

**APPENDIX G: HEALTH RISK AND NEEDS ASSESSMENT OF  
METHYLENE CHLORIDE, PERCHLOROETHYLENE, AND  
TRICHLOROETHYLENE**

## **Health Risk and Needs Assessment for Prohibiting Methylene Chloride, Perchloroethylene and Trichloroethylene in Aerosol Adhesive Products**

As discussed in Chapter VI of the Staff Report, methylene chloride (MeCl), perchloroethylene (Perc), and trichloroethylene (TCE) are only used in a small number of aerosol adhesive products. Therefore, the overall exposure to aerosol adhesives containing MeCl, Perc, or TCE is expected to be small. However, given the fact that the three compounds are toxic, and used in numerous other consumer products and industrial processes, staff believes that the proposed prohibition on their use in aerosol adhesives would reduce the overall cumulative exposure and risk from these many sources. This appendix describes staff's assessment of the health risk due to the use of MeCl, Perc and TCE in aerosol adhesives and the need to reduce exposure to these compounds.

### **A. Overview**

Under the California Toxic Air Contaminant (TAC) Identification and Control Program, established under Assembly Bill 1807, the ARB has authority to identify and control TACs. This involves a two step process, in which compounds are first identified as a TAC through a formal process, and then subsequently controlled to lower the risk of exposure to the public. Proposed TAC controls require the preparation of a risk and needs assessment.

The Board identified MeCl as a TAC at a Board hearing held in July 1989. The details of staff's evaluation is contained within the ARB staff report, "Staff Report: Proposed Identification of Methylene Chloride as a Toxic Air Contaminant", dated May 1989. In October 1990, the Board identified trichloroethylene as a TAC. The technical evaluation is contained in the ARB staff report, "Staff Report: Proposed Identification of Trichloroethylene as a Toxic Air Contaminant", dated August 1990. Also, in October 1991, the Board identified perchloroethylene as a TAC. The complete analysis for Perc is contained within the ARB staff report, "Initial Statement of Reasons for Rulemaking: Proposed Identification of Perchloroethylene as a Toxic Air Contaminant", dated August 1991

Based on recommendations from the Department of Health Services and on corroboration from the Scientific Review Panel and the Office of Environmental Health Hazard Assessment (OEHHA), the Board determined that all three compounds are probable human carcinogens and insufficient data existed to establish minimum threshold levels, below which there are no adverse health effects.

For TACs that have no identified minimum threshold levels, the Health and Safety Code (HSC) section 39666(c) requires that those TACs be controlled to the lowest achievable level using best available control technology (BACT). The

HSC Section 39665 requires that an assessment of the public health needs be prepared, to the extent information is available, for a given TAC to show:

1. rate and extent of identified TAC emissions, estimated human exposure, and risks associated with those levels
2. the stability, persistence, transformation products, dispersion potential and other chemical characteristics of the TAC substance when present in ambient air
3. the categories, numbers, and relative contribution of present and future sources of the TAC, including mobile, industrial, agricultural, and natural sources
4. TAC control measure technological feasibility, anticipated effect of the proposed airborne toxic control measure, the degree to which the proposed airborne toxic control measure is compatible with recent technological improvements, or other actions taken in the past to reduce emissions
5. the approximate control cost, magnitude of risks as reflected by the amount of emissions from the source or category of sources, and the reduction in risk attributed to the airborne toxic control measure
6. the availability, suitability and relative efficacy of other substitute compounds of a less hazardous nature.
7. Potential adverse health, safety, or environmental impacts that may occur as a result of implementation of the toxic control measure.
8. Any basis for finding that an existing control measure does not achieve the expected emissions reductions (if necessary)

MeCl, Perc and TCE were previously evaluated during the TAC identification process for human exposure, potential cancer risk, chemical persistence in the atmosphere, and potential sources of these toxic compounds as referenced in the earlier discussion on the identification of those TACs. As indicated above, no minimum acceptable exposure levels were identified for these toxic compounds.

A discussion of the technological feasibility of the proposal to prohibit MeCl, Perc, and TCE in aerosol adhesives is contained in Chapter VI and Appendix F. In Appendix F, staff discusses potential substitute compounds for aerosol adhesives that are less hazardous. Costs associated with the proposed prohibition are discussed in Chapter VIII of this Staff Report, and environmental impacts are discussed in Chapter VII.

To complete the needs assessment to prohibit MeCl, Perc, and TCE (as required by HSC sect. 39665) in aerosol adhesives, this appendix addresses potential sources, potential health effects, dose-response values, exposure assessments, and risk characterizations for these three TACs. To evaluate exposure and risk, staff performed an assessment of worker exposure and estimated public risk due to the use of aerosol adhesives containing MeCl, Perc, and TCE.

To determine health impact of the three TACs, we considered the breathing or inhalation pathway only. We are not evaluating other routes of exposure because at this time the OEHHA does not routinely use other pathway exposures for volatile compounds such as MeCl, Perc, and TCE. Inhalation is the primary route of exposure for these compounds found in aerosol adhesives.

## **B. Sources of MeCl, Perc, and TCE**

The 1998 aerosol adhesive product survey showed that 33 out of 136 aerosol adhesive products were formulated with MeCl, Perc or TCE. Of this group, 29 products were formulated with MeCl alone in concentrations ranging from 13 to 73 wt%. In the past, aerosol manufacturers have favored MeCl because it is considered an excellent solvent with low flammability and low boiling point. These desirable properties have led to more widespread use of MeCl, than Perc or TCE. The 1998 product survey identified three products containing Perc, and only one product containing TCE. Together, these 33 products accounted for about three percent of total aerosol adhesive product sales.

The aerosol adhesive products containing MeCl, Perc and TCE were categorized by staff according to their use. Multipurpose adhesives represented the largest amount of sales, but actual uses of this general category of aerosol adhesives is difficult to determine. Upholstery and fabric adhesives represented the largest amount of sales for a specific purpose, whereas, aerosol adhesives used for silk screening applications represented the second major specific use of aerosol adhesives. Other uses of these aerosol adhesives included laminate table top installation and artist/advertising applications.

As previously mentioned, numerous consumer and industrial products, other than aerosol adhesives, contain MeCl, Perc, or TCE. For instance, all three TACs are used in paint and coating products. MeCl is also used in many paint remover products.

MeCl, Perc and TCE are also used in many industrial applications as well. The ARB has estimated that 80 percent of statewide Perc emissions are derived from dry cleaning and degreasing operations. TCE is almost exclusively emitted from industrial metal part degreasing operations. MeCl is used in the manufacturing of polyurethane and pesticides, as well as in certain pharmaceutical and electronics applications.

## **C. Potential Health Effects**

This section summarizes the cancer and non-cancer impacts that can result from exposure to MeCl, Perc, and TCE.

1. Methylene Chloride

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.

a. 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 the International Agency for Research on Cancer (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 toxic air contaminant (TAC) in July 1989. The State of California under Proposition 65 listed MeCl as a carcinogen in April 1988. Table G-1 presents the current health effects values that are used in this health risk assessment (HRA) for determining the potential health impacts.

In 1990, the U.S. Congress listed MeCl 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 MeCl in Group B2, as a probable human carcinogen. The IARC has classified MeCl in Group 2B, as a possible human carcinogen.

b. 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.

The California Air Pollution Control Officer's Association (CAPCOA) and OEHHA listed MeCl as having acute and chronic non-cancer RELs. The U.S.EPA also 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). Table G-1 presents the current health effects values that are used in this HRA for determining the 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.

**Table G-1  
Health Effects Values Used for Determining Potential Health Impacts<sup>1</sup>**

Compound	Cancer Unit Risk Factor (ug/m3) <sup>-1</sup>	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; liver and gastrointestinal system
Methylene Chloride (MeCl)	1.0 E-6	14,000	3000	central nervous system	central or peripheral nervous system; liver and gastrointestinal system
Trichloroethylene (TCE)	2.0 E-6	none	640	None	central or peripheral nervous system; liver and gastrointestinal system

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

- A) California Air Pollution Control Officer's Association, Air Toxics Hot Spots Program, Revised 1992 Risk Assessment Guidelines, October 1993.
- B) 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, April 1999.
- C) Office of Environmental Health Hazard Assessment, Air Toxic Hot Spots Program Risk Assessment Guidelines, Part I, The Determination of Acute Reference Exposure Levels for Airborne Toxicants.

## 2. Perchloroethylene

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

### a. Cancer

The 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. The State of California under Proposition 65 listed Perc as a carcinogen in April 1988. Table G-1 presents the current health effects values that are used in this HRA for determining the potential health impacts.

In 1990, the U.S. Congress listed Perc 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 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 IARC has classified Perc in Group 2A, as a probable human carcinogen, based on sufficient evidence in animals and limited evidence in humans.

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.

b. Non-Cancer

Acute and 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. 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.

In addition to CAPCOA and OEHHA listing Perc as having acute and chronic non-cancer RELs, 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. Table G-1 presents the current health effects values that are used in this HRA for determining 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 of 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.

3. Trichloroethylene

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

a. 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. The State of California under Proposition 65 listed TCE as a carcinogen in April 1988. Table G-1 presents the current health effects values that are used in this HRA for determining the 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 IARC classified TCE in Group 2A, as a probable human carcinogen, based on sufficient evidence in animals and limited evidence in humans.

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.

b. Non-Cancer

Acute and 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.

A chronic non-cancer REL is listed in the CAPCOA, Revised 1992, Risk Assessment Guidelines, October 1993. Table G-1 presents the current health effects values that are used in this HRA for determining the potential health impacts. The U.S. EPA currently is reviewing the Reference Concentration (RfC) and the oral Reference Dose (RfD) for TCE.

## D. Dose-Response Values

Dose-response or pollutant-specific health effects values are developed to characterize the relationship between a person's exposure to a pollutant 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.

As presented earlier in section B of this appendix, exposure to Perc, MeCl, and TCE may result in both cancer and non-cancer health effects. The inhalation URFs and non-cancer acute and chronic RELs that are used for this evaluation are listed in Table G-1. Also included in Table G-1 are the non-cancer acute and chronic toxicological endpoints for Perc, MeCl, and TCE. During this assessment, new acute RELs were adopted by OEHHA for Perc and MeCl. Table G-1 reflects the most current OEHHA-adopted health effects values for these compounds. The acute impacts presented in the June 1997 Status Report or Needs Assessment used the previous acute REL for Perc. In that report, the acute non-cancer results were all reported to be less than a hazard index of 1.0. 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. Since the current acute Perc REL is 2.94 times higher than the previous REL and it is used as a denominator in non-cancer hazard index calculations, the net result of the current REL, if it were applied to the results presented in the 1997 Needs Assessment, would show a decrease in the acute hazard indices by a factor of 2.94. Currently, OEHHA is in the process of reviewing studies for developing new or updating existing chronic RELs. MeCl and TCE are among the compounds under review. Once the chronic RELs are adopted by OEHHA, they may be used in HRAs.

A URF is defined as the estimated upper-confidence limit (usually 95%) probability of a person contracting cancer as a result of constant exposure to a concentration of 1 ug/m<sup>3</sup> over a 70-year lifetime. In other words, using the URF for Perc as an example, which is  $5.9 \times 10^{-6}$  (microgram per cubic meter)<sup>-1</sup> or (ug/m<sup>3</sup>)<sup>-1</sup>, the potential excess cancer risk for a person continuously exposed over a 70-year lifetime to 1 ug/m<sup>3</sup> of Perc is estimated to be no greater than 5.9 chances in 1 million.

An REL is used as an indicator of potential non-cancer adverse health effects. An REL 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.

## **E. Worker Exposure Assessment**

To assess worker exposure, staff used the emissions model that was used to calculate exposure levels of perchloroethylene from brake cleaner aerosol products. This analysis may be found in the ARB report, "Initial Statement of Reasons for Proposed Amendments to the California Regulations for Reducing Volatile Organic Compound Emissions From Consumer Products and Aerosol Coating Products", October 1996. Staff used this model as a surrogate since the use of aerosol adhesives and the facilities where these products are applied can be similar. Staff believes that the assumptions used in the model represent a worst case scenario.

From the 1998 aerosol adhesives survey, staff found that a predominant amount of spray adhesives containing MeCl and Perc are used in paper bonding, silk screening, and upholstery applications. In addition to MeCl and Perc, a limited amount of TCE was used in one aerosol adhesive product. This product contained about 30 percent TCE, and accounted for about 1 percent of the total sales in the special purpose aerosol adhesives category. Staff believes that based on the relative little use of this product, the exposure to TCE from aerosol adhesive products would be significantly less than the exposure to MeCl and Perc. Therefore, staff did not conduct an exposure assessment on TCE.

For the types of applications these products can be used, staff determined that upholstery operations best represented the largest use of these products. Therefore, upholstery operations were evaluated to determine workplace exposure to Perc and MeCl. Products containing MeCl, or a combination of MeCl plus Perc, were addressed because some aerosol adhesives contained one or both of these compounds in their formulations.

To estimate exposure to MeCl, staff evaluated upholstery operations, which are performed in an enclosed shop. A mathematical emissions model was used to relate the time-weighted concentration of MeCl in a typical upholstery shop during an 8-hour work day. The range of MeCl present in upholstery aerosol adhesives ranges from 34.5% to 53.5%.

As mentioned above, the mathematical model was previously used for calculating perchloroethylene exposure from brake cleaners, and can be used to assess the exposure of MeCl, taking into account its molecular weight and its emission rate.

For estimating the MeCl concentration, the equation is:

$$C_{\text{MeCl}} = \frac{(24.45 \times 10^{-3} \text{ m}^3/\text{mol}) (A)(B) \times 10^6}{(M)(V)(1+D)} \quad \text{where,}$$

- $C_{\text{MeCl}}$ - Estimated room concentration of methylene chloride, ppm
- A- Worst Case MeCl content per can, grams/can (304 gm/can)  
**MeCl/20 oz. can=>** 196 gm/can – 304 gm/can (34.5% - 53.5% MeCl )
  - B- Number of cans used per work period (1 can per 8 hr. work period)
  - M- Molecular weight of methylene chloride- $\text{CH}_2\text{Cl}_2$  (84 gm/mol)
  - V- Shop volume,  $\text{m}^3$  (1874  $\text{m}^3$ -Aerosol Coatings ISOR 10/96)
  - D- Shop volume changes per work period (48 changes/work period)

Staff used the same assumptions for shop volume and shop air flow used in the evaluation of brake cleaning operations since upholstery shops can be similar in size and use. Using the parameters for upholstery shops into the equation above, the localized concentration in the shop was calculated to be:

$$C_{\text{MeCl}} = 0.97 \text{ ppm, for the worst case application (20 oz. can)}$$

This compares to the MeCl federal OSHA time weighted exposure limit of 25 ppm per 8-hr work day

*Products Containing Both Perc and MeCl:*

A few products reported in the 1998 product survey contained both Perc and MeCl in their formulations. One product reported in the 1998 product survey contained 28% Perc and 24% MeCl.

By assuming the same upholstery operations and using the equation above, the concentration for Perc is calculated to be:

$$C_{\text{Perc}} = \frac{(24.45 \times 10^{-3} \text{ m}^3/\text{mol}) (A)(B) \times 10^6}{(M)(V)(1+D)} \quad \text{where,}$$

- $C_{\text{Perc}}$ - Estimated room concentration of Perc, ppm
- A- Worst Case Perc content per can, grams/can (159 gm/can)  
**Perc/20 oz. can=>** 159 gm/can (28% Perc formulation)
  - B- Number of cans used per work period (1 can per 8 hr. work period)
  - M- Molecular weight of Perc (165.8 gm/mol)
  - V- Shop volume,  $\text{m}^3$  (1874  $\text{m}^3$ -Aerosol Coatings ISOR 10/96)
  - D- Shop volume changes per work period (48 changes/work period)

Perc →  $C_{\text{Perc}} = 0.26 \text{ ppm, for the worst case application (20 oz. can)}$

This compares with the Perc federal OSHA time weighted exposure limit of 100 ppm per 8-hr work day

The concentration of the MeCl portion of the product containing 28% Perc and 24% is calculated:

MeCl →  $C_{\text{MeCl}} = 0.43 \text{ ppm}$

Again, this compares to the MeCl federal OSHA time-weighted exposure limit of 25 ppm per 8-hr workday.

Staff also calculated the worker exposure due to the only TCE containing product reported in the 1998 product survey. The results indicated that the exposure level to TCE was more than two orders of magnitude lower than the current federal OSHA standard of 100 ppm (8-hr time weighted avg).

## **F. Risk Assessment**

As pointed out in sections C and D of this appendix, MeCl, Perc, and TCE are probable human carcinogens, with no identified threshold levels below which there is no carcinogenic effects. These TACs are commonly used in numerous consumer products and industrial processes. Therefore, the proposed prohibition on the use of MeCl, Perc, and TCE in aerosol adhesives would incrementally reduce long term and short term exposure and risk from these compounds.

To assess the potential health risks of aerosol adhesives, staff modeled their evaluation on a recent ARB analysis to assess the health risk of aerosol brake cleaners (ARB Staff Report, "ISOR for Proposed Airborne Toxic Control Measure for Emissions of Chlorinated Toxic Air Contaminants from Automotive Maintenance and Repair Activities," March 2000). Again, upholstery shops and brake shops can be very similar and both have similar environmental factors (e.g. shop size, product use, etc.).

Please note that staff's objective in this assessment was to establish that potential risks exists from the use of aerosol adhesives which contain these TACs, rather than bracketing the actual risks from these facilities. Staff believes that the assumptions used in this model represents worst case conditions.

Table G-2 contains staff's estimates for exposure and risk from aerosol adhesives containing MeCl and Perc. As shown in table G-2, cancer risk for MeCl ranges from 0.2 chances in a million to about 6 in a million, depending on the distance from the source. For the combined product using MeCl and Perc, the cancer risk ranges from 3 in a million to about 30 in a million (cancer risk of MeCl plus risk of Perc), again depending on distance. The highest annual average concentration and risk occurs nearest the source, while the lowest exposure and risk occurs farthest from the source. Therefore, actual risk is dependent on receptor location. In conducting this assessment, staff did not

**Table G-2**

<b>TAC</b>	<b>Ann Avg. Exposure</b> (ug/m <sup>3</sup> )		<b>URF</b> (ug/m <sup>3</sup> )	<b>Cancer Risk</b> (chance/10 <sup>6</sup> )	
	@ 20M	@ 150 M		@ 20 M	@ 150 M
<i>Products w/ MeCl Only:</i>					
MeCl Only	438	12.8	1.0X10-6	5.8	0.16
<i>Products w/Perc&amp;MeCl:</i>					
Perc Portion	132	14.5	5.9x10-6	26.6	2.7
MeCl Portion	219	6.4	1.0X10-6	2.9	0.08

evaluate possible receptor locations or population density in locations near upholstery facilities. It should be noted that the estimated exposure and risk from this assessment could be several factors lower if more typical assumptions were used in the model.

**G. Rationale for Reducing Exposure to MeCl, Perc, and TCE**

As indicated in the previous section, possible exposure to MeCl, Perc, and TCE can exist from the use of aerosol adhesives. These compounds are toxic compounds and are considered probable human carcinogens.

In addition to aerosol adhesives, MeCl, Perc, and TCE are found in numerous other consumer and industrial products, and used in industrial processes. Although exposure and risk to these TACs are likely to be small from a single source, the cumulative exposure from many sources could be significant. Staff believes by eliminating the use of these TACs in aerosol adhesives, overall exposure and risk to these TACs would be reduced.