a prohibition on the use of Perc, MeCl, and TCE in Gasket or Thread Locking Adhesive Remover is appropriate.

No General Purpose Adhesive Removers or Specialty Adhesive Removers reported the use of Perc, MeCl, or TCE. However, staff believes that to prevent the use of these compounds, as manufacturers reformulate to meet the proposed VOC limits, a prohibition on their use is appropriate in these categories as well.

b. Contact Adhesives

Contact Adhesives are products designed for application to both surfaces to be bonded together, in which the two surfaces are allowed to dry before being placed in contact with each other. Contact adhesives form an immediate bond that is impossible, or difficult, to reposition and does not need sustained pressure or clamping of surfaces to establish full contact between both surfaces. Of the three chlorinated solvents of concern, only MeCl was reported as used in this category. Total emissions of 4,249 pounds per year of MeCl were reported in the 2001 Survey. Even though the emissions may seem low a person's exposure to MeCl could pose a health hazard.

We have evaluated the potential cancer impacts from using Contact Adhesives containing MeCl by assuming that the "worst case" exposure scenario developed to assess health impacts associated with using aerosol adhesives containing MeCl would be analogous. In this instance, at a distance of 20 meters, we found a potential excess cancer increase of 5.8 per million persons. This cancer risk was based on products containing similar percentages of MeCl as were reported for Contact Adhesives. No analysis for TCE was done for aerosol adhesives because it was found that TCE was not used in these products. However, one scenario considered products containing both Perc and MeCl. In this case, the increased use from the Perc portion of the example product showed an increased potential excess cancer risk of about 27 per million persons at 20 meters. The combined risk for the example product containing

both Perc and MeCl was almost 30 chances for excess cancer occurrences per million persons.

The 2001 Survey data show that MeCl is only used in 1 of 9 Special Purpose Contact Adhesives, and Perc and TCE are not used. Survey data do not indicate the use of Perc, MeCl, or TCE in General Purpose Contact Adhesives.

In discussions with the manufacturer, we have learned that the one product that contained MeCl is no longer for sale in California. The withdrawal from the market is due to the pending prohibition on use of MeCl in Contact Adhesives in the South Coast Air Quality Management District (see Rule 1168), effective in 2005.

Because of the abundance of alternative products, we believe that to adequately protect public health, the proposed prohibition on the use of Perc, MeCl, and TCE in all Contact Adhesives is appropriate. At present, no products containing Perc, MeCl or TCE are sold in California, so the staff's proposal would essentially prohibit manufacturers from beginning to use these solvents as products are reformulated.

c. Electrical and Electronic Cleaners

Electrical Cleaners are products designed to clean heavy greases, oil and other contaminants from electrical equipment such as motors, gears, generators, etc. Electronic Cleaners are products designed to clean light soils and flux from precision electronics such as circuit boards. Of the three chlorinated solvents of concern, all are used in Electrical Cleaners, but none are used in Electronic Cleaners. Total emissions of 162,421 pounds per year of TCE were reported for Electrical Cleaners, in the 2001 Survey. Reported emissions of Perc and MeCl in Electrical Cleaners were 145,407 and 12,120 pounds per year, respectively. The range of TCE contained in Electrical Cleaners was between 95 to 100 percent by weight. The range of Perc reported in Electrical Cleaners was 6 to 100 percent by weight, while reported MeCl ranged from 15 to 58 percent by weight. Thus, a person's exposure to Perc, MeCl, or TCE could pose a health hazard.

We have evaluated the potential cancer impacts from using Electrical and Electronic Cleaners containing these three chlorinated solvents by reviewing the data developed to assess health impacts associated with using automotive products at AMR facilities. It is very likely that the exposure scenarios developed for this ATCM would be applicable to Electrical and Electronic Cleaners—especially Electrical Cleaners. Because of the types of soils removed, we believe Electrical Cleaners and automotive products are used similarly and in similar environments. For purposes here, we will review two data sets from the ATCM.

In the first case we assume a small, generic AMR facility using Perc-containing automotive products, representative meteorology, and a residential receptor at 20 meters. Perc-containing products ranged from 22 to 98 percent by weight Perc. Potential excess cancers in this scenario ranged from 18 to 64 per million persons.

In the second case, we summarize the modeling results from 12 actual AMR facilities using automotive products containing a combination of Perc/MeCl or Perc/TCE. In this case, using SCREEN3 modeling, default meteorology, and at a distance of 20 meters for near-source receptors, the potential excess cancers from using these products ranged from 1 to 46 chances per million persons.

Based on the foregoing, ARB staff concludes that the potential cancer risks from using Electrical and Electronic Cleaners would be similar to those potential risks determined in the ATCM for AMR facilities. The products would likely be used in similar scenarios and the amount of chlorinated compounds in the reported products is similar to the amounts used to model potential cancer risk at AMR facilities using chlorinated solvents.

The 2001 Survey data show that there are many alternative products that do not contain Perc, MeCl, and TCE. In fact, no Electronic Cleaners contain these solvents, and for Electrical Cleaners, 64 percent of sales were for products that do not contain Perc, MeCl, or TCE. Because of the abundance of alternative products, we believe that to adequately protect public health, the proposed prohibition on the use of Perc, MeCl, and TCE, in Electrical and Electronic Cleaners is appropriate. The proposed prohibition on use in Electronic Cleaners, because no products currently contain these solvents, would essentially not allow manufacturers to reformulate using Perc, MeCl, or TCE.

The exception to this prohibition would be for Electrical Cleaners that are used in applications where the equipment is cleaned while there is an active or residual power source. Under the staff's proposal, because of safety concerns related to equipment shorting out, or spark and fire hazard, these "Energized Electrical Cleaners" would be allowed to continue to use Perc, MeCl, and TCE. Based on product labels that were received as part of the 2001 Survey, staff estimates that TAC emissions from Energized Electrical Cleaners would be about 0.04 tpd. Absent HCFC-141b, which is being phased out under the Montreal Protocol (see section D 4 of this chapter), staff is not aware of feasible alternatives to these solvents at this time. Staff will continue to follow progress in technologies to clean energized equipment without the use of chlorinated solvent.

d. Footwear or Leather Care Product

Footwear and Leather Care products are designed to clean, polish, enhance or restore shoes, boots, and other footwear, as well as, leather products such as handbags, jackets, and leather furniture. The Survey data show that only one product, out of over 200 reported, contains Perc, and at a fairly low percentage. Total emissions of 373 pounds per year were reported. The usage of Footwear and Leather Care products is probably not analogous to other scenarios in which we were able to draw parallels with earlier work done to assess potential excess cancer risk. However, because of the plethora of alternative products that function effectively without Perc, we believe that the use of Perc is not needed and presents an unnecessary potential health

hazard. Therefore, staff is proposing to prohibit the use of Perc in Footwear or Leather Care Products. Again, this approach aligns with State law to mitigate potential adverse impacts and require BACT in instances where no safe exposure threshold is known. Even though MeCl and TCE are not reported as used, to prevent their use as products are reformulated, staff is proposing to prohibit their use as well.

e. Graffiti Removers

Graffiti Removers are products designed to remove spray paint and ink graffiti from a variety of substrates, typically without damaging the substrate. They are also used to remove crayon, lipstick and shoe polish. Of the three chlorinated solvents of concern all are used in this category, but mostly in the aerosol product form. Total emissions of 30,460 and 3,044 pounds per year of MeCl and TCE, respectively, were reported in the 2001 Survey. Perc was reported in this category, however to protect confidentiality the amount is not reported here, but is included in the total Perc emissions shown in IX-4. However, the Perc reported was contained in products using other chlorinated solvents. Even though the emissions of MeCl and TCE may seem low the range of MeCl reported in the products containing these toxics are about 30 to 35 percent by weight. The range of TCE reported is about 40 to 90 percent by weight. Thus, a person's exposure to Perc, MeCl, or TCE could pose a health hazard.

We have evaluated the potential cancer impacts from using Graffiti Removers containing MeCl by assuming that the "worst case" exposure scenarios developed to assess health impacts associated with using aerosol adhesives and aerosol coatings containing MeCl would be analogous. In these instances, at a distance of 20 meters, we found a potential cancer increase of 5.8 and 3.3 per million persons, for aerosol adhesives and aerosol coatings, respectively.

These cancer risks for aerosol adhesives and coatings were based on products containing similar percentages of MeCl as were reported for Graffiti Removers. No analysis for risks associated with Perc or TCE use was done for aerosol adhesives or aerosol coatings because no products contained either solvent. However, we believe that a similar exposure scenario would be appropriate to assess potential cancer increases associated with products containing Perc and/or TCE. Because the cancer URFs for Perc and TCE are higher than that of MeCl (5.9×10^{-6} for Perc; 2.0×10^{-6} for TCE; and 1.0×10^{-6} for MeCl) one could assume that the potential cancer risk would be higher than that found for products containing MeCl. Based on this comparison we believe it is appropriate to propose a prohibition on the use of Perc, MeCl and TCE in Graffiti Removers.

The 2001 Survey data show that there are many alternative products that do not contain Perc, MeCl, and TCE. In fact, of the 35 aerosol Graffiti Removers reported, 30 products, representing 86 percent of sales did not contain Perc, MeCl, or TCE. Because of the abundance of alternative products, we believe that to adequately protect public health the proposed prohibition on the use of Perc, MeCl, and TCE in Graffiti Removers is appropriate.

f. General Purpose Degreasers

General Purpose Degreasers are products designed to remove or dissolve grease, grime, oil and other oil-based contaminants from a variety of substrates, including automotive or miscellaneous metallic parts. General Purpose Degreasers were regulated for VOC content in an earlier rulemaking. No changes to the VOC limits for General Purpose Degreasers are proposed in this rulemaking, although, we surveyed this category in 2001 to help categorize other similar product categories. However, in this rulemaking, staff is proposing to prohibit the use of Perc, MeCl, and TCE in this category.

Of the 622 General Purpose Degreasers reported in the 2001 Survey, only 32 products contained one or more of these chlorinated solvents. A review of these labels showed that many products reported were already subject to the AMR ATCM such that use of Perc, MeCl, and TCE had already been prohibited. However, the sell-through period for products subject to the AMR did not end until July 1, 2002, such that it was appropriate to report these products in the Survey. We also found that some Electrical Cleaners had been mistakenly reported as General Purpose Degreasers. Accounting for all of these products resulted in only 2 products containing about 600 pounds of Perc per year. Thus, almost all General Purpose Degreasers have already reformulated to eliminate the use of Perc, MeCl, and TCE. However, to prevent products from being formulated with these compounds staff is proposing to prohibit their use.

General Purpose Degreasers containing chlorinated solvents are used to perform similar functions as those performed by degreasers for automotive use (which were evaluated as part of the ATCM for AMR facilities). It was found that using automotive general purpose degreasers containing Perc, MeCl, and/or TCE posed a potential health hazard. In the ATCM for AMR facilities it was found that in using automotive products containing one or more chlorinated solvents there was an increased cancer risk of between 1 and 46 chances per million people. Staff believes this analysis is applicable to non-automotive use General Purpose Degreasers and that use of these products would pose similar health hazards as those found by using automotive use General Purpose Degreasers.

The 2001 Survey data show that almost all General Purpose Degreasers already do not contain Perc, MeCl, or TCE. Because alternative products exist, we believe that to adequately protect public health proposing a prohibition on the use of Perc, MeCl, and TCE in General Purpose Degreasers is appropriate.

g. Summary

The prohibition on chlorinated solvents is being proposed as a mitigation measure under the California Environmental Quality Act (Public Resources Code section 2100 et seq.). An alternative basis for the prohibition, however, is the authority granted the ARB to control toxic air contaminants (TACs) under Health and Safety Code section 39665 et seq. Chapter VII of this Initial Statement of Reasons contains a

description of California's TAC identification and control program. This section E, comprises the "needs assessment" report for the prohibition on chlorinated solvents, as specified in Health and Safety Code section 39665.

Additional information to support the proposed prohibition on use of Perc, MeCl, and TCE in Adhesive Removers (all subcategories), Contact Adhesives, Electrical and Electronic Cleaners, Footwear and Leather Care Products, Graffiti Removers and General Purpose Degreasers are contained in other documents and within other chapters of this Initial Statement of Reasons. Information regarding sources of these TACs (sources of emissions other than what is discussed in this Chapter) and atmospheric persistence has already been presented in the Initial Statement of Reasons for the Proposed Airborne Toxic Control Measure for Emissions of Chlorinated Toxic Air Contaminants from Automotive Maintenance and Repair Activities, March 10, 2000 (ARB, 2000a). The reader is referred to this document for further information.

More detailed information on alternative products and chemicals that can be used as replacements to Perc, MeCl, and TCE is contained in Chapter VI of this report. Costs for reformulating and cost effectiveness of the proposal is contained in Chapter VIII of this report.

In the federal Clean Air Act Amendments of 1990, the United States Environmental Protection Agency (U.S. EPA) identified Perc, MeCl, and TCE as hazardous air pollutants (HAPs) because evidence indicated the substances may have adverse effects on human health or the environment. As of the writing of this report, the U.S. EPA has not promulgated a comparable NESHAP control measure specifically for consumer products containing Perc, MeCl, or TCE. The U.S. EPA has adopted NESHAP standards which control emissions of these HAPs from other sources. These other measures are described in the ATCM for AMR facilities (ARB, 2000a).

As provided in Health and Safety Code section 39665(c), relevant comments on the proposal to prohibit use of Perc, MeCl, and TCE in seven categories of consumer products, that were received by the ARB, have been included in the administrative record. They are listed as a reference at the end of this Chapter (Toxic Prohibition Comments) and are available from ARB staff upon request for public review and comment.

To summarize, staff finds that the proposed prohibition on use of Perc, MeCl, and TCE in Adhesive Removers (all subcategories), Contact Adhesives, Electrical and Electronic Cleaners, Footwear and Leather Care Products, Graffiti Removers and General Purpose Degreasers is necessary to reduce the health risk associated with use of these compounds. In each category staff has identified the potential for increased chances of contracting cancer from using products containing these compounds. The proposed prohibitions are necessary to mitigate potential adverse impacts that would result from implementing VOC limits for these categories. The prohibitions would also

align with State law that requires use of BACT in instances where no safe exposure threshold is known.

F. RISK ASSESSMENT FOR REDUCED EXPOSURE TO OZONE AND TACS

The actual health risk reductions that would result from reducing VOC emissions, if the staff's proposal were to be adopted, cannot be fully quantified due to lack of appropriate tools and data to characterize the reduced risk. However, qualitatively, we are able to conclude that reducing VOC emissions, in any amount, will result in incremental improvement of the public's health--whether it be in fewer incidences of asthma or hospitalizations, or improvement in lung function.

The VOC reductions from the proposed amendments are designed as partial fulfillment of the State Implementation Plan (SIP), which when fully implemented by 2010, will allow all non-attainment regions of the State to reach attainment for ozone (ARB, 2003b). Thus one can conclude that increments of progress towards attainment improve the public's health. The proposed amendments will also likely reduce PM (SOA). However, our focus here is on reducing ground level ozone, and the impacts of our proposal on SOA formation are not clear, although we do not expect a disbenefit.

The health risks associated with ozone exposure have been known for many years and are discussed in detail in Chapter IV. Studies have shown that when inhaled, even at relatively low levels, ozone can impact lung tissue and lung function. The greatest risk is to those who are more active outdoors during smoggy periods, such as children, athletes, and outdoor workers. Exposure to levels of ozone above the current ambient air standard leads to lung inflammation and lung tissue damage, and a reduction in the amount of air inhaled into the lungs. Recent evidence has, for the first time, linked the onset of asthma to exposure to elevated ozone levels in exercising children (McConnell 2002).

The proposed amendments to the Regulation are designed to achieve the maximum feasible VOC emission reduction from the categories proposed for regulation at this time. Based on predicted emissions in 2009, these reductions from adopting the amendments would result in a total of about 6.8 tpd from 15 product categories. This represents about a 65 percent reduction in VOC emissions from these categories. This compares favorably with other consumer product regulations adopted by ARB. Historically, emission reductions from all regulated categories have been reduced by 50 percent.

Because of the potential health impacts associated with elevated concentrations of ozone, any decrease in ozone precursors, namely VOCs, benefits the health of all Californians.

We are better able to assess the reduced health risk associated with prohibiting the use of the chlorinated solvents Perc, MeCl, and TCE in several categories, and prohibiting the use of PDCB in toilet care and air freshener products. Overall, the

proposed amendments would reduce chlorinated solvent emissions by over 559 tons annually in 2006. Our analysis found that potentially, in a given category, increased cancer risk could be reduced by up to 64 chances per million persons. Overall in these seven categories the potential excess cancer risk associated with their use would be reduced substantially. It should also be noted that the scenarios analyzed to determine increased cancer risk evaluated concentrations in the outdoor air. It is likely that, in indoor environments, workers' and other end-users' chances of increased cancers would be higher from use of products containing these chlorinated solvents.

Regarding the proposed ATCM, emissions of PDCB would be reduced by about 1,219 tons per year in 2006. The number of potential excess cancers potentially avoided, by eliminating the use of PDCB in toilet care products and air fresheners, would be about 9 per million persons, at a distance of 20 meters downwind from the perimeter of the dechlorination process area. For indoor exposures, we found a potential cancer risk of 145 excess cancer cases per million persons. The complete analysis relating to the proposed ATCM for PDCB is found in Chapter VII.

In summary, our health risk analysis shows that, by achieving these VOC reductions, the proposed amendments would reduce health risks posed by ground level ozone by slightly lowering ambient concentrations. The proposed ATCM would have a dual benefit of reducing potential excess cancers and also result in VOC reductions. Moreover, a substantial number of potential excess cancers would likely be avoided by prohibiting the use of chlorinated TACs. Table IX-8 below summarizes the VOC and TAC reductions anticipated in each category.

Table IX-8
Summary of VOC and TAC Reductions in Categories Proposed for Regulation

Product Category	Product Form	Proposed VOC Limit (wt %)	VOC Emission Reductions (TPD) ¹	TAC Emission Reductions (TPD) ²
Adhesive Removers :				
Gasket or Thread Locking Adhesive Remover	All	50	-0.011 ³	
Floor or Wall Covering Adhesive Remover	All	5	0.630	0.99
General Purpose Adhesive Remover	All	20	0.258	
Specialty Adhesive Remover	All	70	0.138	
Air Freshener ⁴	--	--	0.624	0.624 ⁷
Anti-Static Product	Aerosol	80	0.057 (12/31/08)	--
	Non-aerosol	11	0.000	
Contact Adhesive :				
Contact Adhesive - General Purpose	All	55	0.003	0.007
Contact Adhesive - Special Purpose	All	80	0.000 ⁵	
Electrical Cleaner	All	45	0.070	0.48 ⁸
Electronic Cleaner	All	75	0.049	
Fabric Refresher	Aerosol	15	0.221	--
	Non-aerosol	6	0.220	
Footwear or Leather Care Product	Aerosol	75	0.008	<0.001
	Solid	55	0.039	
	All Other Forms	15	0.060	
Graffiti Remover	Aerosol	50	0.014	0.055 ⁸
	Non-aerosol	30	0.071	
Hair Styling Product	Aerosol,	6	0.404	--
	Pump Spray	2	0.163	
	All Other Forms			
Shaving Gel	All	7	0.124	--
		4	0.435 (12/31/09)	
Toilet/Urinal Care Product	Aerosol	10	PD ⁶	2.716 ⁷
	Non-aerosol	3	2.709	
Wood Cleaner	Aerosol	17	0.019	--
	Non-aerosol	4	0.232	
Total Reductions by 2006			6.05	4.87
Total Reductions by 2008			6.28	5.01
Total Reductions by 2009			6.81	5.09

1. Survey emissions adjusted for market coverage as discussed in Volume II, Chapter IV; reduction on the effective date of limits which is December 31, 2006, except where otherwise noted.

2. Based on survey emissions; reduction on the effective date of limits which is December 31, 2006.

3. VOC emission increase as result of prohibition on use of certain specified TACs.

4. Currently a regulated category; with elimination of the exemption for 98% para-dichlorobenzene (PDCB) products, additional reductions will be achieved from replacement with lower VOC air fresheners.

5. No reductions; Contact Adhesive was separated into two subcategories and the existing 80% VOC limit was retained for this subcategory.

6. PD = Protected Data; reductions omitted to protect manufacturers' confidential information.

7. PDCB emissions are also included in VOC Emission Reductions.

8. Trichloroethylene emissions are also included in VOC Emission Reductions.

G. OTHER POTENTIAL ENVIRONMENTAL IMPACTS

Solid Waste Disposal

We do not expect an adverse impact on solid waste disposal from the proposed amendments relating to VOC limits, or the proposed prohibition on use of chlorinated solvent TACs Perc, MeCl, and TCE. The Regulation is designed so that all current product forms will be available. Because of this, we do not anticipate any changes in packaging or disposal due to the amendments.

With regard to the proposed ATCM, staff has evaluated whether there would be an increase in solid waste due to prohibiting the use of PDCB in toilet/urinal care products and air fresheners. If PDCB products are prohibited, the use of alternative products for toilet and urinal care could create more waste from the disposal of plastic screens, plastic containers, and VOC medium used for alternative products.

Staff found that both PDCB and alternative products create waste. Some PDCB urinal products use plastic screens, while some alternative products are blocks sold without screens. For toilet bowls, both the PDCB and alternative products must use plastic or metal hangers for toilet bowl rims. The products sold in plastic containers will not be typical replacements for the PDCB products. For example, we do not expect the use of air freshener sprays for room deodorizing to substantially increase, because the alternative urinal and toilet bowl block products are already available.

We have no information showing that greater use of the alternative products would create a new and environmentally significant solid waste or other disposal problem. Even if alternative products do create additional waste, we would consider the small increase in solid waste to be out-weighted by the substantial benefits of reducing potential increased cancer risk from continued use of PDCB.

Impacts on Waste Water

Sanitation districts have been concerned about the amount of chlorinated compounds found in the waste effluent at treatment plants. Currently, many treatment plants do not have the equipment necessary to process industrial wastes such as chlorinated compounds and these compounds have been detected at elevated levels at some facilities. Over the last several years, increased influent concentrations of Perc were observed at several wastewater treatment plants. The influent concentrations of Perc have been high enough to potentially cause violations of the plants' discharge limit of 5 micrograms per liter (ug/L) (ARB, 2000a). Regarding PDCB, according to data from the Los Angeles County Sanitation District, influent levels of PDCB ranged from 2 to 5 ug/L; with effluent levels ranging from 1 to 2 ug/L.

Use of Adhesive Removers (all subcategories), Contact Adhesives, Electrical and Electronic Cleaners, Footwear and Leather Care Products, Graffiti Removers and General Purpose Degreasers would not typically have a waste water fate. However, the

proposed removal of Perc, MeCl, and TCE from these categories proposed for regulation may result in a reduction in the amount of chlorinated solvents reaching the storm drains and the waste water treatment plants if these products have been misused or improperly discarded.

On the other hand, PDCB toilet care products do have a waste water fate. Because the proposed limits for toilet/urinal care products effectively prohibit the use of PDCB, we would expect to nearly eliminate PDCB from waste water influent levels. This results in reduced cancer risk.

Staff also evaluated if the use of alternative products for toilet and urinal care would create any other waste water impact if PDCB products are prohibited. This is because some plastics in the alternative products dissolve into the flush water, or may contain other VOCs.

VOC medium, such as alcohol, may be used in some products, although most of the alternative products are solids with no VOC medium. We do not expect the VOC medium to cause a waste disposal problem, since the user would be knowingly throwing away useful product carried by the medium. Medium that enters sewer systems would be readily treated by wastewater treatment plants and would not be a solid waste issue. Representatives of "publicly owned treatment works" (POTWs) support our proposal (see next section), and do not cite VOC ingredients from alternatives to be an issue at treatment works. Our Consumer Products Program takes into account any VOC medium that may be used, for determining product compliance with VOC standards, and for determining VOC emissions and emission reductions.

In written comments, representatives of POTWs strongly support our proposal to essentially prohibit the use of PDCB products now marketed for toilets and urinals. The representatives also strongly support the use of alternative products already available, and have not indicated any water quality problem associated with the plastic screens, plastic containers, or ingredients of the alternative products. Instead, the representatives provided compelling data showing that it is the PDCB products, specifically, that are causing a significant wastewater pollution problem, with an associated air quality problem. Removal of the PDCB products from the marketplace will essentially mitigate both problems (Green, 2004; Martyn, 2004).

In summary, with regard to solid waste and water quality impacts, staff finds that the proposed rulemaking would not likely adversely impact solid waste or water quality. In fact, the proposal should result in no impact on solid waste and should have a positive impact on water quality.

H. POTENTIAL FLAMMABILITY OF PRODUCTS THAT CONTAIN VOCs

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 that there is a need for non-flammable solvents such as Perc, MeCl, and TCE, to clean electrical equipment that must be cleaned while there is an active or residual power source. We are not proposing to prohibit use of these compounds in these applications. While we agree that the cleaning of energized electrical equipment poses a risk, flammability is a lesser concern in other applications, for example in cleaning low voltage electrical equipment such as automobiles.

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, 2000a)

Instead, discussions with AMR facility operators indicated that most facilities consider all aerosol products flammable and use common safety precautions when using these products. Therefore, flammability is sufficiently addressed by the use of good operating practices on the part of facility owners, mechanics, and technicians. (ARB, 2000a)

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, address the issue of flammability.

I. STATE IMPLEMENTATION PLAN (SIP) IMPACT

On October 23, 2003, the ARB adopted *the Proposed 2003 State and Federal Strategy for the California State Implementation Plan* (Statewide Strategy) which reaffirms the ARB's commitment to achieve the health-based air quality standards through specific near-term actions and the development of additional longer-term strategies. The Statewide Strategy identifies the Board's near-term regulatory agenda to reduce ozone and particulate matter by establishing enforceable targets to develop and adopt new measures for each year from 2003 to 2006, including commitments for the Board to consider 19 specific measures.

The measures outlined in the adopted Statewide Strategy are being incorporated into SIP revisions. The Statewide Strategy will update all elements of the approved 1994 SIP and includes additional consumer products measures. Upon approval by U.S. EPA, the 2003 SIP will replace the State's commitments in the 1994 SIP. Together with significant reductions from stationary industrial facilities, mobile sources, and other areawide sources, the reductions in the consumer products element of the SIP are an essential part of California's effort to attain the air quality standards.

The ARB has committed, in the Statewide Strategy, to develop a measure to be proposed to the Board by 2004 and implemented by 2006 that would reduce VOC emissions from consumer products by at least 5.3 tons per day (tpd) statewide in 2010. The amendments to the consumer products regulation proposed in this document are intended to fulfill this commitment.

In addition to the SIP commitment, as part of a lawsuit settlement (see Chapter I, section C 4), ARB staff committed to propose to the Board by June 30, 2004, a control measure for a 2 tpd VOC emission reduction in the South Coast Air Basin. The amendments to the consumer products regulation proposed in this report are intended to fulfill the 2 tpd commitment and to partially fulfill the remaining VOC reduction commitment in the lawsuit settlement agreement.

J. ENVIRONMENTAL JUSTICE

State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. The ARB is committed to evaluating community impacts of proposed regulations, including environmental justice concerns.

Consumer products are considered area sources and, as such their use is not focussed in a particular area leading to a potential "hot spot." Generally, use of consumer products is fairly uniform across the State, tracking with housing units, and their emissions are spread over the course of a day, rather than concentrated at a particular time of day. For these reasons, we do not believe that people of any given race, culture, or income would be more impacted than any others would. All Californians should benefit equally from the reduction in VOC emissions from the consumer product categories proposed for regulation, as well as from the prohibition on use of chlorinated solvents that are TACs in the categories containing them.

Because the proposed limits for toilet/urinal care products effectively prohibit the use of PDCB, we would expect to nearly eliminate PDCB from waste water influent and effluent levels. As a result, PDCB concentrations in the air near Publicly Owned Treatment Works (POTWs) will be reduced. The lowering of PDCB levels in effluents from POTWs across the state would provide an environmental benefit to the communities where they are located, including low income communities and communities of color.

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