BEFORE THE CALIFORNIA AIR RESOURCES BOARD

PROPOSED AMENDMENTS TO THE CONTROL MEASURE FOR PERCHLOROETHYLENE DRY CLEANING OPERATIONS

Comments of the
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May 16, 2006

Table of Contents

I. Introduction

The Halogenated Solvents Industry Alliance, Inc. (HSIA) appreciates the opportunity to provide comments on the Air Resources Board's (ARB) proposed amendments to the air toxic control measure for perchloroethylene dry cleaning operations. HSIA represents users and producers of halogenated solvents, including perchloroethylene (PERC).

In 1993, ARB promulgated an air toxics control measure (ATCM) to reduce emissions of PERC from dry cleaning facilities. The ATCM set forth requirements for dry cleaning equipment using PERC, as well as requirements for equipment operation and maintenance, recordkeeping, and reporting. The proposed amendments would use currently available emission reduction technologies to further reduce the public's exposure to PERC from dry cleaning operations. Existing PERC facilities would be required to use dry cleaning equipment with integral secondary control. New PERC facilities would be required to use integral secondary control dry cleaning machines and to be located no less than 300 feet from residences or other sensitive receptors. In addition, new PERC facilities would be prohibited from locating in residential buildings and existing co-residential facilities would be required to phase out their use of PERC dry cleaning machines.

The proposed amendments also would require all PERC dry cleaning facilities to be equipped with enhanced ventilation systems. The requirement for enhanced ventilation would be phased in among existing facilities, depending on the facility's distance to sensitive receptors.

HSIA wholeheartedly agrees with the Board's conclusion that PERC can continue to be used safely, without presenting a public health risk, through the application of readily available control technology. We support the ARB proposal to require that all PERC dry cleaning equipment include integrated secondary controls. We further support the proposal to phase in the requirement for secondary control, as the current equipment reaches the end of its useful life, but oppose the proposal to accelerate replacement in situations where the cleaner is within 100 feet of a sensitive receptor.

The proposal to create such distance criteria is arbitrary and based on an overly conservative assessment of the potential public health risks presented by cleaning facilities. For the same reasons, HSIA is opposed to the proposed limitations on the location of new PERC facilities. The proposed criteria would preclude new PERC plants from opening in many parts of the state.

Although HSIA supports the use of enhanced ventilation to further reduce exposure to PERC, we believe that the ventilation requirement should be limited to cleaners in mixed use settings (i.e., co-located with residences or businesses) as is required by the New York State Department of Environmental Conservation (Title 6 NYCRR Part 232).[1] As evidenced by the Board's own estimates, requiring enhanced ventilation in stand-alone facilities provides little, if any, additional public health benefit.

HSIA also opposes the proposal to phase out PERC facilities in residential buildings (i.e., co-residential facilities) and to prohibit new co-residential plants from using PERC. These proposals are inconsistent with the available data from the San Francisco Bay Area and the country of Germany indicating that modern equipment and enhanced ventilation are sufficient to reduce potential risks to acceptable levels. Since the bulk of the co-residential facilities in the state are located in the Bay Area, moreover, the application of technology-based controls would have minimal economic impact.

II. Current Ambient Levels

ARB's proposal to amend the dry cleaning ATCM is based, in part, on the determination that a significant public health risk remains after the application of the 1993 requirements. The Staff Report[2] notes, however, that PERC emissions have been reduced by "about 70 percent" as a result of the dry cleaning ATCM. Monitoring data available from ARB indicate, moreover, that the resulting decline in ambient levels of PERC throughout the state has been equally dramatic.

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1 New York State Code of Rules and Regulations, Title 6, Part 232, Perchloroethylene Dry Cleaning Facilities.

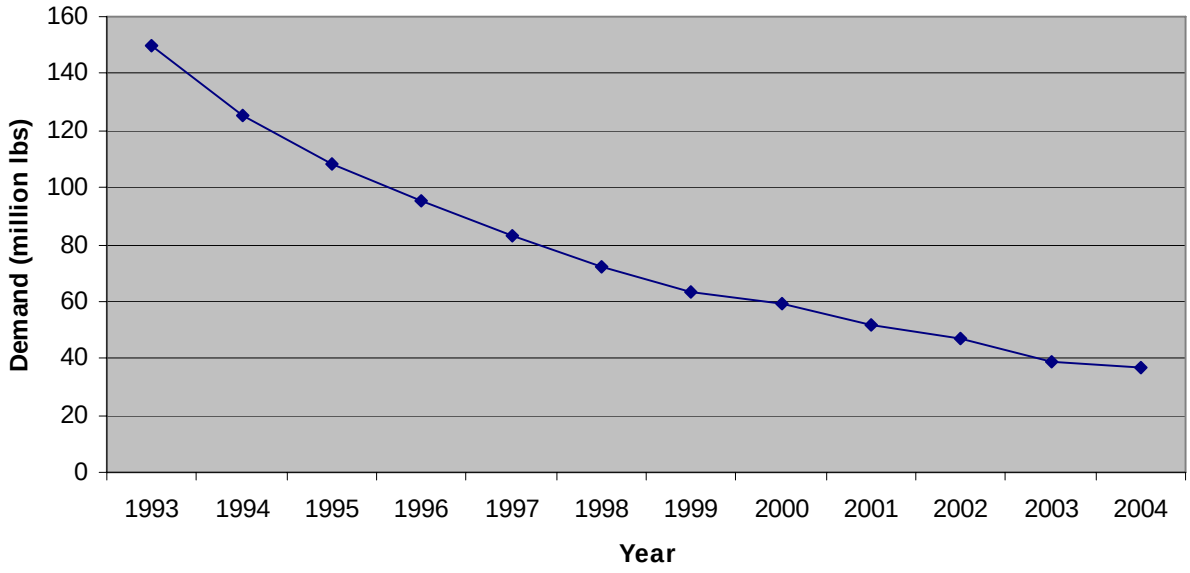
2 Air Resources Board, Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Adoption of the Proposed Amendments to the Control Measure for Perchloroethylene Dry Cleaning Operations. (April 7, 2006)

Data from the 17 monitoring stations in the state, including several in urban areas, indicate that the 90th percentile of PERC measurements at all stations are below a potential cancer risk of ten-in-a-million (10^{-5}), using the CalEPA unit risk estimate (URE) of 5.9 x 10^{-6} per microgram per cubic meter (ug/m^3).

A. Ambient Levels of PERC Have Dropped Dramatically

ARB estimates that the use of PERC by drycleaners between 1991 and 2003 declined by 66 percent and that emissions of PERC from dry cleaning plants were reduced by 70 percent over this same time period. Although some of this reduction is attributable to a drop in the number of PERC machines in the state, ARB estimates that the average pounds of clothes cleaned per PERC machine remained about the same.[3] A comparison of the industry-wide solvent mileage (e.g., total pounds of clothes cleaned/total gallons of PERC emitted) between 1991 and 2003 indicates that the industry has increased its efficiency by 290 percent – from 332 to 963 pounds/gallon – during the 12-year period. This remarkable increase in efficiency, and

Figure 1. PERC Demand in the US Drycleaning Industry, 1993 – 2004.

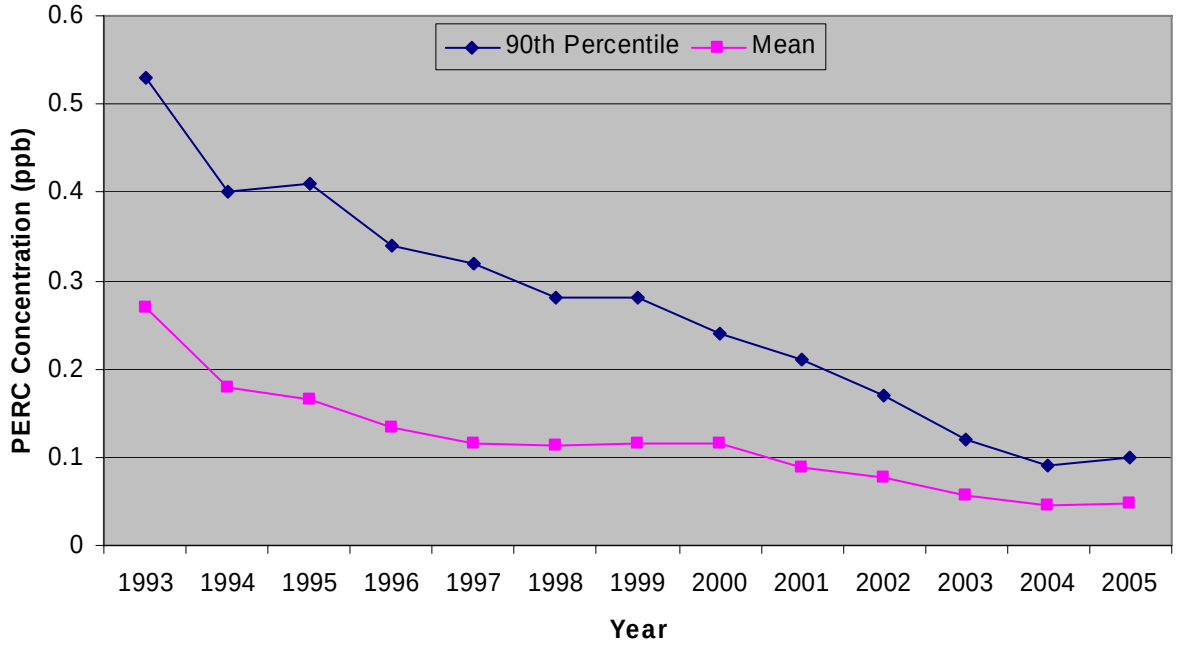


[3] ARB estimates that there were 5,310 PERC machines cleaning 247 million pounds of garments in 1991 and 4,670 PERC machines cleaning 214 million pounds in 2003. The average amount of clothes cleaned per PERC machine can be calculated to be 46,516 pounds in 1991 and 45,824 pounds in 2003. This represents a decrease of 1.5 percent. (ARB, California Dry Cleaning Industry Technical Assessment Report, February 2006.)

resulting significant decrease in emissions, is consistent with the national trend in PERC demand over the time period. (See Figure 1.)

The significant reduction in emissions is reflected in the ambient levels of PERC from the 12 monitoring stations from which ARB has been collecting data continuously since 1991.[4] Figure 2 shows a state-wide summary of these data, indicating a dramatic decline in both the mean concentration, as well as the concentration representing the 90th percentile of monitored PERC levels. The ARB data show that, state-wide, both values have fallen below 0.1 parts per billion (ppb),[5] and that the gap between the mean and 90th percentile values has narrowed considerably. These trends also can be observed at each of the 12 monitoring stations for which data are available from 1991 to the present.

Figure 2. Ambient Levels of PERC – Statewide Summary[6]



[4] These stations include: Burbank (West Palm Avenue), Chico (Salem Street/Manzanita Avenue), Chula Vista, El Cajon (Redwood Avenue), Fremont (Chapel Way), Fresno (1st Street), Los Angeles (North Main Street), North Long Beach, Riverside (Rubidoux), Simi Valley (Cochran Street), San Francisco (Arkansas Street), and Stockton (Hazelton Street).

[5] Equal to 0.7 ug/m^3.

[6] Data were obtained from the ARB web site (http://www.arb.ca.gov/adam/toxics/statesubstance.html).

B. Current Levels of PERC Do Not Present a Significant Public Health Concern

The evidence is quite clear that exposure to PERC has dropped dramatically as a result of the 1993 ATCM. ARB estimates that the average population weighted potential cancer risk from exposure to PERC currently is "between 1 and 2 chances per million." Most of the focus of ARB's current investigation, therefore, is not on overall PERC exposure but on exposures in the localized areas surrounding dry cleaning facilities. In this regard, the Staff Report provides the results of air dispersion modeling for a generic facility using data from four meteorological stations in the state. As discussed in more detail later in this comment, these modeling data are based on conservative assumptions. As a consequence, the Board's modeling results overstate emissions and the resulting ambient levels from typical dry cleaning facilities. ARB has not provided, and HSIA is not aware of, monitoring data collected by the Board in the area surrounding a dry cleaning plant. HSIA is aware, however, of monitoring data collected from stations located throughout the state that currently are collected by ARB. While we recognize that this monitoring network is designed to provide a state-wide average, we believe that the station locations are sufficiently representative of the California ambient environment. As such, HSIA believes that consideration of the PERC data available from the network is appropriate for the current evaluation of the localized effects of PERC dry cleaning facilities.

Table 1 provides the mean and 90^{th} percentile PERC concentrations from the 12 monitoring stations operated outside of the South Coast Air Quality Management District (SCAQMD) in 2005.[7] The mean PERC level at half of the monitoring stations is below the concentration that would present a theoretical cancer risk of 10^{-6}; the mean level at all of the stations is below the 10^{-5} level.[8] The concentration representing the 90^{th} percentile of the samples at all of the stations also is below the 10^{-5} risk level. Given the uncertainty of the CalEPA URF for PERC, discussed below, these potential risk estimates are indistinguishable from background incidence.

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[7] The Staff Report indicates that the South Coast AQMD will be unaffected by the proposed amendments as a result of the Air District's Rule 1421 which is equivalent to, or more stringent than, the ARB proposal.

[8] CalEPA's unit risk factor (URF) for PERC is 5.9×10^{-6} per $u g/m^3$, which is equal to a potential cancer risk of 39.3×10^{-6} per ppb. Using the CaEPA URE, lifetime exposure to a PERC concentration of 0.025 ppb would present a potential cancer risk of 10^{-6}.

Table 1. Current PERC Levels at ARB Monitoring Stations (in ppb)

Station Name	Mean	90th Percentile
Bakersfield	0.043	0.08
Calexico (Ethel Street)	0.064	0.11
Chico (Manzanita Avenue)	0.028	0.02
Chula Vista	0.036	0.07
El Cajon (Redwood Avenue)	0.045	0.08
Fremont (Chapel Way)	--	0.05
Fresno (1st Street)	0.028	0.05
Roseville (N Sunrise Blvd)	0.014	0.03
San Francisco (Arkansas Street)	0.026	0.05
San Jose (Jackson Street)	0.032	0.07
Simi Valley (Cochran Street)	0.038	0.07
Stockton (Hazelton Street)	0.024	0.04
State-Wide Average	0.047	0.10

C. PERC Levels Can Be Expected to Decline Further

Notwithstanding the amazing advancement in efficiency that the dry cleaning industry has achieved since the promulgation of the 1993 ATCM, additional progress can be expected. According to ARB estimates, about 67 percent of the PERC equipment currently in operation does not contain secondary controls.[9] According to a survey conducted by ARB in 2003, the average age of this primary control equipment is 10 years. Even in the absence of a revision to the ATCM, one can expect that this equipment will be replaced with new, more efficient machines over the next 10 years. According to ARB estimates, machines with secondary controls emit 46 percent less PERC than machines with primary controls only.[10]

Replacement of the primary-control equipment with machines with integral secondary controls will reduce PERC emissions by an additional 31 percent by 2016, to about 150 million pounds.[11] As a result of this additional reduction in emissions, mean PERC levels would be expected to fall to below 10^{-6} risk at all but one of the 12 monitoring stations.

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[9] Based on its 2003 survey, ARB estimates that 1,540 machines out of a total of 4,670 PERC machines include secondary controls (33 percent).

[10] The ARB estimates are based on the 2003 survey results and are summarized in Table III-6 (page III-17) of the Staff Report. For a cleaner processing 46,600 pounds of garments/year, ARB estimates that average PERC emissions for primary and secondary machines are 759 and 410 pounds, respectively.

[11] Replacement will occur more quickly among cleaners in the South Coast AQMD because of Rule 1421.

III. Risk Assessment Concerns

Much of the information on potential cancer risk included in the Staff Report provides a misleading picture of the potential risks presented by typical PERC dry cleaners in the state. Tables ES-5 (page ES-8) and IV-3 (page IV-8) present risks only for the 90th percentile of PERC usage and emissions. Similarly, the distribution of potential risks based on the proximity of residences on pages ES-9 and IV-9 is based on risk estimates from the 90th percentile of facility emissions. Although Table IV-6 (page IV-13) presents potential risks for the various ventilation scenarios based on both high-end and average emissions, risks are calculated for the "point of maximum impact (e.g., 20 meters)." Figures ES-1 (page ES-10) and V-1 (page V-3) also present estimated risks for 20 meters. According to ARB survey data, a residential receptor distance of 20 meters is relevant to only about 20 percent of existing cleaners. It is only in the final summary table of potential risks (Table IV-5 on page IV-11) that ARB provides risks for average emissions and at various receptor distances.

Apart from the concerns about Staff Report's presentation of potential risks, HSIA is very concerned about the underlying assumptions related to the carcinogenic potential of PERC. As discussed below, the URF used for the assessment is inconsistent with risk estimates derived by USEPA and others. In addition, a recently published epidemiology study failed to find an association between PERC exposure and an increased cancer incidence among dry cleaning workers in the Nordic countries.

A. CalEPA's URF Overstates the Potential Cancer Risk Presented by PERC Dry Cleaning Emissions

In its recent proposal to amend the national emissions standards for PERC dry cleaning facilities[12], the U.S. Environmental Protection Agency (USEPA) discusses the variation in URFs that have been developed for PERC, including the estimate developed by CalEPA. This discussion notes that the CalEPA value is an order of magnitude higher than other published estimates, including the estimate derived by USEPA in 1986 as part of its most recent Agency-

[12] 70 *Federal Register* 75884, December 21, 2005.

wide assessment of PERC.[13] In its proposal, USEPA uses both the CalEPA URF and a lower value (7.1×10^{-7} per ug/m^3) developed in 1998 by its own Office of Pollution Prevention and Toxic Substances (OPPTS) for its estimate of potential cancer risks.[14] In discussing the CalEPA and OPPTS values, the December 2005 proposal notes that:

> [b]oth are derived with consideration of findings of liver tumors in mouse laboratory bioassays, with the OPPTS value additionally considering laboratory findings of mononuclear cell leukemia in rats, and both have received public comment and scientific peer review by external panels.

In its discussion, USEPA correctly recognizes that one "significant contributing factor" to the differences in the risk estimates that have been developed is the variability in the "characterization of human metabolism of [PERC]." As noted in the Agency's 1985 Health Assessment Document (HAD),[15] experimental studies indicate that PERC metabolism in humans is "very limited" and amounts to "only about 1 to 3 percent of the estimated amounts absorbed." The basis for this conclusion is human volunteer studies and several empirical studies of occupationally exposed workers published in the scientific literature. In generating its URF for PERC, however, CalEPA assumes that a much higher fraction of the dose (18.5 percent) is metabolized in humans. CalEPA's assumption is based on the inclusion of data from a study of Japanese workers in a kimono manufacturing facility[16] suggesting that PERC may be more readily metabolized than predicted by the volunteer studies, particularly at low ambient concentrations.

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13 USEPA, Addendum to the Health Assessment Document for Tetrachloroethylene (Perchloroethylene), Updated Carcinogenicity Assessment for Tetrachloroethylene (Perchloroethylene, PERC, PCE), Office of Health and Environmental Assessment, EPA-600/8-82/005FA, External Review Draft (March 1986).

14 USEPA, Cleaner Technologies Substitutes Assessment for Professional Fabricare Processes, Office of Pollution Prevention and Toxics, EPA 744-B-98-001 (June 1998).

15 USEPA, Health Assessment Document for Tetrachloroethylene (Perchloroethylene), Office of Health and Environmental Assessment, EPA/600/8082/005F (July 1985).

16 Ikeda *et al*., Urinary Excretion of Total Trichloro Compound, Trichloroethanol, and Trichloroacetic Acid as a Measure of Exposure to Trichloroethylene and Tetrachloroethylene, *British Journal of Industrial Medicine* 29: 328-333 (1972).

Interpretation of these occupational data is complicated by several factors, as noted in EPA's 1985 HAD and draft 1986 HAD Addendum. These factors include: (1) the difficulty of accurate measurement of the dose of PERC received from the exposure, (2) imprecision of older methodologies used to quantify the products of metabolism, (3) the possibility that metabolites other than those monitored may be excreted, and (4) the very long half-life of PERC urinary metabolites that necessitates extended collection of samples. In particular, the study of Japanese kimono workers included in the CalEPA analysis used the older (Fujiwara) method for measuring the metabolite and did not account for dermal exposures resulting from the workers' handling of PERC-laden cloth.[17] The authors of the original paper have, in fact, subsequently acknowledged a much lower rate of metabolism in humans.[18]

A recent article by Clewell *et al*.[19] summarizes the various estimates of human metabolism that have been used in risk assessments of PERC. Clewell *et al*. consider more recent experimental data from human subjects exposed to relatively low concentrations of the solvent.[20] The authors conclude that the fraction of PERC metabolized following inhalation and oral exposure is 1.1 percent and 2.6 percent, respectively.

Clewell *et al*. also compare the estimate of the exposure level that would result in the public health goal (PHG) of one-in-a-million (10^{-6}) risk developed by CalEPA in a 2001 assessment[21] for drinking water exposure to one derived using a preferred model by Gearhart *et*

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17 Reitz *et al*., *In Vivo* and *In Vitro* Studies of Perchloroethylene Metabolism for Physiologically Based Pharmacokinetc Modeling in Rats, Mice, and Humans, *Toxicology and Applied Pharmacology* 136: 289-306 (1996).

18 Ohtsuki *et al*., Limited Capacity of Humans to Metabolize Tetrachloroethylene, *International Archives of Occupational and Environmental Health* 51: 381-390 (1983). The authors conclude that "less than 2 percent of [PERC] would be metabolized."

19 Clewell *et al*., Evaluation of Physiologically Based Pharmacokinetic Models in Risk Assessment: An Example with Perchloroethylene, *Critical Reviews in Toxicology* 35: 413-433 (2005). (Attached as Exhibit 1.)

20 Völkel *et al*., Biotransformation of Perchloroethene: Dose-Dependent Excretion of Trichloroacetic Acid, Dichloroacetic Acid, and N-acetyl-S-(trichlorovinyl)-L-Cysteine in Rats and Humans after Inhalation, *Toxicology and Applied Pharmacology* 153: 20-27 (1998). The results of this study are consistent with the earlier volunteer studies used by EPA in the 1985 and 1986 assessments.

21 CalEPA, Public Health Goal for Tetrachloroethylene in Drinking Water, Office of Environmental Health Hazard Assessment (August 2001).

al.[22] that includes the generally accepted estimates of human metabolism. The preferred model yields a URF of 3.8 x 10^{-7} per ug/m^3, which is very similar to the OPPTS URF of 7.1 x 10^{-7} per ug/m^3, as well as the URF derived by EPA in its last Agency-wide assessment for PERC (5.8 x 10^{-7} per ug/m^3).[23] The article concludes that the PHG developed by CalEPA is 240-fold lower (*i.e.*, more stringent) than that predicted by the Gearhart *et al* model. Clewell *et al.* conclude that this difference "is primarily due to the different estimates of fractional metabolism in the human." Most significantly, Clewell *et al.* conclude that the CalEPA model "greatly overestimates fractional metabolism in humans at the low exposures of interest for risk assessment. Therefore, the upper bound estimates of fractional metabolism obtained with [the CalEPA] model must be considered highly suspect."

By assuming a rate of PERC metabolism that is 6 to 18 times higher, CalEPA has derived a URF that is an order of magnitude higher than all other available estimates, including the two published estimates developed by USEPA. ARB's use of this estimate can be expected to yield risks that will be about 10-fold greater than those that would be derived with any of the other estimates. Using a more appropriate estimate of potential cancer risk, the estimates for residential risks presented in Table IV-5 would range from less than 0.1 – 10 x 10^{-6} instead of the 1 – 100 x 10^{-6} range currently presented.

B. <u>A Recent Epidemiological Study Strongly Suggests PERC Exposure is Not Associated with Increased Cancer Incidence in Dry Cleaning Workers</u>

Prior studies of dry cleaners, primarily from the United States, had indicated that PERC exposure might increase the risk of esophageal and cervical cancer, as well as non-Hodgkin's lymphoma (NHL). These earlier studies suffered from limitations, however, that included exposure to solvents other than PERC and the inability to take into account lifestyle factors (*e.g.*, smoking) known to affect the incidence of these cancers. As described in a 2003 review of the

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[22] Gearhart *et al.*, Variability of physiologically-based pharmacokinetic (PBPK) model parameters and their effects on PBPK model predictions in a risk assessment for perchloroethylene (PCE), *Toxicology Letters* 68: 131- 144 (1993).

[23] The value of 5.8 x 10^{-7} per ug/m^3 was calculated as the geometric mean of risk estimates from several different data sets in the Agency's 1986 draft Addendum to the HAD, which was never finalized. The value in the original 1985 HAD was 4.8 x 10^{-7} per ug/m^3.

existing epidemiological literature by Mundt *et al.*,[24] the existing studies were limited by a "widespread lack of valid exposure measurements or other adequate indicators of potential for exposure." Based on these limitations, the Mundt review concluded that the "current epidemiological evidence does not support a conclusion that occupational exposure to [PERC] is a risk factor for cancer of any specific site." Specifically, the authors found that, based on existing evidence, a relationship between PERC and cancer of the oral cavity, liver, pancreas, cervix, and lung was considered unlikely. Scientific evidence was found to be inadequate for laryngeal, kidney, esophageal and bladder cancer. The article also stated, however, that because there had been a number of positive findings suggested in some of the studies (*e.g.*, for esophageal cancer) additional evidence was needed to elucidate if any real associations do exist.

A recent epidemiological study by Lynge *et al.*[25] provides strong evidence that the incidence of several important cancer types among dry cleaning workers in the Nordic countries was not related to PERC exposure. This study presents important information directly relevant to ARB's assessment of potential cancer risk from PERC use in dry cleaning.

The Nordic study, conducted by five prominent European epidemiologists, responded to most of the shortcomings identified by Mundt *et al.* The Nordic study was undertaken as a series of case-control studies nested in groups of laundry and dry cleaning workers identified from 1970 census data in Denmark, Norway, Sweden and Finland – a total of over 46,000 persons. It covers a period when PERC was the dominant solvent and included all persons working in dry cleaning in the four countries in 1970. The nested case-control design allowed the researchers to compare the cancer risks of dry cleaners with those of laundry workers, a similar group apart from the use of PERC. In particular, cigarette smoking was equally frequent among exposed and unexposed subjects.

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[24] Mundt *et al.*, Critical Review of the Epidemiological Literature on Occupational Exposure to Perchloroethylene and Cancer, *International Archives of Occupational and Environmental Health* 76: 473-491 (2003). (Attached as Exhibit 2.)

[25] Lynge *et al.*, Cancer in Persons Working in Dry Cleaning in the Nordic Countries, *Environmental Health Perspectives* 114: 213-219 (2006). (Attached as Exhibit 3.)

Lynge *et al.* found that the risks of esophageal, liver, kidney, pancreatic, and gastric cardia cancer and NHL were not increased among the Nordic dry cleaners. An elevated incidence of cervical cancer was not observed in women directly involved in dry cleaning, and was determined by the researchers not to be related to PERC exposure. The authors observed a small increase in bladder cancer that also was not associated with the extent of exposure to PERC, consistent with previous studies where incidence of this cancer was not increased in the study populations exposed only to PERC.

In light of some of the previous findings, perhaps the most significant finding in the Nordic study is the absence of an increase in esophageal cancer. Prior studies of smaller groups of U.S. workers reported an increase in esophageal cancer, which is associated with smoking, alcohol consumption, and poor nutrition. The Nordic researchers note that, while the U.S. studies compared cancer incidence among dry cleaners with that of the national population, the current study controlled for the possible effects of smoking and other lifestyle factors by comparing incidence between two similar groups – dry cleaning and laundry workers. In sum, the Nordic study methodology significantly improved the ability to detect the potential for an increase in cancer incidence as the result of PERC exposure, and found no increases in cancer associated with PERC exposure using that improved methodology.

The results of the Nordic study strongly suggest that CalEPA should seriously reconsider whether the evidence supports regulation of PERC based on potential human carcinogenicity.

IV. Concerns about PERC Alternatives

The proposed ATCM amendments would allow continued use of PERC in most situations, but the additional requirements likely will encourage dry cleaners to consider alternative solvents and processes. This possibility is confirmed by the results of ARB's 2003 survey indicating that less than half of cleaners would consider purchasing a PERC machine if they had to replace their existing equipment. In light of a potentially significant switch from PERC, an assessment of the alternative processes is critical.

The Summary Report reviews several available alternatives to PERC, the most notable of which are synthetic hydrocarbon solvents, volatile methyl siloxane, carbon dioxide, and wet cleaning. As suggested in the Staff Report, and discussed in greater detail below, technical and economic limitations of carbon dioxide and wet cleaning likely will preclude these processes from widespread use. The Staff Report also suggests that concerns about the potential toxicity of volatile methyl siloxane may keep cleaners from selecting it, despite the fact that it is exempt from control as a volatile organic compound (VOC). As a result, the synthetic hydrocarbon solvents are the most likely candidate for cleaners considering an alternative solvent. As emissions of these solvents contribute to the formation of ozone in the lower atmosphere, their widespread use in the drycleaning industry would be problematic.

A. Additional Use of Hydrocarbon Solvents Will Contribute to Smog Production

ARB's survey indicates that about 400 cleaners (8 percent) currently use hydrocarbon and about a quarter of cleaners indicated that they would purchase a hydrocarbon machine if they had to replace their equipment. As described in the Staff Report, use of hydrocarbon solvents creates air quality concerns for ARB and the local air district. Based on information developed by the South Coast Air Quality Management District (SCAQMD),[26] ARB estimates that the proposed amendments to the ATCM for PERC dry cleaning (combined with SCAQMD's current Rule 1421 requirements) would increase VOCs statewide by 1.4 tons per day. The Staff Report further notes that this increase would need to be addressed in the next comprehensive revisions of California's State Implementation Plan (SIP) for ozone.

As noted in the Status Report, ozone adversely affects the respiratory functions of humans and animals. Human health studies show that short-term exposure to ozone injures the lung. In some animal studies, permanent structural changes with long-term exposures to ozone concentrations considerably above ambient levels were noted; these changes remain even after periods of exposure to clean air. Ozone is a strong irritant that can cause constriction of the

[26] As part of the environmental assessment for Rule 1421, SCAQMD estimated an increase in VOC emissions of 0.57 tons/day. This estimate is based on the assumption that hydrocarbon cleaners emit 34 percent of the solvent they consume. Using ARB's assumption that 46 percent of the hydrocarbon solvent is emitted, the estimate for SCAQMD would increase to 0.77 tons/day. It is also important to note that SCAQMD estimated that, assuming the maximum potential usage, VOC emissions would increase by 2.4 tons/day.

airways, forcing the respiratory system to work harder in order to provide oxygen to the body. Ozone is a powerful oxidant that can damage the respiratory tract, causing inflammation and irritation, and induces symptoms such as coughing, chest tightness, shortness of breath, and worsening of asthma symptoms. Ozone in sufficient doses increases the permeability of lung cells, rendering them more susceptible to toxins and microorganisms.

The greatest risk of ozone exposure is to those who are more active outdoors, 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. Ozone has been associated with premature death and ARB estimates that it may cause 630 deaths per year. Recent evidence, moreover, suggests a link between the onset of asthma and exposure to elevated ozone levels in exercising children.

B. Silicone-Based Solvents May Present Toxicity Concerns

The Staff Report indicates that the Office of Environmental Health Hazard Assessment (OEHHA) is conducting an assessment of the public health impacts from the volatile methyl siloxane solvent (decamethylcyclopentasiloxane, or D5) used by about 90 cleaners in the state. While HSIA can not comment on the available toxicity information, we note that OEHHA's 2003 preliminary review of D5 and a related product (octamethylcyclotetrasiloxane, or D4) concluded:

> While basic testing is still underway for D4 and D5, staff has evaluated the available data. We have concerns about the potential carcinogenicity of D5 and the estrogenic activity of D4. Since D5 is very lipophilic, we are concerned that it will bioaccumulate in the food chain. Dow-Corning conducted a two year study of D5 by inhalation in rats. After both 12 and 24 months, female rats showed an increase in tumors of the uterine endometrium. Dow Corning noted that the usual progression of hyperplasia to adenoma to adenocarcinoma was not observed in the experiments and that the statistically significant increase in adenocarcinomas alone is lost when the other tumors (adenomas) are added in. However, a statistically significant increase in a malignant tumor due to D5, a chemical that is bioconcentrated and is a candidate to replace [PERC], indicates a potential hazard for workers in the dry cleaning industry and perhaps for the general public.[27]

[27] Memo to Peter Venturini, ARB, from George Alexeff, OEHHA, Health Effects of Exposure to Alternative Dry Cleaning Solvents, December 2, 2003.

Pending the outcome of OEHHA's current review, D5's status as an exempt solvent under California's State Implementation Plan (SIP) for ozone could make it an attractive solvent to many cleaners in the state. This is particularly true if financial assistance from the state's Non-Toxic Dry Cleaning Incentive Program were to become available to cleaners wishing to use D5.

C. Wet Cleaning and Carbon Dioxide Systems are Not Economically Viable Alternatives to PERC Dry Cleaning

Despite the fact that wet cleaning and cleaning with liquid carbon dioxide (CO_2) have been commercially available for many years and can be considered mature technologies, their market penetration has been minimal. Based on its 2003 survey, in fact, ARB estimates that the two technologies combined comprise less than 1 percent of the state's dry cleaning capacity, with only 49 wet cleaning facilities[28] and 5 CO_2 facilities in operation. While HSIA recognizes that additional facilities have opened since 2003, stimulated primarily by financial assistance from the state's Non Toxic Dry Cleaning Incentive Program, the inherent properties of wet cleaning and CO_2 cleaning will continue to substantially limit their potential use.

The Staff Report briefly discusses the advances in wet cleaning processes since the introduction of the process in 1991. These advances, reviewed in additional detail in the technology evaluation conducted for ARB by the Institute for Research and Technical Assistance (IRTA),[29] are primarily designed to minimize the potential for shrinkage and distortion of the garments and to improve finishing.[30] The IRTA evaluation describes the current wet cleaning process as follows:

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[28] The Staff Report suggests that about 40 percent of the wet cleaning facilities (20 out of 49) are demonstration facilities. Consequently, the number of commercially successful wet cleaning facilities is less than the 49 facilities reported.

[29] Institute for Research and Technical Assistance, Evaluation of New and Emerging Technologies for Textile Cleaning (August 2005).

[30] While the Staff Report discusses the Green Jet® and cold water cleaning systems as separate technologies, HSIA believes it is more accurate to characterize them as alternative approaches to cleaning with water.

> The process generally consists of a computer controlled washer and dryer and specialized finishing units called tensioning equipment. In order to prevent dimensional change and to make finishing easier, many garments are dried with a residual of moisture. Garments that are dried completely may shrink and are difficult to finish. The dryers include moisture sensors and can be shut off at a particular moisture level. After they are removed from the machine, the still wet garments are hung and later finished using tensioning equipment. The tensioning equipment helps to form garments and restore constructed garments during finishing and helps to prevent them from shrinking.

The process, as described by IRTA, suggests the basic problem cleaners face when attempting to switch exclusively to a wet cleaning process. While the advances in technology have extended the range of garments that can be processed, the additional steps necessary increase the amount of time and labor required. Since labor already is the largest for a dry cleaning operation (regardless of the process used), increased labor costs are of great concern. As a result, wet cleaning is now generally accepted as a useful supplement to – not a replacement for – a solvent-based process.

The application of pressurized CO_2 (in either liquid or supercritical form) has been suggested as an alternative to various solvent processes over the years. In general, CO_2 systems have only been successful in a few applications that produce a high-value product capable of withstanding a high-pressure environment (e.g., solvent extraction of certain pharmaceutical and food ingredients). In the application of CO_2 to dry cleaning, the various manufacturers use lower pressures (700 to 800 pounds per square inch) to reduce the safety requirements (and costs) of the equipment. The reduced pressure, however, limits the cleaning ability of the process. While the equipment is cheaper, moreover, machine costs still exceed $100,000.

As noted in the Staff Report, the high cost of the CO_2 equipment is a major obstacle to more widespread use by dry cleaners. While financial assistance is available, the funds represent only a small fraction (10 percent or less) of the cost of the equipment. Additional efforts to reduce the cost of the equipment likely will either further reduce the cleaning ability or compromise the safety of the equipment.

V. Economic Impacts

The Staff Report concludes that, while compliance with the proposed ATCM amendments would have a significant adverse economic impact on cleaners in the state, the amendment is not considered to be a "major regulation" because the estimated cost to California business enterprises does not exceed $10 million in any single year. As a result, ARB has not conducted an economic impact analysis of submitted alternatives to the proposed amended regulation as otherwise required by Section 57005 of the Health and Safety Code. The economic assessment also does not include consideration of potential impacts on SCAQMD cleaners because it does not expect them to be impacted by the proposed ATCM revisions.

As outlined below, HSIA disagrees with ARB's conclusions that the proposed amendment is not a major regulation and that it does not impact cleaners in the South Coast AQMD.

A. The Proposed Amendments Will Impact SCAQMD Cleaners

As described in the Staff Report, SCAQMD amended Rule 1421, Control of Perchloroethylene Emissions from Dry Cleaning Systems, to require secondary control on all dry cleaning machines and to limits the lifetime cancer risk from a facility to no more than 25 in a million. In addition, Rule 1421 will phase out the use of PERC in dry cleaning operations by December 1, 2020.

Although ARB's proposed requirement for secondary controls is consistent with the requirement in Rule 1421, other aspects of the proposal are not. Of particular note is the proposed requirement for enhanced ventilation for all PERC facilities by 2010. Although it is possible that SCAQMD cleaners may elect to use enhanced ventilation to comply with the risk-based limits of 1421, South Coast AQMD does not specifically require it. In its assessment of the impacts of its rule, in fact, South Coast AQMD did not address the use of vapor barrier rooms or localized ventilation to comply with its requirements.

While the equipment requirements of ARB's proposal represent the largest contributor to the economic impact overall, the ventilation requirements are phased in over a shorter period of

time. As a consequence, they make a significant contribution to costs of the proposal between now and 2010. HSIA's analysis of these impacts is described below.

B. ARB's Proposal Represents a Major Regulation Under HSC Section 57005

Based on the information presented in the Staff Report, HSIA estimates that the equipment costs of ARB's proposal total about $68 million dollars. A breakdown of these costs is provided in Table 2. As noted, the proposal would require the replacement of 48 machines located in co-residential facilities with an alternative technology by 2010. Based on the available evidence, we assume that these cleaners will purchase hydrocarbon equipment at a cost of $60,000.[31] The cost of the requirement is estimated to be $2.9 million over 4 years, or $720,000 per year.

The proposal requires replacement of primary machines according to a timetable determined by facility's proximity to a sensitive receptor and the age of the equipment. Using the information on the total number of primary machines, the average age of these machines, and the proximity to receptors provided in the Staff Report,[32] HSIA assumes that 587 primary

Table 2. Equipment Costs for the Proposed ATCM Amendments

	No. of Machines	Cost/Machine	Total Costs (x 1,000)	Annualized Cost (x 1,000)[a]
Co-Residential	48	$60,000	$2,880	$720
Primary Control				
< 100 feet	587	$40,000	$23,472	$4,694
≥ 100 feet	1,043	$40,000	$41,728	$4,172
Secondary Control	812	$0	$0	$0
TOTAL	2,490	--	$68,080	--

[a] Costs are averaged over 4 years for co-residential machines, over 5 years for primary machines within 100 feet of a sensitive receptor, and over 10 years for primary machines outside of 100 feet of a sensitive receptor.

[31] The analysis uses the equipment cost estimates presented in the Assessment Report.

[32] According to the Staff Report, 36 percent of cleaners are within 100 feet of a residence. While the Staff Report did not provide distances for other sensitive receptors, the data provided in the Technical Assessment indicated that residences were the primary determining factor.

machines would need to be replaced by 2011 and the remaining 1,043 primary machines would have to be replaced by 2016. We assume all of the facilities decide to purchase a secondary PERC machine at a cost of $40,000. The total cost of the equipment is $65.2 million. The annualized cost is between $4.2 and $4.7 million, depending on the replacement timetable.

Our estimate of the costs of the proposed ventilation requirement is summarized in Table 3. For the reasons described above, we have included a cost component for dry cleaners located in the South Coast AQMD. Using ARB's estimate of the total number of the cleaners outside of South Coast that would be affected by the proposed requirement and ARB's estimates for type of equipment and receptor distances, we distributed the total numbers among the various categories. For SCAQMD cleaners, we used ARB's proximity distribution to estimate the number of cleaners between the two distance categories.

Table 3. Ventilation Costs for the Proposed ATCM Amendments

	No. of Facilities	Cost/Facility	Total Cost (x 1,000)	Annualized Cost (x1,000)[a]
Outside SCAQMD				
Co-Residential	48	$0	$0	$0
Primary Control				
< 100 feet	536	$3,700	$1,985	$662
≥ 100 feet	954	$3,700	$3,528	$882
Secondary Control				
< 100 feet	199	$3,700	$735	$245
≥ 100 feet	353	$3,700	$1,307	$327
SUBTOTAL	2,090		$7,555	
SCAQMD				
< 100 feet	720	$3,700	$2,664	$888
≥ 100 feet	1280	$3,700	$4,736	$1,184
SUBTOTAL	2,000		$7,400	
TOTAL	4,090		$14,955	

[a] Costs are averaged over 3 years for facilities within 100 feet of a sensitive receptor and over 4 years for facilities outside of 100 feet of a sensitive receptor.

For cleaners outside SCAQMD, the analysis indicates a total cost of $2.7 million ($900,000 per year) for cleaners within 100 feet of a receptor and $4.8 million ($1.2 million/year) for cleaners at or beyond 100 feet. For SCAQMD cleaners, the costs are $2.7

million ($888,000/year) for cleaners with 100 feet of a sensitive receptor and $4.7 million ($1.2 million/year) for cleaners at or beyond 100 feet.

Table 4 provides a summary of HSIA's cost analysis, which indicates that the total costs in each of the first 4 years exceeds $10 million, even if the ventilation costs for South Coast cleaners are not included. This information is contrary to ARB's analysis and suggests that the proposed ATCM amendments must be considered a major regulation under Section 57005 of the Health and Safety Code.

Table 4. Summary of Estimated Costs (in millions) of the Proposed Amendments to Dry Cleaning ATCM

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Equipment										
Co-Residential	$0.7	$0.7	$0.7	$0.7						
Primary Control										
< 100 feet	$4.7	$4.7	$4.7	$4.7	$4.7					
≥ 100 feet	$4.2	$4.2	$4.2	$4.2	$4.2	$4.2	$4.2	$4.2	$4.2	$4.2
Ventilation										
<100 feet	$0.9	$0.9	$0.9							
≥ 100 feet	$1.2	$1.2	$1.2	$1.2						
SUBTOTAL	$11.7	$11.7	$11.7	$10.8	$8.9	$4.2	$4.2	$4.2	$4.2	$4.2
Ventilation/SCAQMD										
< 100 feet	$0.9	$0.9	$0.9							
≥ 100 feet	$1.2	$1.2	$1.2	$1.2						
TOTAL	$13.8	$13.8	$13.8	$12.0	$8.9	$4.2	$4.2	$4.2	$4.2	$4.2

VI. Proposed Co-Residential and Facility Location Restrictions

The ARB proposal would impose significant limitations on new PERC dry cleaning facilities by prohibiting new facilities in residential buildings and preventing other new facilities from locating within 300 feet of a residence or an area zoned residential. The proposal also

would phase out existing co-residential cleaners by 2010 and require all PERC facilities to install enhanced ventilation.

As discussed below, the proposed requirements for enhanced ventilation and location restrictions on new facilities are not supported by the available evidence and would not provide a significant public health benefit. In addition, available data suggest that concerns about PERC exposures in residences co-located with dry cleaning facilities can be addressed through available technology and do not require that these facilities switch to an alternative solvent.

A. Controls Based on BAAQMD Requirements Would Adequately Control PERC Emissions From Co-Residential Facilities

Several jurisdictions in the United States and Europe have successfully implemented technology-based controls on PERC dry cleaners located in residential buildings. These include the states of New York and Rhode Island and the Bay Area Air Quality Management District (BAAQMD), as well as Germany and the Netherlands. Although the requirements vary somewhat among the jurisdictions, all five include requirements for equipment with primary and secondary controls and a separately ventilated enclosure to act as a barrier against diffusion of vapors.

Despite the interest in residential exposures in metropolitan New York, Germany, and the other three jurisdictions, little representative data exists on PERC levels in residences co-located with dry cleaners following the implementation of regulatory requirements. The controls on co-residential cleaners have been in place in Rhode Island and the Netherlands for just over two years, and have not yet become fully effective. Although vapor barriers have been required for several years in New York State, the requirement for secondary control equipment only became effective in mid-2003.[33] The two regulatory agencies with the most experience with the requirements, namely those in Germany and BAAQMD, appear to be sufficiently satisfied with their effectiveness that they have performed only limited sampling.

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[33] In comments submitted to USEPA, the New York State Department of Environmental Conservation notes that "the Department's Part 232 regulation of PERC dry cleaners has succeeded in reducing . . . indoor PERC levels in adjacent occupancies in mixed-use facilities by substantial amounts."

Germany was the first to impose controls on dry cleaners located in residential buildings. As part of 1990 regulations[34] to implement the Federal Emissions Control Act, all cleaners were required to operate equipment that achieves a concentration of 2 grams per cubic meter (equal to 300 parts per million, or ppm) in the drum at the end of the drying cycle and includes a lock on the loading door.[35] In addition, PERC emissions generated in the areas of the machines, storage of solvent, storage of treated objects, ironing boards, and steam devices are required to be ventilated by an "exclusive" ventilation system. The regulations also require that diffusion barriers be used to prevent the average PERC concentration in residences adjacent to dry cleaning equipment from exceeding 0.1 milligrams per cubic meter (100 micrograms per cubic meter, equal to 15 parts per billion or ppb).

In 1994, the Hohenstein Institute conducted a study of the effectiveness of these requirements in limiting PERC concentrations in adjacent residences.[36] The report looked at PERC concentrations in residences and/or businesses adjacent to 21 cleaners and concluded that "consistent application of state-of-the-art emissions reduction measures as stipulated by [2.BImSchV] means reliable adherence to the neighborhood precaution value in the environmental vicinity of textile cleaners." The document found, moreover, that even facilities that were not in full compliance with the German regulation achieved the 15-ppb limit 50 percent of the time.[37]

BAAQMD has required since 1997 that cleaners using PERC in a co-residential building use a machine with primary and secondary controls, a vapor barrier, and a separate ventilation system. BAAQMD has jurisdiction over dry cleaners in the Bay Area of San Francisco, which is

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[34] 2.Bundesimmissionsschutzverordnung (Federal Immissions Protection Regulation), 2.BImSchV of December 10, 1990.

[35] The regulations in New York State, Rhode Island, and BAAQMD specify that equipment with primary and secondary controls be able to achieve a level of 300 ppm in the drum, but do not require a door lock.

[36] Klein, P. and J. Kurz, Summary of Research Project, Investigation of Measures for Reducing the Concentration of Solvents in the Neighborhood of Textile Dry Cleaners, Bekleidungsphysiologisches Institut Hohenstein (November 1994). *See* EPA Docket Number 147.

[37] Those facilities not in compliance generally lacked an intact diffusion barrier. In many cases, the diffusion barrier appears to have consisted of a "painted coating," rather than the more impermeable materials required by New York State, Rhode Island, and BAAQMD.

believed to include the largest concentration of co-residential cleaners in the United States outside of metropolitan New York.[38] As part of the state's Air Toxics Hot Spots (ATHS) Program, BAAQMD is required to evaluate the potential health effects resulting from dry cleaners and other facilities that emit toxic air contaminants. In its 2002 annual report,[39] the District noted that:

> In 1994, the District adopted Regulation 11, Rule 16, Perchloroethylene and Synthetic Solvent Dry Cleaning Operations, which incorporated the risk reduction requirements of [the ATHS Program] because many dry cleaners had been identified as having risks of [10^{-4}] or greater. The risk reduction measures required by this rule have been fully implemented, and the health risks from all permitted dry cleaners have been reduced to [10^{-5}] or lower. There are currently no facilities in the Bay Area (including dry cleaners and gasoline dispensing facilities) that have been identified as having [10^{-4}] risks or greater requiring mandatory risk reduction measures under the ATHS Program.

BAAQMD has reinforced this position in discussions with USEPA in recent months. While stressing the importance of equipment maintenance, Bay Area staff conclude that "4th generation machines and vapor barrier rooms can be very effective in minimizing the risk inside residential building[s] co-located with a dry cleaner."[40]

In analyzing the results of air dispersion modeling under its ATHS Program, BAAQMD calculates risks for the "maximally exposed individual" (MEI). Under the District's risk assessment procedures, the MEI may be "either a residential site, an offsite worker, or any K-12 schools within 1000 feet of the source." Considering the mandate of the ATHS Program to address MEI risks, it seems unlikely that the District would not have attempted to approximate risk for residents in co-located apartment buildings for the assessment in its annual report. Given this fact, combined with the strong likelihood that the cleaners' emissions were overstated, it would appear that the discussion of the minimal risks posed by Bay Area cleaners in the 2002 annual report includes the District's co-residential cleaners.

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38 BAAQMD currently estimates that there are 57 PERC cleaners in residential buildings within its jurisdiction.

39 BAAQMD, Toxic Air Contaminant Control Program – Annual Report 2002 (June 2004).

40 Email from Scott Lutz, BAAQMD, to Rhea Jones, USEPA (August 23, 2005).

The addition of controls on co-residential cleaners in the Bay Area was based, in part, on the results of a study of PERC levels in four apartment buildings conducted by District staff in 1993.[41] Although the sample size was small, the study author concluded that "the combination of state-of-the-art equipment, good diffusion proofing (barriers/taping) and high ventilation rates . . . may be the optimal solution for preventing exposure of PERC to people residing above dry cleaning facilities." This conclusion has proven correct after nearly a decade of experience in the Bay Area.

The available data from Germany and the Bay Area contradict ARB's conclusion that a technology-based approach cannot reduce PERC levels sufficiently to protect apartment residents. Together, they represent independent verification of the effectiveness of a technology-based approach over an extended period of time. Combined with the data from those New York buildings where the cleaners were operating secondary control equipment and vapor barriers, they provide a compelling argument to support the technology-based option for regulating co-residential cleaners discussed in the preamble.

B. Enhanced Ventilation Requirements Should be Limited to Facilities Co-Located with Residences or Businesses

As discussed above, the use of enhanced ventilation has proven to be an effective approach to reducing PERC exposures in situations where the dry cleaning facility is co-located with a residence or other business. While HSIA supports ARB's proposal to require localized ventilation or full/partial vapor barrier rooms (VBRs) in co-located facilities, however, we oppose the proposal to require all PERC facilities to install enhanced ventilation systems. Contrary to ARB's assertion, the available data do not suggest that such requirement provides a significant public health benefit.

According to the results of its 2003 survey, ARB estimates that most dry cleaning facilities (50 to 60 percent) operate a general ventilation system and that only about 10 percent currently operate an enhanced ventilation system. Consequently, ARB's proposal would require

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[41] S. Lutz, An Investigative Survey of Perchloroethylene in Residential Areas above Dry Cleaners in San Francisco, BAAQMD Toxic Evaluation Section, Permit Services Division (June 30, 1993).

that 90 percent of cleaners install enhanced ventilation. As indicated above, the total cost of this is about $15 million over 4 years. Although the Staff Report suggests that the ventilation requirement would achieve a potential risk reduction of 63 percent, other information in the report does not appear to support the Board's contention. In fact, ARB's comparison of potential risk estimates associated with the various ventilation systems and receptor distances, contained in Table IV-5 (page IV-11) and reproduced (in part) as Table 5 below, shows only marginal improvement in the potential risk estimates when moving from general to enhanced ventilation systems.

Table 5. ARB Estimates of the Potential Cancer Risk at Residential Receptors from a Typical Dry Cleaner Using Secondary Control

	Receptor Distance (meters)				
Ventilation Type	20	40	60	80	100
General	22-43	9-17	5-9	3-6	2-4
General (B)[a]	14-28	7-13	4-8	3-5	2-4
Local	12-16	6-9	4-6	2-4	2-3
Partial VBR	12-19	7-11	4-7	2-4	2-3
Full VBR	12-18	6-10	4-7	2-4	2-3

a Scenario assumes the facility is 2,500 square foot and 18 feet high. All the other scenarios assume the facility is 1,100 square feet and 12 feet high.

According to the Board's estimated distribution of the distances, 34 percent of cleaners are more than 100 meters away from residences and sensitive receptors and 64 percent are more than 30 meters away. As a result, the proposed enhanced ventilation requirement would appear to have no impact on ARB's risk estimate for a large percentage of cleaners in the state.

C. <u>The Restrictions on the Location of New PERC Facilities Are Arbitrary and Provide No Health Benefit</u>

Based on the analysis in the previous sections of this comment, HSIA also is opposed to the proposal to prohibit a new PERC dry cleaning facility from locating within 300 feet of an existing residence or other sensitive receptors or an area that is zoned for residential use. Although we commend ARB's decision to allow new PERC cleaners, we believe that the 300-foot requirement is arbitrary, provides no public health benefit, and would preclude the use of PERC at new facilities in much of the state. Such a stipulation is an unnecessary infringement on new business development and, potentially, on local zoning efforts.

VII. Conclusion

HSIA strongly supports ARB's proposal to allow continued use of PERC in existing and new dry cleaning facilities. We support the proposal to require that all PERC equipment include integral secondary controls and that this requirement be phased in over the next 10 years (by 2016). We support a requirement for enhanced ventilation for dry cleaning facilities co-located with residences and other businesses, but are opposed to the proposal to require enhanced ventilation at all PERC facilities. We are opposed to the requirement that new PERC facilities be no closer than 300 feet from a\ residence or area zoned residential and to the prohibition on PERC cleaners in co-residential settings.