California Environmental Protection Agency

AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR THE PROPOSED AMENDMENTS TO THE CONTROL MEASURE FOR PERCHLOROETHYLENE DRY CLEANING OPERATIONS AND ADOPTION OF REQUIREMENTS FOR MANUFACTURERS AND DISTRIBUTORS OF PERCHLOROETHYLENE

Stationary Source Division
Emissions Assessment Branch

Release Date: December 8, 2006

State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

Public Hearing to Consider

ADOPTION OF THE PROPOSED AMENDMENTS TO THE CONTROL MEASURE FOR PERCHLOROETHYLENE DRY CLEANING OPERATIONS AND ADOPTION OF REQUIREMENTS FOR MANUFACTURERS AND DISTRIBUTORS OF PERCHLOROETHYLENE

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California Environmental Protection Agency
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State of California
AIR RESOURCES BOARD

PROPOSED AMENDMENTS TO THE CONTROL MEASURE FOR PERCHLOROETHYLENE DRY CLEANING OPERATIONS AND ADOPTION OF REQUIREMENTS FOR MANUFACTURERS AND DISTRIBUTORS OF PERCHLOROETHYLENE

Staff Report

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Staff Report: Initial Statement of Reasons for the Proposed Amendments to the Control Measure for Perchloroethylene Dry Cleaning Operations and Adoption of Requirements for Manufacturers and Distributors of Perchloroethylene

Executive Summary

I. INTRODUCTION

This Executive Summary presents a summary of the Air Resources Board (ARB or Board) staff's proposed amendments to the Airborne Toxic Control Measure for Emissions of Perchloroethylene (Perc) from Dry Cleaning Operations (Dry Cleaning ATCM or Perc ATCM). The proposed amendments are designed to further protect public health by prohibiting the use of Perc dry cleaning machines at new facilities and phasing out Perc machines at existing facilities. The staff will be presenting these proposed amendments to the Board for consideration on January 25, 2007. After considering the proposed amendments, the alternatives discussed below, and the public comments, the Board may choose to adopt these amendments or alternative requirements.

In 1991, the Board identified Perc as a toxic air contaminant (TAC) under California's Toxic Air Contaminant Identification and Control Program (Health and Safety Code (HSC) section 39650 *et. seq*.). In that process, the Board found that no threshold exposure level could be identified below which adverse health effects would not be expected. As a result of its identification, HSC section 39665(a) requires ARB to prepare a report on the need to control Perc and adopt appropriate measures. On October 14, 1993, the Board adopted the Dry Cleaning ATCM. This regulation is codified in title 17 of the California Code of Regulations, section 93109. The Dry Cleaning ATCM sets forth the equipment, operations and maintenance, recordkeeping, and reporting requirements for dry cleaning operations.

In 2003, staff began an evaluation of the effectiveness of the Dry Cleaning ATCM. The evaluation found that, as a result of the Dry Cleaning ATCM, Perc emissions from dry cleaning operations have been reduced by about 70 percent. However, the evaluation also showed that there are residual health risks associated with Perc emissions from dry cleaning operations, the best available control technology (BACT) for Perc dry cleaning operations has improved, more effective ventilation systems exist, and alternative technologies are available and viable.

As a result of this evaluation, staff proposed amendments to the Dry Cleaning ATCM for the Board's consideration. Staff's initially proposed amendments were presented in a staff report released April 7, 2006 and considered at the Board's May 25, 2006 public hearing. After hearing the public comments and considering staff's proposal, the Board voted unanimously not to proceed with the rulemaking and directed staff to return to the Board at a future date with a proposal that would phase out the use of Perc in dry cleaning operations. The proposed amendments presented herein are staff's response to the Board's direction.

Presented below is a summary which briefly describes the proposed amendments to the Dry Cleaning ATCM, provides an overview of the dry cleaning industry and technologies, presents emissions and risk from dry cleaning operations, and discusses the potential impacts from implementation of the proposed amendments. For simplicity, the discussion below is presented in question and answer format using commonly asked questions about the proposed amendments to the Dry Cleaning ATCM. This summary provides only a brief discussion on the topics. The reader is directed to subsequent chapters in the main body of the report for more detailed information.

II. SUMMARY OF PROPOSED ATCM

1. What would the proposed amended Dry Cleaning ATCM require for Dry Cleaners?

The proposed amended Dry Cleaning ATCM requires the complete phase out of Perc machines in dry cleaning operations by January 1, 2023. A summary of the major requirements of the proposed amended Dry Cleaning ATCM are presented below and in Table ES-1.

The proposed amendments prohibit any new installation of Perc machines beginning on January 1, 2008. Perc machines at existing co-residential facilities (facilities that share a wall with, or are located in the same building, as a residence), must be removed from service by July 1, 2010. Converted machines, and machines that are 15 years or older, must be removed from service by July 1, 2010. The remaining Perc machines must be removed from service once they become 15 years old. As a result of these requirements, the complete phase out of Perc machines in dry cleaning operations will occur by January 1, 2023.

Table ES-1. Summary of Major Requirements of the Proposed Amendments

Applicability	Facility Type	Requirements
Applies to any person who sells or distributes Perc and who installs, owns, operates, or distributes dry cleaning equipment in California that uses any solvent that contains Perc.	**New Facility**	No new installation of Perc machines starting on January 1, 2008.
	Co-residential Facility (Any facility that shares a wall with a residence or is located within the same building.)	Perc machines will need to be removed from service by July 1, 2010.
	Existing Facility (Any facility that operated Perc dry cleaning equipment prior to January 1, 2008.)	No new installation of Perc machines starting on January 1, 2008. Converted Perc machines will need to be removed from service by July 1, 2010. On July 1, 2010, all other Perc machines that are 15 years or older will need to be removed from service. After 2010, Perc machines will need to be removed from service when they are 15 years old.
	All Facilities	Completed phase out of all Perc machines by January 1, 2023.

2. <u>What would the proposed requirements for manufacturers and distributors of perchloroethylene require</u>?

Any Perc manufacturer that sells Perc into California is required to keep monthly sales records of gallons of Perc sold for use in dry cleaning in California. In addition, there is a one time reporting requirement of their distributors' contact information and a requirement to report changes to the contact information provided.

Any solvent distributor that sells Perc or recycled Perc to a California dry cleaning facility or to others for sale in dry cleaning in California (Perc distributor) is required to retain records of the Perc purchased and sold, the dry cleaner's contact information, and the contact information of their Perc distributor(s), if applicable. In addition, there is a one time reporting requirement of their Perc distributors' contact information, a requirement to report changes to the contact information provided and an annual reporting requirement of the gallons of Perc and recycled Perc sold to California dry cleaning facilities.

III. OVERVIEW OF THE DRY CLEANING INDUSTRY

This section contains a brief description of dry cleaning industry, a discussion of the technologies being used, and the market share of these technologies.

1. What is a "typical" dry cleaning business?

Typically, dry cleaners are small, owner-operated businesses that employ fewer than five employees. Over half of all dry cleaners in California employ two or less full-time employees. Dry cleaners are typically located in shopping centers or strip malls. Perc is the solvent most widely used by the dry cleaning industry in California. Over 70 percent of all dry cleaners in California use Perc.

2. What types of dry cleaning technologies are used in California?

Table ES-2 shows the types of commercial dry cleaning technologies used in California and the current market share for each technology. As shown in Table ES-2, Perc is the most widely used commercial dry cleaning technology. Of the estimated 5,210 dry cleaning machines, about 3,660 (70 percent) are Perc dry cleaning machines.

Table ES-2. Dry Cleaning Technologies and Market Share[1]

Type of Dry Cleaning Machines	Number of Machines (2006)	Percent Market Share (Total)	Percent Market Share (Non-Perc)
Perc	3,660	70	
Hydrocarbon (High Flash Point)	1,100	21	71
GreenEarth	190	4	12
Water Based Cleaning Systems[2]	170	3	11
Carbon Dioxide	10	<1	<1
Others[3]	80	2	5
Total	5,210		

1. Source: ARB 2006 Facility Survey, values are rounded to nearest 10.
2. Includes mixed shops.
3. Others include Rynex 3 (a propylene glycol ether solvent), as well as other hydrocarbon solvents.

As shown in Table ES-2, the fastest growing and second most commonly used cleaning technology is a high flash point synthetic hydrocarbon solvent technology. Most advanced hydrocarbon machines can use any of several different hydrocarbon solvents. Staff estimates that about 1,100 dry cleaning machines in California are currently using high flash point hydrocarbon solvents. This represents about 21 percent of all commercial dry cleaning machines and over 70 percent of the all non-Perc machines. Hydrocarbon solvents are classified as volatile organic compounds (VOCs).

The next most commonly use dry cleaning technology used in California is GreenEarth® (GreenEarth). GreenEarth uses methyl siloxane or D_5 as the cleaning solvent. GreenEarth solvent is being used in about 190 machines and makes up approximately 4 percent of all dry cleaning machines and 12 percent of all non-Perc machines. GreenEarth is not classified as a VOC. The Office of Environmental Health Hazard Assessment (OEHHA) is currently evaluating the solvent's toxicity based on testing data submitted by GreenEarth.

Professional wet cleaning (wet cleaning) is the next most widely used cleaning technology. This alternative to dry cleaning was first introduced in 1991. Wet cleaning uses computer-controlled washers and dryers. Finishing equipment includes pressing and tensioning units. This equipment is used to touch-up, stretch, reform, and finish garments. Wet cleaning systems use non-toxic, biodegradable detergents, which are approved for disposal into the sewer. Wet cleaning is being used in about 170 machines and makes up approximately 3 percent of all dry cleaning machines and 11 percent of all non-Perc machines.

Cleaning with CO_2 is a process that operates within a pressurized machine. The CO_2 used in this process is an industrial by-product from existing operations, primarily anhydrous ammonia (fertilizer) production. There is no net increase in the amount of CO_2 emitted; therefore, this process does not contribute to global warming. CO_2 is being used in about 10 machines and makes up less than 1 percent of all dry cleaning machines.

There are a variety of other dry cleaning technologies that use hydrocarbon cleaning solvents different from the high flash point solvents mentioned earlier. The solvents include Rynex™ (Rynex 3), a glycol ether, and other speciality hydrocarbon formulations. These solvents are listed in Table ES-2 as "Other." There are about 80 machines currently in this category and they make up approximately 2 percent of all dry cleaning machines and 5 percent of all non-Perc machines.

3. <u>How has the market share of Perc dry cleaning changed over the past several years</u>?

Table ES-3 shows the change in market share of Perc dry cleaning machines between 2003 and 2006. As shown in Table ES-3, from 2003 to 2006, the market share of Perc machines decreased from 86 percent to 70 percent. During the same period, the number of non-Perc machines increased from 14 percent to 30 percent.

Table ES-3. Change in Market Share of Perc and Non-Perc Machines between 2003 and 2006[1]

Type of Dry Cleaning Machines	Estimated Number of Machines (2003)	Estimated Number of Machines (2006)	Market Share (2003)	Market Share (2006)
Perc	4670	3660	86%	70%
Non-Perc	770	1550	14%	30%

1. Values rounded to the nearest 10.

Part of this downward trend in Perc machines is due to the South Coast Air Quality Management District (South Coast AQMD) rule for dry cleaning. South Coast AQMD amended its dry cleaning rule (Rule 1421) in December 2002. These amendments will phase out the use of Perc in the South Coast AQMD by December 2020.

IV. POTENTIAL EMISSIONS AND RISK

This section includes a brief discussion of the emissions, the potential health effects, and health impacts from Perc use in the dry cleaning industry.

1. How much Perc is being emitted by dry cleaning machines?

Based on ARB's 2006 survey of dry cleaning operations, staff estimates that approximately 3.0 tons/day of Perc were emitted from dry cleaning in 2006. This represents a decrease of approximately 1.1 tons/day from the estimated 2003 emissions of 4.1 tons/day. About 80 percent of Perc sold for use in California is used in dry cleaning operations.

2. What are the potential health effects associated with exposure to Perc?

Exposure to Perc may result in both cancer and noncancer (acute and chronic) health effects. The primary route of human exposure for these compounds is inhalation. In 1991, OEHHA concluded that Perc is a potential human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. In 1998, the State of California, under Proposition 65, listed Perc as a carcinogen. Noncancer health effects associated with exposure to Perc include headache, dizziness, rapid heartbeat, and liver and kidney damage.

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. The United States Environmental Protection Agency (U.S. EPA) has classified Perc in Group B2/C as a probable human carcinogen. The International Agency for Research on Cancer (IARC) has also classified Perc as a probable human carcinogen.

3. What are the potential health impacts to individuals from existing Perc dry cleaning operations?

To estimate the potential health impacts to the public due to Perc emissions from existing dry cleaning operations, ARB staff conducted a health risk assessment using the methodology outlined in *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003* (OEHHA Guidelines).

Table ES-4 provides estimates of the potential cancer risk for a resident living near a typical Perc dry cleaning facility. The estimated cancer risk for the current Perc technology (secondary controls) ranges from 40 chances per million at 20 meters, to about 4 chances per million at 100 meters.

Table ES-4. Potential Cancer Risk for High Perc Use Dry Cleaning Facilities[1]

Distance [meters (feet)][2]	Range of Potential Cancer Risk (chances per million)		
	Converted Machine with General Ventilation	Primary Control Machine with General Ventilation	Secondary Control Machine with General Ventilation
20 (66)	75	60	40
30 (100)	45	40	25
100 (330)	8	6	4

1. Assumes high-end (90%) Perc emissions rates of 113 gallons per year for converted machines, 94 gallons per year for primary machines, and 61 gallons per year for secondary machines. The results in this table are taken from Tables B-4 to B-6 in Appendix B. The results are adjusted for emission rates and averaged across three meteorological data sets (Fresno, Oakland (port), and San Diego (Miramar)). Calculations assume a 70-year exposure duration and use the 80th percentile daily breathing rate. Building size is assumed to be approximately 1,100 square feet. Results are for the inhalation pathway. All results are rounded.
2. Distances are presented from the building edge.

The maximum anticipated noncancer impacts for all generic dry cleaning scenarios, as represented by the hazard index, are less than 0.4 at residential receptor locations and less than 1.5 at adjacent worker locations. The adjacent workers' hazard index decreases to less than 1.0 within 30 meters of the dry cleaner. The noncancer acute hazard indices are less than 0.2 at any receptor location. Hazard indices less than 1.0 are not considered to be a concern to public health.

V. IMPACTS OF THE PROPOSED AMENDMENTS

In this section, we will discuss the potential environmental, health, and economic impacts that may result from implementation of the proposed dry cleaning ATCM.

1. What are the environmental impacts of the proposed Dry Cleaning ATCM?

The proposed amendments will practically eliminate all Perc emissions from dry cleaning operations. At full implementation, the proposed amendments will reduce Perc emissions by about 1.8 tons per day outside of the South Coast AQMD. Statewide, the proposed amendments and the South Coast AQMD rule will result in 3.0 tons per day reduction in Perc emissions. The only remaining sources of Perc emissions may come from the intermittent and limited use of spotting agents containing Perc or residual Perc from clothes last cleaned outside California. In addition, the amount of hazardous waste produced will be reduced and the potential for Perc soil and water contamination will be nearly eliminated.

With full implementation, there will be an increase in VOCs due to the increased use of hydrocarbon solvents. If all Perc facilities switch to hydrocarbon, an increase in hydrocarbon emissions of about 0.7 ton per day would occur outside of the South Coast AQMD.

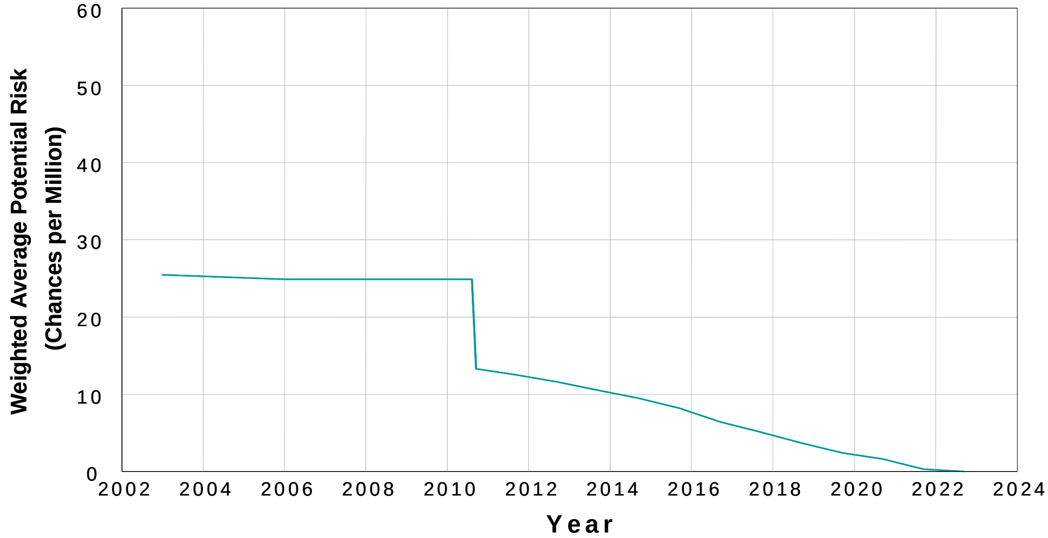
2. What are the potential health impacts to individuals after implementation of the proposed amended Dry Cleaning ATCM?

At full implementation, the proposed amended Dry Cleaning ATCM will virtually eliminate Perc exposure and resulting potential health risk due to dry cleaning operations. Figure ES-1 shows the current and projected average potential cancer risk after implementation of the proposed amended Dry Cleaning ATCM for facilities outside the South Coast AQMD that use Perc in California. The figure uses potential risk results for a receptor at 20 meters.

On a regional basis, the average population weighted cancer risk from exposure to ambient levels of Perc is estimated between 1 and 2 chances per million. After full implementation of the proposed Perc ATCM and with other Perc measures in place, the average potential statewide cancer risk from exposure to ambient Perc levels is expected to drop below 1 chance per million.

The proposed amendments are expected to result in increased usage of alternative technologies and solvents. No adverse emission-related health impacts are expected with the use of wet cleaning or CO_2. There is relatively little health data available on some of the other alternatives to Perc and no California health values have been adopted for solvents used in these alternatives. Based on a literature review, OEHHA has estimated several interim chronic noncancer reference exposure levels (RELs) and is continuing to follow the peer-reviewed literature on toxicity studies for the alternative solvents. The interim health values are not expected to result in adverse chronic noncancer impacts from the use of the alternatives. Currently, there are no cancer potency factors for Perc alternatives.

Figure ES-1. Potential Cancer Risk at Perc Dry Cleaners Subject to the Proposed Amended ATCM[1]



1. Excludes all dry cleaners within South Coast AQMD since they have their own dry cleaning rule. Figure is based on potential risk estimates at 20 meters.

The most popular Perc alternative is a high flash point hydrocarbon solvent. The switch to hydrocarbon solvents will result in increased VOC emissions. VOC emissions contribute to the formation of ozone. Ozone is linked to adverse health effects including respiratory irritation, asthma, and premature death.

3. How does the proposed amended Dry Cleaning ATCM impact the dry cleaners in the South Coast Air Quality Management District?

The proposed amendments are not expected to impact the dry cleaners in the South Coast AQMD. In 2002, the South Coast AQMD amended Rule 1421, Control of Perchloroethylene Emissions from Dry Cleaning Systems (Rule 1421). These amendments prohibit new Perc dry cleaning facilities and phase out the use of Perc in existing dry cleaning operations by December 1, 2020. In addition, all existing Perc dry cleaners in the South Coast AQMD are required to use secondary control and comply with the South Coast AQMD Rule 1402, Control of Toxic Air Contaminants from Existing Sources, which limits the lifetime cancer risk from a facility to no more than 25 in a million, by November 1, 2007.

There are differences between the South Coast AQMD rules and the proposed amendments. These differences pertain to the use of Perc dry cleaning machines. Under the South Coast AQMD rules, an existing facility is allowed to continue using their Perc secondary control machine providing it meets the requirement under Rule 1402 which limits the lifetime cancer risk from a facility to not more than 25 in a million. Additionally, an existing facility is allowed to replace their existing Perc machine with secondary control Perc machine if the facility meets a 10 in a million requirement for lifetime cancer risk. Overall, ARB staff believes that the proposed amendments and South Coast AQMD rules will achieve the same level of emission reductions.

4. **What are the estimated economic impacts of the proposed amendments?**

The ARB staff estimates the statewide cost for compliance with the proposed amendments to be approximately $41 million over 15 years. This corresponds to an annualized cost (in 2006 dollars) of $4 million per year from 2008 through January 2023. And, it corresponds to an annual cost of about $1,960 per year over 15 years for the 2,020 affected facilities. The statewide costs are based on 2006 dollars and represent the capital cost of new alternative equipment, and change in recurrent costs from 2008 through January 2023.

The cost for a typical business to comply with the proposed amendments varies and depends largely on the alternative technology that is chosen. The timing of when the cost will be incurred depends on facility type, machine type, and machine age. The total annual net increase in cost relative to using Perc technology typically ranges from $1,000 to $3,020 per year over 15 years. For facilities that operate with a primary control machine and opt to use carbon dioxide, the most expensive technology, the annual net increase is $14,530 per year over 15 years. Staff estimates the overall cost-effectiveness of the proposed amendments to be about $3.10 per pound of Perc reduced.

5. **Are these economic impacts considered to be significant to individual dry cleaners?**

Staff estimates that the typical Perc facility owner would have to charge an additional $0.41 (41 cents) to $0.57 (fifty-seven cents) per garment to recover the cost of a new alternative dry cleaning technology within 5 years. The ability to pass on these costs would be dependent on local competition for dry cleaning services. If there is a relatively high density of dry cleaners in one area, and all of them do not have to upgrade their equipment, then the ability to recover cost may be constrained.

To look at the impact of the proposed ATCM on dry cleaning profits, staff used the change in the return on owner's equity (ROE). A decline in ROE of 10 percent or more is considered to indicate a significant adverse impact. Without accounting for grants or financial incentives that are available to some qualified facilities, the calculated ROEs are all greater than 10 percent independent of technology type and may have a significant adverse economic impact to a typical facility. The range of decline in ROE due to the proposed amended Dry Cleaning ATCM is from 18 percent (when switching from a secondary control Perc machine to a professional wet cleaning system) to about 55 percent (when switching from a primary control Perc machine to a hydrocarbon machine).

The ROE calculations assume that the facilities are unable to pass costs onto its customers. In addition, the ROE calculations are based on financial data obtained from the staff's evaluation and financial ratios from Dunn and Bradstreet for a typical dry cleaner. For this evaluation, staff calculated that the typical dry cleaner's total gross revenue is $250,000 per year, and that the total net profit after tax is about $3,300 per year. Using the most likely scenario of switching from a primary control Perc machine to a hydrocarbon machine, the net profit for the facility will be reduced to about $1,800 per year.

6. <u>Is there financial assistance for dry cleaners who would like to replace their Perc dry cleaning systems</u>?

The California State Legislature enacted Assembly Bill (AB) 998, which established the Non-Toxic Dry Cleaning Incentive Program. The Non-Toxic Dry Cleaning Incentive Program is composed of a grant program and a demonstration program. The grant program provides financial assistance ($10,000) to California dry cleaners who replace their existing Perc dry cleaning systems with non-toxic and non-smog forming systems such as water-based (i.e., professional wet cleaning, Green Jet®, and cold water cleaning) and carbon dioxide (CO_2) cleaning systems.

The grant program for the dry cleaning industry began in April 2005. To date, ARB has awarded 23 grants to eligible dry cleaning recipients which total $230,000 in grant awards. The grant guidelines and application package are made available to all dry cleaners annually. Grant applications and approval are made on a continuous basis. Staff anticipates being able to fund approximately 20 grants per year. However, the funds available will significantly decrease beginning in 2010 due to the phase out of Perc.

VI. REGULATORY ALTERNATIVES

After considering the proposed amendments, the four alternatives discussed below, and the public comments, the Board may choose to adopt the proposed amendments or alternative requirements or any combination thereof. Possible alternative approaches include changes to the phase out period or a risk-based threshold.

1. <u>Phase Out the Use of Perc and Prohibit Use of New Machines that Emit Smog-forming Emissions</u>

This alternative would phase out Perc machines as staff is proposing with the inclusion of a provision to prohibit the use of hydrocarbon solvents. This option would provide the maximum protection from emissions of Perc while preventing an increase in volatile organic compound (VOC) emissions from hydrocarbon solvents. Staff is not recommending this option primarily because of cost, 17 percent more than the proposed amendments, and district opposition.

2. <u>Increase the Phase Out Period</u>

Under this alternative, the phase out period would be extended by 2 years. Extending the phase out period would lessen the economic burden on the dry cleaning facility owners by allowing more time for the facility to replace their existing machines.

Staff does not recommend this option because of the adverse health impacts associated with delaying the reduction of Perc.

3. <u>Decrease the Phase Out Period</u>

This alternative would shorten the time frames in the regulation which require facilities to phase out the use of Perc in dry cleaning five years earlier. Shortening the time frames in the regulation would significantly increase the cost of compliance. The amount of the increase would depend on which requirement is adjusted and how significant the change is in the compliance date. The main cost impacts beyond the proposed ATCM would be associated with the loss of residual value in existing machines due to accelerated replacement of non-Perc alternative machines. For example, a 5 year decrease in phase out time would result in potential statewide cost of $59 million over 15 years, which is about 44 percent higher compared to the proposed amendments. Staff is not recommending this option because of the increased costs.

4. <u>Phase Out Use of Perc and Require Add-On Secondary Control for Primary Control Machines</u>

This alternative would phase out Perc machines as staff is proposing with the inclusion of a requirement for add-on secondary control devices for existing primary control machines. This option would reduce the amount of Perc emitted from primary control machines by an additional 46 percent at a cost of about $6,000 per machine. This option would be about 14 percent more costly than the proposed amendments. Under the staff proposal, beginning July 1, 2010, primary machines must be removed from service when they are 15 years old. This provision will result in almost 50 percent of the all primary control Perc machines being removed from service by July 1, 2010 and almost all primary control machines removed from service by 2016. Given this rapid phase out of primary machines, staff believes that this alternative is impractical and not cost effective.

VII. PUBLIC OUTREACH AND ENVIRONMENTAL JUSTICE

Below is a brief summary of the actions taken during this rulemaking by ARB staff to work with the public and affected parties and to address ARB's goals on Environmental Justice.

1. <u>What actions did ARB staff take to ensure that the public and affected parties participated in the rulemaking process</u>?

A public process that involves all parties affected by the proposed ATCM is an important component of the ARB actions. As part of ARB's outreach program, staff made extensive personal contacts with industry representatives, state and local regulatory agencies, environmental/pollution prevention and public health advocates, and other interested parties through site visits, meetings, telephone calls, and electronic mail. Staff developed a workgroup consisting of industry and environmental group representatives. Staff visited over 100 dry cleaning facilities, attended several water-based cleaning and CO_2 technology demonstrations, held 17 workgroup meetings, attended three evening meetings with the Northern California Korean Dry Cleaners-Laundry Association, conducted five public workshops, and attended the Fabricare 2006 Show.

Staff made special efforts to have key materials translated into Korean and to have translator services available at the workshops. The materials translated included the proposed regulation, this Executive Summary, and the Hearing Notice. Additionally, to further increase the general public's participation in this assessment, staff made information available via ARB's website (*www.arb.ca.gov/toxics/dryclean/dryclean.htm*).

2. How does the proposed amended Dry Cleaning ATCM relate to ARB's goals on Environmental Justice?

ARB is committed to evaluating community impacts of proposed regulations including environmental justice concerns. Given that some communities experience higher exposure to toxic pollutants, it is a priority of ARB to ensure that full protection is afforded to all Californians. The proposed amended Dry Cleaning ATCM is not expected to result in significant negative impacts in any community. The proposed amended Dry Cleaning ATCM is designed to further reduce emissions of TACs, such as Perc, to residents and off-site workers living or working in communities near the affected facilities.

VIII. RECOMMENDATION

We recommend the Board approve the proposed amended Dry Cleaning ATCM presented in this report (Appendix A). The proposed amended Dry Cleaning ATCM will, in time, eliminate Perc emissions from dry cleaning operations. The proposed amended regulation will provide air quality benefits for all Californians, particularly those living near dry cleaning facilities. ARB staff believes the proposed amended regulation is technologically feasible and necessary to carry out the Board's responsibilities under State law.

STAFF REPORT: INITIAL STATEMENT OF REASONS

I. INTRODUCTION

A. Overview

Perchloroethylene (Perc) is the solvent most commonly used by the dry cleaning industry to clean clothes or other materials, such as curtains, sleeping bags, blankets, comforters, and leather goods. Perc is emitted to the air from dry cleaning operations, which contribute to the public's exposure to Perc.

In 1991, the Air Resources Board (ARB or Board) identified Perc as a toxic air contaminant (TAC) under California's Toxic Air Contaminant Identification and Control Program (Health and Safety Code (HSC) section 39650 *et. seq.*). Once Perc was identified as a TAC, the ARB was required under HSC section 39666 to evaluate the need for a regulation to reduce emissions from Perc. State law requires that control measures for TACs without a Board-specified health based threshold exposure level be based on the best available control technology (BACT) or a more effective control method in consideration of cost and risk. Accordingly, on October 14, 1993, the Board adopted the Airborne Toxic Control Measure for Emissions of Perchloroethylene from Dry Cleaning Operations (Dry Cleaning ATCM). This regulation is codified in title 17 of the California Code of Regulations (CCR), section 93109. The Dry Cleaning ATCM sets forth the equipment, operations and maintenance, recordkeeping, and reporting requirements for dry cleaning operations.

From 2003 to 2005, staff performed an evaluation of the effectiveness of the Dry Cleaning ATCM. Although the evaluation showed that Perc emissions from dry cleaning decreased by about 70 percent, residual health risks remained associated with Perc dry cleaners. Also, in the years since 1993, BACT has improved and alternative technologies are available and viable. As a result of the evaluation, the staff developed proposed amendments to the Dry Cleaning ATCM which the Board heard on May 25, 2006.

After hearing the public comments and considering staff's proposal, the Board made a decision not to proceed with the proposed rulemaking and directed staff to return to the Board with a new proposal to phase out the use of Perc in dry cleaning operations. This report presents the staff's proposal to virtually eliminate Perc use in dry cleaning operations by January 2023.

B. Purpose

ARB continues to take actions to eliminate or reduce emissions of TACs to protect public health. These actions are important because sources of TACs are often located near homes or schools. While the ARB is developing new measures to continue the progress in reducing health risks from toxics in the air, we are also re-evaluating whether some of the control measures adopted in the past can be even more protective. ARB lists Perc as one of the top ten TACs that contribute the most to our overall statewide cancer risk. This ranking is based on ambient air measurements from ARB's monitoring network. Since Perc can be emitted from neighborhood dry cleaning shops and new cleaning technologies have emerged, a complete review of the existing Dry Cleaning ATCM has been conducted to assess the need for revisions to further protect public health.

The technical evaluation of the existing Dry Cleaning ATCM conducted by ARB staff from 2003 to 2005 led to the release of the report entitled California Dry Cleaning Industry Technical Assessment Report (Technical Assessment Report). This report discusses the dry cleaning technology assessment and provides the basis of our efforts to determine the effectiveness of the existing Dry Cleaning ATCM.

Information regarding the California dry cleaning industry was obtained from several surveys of the dry cleaning industry. The ARB staff developed the Dry Cleaning Facility Survey (Facility Survey) in cooperation with the California Cleaners Association, the Korean Dry Cleaners-Laundry Association, other industry representatives, and the local air pollution control and air quality management districts (local air districts). The Machine Manufacturers Survey was used to collect information about equipment and operation costs and other machine information. The Perc Solvent Distributor's Survey was used to collect information on the percentage of Perc that is used by the dry cleaning industry and to confirm Perc usage obtained from the dry cleaning facilities survey. Additionally, the Dry Cleaning Solvent Manufacturers Survey was used to obtain formulation information, which was shared with the Office of Environmental Health Hazard Assessment (OEHHA). Using this information, OEHHA provided ARB with its review of the health effects and toxicity of other alternative cleaning solvents that are discussed in this report.

ARB staff conducted site visits of dry cleaning facilities and conducted emissions testing to enhance understanding of the California dry cleaning industry and the dry cleaning process. Staff visited several facilities in the State and collected relevant information (e.g., distance to receptors, ventilation practices, and solvent usage). Our testing included collecting and testing sludge from Perc and DF-2000™ Fluid (DF-2000) dry cleaning facilities, evaluating the effectiveness of Perc detectors, and measuring Perc concentrations around Perc dry cleaning machines and other locations in the facilities.

As a result of this evaluation, the staff developed proposed amendments to the Dry Cleaning ATCM which the Board heard on May 25, 2006. After hearing the public comments and thorough discussion with staff, the Board stated that more should be done to reduce exposures to Perc for dry cleaning operations. By a unanimous vote, the Board directed staff to return to them with a proposal for their consideration to phase out Perc from dry cleaning operations. The Board also directed staff to consider the cost impacts of the proposal and evaluate ways to minimize these through possible financial assistance programs.

The Board's directions led staff to obtain additional information on the alternative technologies and update cost information on machines and technology operations. This information was gathered through additional workgroup meetings, industry meetings, staff's attendance at the Fabricare 2006 show, and various surveys of the dry cleaning industry, including facilities, machine manufacturers, and solvent distributors.

This Initial Statement of Reasons (ISOR) for the proposed amendments to the existing Dry Cleaning ATCM presents current information on the dry cleaning industry in California. It also presents the exposure and health effects from the use of Perc in the dry cleaning industry. Finally, it will present the proposed amendments to the existing ATCM and the health, economic, and environmental impacts of these proposed amendments.

C. Non-Toxic Dry Cleaning Grant and Demonstration Programs

The California State Legislature enacted Assembly Bill (AB) 998, which establishes the Non-Toxic Dry Cleaning Incentive Program. One objective of this program is to provide financial assistance to California dry cleaners who replace their existing Perc dry cleaning systems with non-toxic and non-smog forming systems such as water-based and carbon dioxide (CO_2) cleaning systems. Another objective of this program is to provide 50 percent matching funds to cover the costs of a demonstration program to showcase professional non-toxic and non-smog forming dry cleaning technologies in the State.

AB 998 requires the ARB to assess a three-dollar ($3) per gallon fee on the importers of Perc for dry cleaning operations beginning January 1, 2004. This fee will increase one dollar ($1) per gallon per year from 2005 through 2013. As required by the legislation, the majority of these funds will be used to establish a grant program to provide $10,000 grants to assist dry cleaners in switching to non-toxic and non-smog forming cleaning technologies. The balance of funds will be used to establish a demonstration program to showcase these technologies statewide. ARB is to ensure that at least 50 percent of the grant funds provided are awarded in a manner that directly reduces the public health risk associated with air contaminants in communities with the most significant exposure to air contaminants or localized air contaminants, or both, including, but not limited to, communities of minority populations or low-income populations, or both.

The grant program for the dry cleaning industry began in April 2005. The 2006 grant guidelines and application package was made available to all dry cleaners to apply in April 2006 with an application deadline of May 5, 2006. To date, ARB has awarded 23 grants to eligible dry cleaning recipients for a total of $230,000. Among these grants, 20 dry cleaners replaced their Perc machines with water-based cleaning systems and 3 dry cleaners installed CO_2 cleaning systems.

Due to insufficient funding from Perc fee collections for the first year, ARB was unable to implement the demonstration program until mid-2006. The 2006 Non-Toxic

Dry Cleaning Incentive Program Demonstration Guidelines were made available for the California Dry Cleaning Industry in May 2006. The final deadline for submitting applications for the newly established demonstration program was June 30, 2006. To date ARB has received two demonstration proposals for consideration. Information for both the grant and demonstration program is available on our website at *www.arb.ca.gov/toxics/dryclean/ab998.htm*.

D. Regulatory Authority

California's air toxics program, established under California law by Assembly Bill 1807 (Statutes 1983, Chapter 1047) and set forth in HSC sections 39650 through 39675, mandates the identification and control of air toxics in California. The identification phase of the air toxics program requires the ARB, with participation of other State agencies, such as OEHHA, to evaluate the health impacts of, and exposure to, substances and to identify those substances that pose the greatest health threat as TACs. The ARB's evaluation is made available to the public and is formally reviewed by the Scientific Review Panel (SRP) on Toxic Air Contaminants established under HSC section 39670. Following the ARB's evaluation and the SRP's review, the Board may formally identify a substance as a TAC at a public hearing. Following the identification of a substance as a TAC, HSC sections 39658, 39665, 39666, and 39667 require ARB, with the participation of the local air districts, and in consultation with affected sources and interested parties, to prepare a report on the need and appropriate degree of regulation for the substance.

E. Summary of Regulations Affecting Dry Cleaners

1. <u>Airborne Toxic Control Measures</u>

Once ARB has evaluated the need and appropriate degree of regulation for a TAC, State law (HSC section 39666) requires ARB to evaluate the need for regulations to reduce TAC emissions to the maximum extent feasible in consideration of cost, risk, and other factors specified in HSC section 39665. To date ARB has adopted two ATCMs that pertain to Perc dry cleaning operations: the ATCM for Emissions of Perc from Dry Cleaning Operations (Dry Cleaning ATCM); and the Environmental Training Regulation for Perc Dry Cleaning Operations. Both regulations were adopted on October 14, 1993.

2. <u>AB 2588 "Hot Spots" Program</u>

Assembly Bill (AB) 2588 (Statutes 1987, Chapter 1252), *Air toxics "Hot Spots" Information and Assessment Act* ("Hot Spots" Program), was enacted in September 1987. This Hot Spots Program supplements the Air Toxics Program by requiring stationary sources to report the types and quantities of substances routinely released into the air, to identify facilities having localized impacts, to ascertain health risks, and to notify nearby residences of significant risks.

In September 1992, the “Hot Spots” Act was amended by Senate Bill (SB) 1731 (Statutes 1992, Chapter 1162) to address the reduction in significant risks caused by a facility. The bill requires that owners of significant risk facilities reduce their risks below the local air district established level of significance. SB 1731 further requires ARB to provide assistance to smaller businesses.

Information gathered from this program has complemented ARB’s existing TAC program by locating sources of substances that were not under evaluation and by providing exposure data needed to develop regulations for control of toxic pollutants. Additionally, the program has been a motivating factor for facility owners to voluntarily reduce their facility’s toxic emissions. Dry cleaners have been identified as facilities subject to the Air Toxics Hot Spots Program. Currently, the California Air Pollution Control Officers Association is developing an industry-wide risk assessment for dry cleaners. The purpose of this industry specific assessment is to assist both the local air districts and facilities with the emissions inventory and risk assessment requirements of the Hot Spots program.

3. National Emission Standards for Hazardous Air Pollutants

In the federal Clean Air Act Amendments of 1990, the United States Environmental Protection Agency (U.S. EPA) identified Perc as a hazardous air pollutant (HAP) because of its known or possible adverse effects on human health or the environment. In 1993, and as a result of State legislation AB 2728, the Board designated federal HAPs as TACs (HSC section 39658(b)). Therefore, Perc is a TAC both because it has been identified by the Board through the TAC identification and control program and because it is a HAP.

In 1993, the U.S. EPA promulgated technology-based emissions standards to control emissions of Perc from dry cleaning facilities. The National Emission Standards for Hazardous Air Pollutants was based on the application of equipment and work practice standards. On May 21, 1996, the current California Dry Cleaning ATCM was granted federal equivalency (Volume 61, Federal Register, page 25397). Federal equivalency means that the U.S. EPA has determined that the California Dry Cleaning ATCM is equivalent to, or more effective than, the federal dry cleaning regulation. As a result, Perc dry cleaners in California need only comply with the California Dry Cleaning ATCM. Effective July 27, 2006, U.S. EPA promulgated revisions to their 1993 standards to limit emissions of Perc from existing and new dry cleaning facilities. Based on a review of U.S. EPA’s final rule, staff is confident that the emissions-related requirements of the proposed amended Dry Cleaning ATCM are more stringent than U.S. EPA’s final rule. However, if approved, the proposed amended Dry Cleaning ATCM will need to be submitted to U.S. EPA for a federal equivalency determination.

4. Other State Regulations

California dry cleaners are regulated either directly or indirectly by other government environmental agencies in addition to ARB and the local air districts. The

Regional Water Quality Control Boards regulate Perc discharges into State waters from local sanitation districts that process wastewater discharge by dry cleaners. The California Department of Industrial Relations/Division of Occupational Safety and Health (CAL/OSHA) regulates Perc in the workplace environment.

Dry cleaners are also regulated by DTSC for the storage, disposal, and treatment of hazardous waste. As mentioned earlier, DTSC is given the responsibility to regulate hazardous waste in California as a federally authorized State program. Solid waste consists of cartridge filters and spent carbon; liquid wastes consist of separator water, still bottoms, and condensate from steam presses and from the carbon desorption process. Typically, hazardous wastes are picked up by a licensed hazardous waste hauler or Perc recycler for disposal or treatment.

To protect worker safety, CAL/OSHA has established a permissible exposure limit (PEL) for Perc of 25 parts per million by volume (ppmv). The PEL is the maximum, eight-hour, time-weighted average Perc concentration for occupational exposure. CAL/OSHA also requires employee training on procedures for the safe handling of hazardous substances in the workplace and the health effects of those substances. However, the CAL/OSHA requirements do not apply to the smallest owner-operated facilities with no employees.

5. <u>Local Agencies</u>

a. <u>Local Air Districts</u>

In California, 14 out of 35 local air districts have specific regulations for Perc dry cleaners. The remaining local air districts have adopted or implemented the existing ARB Dry Cleaning ATCM. As required, all local air district rules are at least as stringent as the ARB Dry Cleaning ATCM. The local air districts with Perc dry cleaning regulations are: Antelope Valley Air Quality Management District (AQMD), Bay Area AQMD, El Dorado County AQMD, Imperial County Air Pollution Control District (APCD), Kern County APCD, Lake County APCD, Mendocino County APCD, North Coast Unified AQMD, Northern Sonoma County APCD, San Joaquin Valley APCD, San Luis Obispo County APCD, South Coast AQMD, Ventura County APCD, and Yolo-Solano AQMD. Some of these local air districts, plus a number of other local air districts, also have rules or policies that affect the permitting of new sources of air toxics, including Perc dry cleaning facilities.

The Bay Area AQMD has adopted Regulation 11, Rule 16, a specific regulation for dry cleaners using halogenated solvents such as Perc. Under the Bay Area rule, dry cleaners in co-residential facilities are required to use secondary control and install vapor barrier rooms. In addition, existing and new non-residential facilities may be required to install enhanced ventilation depending on facility type and potential health risk caused by the facility.

In 2002, the South Coast AQMD amended its Rule 1421, Control of Perchloroethylene Emissions from Dry Cleaning Systems (Rule 1421). These amendments prohibit new or relocated Perc dry cleaning facilities and will phase out the use of Perc in existing dry cleaning operations by December 1, 2020, within the South Coast AQMD. Rule 1421 required converted machines to be phased out by July 1, 2004. In addition, all existing Perc dry cleaners in the South Coast AQMD are required to use secondary control and comply with Rule 1402, Control of Toxic Air Contaminants from Existing Sources, which limits the lifetime cancer risk from a facility to no more than 25 in a million, by November 1, 2007. Prior to December 1, 2020, if an existing facility chooses to replace its existing machine with a new Perc machine, the facility would need to purchase a secondary control machine and comply with Rule 1401, New Source Review of Toxic Air Contaminants. Rule 1401 limits the lifetime cancer risk from a facility to less than 10 in a million.

b. Local Publicly-Owned Treatment Works

The dry cleaning process generates wastewater containing trace amounts of Perc. This waste is generated from water separators, steam presses, and desorption of carbon adsorbers. In the past, the Perc-laden water was discharged into the sewer. However, that practice has been phased out by the local publicly-owned treatment works (POTWs) in the State. A dry cleaner may be held liable for direct Perc discharges if Perc escapes from the sewer system and migrates into the groundwater. In this situation, dry cleaners and local POTWs can be held liable for cleanup and abatement under the California Water Code. In most areas of the State, local POTWs have established their own Perc discharge limits to avoid possible liability resulting from Perc contaminated wastewater entering groundwater via the sewer collection system (ARB, 2006a).

II. SUMMARY OF THE PROPOSED AMENDED CONTROL MEASURE

This chapter provides the basis for the proposed amendments and summarizes the proposed changes to the Dry Cleaning ATCM, including new requirements for the Perc manufacturers and distributors. The complete text of the proposed Dry Cleaning ATCM and the new requirements are provided in Appendix A.

A. Basis and Rationale for the Proposed Amended Control Measure

The Board approved the current Dry Cleaning ATCM in 1993. The measure reduced public exposure to Perc emissions from dry cleaning facilities through the use of BACT and operator training. The Dry Cleaning ATCM phased out the more emissive Perc technologies (i.e., transfer and vented machines), set requirements for training, good operating and maintenance practices, and recordkeeping and reporting. The implementation of the Dry Cleaning ATCM resulted in lower Perc emissions from dry cleaning facilities and, in turn, reduced public exposure to Perc in California by 70 percent.

California HSC section 39658(b)(3) states that if the Board implements an ATCM applicable to the substances and later finds that the purposes set forth are not achieved by the ATCM, the Board may revise the ATCM to achieve those purposes. The Board may revise an ATCM only if it finds that the reduction in risk to the public health that will be achieved by the revision justifies the burden that will be imposed on persons who are in compliance with the ATCM previously implemented.

From 2003 through 2005, the ARB staff conducted an evaluation of the Dry Cleaning ATCM to compare Perc dry cleaning to the available alternatives and determine whether the Dry Cleaning ATCM continues to adequately protect public health. The evaluation showed that some members of the public that live very close to Perc dry cleaning facilities continue to be exposed to elevated levels of Perc. The evaluation also showed that less emissive Perc dry cleaning technology has been proven and is available, that enhanced ventilation systems have been proven and are effective to reduce near source Perc exposure, and alternatives to Perc dry cleaning are available and viable. The result of this evaluation led the staff to develop a proposal to amend the Dry Cleaning ATCM to further reduce risk from Perc in dry cleaning operations.

On May 25, 2006, staff presented to the Board proposed amendments to the Dry Cleaning ATCM. The Board heard testimony from many interested parties, including the affected industries, industry associations, environmental groups, local air districts, and other interested individuals. After hearing the public comments and considering staff's proposal, the Board made a decision not to proceed with the proposed rulemaking and directed staff to return to them with a proposal for their consideration to phase out Perc from dry cleaning operations.

Following the Board's direction, staff is proposing revised amendments to the Dry Cleaning ATCM. The proposed amendments will further reduce potential health impacts for all California residents and off-site workers by eliminating the use of Perc in dry cleaning operations and requiring the use of non-Perc alternatives. These amendments will prohibit the use of Perc in new dry cleaning facilities and will require the phase out of Perc in existing dry cleaning facilities. The amendments will also require co-residential facilities to remove from service any currently installed Perc dry cleaning machine on an expedited.

B. Changes to the Existing Dry Cleaning ATCM

The proposed amendments prohibit the new sales or leases of Perc dry cleaning machines for use in California effective January 1, 2008. For existing co-residential facilities (those that share a common wall, floor, or ceiling with a residence, or located within the same building with a residence), the proposed amendments will require replacement of Perc dry cleaning machines by July 1, 2010. This requirement will virtually eliminate the Perc risk from co-residential facilities, where elevated Perc levels in residential areas have been attributed to the co-residential Perc facilities.

For other existing facilities (those that started Perc dry cleaning operations before January 1, 2008), the proposed amendments will phase out Perc machines (i.e., converted machines, primary machines, and secondary control machines) over a set period of time. Existing facilities that currently run a converted Perc machine will be required to replace their machine with a non-Perc alternative machine by July 1, 2010. For all other existing facilities, the proposed amendments will require them to replace their Perc dry cleaning machine with a non-Perc alternative by July 1, 2010, or when the machine is 15 years of age, whichever comes later. By January 1, 2023, all Perc dry cleaning machines must be removed from service. Beginning January 1, 2008, no existing facility may install or operate a new Perc dry cleaning machine.

Good operating practices and recordkeeping and reporting requirements are included for existing facilities that use Perc. All Perc facilities will also be required to have a spare lint filter and a spare set of gaskets on site. This requirement should eliminate delays in replacing parts where the most common leaks can occur.

For all new dry cleaning facilities (those that start operations on or after January 1, 2008), the proposed amendments will prohibit the installation or use of Perc dry cleaning machines.

C. Summary of the Proposed Amended Control Measure

This section summarizes the proposed amendments to the Dry Cleaning ATCM. The complete text of the proposed amended ATCM is provided in Appendix A. For a summary of the differences between the current and proposed amended ATCM, see Appendix C.

1. Applicability

The proposed amendments apply to any person who sells or distributes Perc and who sells, distributes, installs, owns, or operates dry cleaning equipment in California that uses any solvent that contains Perc.

2. Prohibitions

No person shall sell, offer for sale, or initiate a new lease of any Perc dry cleaning machine for use in California on or after January 1, 2008. This provision applies to both existing and new facilities.

Under the proposed amendments to the Dry Cleaning ATCM, and as stated in the original Dry Cleaning ATCM, the owner/operator of a facility shall not operate any equipment related to Perc dry cleaning operations, such as: a transfer machine, any reclaimer or other device in which materials that have been previously dry cleaned with Perc are placed to dry; a vented machine; a self-service dry cleaning machine; a drying cabinet; or dip tanks. In addition, the owner/operator of a facility may no longer use a converted machine after July 1, 2010.

3. Requirements for Co-residential Facilities

A "co-residential" facility is any dry cleaning facility that shares a common wall, floor, or ceiling with a residence or is located within the same building as a residence. For the purposes of this regulation, residence means any dwelling or housing which is owned, rented, or occupied by the same person for a period of 180 days or more, excluding short-term housing such as a motel or hotel room rented and occupied by the same person for a period of less than 180 days.

For co-residential facilities, the proposed amendments will prohibit the use of Perc in dry cleaning machines. Existing co-residential facilities shall remove any currently installed Perc dry cleaning machines by July 1, 2010. However, prior to this phase out date, all Perc co-residential facilities are required to follow good operating practices as specified in the proposed regulation and outlined in Part 6 of this section.

4. New Facilities

A new facility is defined as a facility that did not operate any dry cleaning equipment using Perc prior to January 1, 2008. For all new dry cleaning facilities, the proposed amendments will prohibit the use of Perc in dry cleaning machines and in water-repelling operations.

5. Requirements for Existing Facilities

Existing facilities, defined as any facility that operated Perc dry cleaning equipment prior to January 1, 2008, are prohibited from installing a new Perc dry cleaning machine after this date. A relocated facility which is defined as a facility that moves from one location to another location within the boundaries of the same local air district will be considered an existing facility for the purposes of the proposed regulation. Therefore, all relocated facilities will be subject to the requirements for existing facilities.

For existing facilities, the proposed amendments require that the more emissive technologies (i.e., converted machines) be replaced with a non-Perc alternative by July 1, 2010. For all other existing facilities, the compliance schedule is as follows:

- A facility that operates a primary control, add-on, or secondary control machine must remove from service their Perc dry cleaning equipment by July 1, 2010, or when the machine is 15 years of age, whichever comes later. If the age of the machine cannot be obtained, the machine must be removed from service by July 1, 2010.

- All existing facilities that have not already replaced their machines in accordance with the above schedule, must remove from service their dry cleaning equipment by January 1, 2023.

A summary of Perc equipment compliance times for existing facilities can be found in Table II-1.

Table II-1. Summary of Perc Equipment Compliance Times for Existing Facilities

FACILITY OR EQUIPMENT TYPE	DATE OF COMPLIANCE[1]
Drying Cabinet, or Dip Tank	January 1, 2008
Converted Machine	July 1, 2010
Dry Cleaning Machines at Co-residential Facility	July 1, 2010
Closed-loop Machines: Primary Control Machine; Add-on Secondary Control Machine; or Integral Secondary Control Machine	July 1, 2010 or 15 years after the date of manufacture, whichever comes later. July 1, 2010 if age of machine cannot be determined.
All Perc Dry Cleaning Machines	January 1, 2023

1. Final date(s) by which dry cleaning equipment shall be removed from service or use.

6. Good Operating Practices

The proposed amendments strengthen the good operating practices outlined in the Dry Cleaning ATCM to further reduce fugitive emissions. All facilities are required to follow the good operating practices outlined in the proposed amendments. These include trained operators, operation and maintenance requirements, and leak check requirements.

a. Trained Operators

In the current Dry Cleaning ATCM, each facility is required to have one or more operators who have completed the environmental training requirements. Under the proposed amendments, the length of time to notify the local air district when a trained operator leaves the employment of the facility has been reduced from 30 days to 15 days of the departure. To ensure proper equipment operation, the trained operators must be on-site whenever the dry cleaning machine is operating.

b. Operation and Maintenance Requirements

Since transfer and vented machines are no longer permitted, all language pertaining to these machines has been deleted. To shorten repair time, the facility owner/operator is required to keep on-site a spare set of gaskets for the loading door, still, lint trap, button trap, and water separator. They are also required to keep a spare lint filter on-site. Carbon adsorbers in integral secondary control systems must be designed for non-contact steam or hot air stripping operation, and must be stripped or desorbed in accordance with manufacturer's instructions or at least weekly, whichever is more frequent.

c. Leak Check Requirements

The proposal reduces the timeframe to repair a leak. Since the facility is required to keep spare gaskets and filters on hand, repairs should take less time. Liquid leaks or vapor leaks shall be repaired immediately upon detection. If a facility with a leak does not have parts available, the parts need to be ordered within the next business day of detecting the leak and the part installed within two business days after receipt. A facility with a leak that has not been repaired by the end of the seventh business day, after detection, shall not operate the dry cleaning machine until the leak is repaired.

In addition to the weekly leak checks, a dry cleaning system shall be inspected at least once a year for liquid and vapor leaks using a Perc detector which gives quantitative results with less than ten percent uncertainty at 50 ppmv of Perc. There are several suggested ways a facility can comply with this requirement.

- Purchase a Perc detector that gives quantitative results. See Chapter III for a discussion of Perc detectors.

- Solicit service from an individual or organization to conduct the annual leak check.

- Fulfill this requirement during a local air district inspection. However, a local air district inspector is not prevented from writing a notice of violation if a leak is detected in this circumstance.

7. Recordkeeping Requirements

The retention time to maintain records has been amended from 2 years to 5 years. Also, recordkeeping requirements have been amended to include the additional item listed below.

- For secondary control machines, the start and end time of each regeneration, and temperature of the chilled air on the outlet side of the refrigerated condenser.

8. Reporting Requirements

The reporting requirements are the same as in the Dry Cleaning ATCM with the addition that the annual report submitted by the facility must cover the period of January 1st through December 31st of each year. In addition to the existing reporting requirements, the facility must include the make, model, serial number, and the age of the dry cleaning machine. The owner/operator shall furnish this annual report to the local air district by the date specified by the local air district. Although the average facility mileage is no longer a reporting requirement, facility owners are encouraged to keep mileage records to assist them in determining the efficiency of their equipment.

9. Water-repelling Operations

All materials to be treated with Perc water-repelling solutions can only be treated in a converted, primary control, add-on secondary control, or integral secondary control machine. However, the machine used will be required to follow the prohibitions and requirements specified in the proposed Dry Cleaning ATCM (see Appendix A).

10. Requirements for Perc Manufacturers and Distributors

Information gathered under the following two new sections in the proposed Dry Cleaning ATCM will be used by ARB staff and the local air districts to facilitate implementation of the requirements under Health and Safety Code section 41998 (AB 998). In addition, this will allow ARB to track the sales and eventual phase out of Perc from dry cleaning operations.

a. Perc Manufacturers

Any solvent manufacturer that sells Perc to a distributor in California is required to keep monthly sales records (with invoices) of the gallons of Perc sold for use in dry cleaning in California. These records shall be retained for at least 5 years and shall be made available to ARB or the local air districts upon request.

In addition, by January 1, 2008, Perc manufacturers shall report to ARB contact information for all their distributors who sell Perc for use in dry cleaning in California. If there are changes to their list of distributors, the manufacturers are required to report the change(s) to ARB within 30 calendar days after the change has occurred.

b. Perc Distributors

Any solvent distributor that sells Perc or recycled Perc to a facility for the use of dry cleaning in California is required to retain the records listed below for at least 5 years. These records shall be made available to the ARB or the local air district upon request.

- For each dry cleaning facility, Perc distributors shall keep monthly sales records (with invoices) of the gallons of Perc and recycled Perc sold for the use of dry cleaning in California.

- Perc distributors shall keep monthly purchase records (with invoices) of the gallons of Perc purchased for the use of dry cleaning in California.

- Perc distributors shall keep contact information for each California dry cleaner that purchased Perc and recycled Perc.

- Perc distributors shall keep contact information for all their distributors who sell Perc and recycled Perc in California.

Additionally, by specified dates, Perc distributors will be required to report to ARB the following information:

- By January 1, 2008, Perc distributors shall report to ARB contact information for all their distributors who sell Perc in California. If there are changes to their list of distributors, Perc distributors shall report the change(s) to ARB within 10 workdays after the change has occurred.

- Perc distributors shall report to ARB any change(s) in their contact information within 30 calendar days after the change has occurred.

- By January 31 of each year, Perc distributors shall report to ARB the annual gallons of Perc and recycled Perc sold to California dry cleaners from January 1 through December 31 of the previous year.

The proposed amendments require Perc manufacturers and distributors to submit a fee that is based on the fee schedule shown in Table II-2 and the annual amount of Perc sold by the manufacturer or distributor in California. Payment is due upon receipt of an invoice from ARB. A violation of this section of the regulation, which would include the nonpayment of the Perc fee, could result in a penalty of up to $35,000.

Table II-2. Perc Fee Invoice Schedule

Year	*Perc Fee per Gallon Sold* (in U.S. Dollars)	Invoice Cycle	Approximate Invoice Date
2004	$3.00	August 16, 2004 *through* December 31, 2004	January 2005
2005	$4.00	January 1, 2005 *through* June 30, 2005 July 1, 2005 *through* December 31, 2005	July 2005 January 2006
2006	$5.00	January 1, 2006 *through* December 31, 2006	January 2007
2007	$6.00	January 1, 2007 *through* December 31, 2007	February 2008
2008	$7.00	January 1, 2008 *through* December 31, 2008	February 2009
2009	$8.00	January 1, 2009 *through* December 31, 2009	February 2010
2010	$9.00	January 1, 2010 *through* December 31, 2010	February 2011
2011	$10.00	January 1, 2011 *through* December 31, 2011	February 2012
2012	$11.00	January 1, 2012 *through* December 31, 2012	February 2013
2013	$12.00	January 1, 2013 *through* December 31, 2013	February 2014
2014-2022	$12.00	January 1, 2014 *through* December 31, 2014, and each subsequent calendar year *through* 2022	February 2015 and each February thereafter *through* February 2023

D. Regulatory Alternatives

The Board may choose to adopt the staff's proposed amendments or alternative requirements or any combination thereof. The alternative approaches to the proposed amendments to the Dry Cleaning ATCM span a wide range of requirements. The Board is not limited to, but could consider, the following approaches.

ARB staff has identified several alternatives to the proposed regulatory action based on comments and suggestions received during the rulemaking process. In considering these alternatives, ARB staff evaluated the current state of non-Perc alternative technologies, the impacts on public health, and the impact on the economic vitality of the dry cleaning industry. A summary of the more likely alternatives follows.

1. Total Phase Out of Perc and New VOC-Containing Systems

This option would phase out Perc as staff is proposing and include a prohibition on the use of hydrocarbon solvents. This option would provide the maximum protection from emissions of Perc while preventing an increase in volatile organic compound (VOC) emissions from hydrocarbon solvents. This option would have a great economic impact and would result in an industry-wide conversion in California to non-smog-forming technologies such as GreenEarth, water-based cleaning, and CO_2. For this option, the ARB staff estimates that the potential statewide cost is about $48 million over 15 years, with the annualized cost being $4.6 million. This is about 17 percent higher in potential statewide cost compared to the proposed amendments.

Although ARB staff expects that, under this option, most facilities would migrate toward GreenEarth, there could be a considerable number of facilities that choose water-based cleaning. The motivation for the choice of water-based cleaning may come from the unresolved question of the toxicity of GreenEarth and the availability of grant programs, such as AB 998, which provide monetary resources to non-toxic and non-smog-forming alternatives to Perc.

2. Increase the Phase Out Period

The proposed amendments phase out the use of Perc dry cleaning machines based on machine age. Under the proposed amendments, an existing facility with a converted machine will be required to remove any Perc dry cleaning machine by July 1, 2010. All other existing facilities will be required at the earliest date to install, operate and maintain a non-Perc alternative machine by July 1, 2010, or when the primary, converted, or add-on secondary control machine is 15 years of age, whichever comes later. Extending the phase out period would lessen the economic burden on the dry cleaning facility owners by allowing more time for the facility to replace their existing machines with integral secondary control machines during the interim before phase out of all Perc machines or with non-Perc machines during the extended phase out scheduled.

3. Decrease the Phase Out Period

This alternative would shorten the time frames in the regulation which require facilities to phase out the use of Perc in dry cleaning. By decreasing the phase out periods, the emission and risk reduction benefits of the proposed amendments would be realized more expeditiously. However, shortening the time frames in the regulation would increase the cost of compliance. The amount of the increase would depend on which requirement is adjusted and how significant the change is in the compliance date. The main cost impacts beyond the staff's proposed ATCM would be associated with the loss of residual value in existing machines due to accelerated replacement of non-Perc alternative machines. For example, a 5 year decrease in phase out time would result in potential statewide cost of $59 million over 15 years, which is about 44 percent higher compared to the proposed amendments.

4. Total Phase Out of Perc and Require Add-on Secondary Control for Primary Control Machines

This alternative would phase out Perc machines as staff is proposing and require the installation of add-on secondary control devices for existing primary control machines prior to their phase out. This option would reduce the amount of Perc emitted from primary control machines by an additional 46 percent at a cost of about $6,000 per machine. This option would be about 14 percent more costly than the proposed amendments. Under the staff proposal, beginning July 1, 2010, primary machines must be removed from service when they are 15 years old. This provision would likely result in almost 50 percent of the all primary control Perc machines being removed from service by July 1, 2010 and almost all primary control machines removed from service by 2016.

III. SUMMARY OF THE DRY CLEANING INDUSTRY

Typically, dry cleaners are considered small businesses and most employ less than 5 employees. Currently, Perc solvent is the most widely used solvent by the dry cleaning industry in the State of California. About 70 percent of the dry cleaning facilities use Perc as the cleaning solvent. The Facility Survey was conducted in 2003 and designed to collect information from dry cleaning facilities. Based on the Facility Survey, staff estimated that there were about 5,500 dry cleaning machines in California, of which, about 4,670 were Perc machines about 2 percent are co-residential facilities. In 2006, ARB staff conducted an update to the 2003 survey data to estimate the number of Perc and the alternative dry cleaning machines that are currently in operation. Based on information provided by the local air districts and industry, the number of Perc machines in operation in California in 2006 is estimated to be 3,660.

A. Dry Cleaning Technologies

1. <u>Types of Cleaning Technologies</u>

Although Perc is the most widely used dry cleaning solvent in California it is also used in other industry sectors including degreasing operations, industrial products, and some consumer products. The Dry Cleaning ATCM currently permits the use of closed-loop, dry-to-dry machines when Perc is the solvent of choice. The vast majority of California dry cleaners are familiar with the operation of this technology. Vented and transfer machines are prohibited under the current Dry Cleaning ATCM and no Perc dry cleaners should be using these systems at this time.

All hydrocarbon solvents used in dry cleaning consist of aliphatic hydrocarbons, meaning they are straight-chained, branched, or cyclic as opposed to aromatics, which contain stable carbon-ring structures called benzene rings. Hydrocarbon solvents are combustible. Inherent properties of these petroleum-based solvents include high flammability, volatility, odor, and toxicity. Toxicity varies by compound. However, none of the petroleum-based solvents have been evaluated by ARB and OEHHA for their potential to be toxic air contaminants. All of the solvents are VOCs. The machines predominately used for petroleum solvents are closed-loop machines equipped with primary control. Solvent technologies used for these types of equipments are DF-2000™ Fluid, PureDry®, EcoSolv®, Shell Sol 140 HT, and Stoddard Solvent. These technologies are described below.

a. <u>DF-2000™ Fluid</u>

DF-2000™ Fluid (DF-2000) was introduced in 1994 by ExxonMobil as an alternative solvent to Stoddard and Perc. Currently, it is the most popular alternative to Perc. Consisting of C_{11} to C_{13} aliphatic hydrocarbons, it is a synthetic mix of isoparaffins and cycloparaffins (naphthenes) that boils between 185 and 211 degrees Centigrade

(OEHHA, 2003). Machines designed for DF-2000 and other hydrocarbon solvents offer closed-loop, dry-to-dry operation. Most include a primary control device (refrigerated condenser) and offer computerized control.

b. PureDry®

PureDry® (PureDry) was developed as a replacement for Perc. It is a blend of isoparaffinic hydrocarbon and a chemical additive produced by 3M. The mixture contains about 95 percent odorless mineral spirits. The odorless mineral spirits are a mixture of aliphatic hydrocarbons (C_9 to C_{12}). Mineral spirits can cause neurotoxicity, and eye and respiratory irritation at high concentrations. It also contains HFE-7200 (a mixture of ethyl perfluoroisobutyl ether and ethyl perfluorobutyl ether), FC-43 (perfluoro compounds of primarily 12 carbons), PF-5070 (perfluoro compounds of primary seven carbons), and PF-5060 (perfluoro compounds of primarily six carbons) (OEHHA, 2003). The flash point of PureDry is 350°F with a boiling point temperature of 298°F. The flash point of a solvent is the temperature at which vapor given off will ignite when an external flame is applied under specified test conditions. A flash point is defined to minimize fire risk during normal storage and handling. Flash points for all dry cleaning solvents range from 110°F to 350°F.

c. EcoSolv®

Chevron Phillips Chemical Company LP manufactures EcoSolv® (EcoSolv). This dry cleaning fluid is 100 percent isoparaffin with carbon numbers ranging from C_9 through C_{13}. The manufacturer formulated this product by adding butylated hydroxytoluene at 10 parts per million (ppm) to act as an oxygen stabilizer. This solvent is a high purity aliphatic mixture with minimum in aromatics. The isoparaffin is a branched hydrocarbon that is also used for food processing, cosmetic and personal care formulations, and as a solvent for a number of industrial products. EcoSolv has a flash point between140°F and 200°F, and is classified as Class IIIA solvent (ARB, 2004e).

d. Shell Sol 140 HT

Shell Sol 140 HT (Shell 140) is a high flash point hydrocarbon solvent. Shell 140's flash point is 145°F.

e. Stoddard Solvent

Stoddard Solvent (Stoddard), a class of petroleum solvents, consists of a blend of C_8 to C_{12} hydrocarbons and is similar to kerosene. Its flash point is 110°F. Stoddard contains small amounts of chemicals known to be carcinogenic but are not classified as toxic. Stoddard also contains benzene, which has been identified as a toxic air contaminant. It also gives off an irritating odor.

The technologies described above are used as alternatives to Perc dry cleaning. ARB staff estimates that about 1100 dry cleaners in California are currently using hydrocarbon technology. In the South Coast AQMD grant program, about 80 percent of the dry cleaners received grants to switch from Perc to hydrocarbon technologies. In addition to hydrocarbon technologies, dry cleaners are also using other technologies such as decamethylcyclopentasiloxane (D_5), Rynex™, CO_2, Professional Wet Cleaning (wet cleaning), and Green Jet®. These technologies are described below.

f. Volatile Methyl Siloxane Cleaning

Decamethylcyclopentasiloxane (D_5) or volatile methyl siloxane is an odorless, colorless liquid that has many consumer and industrial applications. D_5 is used as an ingredient in a number of personal health and beauty products, including deodorants, antiperspirants, cosmetics, shampoos, and body lotions. It is also used as a dry cleaning solvent.

D_5 is present in the GreenEarth® (GreenEarth) dry cleaning solvent. GreenEarth solvent is mostly being used in hydrocarbon machines and has a flash point of 170°F. Although, GreenEarth is used in some converted Perc machines, the manufacturer does not recommend this option. In order for Perc machines to be converted, the following assemblies must be installed by manufacturer: filtration system; temperature control sensors; pre-water separator filter; water separator; and electrical control panel. GreenEarth solvent is distributed by Dow Corning, General Electric, and Shin-Etsu.

g. Rynex™ (Propylene Glycol Ether) Cleaning

Rynex™(Rynex 3) is an organic and biodegradable solvent with low volatility and a high flash point (>200°F) and is classified as a Class IIIB solvent. Rynex 3 is lighter than water and, therefore, floats on water after separation. It is a mixture of substituted aliphatic glycol ethers. It is also considered a VOC.

Rynex 3 can be used in most hydrocarbon machines with some temperature and timing adjustment. Converting Perc machines to use Rynex 3 is not recommended by the solvent manufacturer. It is not an economically prudent exercise due to the differences in physical properties of Perc and Rynex 3.

h. Carbon Dioxide (CO_2) Cleaning

CO_2 is a process that has been developed for use by commercial and retail dry cleaners. CO_2 is a non-flammable, non-toxic, colorless, tasteless, odorless naturally-occurring gas that, when subjected to pressure, becomes a liquid solvent. The CO_2 used in this process is an industrial by-product from existing operations, primarily anhydrous ammonia (fertilizer) production. There is no net increase in the amount of

CO_2 emitted; therefore, this process does not contribute to global warming. CO_2 is naturally occurring and is also used in other applications such as carbonating soft drinks. To date, there are about 10 CO_2 cleaning systems installed in California.

i. Professional Wet Cleaning

Professional Wet Cleaning (wet cleaning), an alternative to dry cleaning that was first introduced in 1991, is different than commercial laundering in several aspects. Wet cleaning uses computer-controlled washers and dryers with detergents that have been specially formulated for the process. Specialized equipment is used because ordinary washers and dryers lack the control needed to ensure that garments are processed properly. Finishing equipment includes pressing and tensioning units. The tensioning units are used to touch-up, stretch, reform, and finish the garments. Wet cleaning systems use non-toxic, biodegradable detergents, which are approved for disposal into the sewer system.

j. Green Jet®

The Green Jet® (Green Jet) machine cleans and dries garments in a single computer-controlled unit. The process involves using a mist of water and detergent to clean the garments. They are not immersed in liquid. The machine is designed to receive a full 45 pound load of garments. It then dehydrates the garments to remove humidity and reduce surface tension, which allows mechanical action and pulsating air jets to dislodge and remove non-soluble soil from the garments. This soil is then collected in a lint chamber. Next, a pre-determined amount of water-based cleaning solution is injected through air jet nozzles to re-hydrate the fabric. After about a pint of solution has been injected, heavy felt pads attached to the ribs and the cylinder absorb the soluble soil. After the cleaning process, the unit goes into a conventional dry cycle and then a cool-down cycle.

2. Efficacy of Various Technologies

Efficacy, or the ability to effectively clean clothes, is an important factor when considering dry cleaning alternatives. Properties to be considered include: cleaning ability, evaporation rate, and ease of purification of the cleaning solution through distillation. The solvent should not cause fabric to unnecessarily fade, shrink, weaken, or bleed color, and should be compatible with detergents. The overall cleaning ability of a process depends on soil chemistry, textile fabric type, transport medium (aqueous vs. non-aqueous), chemistry of the additives (detergents, surfactants), the use of spotting agents, and process considerations (e.g., time, temperature, and mechanical actions) (U.S. EPA, 1998). Over 95 percent of all soils are water soluble (Cleaners Family, 2004). Table III-1 summarizes the cleaning performance for Perc and the alternatives.

Table. III-1. Summary of Cleaning Performance of Dry Cleaning Solvents

Solvent	Cleaning Performance
Perc	Aggressive, oil-based stains, most water-based stains, silks, wools, rayons. Not good for delicates.
Stoddard	Less aggressive than Perc for oil-based stains. Can handle delicate garments.
PureDry	Less aggressive than Perc for oil-based stains. Can handle delicate garments.
Shell 140	Less aggressive than Perc for oil-based stains. Can handle delicate garments.
EcoSolv	Less aggressive than Perc for oil-based stains. Can handle delicate garments.
DF-2000	Less aggressive than Perc for oil-based stains. Can handle delicate garments
Green Jet (DWX-44 detergent)	Less aggressive than Perc. More effective in cleaning sugar, salt, perspiration stains. Good for delicates. Not good for heavily soiled garments.
Rynex 3	Aggressive, cleans water-soluble and oil-based stains.
GreenEarth	Less aggressive than Perc for oil-based stains. Good for water-based stains, delicates.
CO_2	Good for all stains and most fabrics. Very effective in removing oils, greases, sweats.
Wet cleaning	Aggressive, good for both oil and water-based stains. Can handle delicate garments. Requires tensioning equipment and training for successful operation.

3. Emerging Cleaning Technologies

There are five emerging technologies which are expected to be available to the dry cleaning industry within the next few years. These technologies are: 1) cold water cleaning systems; 2) the Resolve™ Dry Cleaning System; 3) the Impress™ Solvent, 4) Hydroclene Fluids, and 5) 1-Bromopropane (n-propyl bromide). Most of these technologies are still under research and development phase. However, a few cold water cleaning systems are currently in use. More detail about these emerging technologies is described in Chapter II of the Technical Assessment Report (CARB, 2006).

There are two dry cleaning facilities in North Carolina who are using 1-Bromopropane (n-propyl bromide) – a potential dry cleaning solvent. According to the California Department of Health Services (CDHS), this product can harm the reproductive system and the nervous system. 1-Bromopropane is a new solvent intended to replace solvent like Perc in dry cleaning industry. 1-Bromopropane is further discussed in Chapter V of this report.

There are new machines that can operate without a distillation system and/or a refrigerated condenser by using Tonsil® or another bleaching clay mixture. These machines have been in operation using hydrocarbon or GreenEarth solvent. Because these are new technologies, their performance is not well known. However, these new technologies seem to be energy efficient and the costs of the machines are lower than the traditional hydrocarbon machines.

B. Emission Control and Ventilation Technologies

1. Emission Control Technologies

In dry cleaning operations, the majority of solvent is lost either through emissions to the atmosphere or via waste products. Furthermore, with Perc, a very small amount is also retained in clothes (relative to the total Perc emitted from dry cleaning operations). Some of the fugitive emissions can be controlled by using proper emission control and ventilation technologies to further reduce or capture emissions.

Over the past several years, the use of Perc recovery devices has become common in the dry cleaning industry because of economic considerations, environmental concerns, worker exposure concerns, and regulatory actions. Emission reductions from the dry cleaning industry can be attained through the use of proper operating practices and control equipment. These greatly increase the amount of solvent being recycled while at the same time minimizing the solvent loss to the atmosphere. Housekeeping measures include promptly repairing any worn or cracked gaskets, covering all solvent and waste containers, identifying and repairing any leaking equipment, and removing any lint build-up from the steam or water coils. Control devices such as carbon adsorbers, refrigerated or chilled water condensers, and distillation units have proven to be very effective for reducing emissions and recovering the solvent for reuse.

a. Primary Controls

Primary control systems operate during the heating and cool-down phases of the drying cycle. They are designed such that they neither exhaust to the atmosphere nor generate additional solvent-contaminated waste water (where applicable). Today, the most commonly used primary control device is the refrigerated condenser. In the past, carbon adsorbers and polymeric vapor adsorbers (a largely unproven technology) were also considered but could not compete with the overall efficiency of the refrigerated condenser.

Refrigerated condensers operate throughout the drying cycle, in which solvent-laden air is continually recirculated through the condenser. The condenser recovers both the solvent and water vapors from the air stream, sending a liquid solvent and water mixture to a water separator. The solvent is recovered by the water separator then goes to the solvent storage tank. During the drying cycle, the air stream circulates past the refrigerated condenser, is reheated by the heating coils, circulates through the drum evaporating more solvent from the materials, and then flows through the condenser again where the solvent is recovered. The refrigerated condenser keeps the temperature low during the drying cycle (ARB, 1996). A detailed discussion on primary controls is presented in Chapter III of the Technical Assessment Report (CARB, 2006).

b. Secondary Controls

Figure III-1. Secondary Control

A significant source of solvent emissions from closed-loop machines is from opening the drum at the end of the drying cycle to remove materials. For example, the concentration of Perc in the drum at the end of the drying cycle can be as high as 8,600 ppmv (ARB, 1993). The operation of a secondary control device (typically a carbon adsorber - an activated carbon bed contained in a housing), which operates in series with a refrigerated condenser, can further reduce solvent vapor concentrations in the drum and, therefore, reduce fugitive emissions and solvent consumption. Secondary control devices are activated at the end of the cool down step before the machine door is opened. These devices route solvent vapors from the drum and button and lint traps through the refrigerated condenser, then through a vapor adsorber (see Figure III-1), which strips solvent vapors from the air. In order to keep operating efficiently, the carbon must be periodically regenerated. The regeneration process typically uses heat to strip and recover the adsorbed solvent. This desorption process usually occurs after a specific number of loads or according to the manufacturer's recommended schedule (ARB, 1996).

The Dry Cleaning ATCM requires that closed-loop machines with secondary control systems reduce the concentration of Perc in the drum to less than 300 ppmv at the end of the drying cycle. Based on source test results submitted to ARB for the approval of the secondary control systems, some systems can reduce the Perc concentration to below 100 ppmv. There are no similar statewide requirements for other solvents.

2. Ventilation Technologies

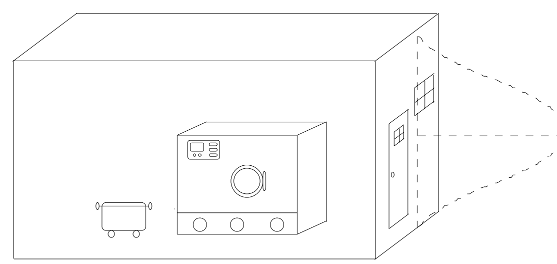
There are different types of ventilation systems in use at dry cleaning facilities. Ventilation affects the dispersion of solvent vapors and other airborne compounds in the facility and impacts the potential health risk to nearby residences and businesses. In many cases, the type of ventilation system found at a facility is a function of its construction. The facility owner most likely had little or no input into the design and construction of the ventilation system. Newer facilities tend to have more aggressive (or "active") systems compared to the relatively passive system used in older facilities. Many facilities do not have active ventilation systems. This means that solvent vapors, such as Perc, are emitted from the doors, windows, roof vents, and other openings throughout the facility. Natural ventilation, window fans, and general ventilation are examples of passive system. Aggressive or enhanced ventilation systems include: local ventilation, partial vapor barrier rooms, and full vapor barrier rooms.

The proposed amendments do not contain requirements for enhanced ventilation systems due to high cost. However, local air districts may require enhanced ventilation to further reduce potential health risks associated with Perc facilities. Enhanced ventilation system should have adequate airflow (minimum 1,000 cubic feet per minute (CFM) but likely much higher: 2,500-10,000 CFM) to maintain a capture velocity greater than 100 feet per minute at any fugitive capture structure (such as a shroud at the loading door and the fume hood). An air change rate of at least once every 10 minutes is generally adequate in a stand-alone building, but greater air change is recommended for mixed-use buildings. The exhaust fan(s) may be installed inside the full vapor barrier rooms, partial vapor barrier rooms or local ventilation systems or outside the facility on a wall or on the roof; should be a high pressure (1-3" H_2O) design with a minimum capacity of 1,000 CFM and should be run whenever the dry cleaning machine is operating or being maintained (BAAQMD, 2001).

a. Natural Ventilation

Natural ventilation depends upon wind and convective forces to move air and is typically considered the least effective. Figure III-2 shows a typical natural ventilation.

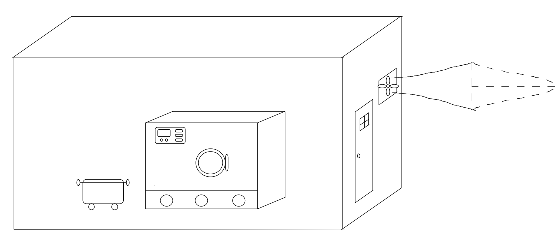
Figure III-2. Natural Ventilation



b. Window Fans

Window fans or wall fans are high flow rate propeller type fans that are installed vertically in a wall (window-type-opening). The air is exhausted horizontally, typically near ground level. These also provide an improvement to a facility with only natural ventilation. Figure III-3 shows a typical window fan configuration.

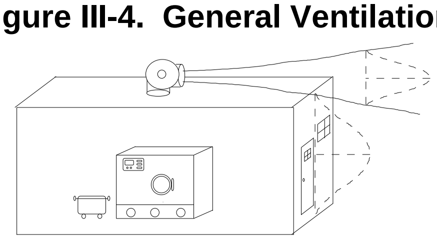
Figure III-3. Window Fan



c. General Ventilation

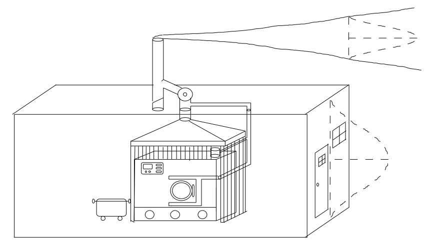
General ventilation systems typically have one or more large capacity fans on the roof of the facility. Capture efficiency depends on the air exchange rate inside the facility and is a function of the fan air flow rate and the size of the facility. General ventilation is considered an upgrade from natural ventilation. Figure III-4 shows a typical general ventilation configuration.

Figure III-4. General Ventilation



d. Local Ventilation System

Figure III-5. Local Ventilation

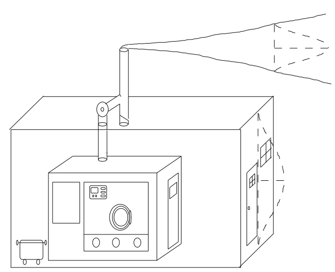


A Local ventilation system is a ventilation system with a high capacity fan, exhaust stack (5 feet from the roof top), and physical apparatus/structure (fume hoods, shrouds, flexible walls, vertical plastic strips) near the dry cleaning machine. This system is designed to capture fugitive emissions. Emissions are then exhausted through a stack on the roof of the facility. Fume hoods should have plastic curtains on the sides (or a combination of walls and curtains) to minimize cross-flow drafts and provide better capture of fugitive emissions.

Based on Bay Area AQMD experience, the ventilation duct or fan intake should be placed near the ceiling directly above the back of the machine or at the rear of the local ventilation system. Walls or plastic strip curtains should extend at least 3 feet in front and back of the machine. The exhaust fan should be mounted above or behind the machine near the ceiling. The exhaust point should be at least 5 feet above the building or adjacent building and 30 feet from any window or air intake. According to ventilation specifications, a minimum of 1,000 cubic feet per minute airflow with a capture velocity greater than 100 feet per minute is required for ventilation. In addition, for a stand-alone building, an air change rate of at least once every 5 minutes is required. Figure III-5 shows a typical local ventilation system (BAAQMD, 2001).

e. Partial Vapor Barrier Rooms

Figure III-6. Partial Vapor Barrier Room

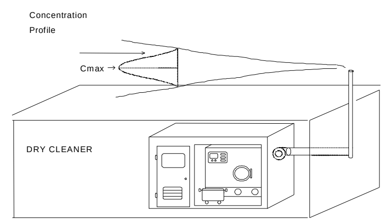


A partial vapor barrier room encloses the back of a dry cleaning machine in a small room with the front panel and loading door exposed for convenient loading and unloading. As a result, partial vapor barrier rooms are able to more effectively capture fugitive emissions from leaks and maintenance activities when compared to local or general ventilation systems. Maintenance doors are normally closed and can be equipped with a self-closing device or alarm. Additionally, any windows are typically constructed of Plexiglas or tempered glass (for safety reasons). Figure III-6 shows a typical vapor barrier room configuration.

The ventilation duct or fan intake should be placed near the ceiling directly above the back of the machine or at the rear of the partial vapor barrier rooms. The stack should extend at least 5 feet above the building's roofline or any adjacent roof and at least 30 feet from any air intake or window. Emissions must be exhausted vertically (no rain caps). Proper stack design eliminates rain intrusion with offset legs, drains, and internal deflectors. External fans may also have drain holes. In addition, there should be one air exchange rate every 5 minutes. The diameter of the stack should generally be 8 to 14 inches with an air flow rate of 1,000 to 2,500 CFM to provide good dispersion (BAAQMD, 2001).

f. Full Vapor Barrier Rooms

Figure III-7. Full Vapor Barrier Room



A full vapor barrier room is more efficient in capturing vapors then a partial vapor barrier room. A full vapor barrier room is able to restrict the diffusion and transport of solvent vapors that escape from a dry cleaning machine because a ventilation fan collects virtually all the vapors and exhausts them through a stack above the building. The door(s) to vapor barrier rooms are normally equipped with a self-closing device. Design features may vary, but normally include a "swinging" design that opens both ways or a sliding door. Additionally, any windows are typically constructed of Plexiglas or tempered glass (for safety reasons). Full vapor barrier rooms are currently required for co-residential dry cleaning facilities in the San Francisco Bay Area and for all dry cleaners in mixed-use buildings in the State of New York. Figure III-7 shows a typical full vapor barrier room configuration.

Full vapor barrier rooms are constructed of material resistant to diffusion of solvent vapors such as sheet metal (recommended), metal foil faced insulation sheets, or heavy plastic sheeting sandwiched between dry wall (gypsum) sheets. Seams should be offset for multiple layers of material. Seams and gaps should be sealed with aluminized tape (not standard duct tape) at each layer. The ventilation duct or fan intake should be placed near the ceiling directly above the back of the machine or at the rear of the full vapor barrier room. Warm air rises transporting solvent vapors towards the ceiling, placing the fan near the ceiling will effectively remove warm air and solvent vapors. The fan should produce an adequate air flow (minimum 1,000 CFM) to maintain a capture velocity greater than 100 feet per minute at any intentional gap or opening or about 50 feet per minute at the entry door when temporarily opened (plastic strips covering doorway will enhance capture). An air change rate of once a minute is recommended. For example a small 10' X 10' room would require a 1,000 CFM fan which would provide an air change rate of once a minute, for larger rooms a proportionally larger fan should be considered.

The exhaust fan may be installed inside the full vapor barrier rooms or near the ceiling at the back of the machine or outside the facility on a wall or on the roof; should be of a high pressure (1-3" H_2O) design with a minimum capacity of 1,000 CFM; and should be run continuously (24 hours a day, 365 days a year) in a co-residential facility and whenever the dry cleaning machine is operating or being maintained in a non-residential facility (interlock fan motor to dry cleaning machine). The stack should extend at least 5 feet (a 10 foot stack is recommended) above the roofline or any adjacent roof and at least 30 feet from any air intake or window. Emissions must be exhausted vertically (no rain caps). Proper stack design eliminates rain intrusion with offset legs, drains, and internal deflectors. External fans may also have drain holes. In addition, there should be one air exchange every 5 minutes. The diameter of the stack should generally be 8 to 14 inches with an air flow rate of 1,000 to 2,500 CFM to provide good dispersion. Spotting using Perc containing solvents should be done within the full vapor barrier rooms for co-residential facilities. In addition, solvent and waste drums may be stored in a full vapor barrier room (BAAQMD, 2001).

C. Dry Cleaning Evaluation

The state of the current dry cleaning industry was assessed based on several surveys, site visits of dry cleaning facilities, and emission testing. More detail information is presented in the Technical Assessment Report (CARB, 2006). In 2006, an updated assessment of the number and types of dry cleaning machines in operation was made based on input from the local air districts and industry.

1. Dry Cleaning Facility Survey Update (2006)

The Facility Survey was conducted in 2003 and designed to collect information from dry cleaning facilities. Based on the original Facility Survey, staff estimated that there were about 5,440 dry cleaning machines in California, of which, about 4,670 were Perc machines. In addition to Perc, the second and the third solvent of choice are DF-2000 and GreenEarth. In 2006, ARB staff conducted on update to the 2003 survey data to estimate of the number of Perc and the alternative dry cleaning machines that are currently in operation. Based on information provided by the local air districts and industry, the number of dry cleaning machines in operation in California in 2006 is estimated to be 5,210, with the number of Perc machines estimated to be 3,660.

This represents about a 20 percent decrease in Perc machines over the last three years. The use of alternative dry cleaning machines have increased during the same period, with the high flash point hydrocarbon technology experiencing the largest growth. A comparison of the number of dry cleaning machines in operation estimated by the 2003 Facility Survey and the 2006 update is shown in Table III-2.

Table III-2. Statewide Estimates - Dry Cleaning Machines in Operation[1]

Statewide Estimates	Number of Machines (2003 Survey)	Number of Machines (2006 Update)
Perc Machines	4,670	3,660
High Flash Point Hydrocarbon	460	1,100
GreenEarth	90	190
Water Based Cleaning Systems[2]	150	170
Carbon Dioxide	3	10
Others (Rynex 3, PureDry, and Stoddard)	60	80

1. Source: 2003 Facility Survey; values are rounded to nearest 10 except for carbon dioxide machines.
2. Includes mixed shops.

For the Perc machines, the machine types were estimated based on input from the local air districts and industry. All Perc machines operating within the South Coast AQMD are required to be integral secondary control machines by November 2007. A summary of the results are shown in Table III-3 below:

Table III-3. Perc Dry Cleaning Machines in Operation (2006)[1]

Facility Description	**Number of Machines (2006 Update)**
Facilities with Converted and Primary Control Machines	1,240
Facilities with Add-on and Integral Secondary Control Machines	880
Co-residential Facilities with Perc Machines	50
Total Perc Machines in South Coast	1,540
Total Statewide Perc Machines	3,660

1. Values are rounded.

2. Leak Detector Evaluation

Based on observations during site visits and conversations with ARB training staff and local air districts, some Perc facility operators do not use their halogenated hydrocarbon detector (HHD) as often as they are required. The reason is that most of the HHDs do not give quantitative results. A majority of the Perc facilities use HHDs made by TIF™ Instruments, Inc. (TIF detectors) that would beep when Perc or other VOCs were detected. The threshold level for beeping to begin is around eight ppm (ARB, 2004c). The TIF detectors cannot be easily used to accurately determine whether a facility is in violation because the Dry Cleaning ATCM requirement for the facility to fix the leak is at 50 ppmv.

ARB staff looked at what is available in the industry for Perc detection and conducted a limited evaluation. The staff evaluated 12 portable detectors, including a TIF detector; a photoionization detector (PID) was available and served as a reference analyzer. The range of technologies tested included: PID, gas sensitive semiconductor, colorimetric tube, infrared, and heated diode sensor technology. Cost information for the detectors is discussed in Chapter VII of the Technical Assessment Report (CARB, 2006). A summary of the evaluation results is shown in Table III-4.

Table III-4. Summary of Leak Detector Evaluation

Model and (Manufacturer)	Detection Principle	Sample Delivery	Display	Response Time[1] (sec)	Leak Check Suitability[2]
Gas Alert Micro 5 (BW Technologies)	Photoionization	Diffusion	LCD with audio and visual alarms	5 – 10	No
PhoCheck 1000 (Ion Science)	Photoionization	Internal pump	LCD	<5	Yes
MiniRAE 2000 (Rae Systems)	Photoionization	Internal pump	LCD with visual alarms	<5	Yes
Aeroqual 200 Leak Detector (Aeroqual)	Gas Sensitive Semiconductor	Internal fan	LCD with audible alarms	<5	Yes
Aeroqual 500 (Aeroqual)	Gas Sensitive Semiconductor	Diffusion	LCD with audio alarm	20 – 30	No
Aeroqual 500 with build-in fan (Aeroqual)	Gas Sensitive Semiconductor	Internal fan	LCD with audio alarm	5 – 10	No
C-21 (Eco Sensors,Inc.)	Gas Sensitive Semiconductor	Diffusion	LED bar with audible alarm	No Response[3]	No
D-Tek (Inficon)	Infrared	Internal pump	Audible with LED bar	No Response	No
Tek-Mate (Inficon)	Heated Diode Sensor Technology	Internal pump	Audible with low and high sensitivity options	<5	Yes
TIF-5100 (TIF Instruments)	Heated Diode Sensor Technology	Diffusion	Audible	<5	Yes
Draeger CMS (Draeger)	Colorimetric	Internal pump	LCD	110	No
HW 101 reference analyzer (h-nu Systems)	Photoionization	Internal pump	Analog Potentiometer	<5	No

1. Response time is the approximate time needed for the detector to display a stable concentration.
2. Leak check suitability based on response time of less than five seconds in the field.
3. No response to calibrated standards, may require humidified gas sample.

As shown in Table III-4, in all cases, the PID detectors with an internal pump or fan performed well and provided quantitative results. The Aeroqual 200 Leak Detector technology (different from the Aeroqual 200 used for monitoring purposes) was also deemed suitable for leak checks and provided quantitative results within 10 percent uncertainty at a 50 ppmv Perc level. With the exception of the TIF-5100, the detectors that used diffusion for sample delivery had response times of five seconds or more in the field and were deemed not suitable for leak detection. The Tek-Mate and the TIF-5100 were sensitive to Perc and will indicate leaks at levels below 50 ppm. The facility background concentrations were mostly non-detectable with the limit of detection of the PID detectors at around one or two ppmv; the largest background concentration reading was between 5 to 10 ppmv.

3. Statewide Estimates of Emissions from Dry Cleaning Operations

Statewide estimates are made based on the 2006 updated number and type of Perc machines in operation and the usage and emission information obtained during the evaluation process and discussed in the Technical Assessment Report. The Perc machines currently in operation statewide are estimated to be emitting about 3.0 tons per day of Perc, with 1.8 tons per day of that being emitted outside of the South Coast AQMD. Upon full implementation of the proposed amendments and the South Coast AQMD's Rule 1421, all of the Perc emissions from Perc machines will be eliminated and there will be a reduction of 3.0 tons per day of Perc statewide.

D. Ambient Air Monitoring of Perchloroethylene

In 1985, the ARB established a 20 station toxic monitoring network to provide data to determine annual average concentrations of toxic air contaminants. This monitoring data is used to prioritize substances for the identification process, and to help assess the effectiveness of controls. The ARB routinely monitors Perc in the ambient air throughout the State.

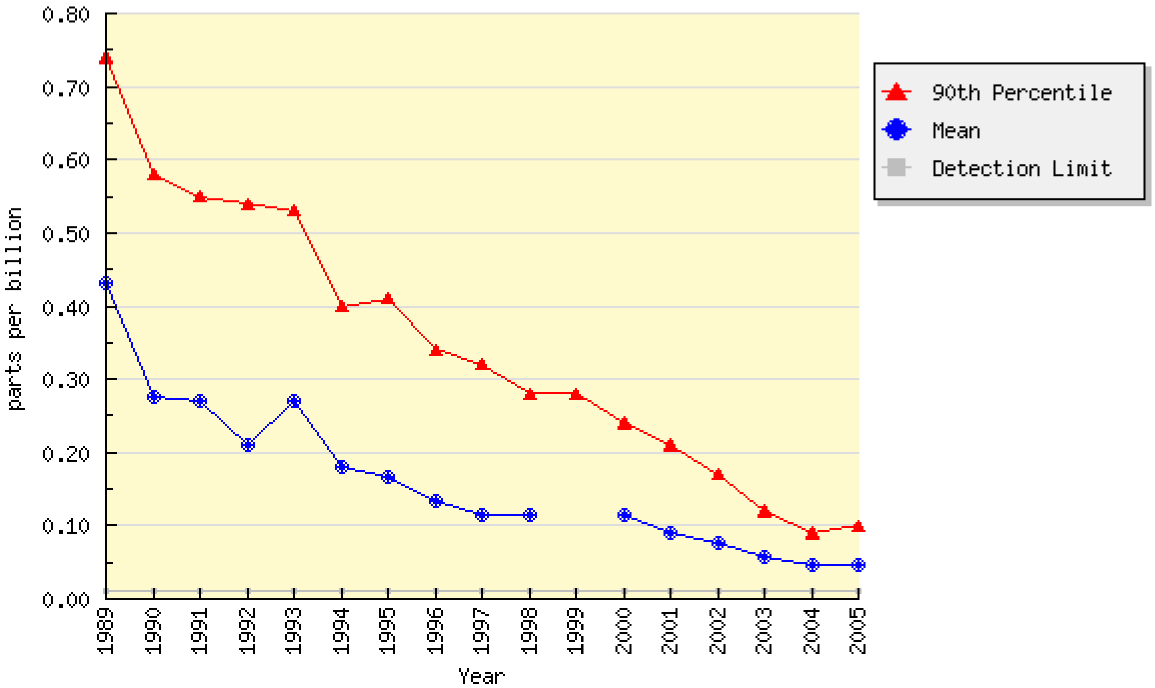
Prior to development of the Dry Cleaning ATCM, the statewide annual average concentration from July 1988 to December 1991 was 0.28 ppb (ARB, 1993a). The statewide annual Perc average for the years 2003 to 2005 is 0.05 ppb (ARB, 2006c). This data shows that the ambient levels of Perc have decreased approximately 80 percent. Figure III-8 on page shows that, overall, there has been a downward trend in the statewide annual averages for Perc.

As mentioned in the previous section, ARB staff expects that upon full implementation of the proposed amendments to the Dry Cleaning ATCM and the effects of the South Coast AQMD Rule, Perc emissions would be reduced to near zero by January 2023. Therefore, we expect that ambient levels will continue to decrease since dry cleaning operations account for the majority of Perc emissions. According to Perc solvent manufacturers, about 80 percent of the Perc is used in the dry cleaning industry and the remaining 20 percent is used in other industries.

On a regional basis, the proposed Dry Cleaning ATCM will eliminate Perc from Perc dry cleaning operations. Based on recent monitoring data (2005), the average population weighted cancer risk from exposure to Perc is estimated between 1 and 2 chances per million[1]. After full implementation of the proposed Perc ATCM and with other Perc measures in place, the average potential cancer risk from exposure to ambient Perc is expected to drop below 1 chance per million.

[1] Excludes the SCAQMD which is applying its own measure.

Figure III-8. Statewide Annual Average Monitored Values for Perchloroethylene[1,2]



1. ARB, 2006b
2. There is no data point for the mean value in 1999 because there was insufficient data or no data to determine the value.

IV. POTENTIAL HEALTH IMPACTS FROM EXISTING PERCHOLOROETHYLENE DRY CLEANING FACILITIES

A. Overview of Health Risk Assessment

A health risk assessment (HRA) is an evaluation that a risk assessor (e.g., ARB, local air district, consultant, or facility operator) develops to describe the potential a person or population may have of developing adverse health effects from exposure to a facility's emissions. Some health effects that are evaluated could include cancer, developmental effects, or respiratory illness. The pathways of exposure can include breathing; dermal exposure; and the ingestion of soil, water, crops, fish, meat, milk, eggs, and mother's (breast) milk.

For this HRA, we are evaluating the health impacts from Perc for the inhalation pathway only. We are not evaluating other pathways of exposure for Perc because OEHHA does not currently recommend using a multipathway methodology when assessing the exposure to volatile compounds such as Perc. Such multiple exposure pathway (multipathway) assessments are traditionally used for lipophilic (fat-loving), semivolatile, or low volatility compounds such as polychlorinated dibenzodioxins (PCDDs or dioxins) and dibenzofurans (PCDFs or furans), polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs).

Generally, to develop an HRA, the risk assessor would perform or consider information developed under the following four steps: hazard identification, dose-response assessment, exposure assessment, and risk characterization.

1. Hazard Identification

In the first step, the risk assessor would determine if a hazard exists, and if so, would identify the pollutant(s) of concern and the type of effect, such as cancer or respiratory effects.

Perc has been formally identified as a TAC under the California Toxic Air Contaminant Program (Assembly Bill 1807: HSC sections 39660-39662). In addition, Perc is listed as a HAP by U.S. EPA under the Federal Clean Air Act (42 U.S.C. 7412). The ARB identified HAPs as TACs pursuant to HSC section 39657(b).

2. Dose-Response Assessment

In this step of risk assessment, the assessor would characterize the relationship between a person's exposure to a pollutant and the incidence or occurrence of an adverse health effect.

This step of the HRA is performed by OEHHA. OEHHA supplies these dose-response relationships in the form of cancer potency factors (CPF) for carcinogenic effects and reference exposure levels (RELs) for non-carcinogenic effects.

The CPFs and RELs that are used in California and those that are used for Perc in this HRA are presented in Section B, part 2 of this chapter.

3. Exposure Assessment

In this step of the risk assessment, the risk assessor estimates the extent of public exposure by looking at who is likely to be exposed, how exposure will occur (e.g., inhalation and ingestion), and the magnitude of exposure.

For dry cleaning activities, the receptors (people) that are likely to be exposed include residents and off-site workers located near the facility. On-site workers are not included in this HRA because Cal/OSHA has jurisdiction over on-site workers. To protect worker safety, Cal/OSHA has established a PEL for Perc. The PEL is the maximum, eight-hour, time-weighted average concentration for occupational exposure and it is 25 ppmv for Perc (Cal/OSHA, 2004). Since the proposed amendments to the Dry Cleaning ATCM will phase out the use of Perc machines in all dry cleaning facilities, on-site worker exposure to Perc at those facilities will be virtually eliminated.

Exposure to Perc at residential and off-site work locations was evaluated via the inhalation exposure pathway. Emission estimates and release parameters for the generic release scenarios were designed from previous work on dry cleaners, data taken from over 100 site visits, evaluation of over 1,600 survey responses, and input from industry representatives and the local air districts. Computer air dispersion modeling was used to provide downwind ground-level concentrations of the Perc at near-source locations.

4. Risk Characterization

This is the final step of risk assessment. In this step, the risk assessor combines information derived from the previous steps. Modeled concentrations, which are determined through exposure assessment, are combined with the CPFs (for cancer risk) and RELs (for noncancer effects) determined under the dose-response assessment. This step integrates this information to quantify the potential cancer risk and noncancer health impacts.

B. Tools and Information Used for this Risk Assessment

The tools and information that are used to estimate the potential health impacts from a source include an air dispersion model and pollutant-specific health values. Information required for the air dispersion model includes emission estimates, meteorological data, physical descriptions of the source, and emission release parameters. Combining the output from the air dispersion model and the pollutant-specific health values provides an estimate of the off-site potential cancer and noncancer health impacts from the emissions of a TAC.

For this assessment, ARB staff is estimating the potential health impacts from Perc emitted during dry cleaning activities. A brief description of the emission estimates, air dispersion modeling, and pollutant-specific health values is provided in this chapter. Additional information on the generic release scenarios used in the air dispersion modeling can be found in Appendix B. This risk assessment is based on the methodology outlined in *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003* (OEHHA Guidelines) (OEHHA, 2003a). In conjunction with the OEHHA Guidelines, staff also followed the ARB's *Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk* (ARB Interim Risk Management Policy) (ARB, 2003a).

1. Air Dispersion Modeling

Air dispersion models are used to estimate the downwind, ground-level concentrations of a pollutant after it is emitted from a facility. The downwind concentration is a function of the quantity of emissions, release parameters at the source, and appropriate meteorological conditions. The model that was used during this HRA was the Hot Spots Analysis and Reporting Program (HARP) (ARB, 2005h). HARP includes the Industrial Source Complex Short Term (ISCST3) air dispersion model, which is recommended by U.S. EPA for refined air dispersion modeling (U.S. EPA, 1995). HARP is a recommended tool for risk analysis in California that can be used for most source types (e.g., point, area, and volume sources) and is currently used by ARB, local air districts, and other states.

a. Emission Estimates

Risk assessment results are based on unit emission rates and can be easily adjusted to reflect any emission rate scenario. Therefore, emissions of Perc from dry cleaning activities for the risk assessment were based on unit emission rates of 100 gallons per year (1,350 pounds per year) for annual emissions and 0.1 gallons per hour (1.35 pounds per hour) for hourly emissions.

Emissions for this assessment were based on data taken from site visits and the evaluation of responses to an ARB facility survey. Table IV-1 shows the high-end (90^{th} percentile) and average annual emission rates and the hourly emission rates that were used in this report for dry cleaners with converted machines, primary control, and secondary control. According to the dry cleaner survey results and our site visits, approximately 90 percent of dry cleaners emit below the high-end annual emission rate.

Table IV-1. Emissions Rates

Scenario	Annual (gallons/year)		Hourly (gallons/hour)[2]
	High-End Emissions[1]	Average Emissions	
Converted Machine	113	76	0.45
Primary Control	94	52	0.13
Secondary Control	61	34	0.06

1. High–end emissions is defined by the 90th percentile of emissions.
2. The hourly emissions are based on the 10th percentile of mileage and 90th percentile for machine capacity from our survey results.

b. Meteorological Data

This assessment uses meteorological data sets from four locations in California. Those locations are Anaheim (81), Fresno (85-89), Oakland (port) (98-00), and San Diego (Miramar) (67-71). The year(s) of meteorological data used at each location are listed in the parenthesis.

c. Physical Descriptions of the Source and Emission Release Parameters

Eight generic dry cleaner scenarios were used for the air dispersion modeling. These generic facilities were created from survey information, information obtained during site visits, and input from draft industry-specific reports, industry representatives, and from local air districts regarding dry cleaning operations. The generic release scenarios address the physical dimensions and emission release parameters used in the HRA. The generic release scenarios are presented in Appendix B.

2. Pollutant-Specific Health Effects Values

Dose-response or pollutant-specific health 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 CPF is used when estimating potential cancer risks and a REL is used to assess potential noncancer health impacts.

As presented in Section C, exposure to Perc may result in both cancer and noncancer health effects. The inhalation CPF and noncancer acute and chronic RELs that are used for this HRA are listed in Table IV-2. Also included in Table IV-2 are the noncancer acute and chronic target organs for Perc. Table IV-2 reflects the most current OEHHA-adopted health effects values for Perc.

Table IV-2. Pollutant-Specific Health Effects Values used for Determining Potential Health Impacts[1]

Compound	Inhalation Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$	Noncancer Reference Exposure Levels (ug/m3)		Target Organs	
		Acute	Chronic	Acute	Chronic
Perchloroethylene (Perc)	2.1×10^{-2}	20,000	35	Nervous System; Eye, & Respiratory	Kidney and Alimentary

1. Health effects values were obtained from: a)The OEHHA Air Toxics "Hot Spots" Program Risk Assessment Guidelines, Part I, The Determination of Acute RELs for Airborne Toxicants, March 1999, (OEHHA, 1999); b) The OEHHA Air Toxics "Hot Spots" Program Risk Assessment Guidelines, Part II, Technical Support Document for Describing Available Cancer Potency Factors (Revised), December 2002, (OEHHA, 2002); c) The Air Toxics Hot Spots Program Risk Assessment Guidelines; Part III; Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels, April 2000, (OEHHA, 2000a); d) The Air Toxics Hot Spots Risk Assessment Guidelines; Part IV; Exposure Assessment and Stochastic Analysis Technical Support Document, September 2000, (OEHHA, 2000b); and e) The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. August 2003, (OEHHA, 2003a).

The CPF, which is currently used for health risk assessment, describes the excess cancer risk associated with exposure to one milligram of a given chemical per kilogram of body weight. The inhalation unit risk factor (URF), which was used in the past for health risk assessment, is defined as the estimated upper-confidence limit (usually 95th percentile) probability of a person contracting cancer as a result of constant exposure to a concentration of 1.0 microgram per cubic meter ($\mu g/m^3$) over a 70-year lifetime. The URF of 5.9×10^{-6} $(\mu g/m^3)^{-1}$ is converted to the cancer potency factor of 2.1×10^{-2} $(mg/kg - day)^{-1}$ by multiplying the URF by 3500 and rounding to two significant figures. The factor of 3500 is derived from a 70 kilogram (kg) human body weight, 20 m^3 inhalation rate, and 1000 factor unit conversion.

Reference exposure levels are defined as a concentration level at or below which no adverse health effects are anticipated and is used as an indicator of potential noncancer adverse health effects. Reference exposure levels are designed to protect 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 one-hour exposure is used to determine acute noncancer impacts. Chronic exposure is defined as long-term exposure usually lasting from one year to a lifetime.

C. Potential Health Effects of Perchloroethylene

This section summarizes the cancer and noncancer impacts that can result from exposure to Perc. Exposure to Perc may result in both cancer and noncancer health effects. The probable route of human exposure to Perc is inhalation (ARB, 1997).

1. <u>Cancer</u>

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 (ARB, 1991). The State of California, under Proposition 65, listed Perc as a carcinogen in April 1988 (OEHHA, 2006). Table IV-2 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 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). The ARB identified these HAPs as TACs pursuant to HSC section 39657(b).

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).

2. <u>Noncancer</u>

Short-term (acute) and long-term (chronic) exposure to Perc may result in noncancer 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, 1996). 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 noncancer RELs (OEHHA, 1999, OEHHA 2000a), 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 IV-2 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 ppmv 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).

D. Factors that Affect the Health Risk Assessment Results

Risk assessment is a complex process that requires the analysis of many variables to simulate real-world situations. There are a few factors that can affect the results of a health risk assessment at a dry cleaner, including: 1) the amount of (Perc) emissions released from the operation; 2) the source release characteristics (e.g., height of stack, stack configuration, flow rate, and building dimensions); 3) local meteorological conditions; 4) the distance to the receptor; 5) the duration of exposure; and 6) the inhalation rate of the receptor. A combination of these factors will determine the potential health impacts.

In this report, potential health impacts are presented for generic facilities. Therefore, the potential health impacts at an actual facility may vary due to that facility's individual characteristics. The generic release scenarios used in the HRA are presented in Appendix B.

E. Summary of the Risk Assessment Results from Generic Dry Cleaner Scenarios

This section presents a summary of the risk assessment results from eight generic dry cleaning facility configurations. This assessment uses meteorological data sets from four locations in California. Those locations are Anaheim, Fresno, Oakland (port), and San Diego (Miramar). The risk assessment used the Tier 1 methodology outlined in the OEHHA Guidelines (OEHHA, 2003a). In conjunction with the OEHHA Guidelines, staff also followed the ARB Interim Risk Management Policy (ARB, 2003a).

Table IV-3 provides estimates of the potential cancer risk for a resident living at 20, 30, or 100 meters from a sample of generic Perc dry cleaning facilities outside the South Coast AQMD. Risk estimates are presented for converted machines, primary control machines, and secondary control machines with general ventilation. Staff used emission rates that will likely include 90 percent of the Perc facilities.

For any receptor located closer than 20 meters from a dry cleaner, it is possible that their potential health impacts may be either higher or lower than the results presented in this report. Factors that may contribute to this variation include meteorology (wind and weather) and the individual release characteristics at each facility. Currently, 20 meters is the minimum air dispersion modeling distance used by the ARB in their Air Toxics Program. Since 1997, the local air districts have used 20 meters as the minimum modeled distance in the industry-wide risk assessment guidelines for sources in the Air Toxics Hot Spots Program. The impacts at the 100 meter distance are identified to provide perspective for potential health impacts at distances further away from a dry cleaning facility.

Table IV-3. Potential Cancer Risk for High Perc Use Dry Cleaning Facilities[1]

Distance [meters (feet)][2]	Range of Potential Cancer Risk (chances per million)		
	Converted Machine with General Ventilation	Primary Control Machine with General Ventilation	Secondary Control Machine with General Ventilation
20 (66)	75	60	40
30 (100)	45	40	25
100 (330)	8	6	4

1. Assumes high-end (90%) Perc emissions rates of 113 gallons per year for converted machines, 94 gallons per year for primary machines, and 61 gallons per year for secondary machines. The results in this table are taken from Tables B-4 to B-6 in Appendix B. The results are adjusted for emission rates and averaged across three meteorological data sets (Fresno, Oakland (port), and San Diego (Miramar)). Calculations assume a 70-year exposure duration and use the 80th percentile daily breathing rate. Building size is assumed to be approximately 1,100 square feet. Results are for the inhalation pathway. All results are rounded.
2. Distances are presented from the building edge.

Table IV-4 provides an estimate of the percentage of facilities that have residents located within 20, 30, or 100 meters from the facility. As can be seen in the table, about 22 percent of the machines are at facilities that have a residence within 20 meters of the facility, 36 percent of machines are at facilities that have a residence within 30 meters, and 66 percent of all machines are at facilities that are within 100 meters of a residence.

The proposed amendments will practically eliminate all Perc emissions from dry cleaning operations. The only remaining Perc emissions may come from the intermittent and limited use of spotting agents. The ARB staff estimates that Perc emissions from facilities will be reduced by nearly 100 percent with full implementation of the proposed amended Dry Cleaning ATCM.

Table IV-4. Percent of Perc Machines at Various Distances from Residences

Distance [meters (feet)]	Percent of Machines
< 20m (66ft)	22%
< 30m (100ft)	36%
<100m (330ft)	66%

Table IV-5 presents a summary of the potential health impacts from the generic scenarios across the four meteorological data sets. Those locations are Anaheim, Fresno, Oakland (port), and San Diego (Miramar). This table provides a summary of the potential cancer risk for both residential and off-site (adjacent) worker receptors exposed to high-end (90^{th} percentile) and average emissions of Perc at existing dry cleaners with secondary control. The purpose for showing the potential health impacts at these two emission levels is to provide a perspective for Perc emissions at dry cleaning facilities in California. According to the dry cleaner survey results and our site visits, approximately 90 percent of dry cleaners emit below the high-end annual emission rate. Appendix B contains more detailed risk assessment results for dry cleaners with secondary control technology using generic unit emission rates that are broken down by meteorological data set, generic source configuration, and receptor breathing rates.

The upper section of Table IV-5 provides a summary of the potential cancer risk for a residential receptor exposed to high-end (90^{th} percentile) and average emissions of Perc at dry cleaners using secondary control. Residential receptor results use the 80^{th} percentile daily breathing rate and a 70-year exposure duration. If a dry cleaner was using a machine with primary control equipment instead of secondary control, then the potential cancer risks discussed below and presented in Table IV-5 are anticipated to increase by approximately 50 percent across all configurations.

Depending on the meteorological data set and the dry cleaner configuration, the potential cancer risk for a residential receptor exposed to the high-end (90^{th} percentile) Perc emissions scenario is estimated to range between approximately 75 chances per million at 20 meters and 3 chances per million at 100 meters. Under the average emissions scenario, the residential receptor potential cancer risk is estimated to range between approximately 42 chances per million at 20 meters and 2 chances per million at 100 meters.

The lower section of Table IV-5 provides a summary of the potential cancer risk for an off-site worker receptor exposed to high-end (90^{th} percentile) and to average emissions of Perc at dry cleaners using secondary control. The exposure duration for a worker is assumed to be 40 years.

Depending on the meteorological data set and the dry cleaner configuration, the potential cancer risk for an off-site worker receptor exposed to the high-end (90^{th} percentile) Perc emissions scenario is estimated to range between approximately 62 chances per million at 20 meters and 2 chances per million at 100 meters. Under the average emissions scenario, the off-site worker potential cancer risk is estimated to range between approximately 35 chances per million at 20 meters and 1 chance per million at 100 meters.

The chronic hazard indices under the high-end (90^{th} percentile) emissions scenario are less than 0.4 at residential receptor locations and less than 1.5 at adjacent worker locations. The adjacent workers' hazard index decreases to less than 1.0 within 30 meters of the dry cleaner. Under the average emissions scenario, chronic hazard indices are less than less than 0.2 at residential receptor locations and less than or equal to 0.8 at adjacent worker locations. The noncancer acute hazard indices are less than 0.2 at any receptor location. All noncancer health impacts would be virtually eliminated under the proposed amendments.

Table IV-5. Potential Cancer Risk at Residential and Off-site Worker Receptors from a Generic Dry Cleaner Emitting at the High-End (90th Percentile) and Average Emission Rates Using Secondary Control [1, 2]

Source Types	RESIDENTIAL Potential Cancer Risk (chances per million)											
	(Based on High-end Emissions)						(Based on Average Emissions)					
	Distance (meters)[3]						Distance (meters)[3]					
	20	40	60	80	100	120	20	40	60	80	100	120
Natural Ventilation	40-75	17-31	9-17	6-11	4-8	3-6	22-42	9-18	5-10	3-5	2-4	1-3
Natural Ventilation (B)[4]	29-53	13-24	8-14	5-9	3-7	3-5	16-29	7-13	4-8	3-6	2-4	2-3
General Ventilation (60/40)[5]	39-77	16-30	9-17	6-11	4-8	3-6	22-43	9-17	5-9	3-6	2-4	2-3
General Ventilation (B)[4] (60/40)[5]	25-51	12-24	8-14	5-9	3-7	3-5	14-28	7-13	4-8	3-5	2-4	1-3
Local Ventilation (80/20)[5]	22-29	11-15	7-10	4-7	3-5	2-4	12-16	6-9	4-6	2-4	2-3	1-2
Partial Vapor Barrier Room (95/5)[5]	22-34	12-19	7-12	4-8	3-6	2-4	12-19	7-11	4-7	2-4	2-3	1-2
Full Vapor Barrier Room	21-32	11-19	7-12	4-8	3-6	2-4	12-18	6-10	4-7	2-4	2-3	1-2

Source Types	OFF-SITE WORKER Potential Cancer Risk (chances per million)											
	(Based on High-end Emissions))						(Based on Average Emissions)					
	Distance (meters)[3]						Distance (meters)[3]					
	20	40	60	80	100	120	20	40	60	80	100	120
Natural Ventilation	33-62	14-26	7-14	5-9	3-6	2-5	18-35	8-15	4-8	3-5	2-3	1-3
Natural Ventilation (B)[4]	24-44	10-20	6-12	4-8	3-5	2-4	13-24	6-11	3-6	2-4	2-3	1-2
General Ventilation (60/40)[5]	32-64	14-25	8-14	5-9	3-6	2-5	18-36	8-14	4-8	3-5	2-3	1-3
General Ventilation (B)[4] (60/40)[5]	21-42	10-20	6-11	4-7	3-5	2-4	11-23	5-11	3-6	2-4	2-3	1-2
Local Ventilation (80/20)[5]	18-24	9-13	5-9	3-6	2-4	2-3	10-13	5-7	3-5	2-3	2-2	1-2
Partial Vapor Barrier Room (95/5)[5]	18-28	10-16	5-10	4-7	3-5	2-3	10-16	5-9	3-6	2-4	1-3	1-2
Full Vapor Barrier Room	17-26	9-16	5-10	3-7	2-5	2-3	10-15	5-9	3-5	2-4	1-3	1-2

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology and four meteorological data sets (Anaheim, Fresno, Oakland (port), and San Diego (Miramar). The high-end (90th percentile) and average emissions of Perc equate to approximately 61 and 34 gallons per year, respectively.
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the 80th percentile daily breathing rate. Workers assume a 40-year exposure duration.
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet and 18 feet high. Other scenarios use a building approximately 1,100 square feet and 12 feet high.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.

V. POTENTIAL HEALTH IMPACTS OF THE PROPOSED AMENDED DRY CLEANING ATCM

A. Emissions and Risk Reduction Benefits

At full implementation, the proposed amended Dry Cleaning ATCM, excluding facilities in South Coast AQMD, will reduce the emissions of Perc from dry cleaning facilities by approximately 1.8 tons per day. Based on the 2006 updated information, the proposed ATCM and the South Coast AQMD rule will result in a 3.0 tons per day reduction statewide in Perc emissions. This emission reduction will lead to reductions in exposure and decrease the potential health impacts from Perc exposure.

The proposed amendments will completely phase out all Perc machines by January 1, 2023. The potential cancer risk for any receptor [i.e., resident or off-site (adjacent) worker] will be reduced to essentially zero. The only remaining Perc emissions may come from the intermittent and limited use of spotting agents containing Perc or residual Perc from clothes last cleaned outside California.

On a regional basis, the average population weighted cancer risk from exposure to ambient levels of Perc is estimated between 1 and 2 chances per million[1]. After full implementation of the proposed Perc ATCM and with other Perc measures in place, the average potential statewide cancer risk from exposure to ambient Perc levels is expected to drop below 1 chance per million.

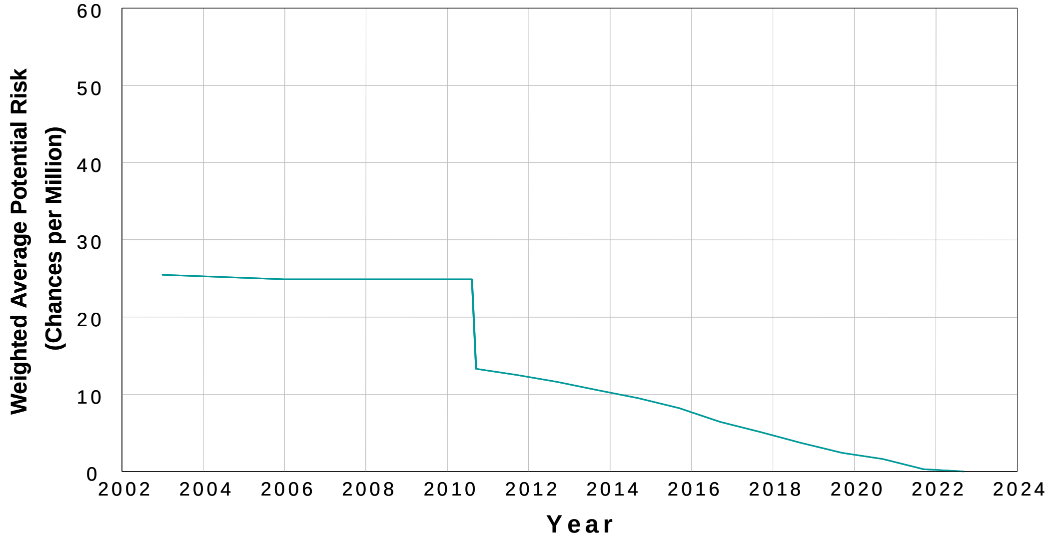
Appendix B contains more detailed risk assessment results for dry cleaners with secondary control technology using generic unit emission rates that are broken down by meteorological data set, generic source configuration, and receptor breathing rates.

Figure V-1 shows the current and projected average potential cancer risk after implementation of the proposed amended Dry Cleaning ATCM for facilities outside the South Coast AQMD that use Perc in California. The figure uses potential risk results for a receptor at 20 meters.

On July 1, 2010, the proposed Dry Cleaning ATCM will phase out all converted Perc machines, Perc machines that are in excess of 15 years old, and Perc machines in all co-residential buildings. Removal of these initial Perc machines will reduce the overall weighted cancer risk by about 36 percent. After 2010, the steady decline in weighted cancer risk is attributed to the continual phase out of Perc machines as they reach 15 years of age. On January 1, 2023, the weighted cancer risk will be near zero due to full implementation of the proposed ATCM. As shown in Figure V-1, at full implementation, the overall weighted average risk reduction is expected to be about 100 percent.

[1] Excludes the SCAQMD which is applying it's own measure.

Figure V-1. Potential Cancer Risk at Perc Dry Cleaners Subject to the Proposed Amended ATCM[1]



1. Excludes all dry cleaners within South Coast AQMD since they have their own dry cleaning rule. Figure is based on potential risk estimates at 20 meters.

B. Potential Adverse Health Impacts from Perchloroethylene Alternatives

The proposed amendments are expected to result in increased usage of Perc alternatives. The most popular Perc alternative is a high flash point hydrocarbon solvent. A significant issue associated with increased usage of hydrocarbon solvents is increased VOC emissions. VOC emissions contribute to the formation of ozone. Ozone formation in the lower atmosphere results from a series of chemical reactions between VOCs and nitrogen oxides in the presence of sunlight. Ozone is linked to a myriad of health effects including respiratory irritation, asthma, and premature death. Section D contains more information on the health impacts of ozone. See Chapter 3 for more discussion on current emissions and trends of Perc alternatives.

While the impacts of ozone are well documented, there is relatively little health data available on the specific alternatives and no California health values have been adopted. As a result, ARB staff requested OEHHA to review the health effects of alternative dry cleaning solvents as they are used in the dry cleaning industry. The California Dry Cleaning Industry Technical Assessment Report (CARB, 2006), which is available under separate cover, contains a copy of OEHHA's December 2003 memorandum to ARB which provides both a summary of their literature review and toxicity data summaries for many of these compounds. Based on their literature review, OEHHA has estimated several interim chronic noncancer reference exposure levels (RELs) and is continuing to follow the peer-reviewed literature on toxicity studies for the alternative solvents. Currently, there are no cancer potency factors or acute RELs for Perc alternatives.

1. Hydrocarbon Solvent Cleaning (DF-2000, PureDry, EcoSolv, Shell 140, Stoddard)

Hydrocarbon solvents, sometimes referred to as mineral spirits and petroleum solvents, are mixtures of hydrocarbons with or without other materials. Hydrocarbons have been used in the dry cleaning industry for many years and are some of the more common alternatives to Perc dry cleaning. The hydrocarbon solvents are a unique mixture of carbon and hydrogen molecules that co-exist as linear and branched chains, as well as in cyclic forms (U.S. EPA, 1998).

A recent two-year inhalation study of Stoddard solvent conducted by the National Toxicology Program (NTP) concluded that there was some evidence of carcinogenic activity in male rats (NTP, 2004). In general, this study confirmed previous studies on toxicity for Stoddard. Most of the studies found in the literature for short and long-term toxicity identified the kidney and liver as the major target organs (NTP, 2004). Additionally, stoddard solvent can be irritating to the eyes, nose, throat, and can also have effects on the nervous system (U.S. EPA, 1998).

There is also very limited health information on other hydrocarbon mixtures. DF-2000 contains C_{11} to C_{13} synthetic isoparaffin aliphatic hydrocarbons. PureDry contains 95 percent mineral spirits, which can cause neurotoxicity, and eye and respiratory irritation at high concentrations (OEHHA, 2003). EcoSolv and Shell 140 have similar hydrocarbon properties. ARB staff has not received information indicating that TACs or HAPs are present in hydrocarbon mixtures.

Most information is lacking on the environmental persistence of these and other hydrocarbon mixtures; however the manufacturer of DF-2000 indicated that their solvent can exhibit moderate rates of biodegradation (ExxonMobil, 2003). The manufacturer of EcoSolv indicated their solvent can exhibit moderate to rapid rates of biodegradation (Chevron Phillips, 2005).

For hydrocarbon mixtures, OEHHA has developed an interim chronic REL of 1,200 $\mu g/m^3$. The development of this interim value, which has not been through scientific peer review, is based on a study by Phillips and Egan on male and female rats. Additional information on this study can be found in the Technical Assessment Document (CARB, 2006).

An occupational exposure limit (OEL) can be calculated for various hydrocarbon solvents. Guidance values for individual hydrocarbon constituents or groups of constituents were recently published in the Journal of Occupational and Environmental Hygiene article, *A Proposed Methodology for Setting Occupational Exposure Limits for Hydrocarbon Solvents*, October 2005 (JOEH, 2005). Information on calculating OELs and guidance values for other substance groups can be found in this article.
Note however, these guidance values have not been approved for use in California's regulatory programs.

One detrimental environmental and secondary health effect of hydrocarbon solvents is their contribution to the formation of ozone. See Section D for more discussion on the health impacts of ozone.

2. Volatile Methyl Siloxane Cleaning

D_5 is a cyclosiloxane which is now being used as a dry cleaning solvent. Historically, it has been used as an ingredient in many personal health and beauty products. D_5 is present in GreenEarth solvent. Dow-Corning, who manufacturers the solvent, conducted a two-year study with rats in which preliminary data showed an increase in tumors of the uterine endometrium. Preliminary findings may indicate that there is a potential carcinogenic hazard associated with D_5 (U.S. EPA, 2003). The observance of adverse effects on the uterus by D_5 is of concern (OEHHA, 2003). Because D_5 is lipophilic there is also concern that D_5 may bioaccumulate in the food chain.

A study by Burns-Naas *et al*. (1998) evaluated the subchronic toxicity of D_5. This study showed there were several minor changes observed in clinical biochemistry parameters; the most notable was an increase in gamma glutamyl transferase (a liver enzyme) in both sexes at the high dose. This study also showed that there was an increase in liver weight in rats. McKim et al. (1999) investigated the effects of D_5 on the expression and activity of selected rat hepatic phase I and phase II enzymes. Additional information on the Burns-Naas *et al*. and McKim *et al*. studies can be found in the Technical Assessment Document (CARB, 2006).

In June 2005, D_5 manufacturers submitted final toxicity testing data to ARB, OEHHA, Department of Health Services (DHS), and U.S. EPA. After these agencies review the data, a better assessment of the public health impacts from GreenEarth emissions can be made.

3. Propylene Glycol Ether (Rynex 3)

Rynex 3 is a form of propylene glycol ether and water. This solvent had some changes in formulation since its inception. Rynex 3 represents the current formulation for Rynex™. Currently, there is limited toxicity data on Rynex 3.

Based on a recent study by NTP on a previous formulation for Rynex™, propylene glycol t-butyl ether, OEHHA expressed concerns over its toxicity and carcinogenic potential. Of particular concern was the presence of tumors in mice. OEHHA has developed an interim chronic REL for propylene glycol t-butyl ether of 200 $\mu g/m^3$ to prevent adverse effects in the respiratory system. In addition, an interim inhalation unit risk factor for cancer was estimated to be 5.2×10^{-7} $(\mu g/m^3)^{-1}$, about one-tenth that of Perc. There are no developmental or reproductive studies on the chemical. The Technical Assessment Document (CARB, 2006) has more detailed information on the toxicological studies for the previous formulation of Rynex™, propylene glycol t-butyl ether.

The manufacturer of Rynex 3 has indicated that Rynex 3 is not carcinogenic and has low toxicity. A Rynex 3 fact sheet states that, based on laboratory animal studies, propylene glycol ethers do not cause the type of toxicological effects that are associated with exposure to ethylene glycol ethers (Rynex, 2005a). It is unknown if the interim health number or previous studies are still appropriate for Rynex 3. ARB staff has requested the studies on Rynex 3. However, neither ARB nor OEHHA staff have received these toxicological studies and cannot verify the manufacturer's claim for Rynex 3.

4. Carbon Dioxide Cleaning

As discussed in Chapter III, CO_2 cleaning uses liquid CO_2. The CO_2 used in this process is an industrial by-product. There is no net increase in the amount of CO_2 emitted; therefore, this process does not contribute to global warming. CO_2 is naturally occurring and is routinely ingested in food products such as soft drinks. CO_2 is also used in packaging for many foods such as salads, potato chips, and cookies.

5. Professional Wet Cleaning (Wet Cleaning)

Most detergents used in wet cleaning are a complex mixture of water and a variety of chemicals. Most formulations are trade secrets. Because there are a wide variety of formulations, there is difficulty with determining toxicity of these substances. Chemicals used in wet cleaning process commonly include spotting agents, detergents, fabric conditioners and sizing products. Other products may be used for cleaning leather and suede including water repellants.

In general, detergents are approved for disposal into the sewer system by the sanitation districts. U.S. EPA examined the human health and environmental hazards of surfactants because they are the primary components of detergents. In general, they found that there was no expected health risk to the general public. (U.S. EPA, 1998). In addition, the report by the Institute for Research and Technical Assistance, *Evaluation of New and Emerging Technologies for Textile Cleaning,* indicates that detergents are low in toxicity (IRTA, 2005).

In U.S. EPA's *Cleaner Technologies Substitute Assessment: Professional Fabricare Processes* (CTSA), U.S. EPA provided health hazard summaries on surfactants and surfactant aids for some example detergents. The following surfactants were included in their example detergents: cellulose gum (CG), cocamidopropyl betaine (CAPB), ethoxylated sorbitan monodecanoate (P-20), lauric acid diethanolamide (Lauramide DEA), sodium laureth sulfate (SLS), sodium lauryl isethionate (SLI). Surfactant aids include: acetic acid, citric acid, sodium citrate, and sodium carbonate. It is unknown how representative these example detergents were for detergents currently being used. Below is some health information on some of the surfactant and surfactant aids presented in the CTSA.

a. Surfactants

Several studies have been conducted on CG, a water-soluble cellulose ether. This and other water-soluble cellulose ethers exhibit very low oral toxicity, and no neurologic, reproductive, or mutagenic effects (U.S. EPA, 1998).

CAPB is reported as a potentially irritating substance. CAPB has limited data on chronic studies of systemic effects. One study suggests that CAPB does not increase systemic tumors above background, but there are not enough studies to be conclusive. CAPB does not have any studies on neurotoxicity or reproductive and developmental toxicity (U.S. EPA, 1998).

In both animals and humans, P-20 has been found to be essentially nontoxic following acute and long-term oral ingestion and to exhibit little or no potential for skin irritation and sensitization (U.S. EPA, 1998).

No human studies were located regarding the potential toxicity of lauramide DEA following oral or inhalation exposure. Lauramide DEA was not found to be mutagenic. The carcinogenic potential of lauramide DEA is currently being investigated (U.S. EPA, 1998).

SLS, following oral exposures, was found to be "moderately to slightly toxic" in acutely exposed animals and virtually non-toxic in chronically exposed animals. SLS does not appear to exhibit any reproductive, developmental, or carcinogenic effects in animals (U.S. EPA, 1998).

Limited information on SLI suggests that this chemical may not be a skin irritant and is not mutagenic (U.S. EPA, 1998).

b. Surfactant Aids

At high concentrations, acetic acid can result in severe irritation in both humans and animals. Based on short-term mutagenicity tests, acetic acid does not interact with genetic material. Although no direct information on the carcinogenicity of acetic acid was located, one chronic study in rats found no evidence of tumors (U.S. EPA, 1998).

Citric acid is generally considered to be innocuous except in the case of ingestion of large quantities or chronic exposures. Citric acid has been shown to be a mild to moderate skin and eye irritant in humans following inhalation or dermal exposure. No information has been located discussing neurotoxic, mutagenic, or carcinogenic effects associated with citric acid exposures in animals or humans. Sodium citrate is expected to behave chemically like citric acid systemically, but may not have the irritant properties (U.S. EPA, 1998).

Sodium carbonate is a skin and eye irritant. Sodium carbonate is not developmentally toxic to mice, rats, or rabbits. No information was available discussing reproductive, neurotoxic, mutagenic, or carcinogenic toxicity from exposure to humans or animals (U.S. EPA, 1998).

6. Green Jet

The detergent used in the Green Jet system is called DWX-44. The material safety data sheet (MSDS) states that the product is 100 percent biodegradable. It also states that it contains no petroleum solvents, volatile organic compounds, or products from the federal hazardous air pollutant list. ARB staff is not aware of any health studies on this detergent.

7. 1-Propyl Bromide

Although currently not in use in California, 1-propyl bromide, also known as 1-bromopropane, is a solvent that is currently being considered as an alternative to dry cleaning. This compound is a neurotoxicant and reproductive toxicant (OEHHA, 2003) and was listed under Proposition 65 as a reproductive toxicant in December 2004. It causes sterility in both male and female test animals, and harms developing fetuses when tested in pregnant animals. It can damage nerves, causing weakness, pain, numbness, and paralysis (CDHS, 2003).

OEHHA developed an interim chronic REL of 1100 $\mu g/m^3$ (220 parts per billion) for 1-propyl bromide from the reproductive toxicity data in the Ichihara (et.al.) study (OEHHA, 2003). Based on current toxicity data, OEHHA staff is concerned about its use as a dry cleaning solvent (OEHHA, 2003).

C. Interim Health Values

As mentioned earlier in this chapter, OEHHA has developed interim values for some of the dry cleaning alternatives. Interim RELs are estimates based on approved OEHHA procedures; however, interim values have not gone through public comment and scientific peer review. OEHHA is continuing to follow the peer-reviewed literature on toxicity studies for the alternative solvents. Table V-1 summarizes these values. The Technical Assessment Document (CARB, 2006) has a more detailed discussion on the applicability of these values to specific compounds.

As previously stated, the interim health values are not approved for use in a quantitative health risk assessment. However, from a qualitative standpoint and assuming these chronic noncancer values remain unchanged, it would be unlikely that adverse chronic noncancer impacts will result from use of the alternatives. This observation is based on the premise that the interim chronic RELS for the Perc alternatives are at least 20 times higher than the REL for Perc. This increase in the RELs will result in lower chronic hazard indices. As presented in Chapter IV and Appendix B, the chronic hazard indices under the high-end (90^{th} percentile) emissions scenario are less than 0.4 at residential receptor locations and less than 1.5 at adjacent worker locations. The adjacent workers' hazard index decreases to less than 1.0 within

30 meters of the dry cleaner. Because there are no interim acute RELs or CPF factors for Perc alternatives, no qualitative comparison regarding the acute noncancer or cancer impacts for Perc alternatives can be made.

Table. V-1. Summary of Interim Health Values

Compound	Acute REL[1]	Chronic REL	Cancer Potency Factor[1]
D5 (GreenEarth)	N/A	700 µg/m^3	N/A
1-Propyl bromide	N/A	1,100 µg/m^3	N/A
Hydrocarbon mixtures	N/A	1,200 µg/m^3	N/A
Hydrofluoroether (HFE 7200) (a compound in PureDry)	N/A	19,000 µg/m^3	N/A
Perc[2]	2.0x10^4 µg/m^3	35 µg/m^3	2.1x10^{-2} (mg/kg-d)$^{-1}$

1. N/A means not available - not enough health data is available to determine a health value for this compound.
2. The values for Perc are approved by OEHHA and are included for comparison.

D. Potential Health Impacts of Volatile Organic Compounds

As previously mentioned, increased usage of hydrocarbon solvents will lead to increased VOC emissions. VOC emissions contribute to the formation of ozone. Ozone formation in the lower atmosphere results from a series of chemical reactions between VOCs and nitrogen oxides in the presence of sunlight.

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 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 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 (ARB, 2004b). Ozone is also associated with premature death. In 2005, premature deaths from ozone exposure in California are estimated at 630 deaths per year (ARB, 2005i).

VI. PUBLIC OUTREACH AND REPORT PREPARATION

A. Outreach Efforts

A public process that involves all parties affected by the proposed ATCM is an important component of ARB's actions. As part of ARB's outreach program, staff made extensive personal contacts with industry representatives, state and local regulatory agencies, environmental/pollution prevention and public health advocates, and other interested parties through meetings, telephone calls, and electronic mail. Staff developed a workgroup consisting of industry, state and local regulatory agencies, environmental group representatives and other interested parties. Staff held many workgroup meetings, conducted five public workshops and participated in three meetings with the Korean Dry Cleaners Associations in the Bay Area. Staff made special efforts to have key materials translated into Korean and have translator service available at the workshops and the meetings with the Korean Dry cleaners Association. The materials translated included the workshop notices, the proposed regulations, the Executive summary, and the Hearing Notice.

On May 25, 2006, the staff presented its initial proposed rulemaking to amend the Dry Cleaning ATCM to the Board. The Board heard testimony from many interested parties, including the affected industries, industry associations, environmental groups, local air districts, and other interested individuals. Although some of the testimonies were supportive of ARB staff's proposal, others suggested that ARB phase out the use of Perc in dry cleaning operations all together. After hearing the public comments and considering staff's proposal, the Board unanimously voted not to proceed with the proposed rulemaking and directed staff to return to them with a proposal for their consideration to phase out Perc from dry cleaning operations.

B. Public Involvement

As described below, affected industries, other government agencies, and organizations interested in minimizing public health impacts from the use of Perc in dry cleaning industries have been involved in the development of the proposed amended Dry Cleaning ATCM. All members of the public were invited to join the workgroup. ARB staff conducted a total of five public workshops in the following areas: Sacramento, the San Francisco Bay Area, and Southern California. Staff also attended three evening meetings with the Northern California Korean Dry Cleaners-Laundry Association, conducted 17 workgroups meetings, and attended the Fabricare 2006 show. ARB staff also conducted over 100 site visits to various dry cleaners in the State to get a better understanding of existing Perc and available alternative dry cleaning technologies. These facilities were located in 66 cities and covered nine local air districts. Staff further attended water-based cleaning and CO_2 cleaning technology demonstrations throughout the State. Additionally, to further increase the general public's participation in this assessment, staff made information available via ARB's website (*www.arb.ca.gov/toxics/dryclean/dryclean.htm*).

1. Industry Involvement

Industry involvement included but was not limited to, dry cleaning operators, cleaners associations, machine manufacturers, solvent manufacturers, Perc distributors, and environmental groups. They have actively participated in the development of the Dry Cleaning ATCM amendment process providing technical information. They have provided comments and suggestions during the development of our surveys and the Technical Assessment Report (CARB, 2006). They also submitted comments for, and provided testimony at, the Board's May 25, 2006 public hearing on the initial proposal for amendments to the Dry Cleaning ATCM. ARB staff has also had discussions with dry cleaning operators during site visits.

2. Government Agency Involvement

Other local, state, and federal agencies with an interest in potential emissions of, or soil/groundwater contamination by, Perc have been involved in the assessment process to promote statewide consistency in addressing public health concerns and provide a multi-media perspective. These agencies include: air and sanitation districts, Cal/OSHA, OEHHA, DHS, DTSC, and U.S. EPA.

We have kept the local air districts informed of our activities through the California Air Pollution Control Officers Association's (CAPCOA). This work has included telephone calls to the local air districts and presentations at the CAPCOA Toxics and Risk Managers Committee and the CAPCOA Enforcement Managers Committee.

We have reviewed information provided to us by the sanitation districts on increasing concentrations of Perc in the influent to publicly owned treatment works (POTWs). We have also requested information that other agencies may have on Perc and alternative technologies in the dry cleaning industry.

3. Private Organization Involvement

The Institute for Research and Technical Assistance (IRTA) recently partnered with ARB and U.S. EPA (the study's sponsor) to conduct a study of the alternative dry cleaning technologies. IRTA is a non-profit organization that assists industries, primarily small businesses, in reducing or eliminating their use of ozone depleting substances and chlorinated solvents through demonstration and evaluation of new technologies, solvent substitutes, and process modifications. IRTA invited ARB staff to visit facilities in the Los Angeles area and demonstrated how alternative technologies work to clean various types of garments. These facilities were participants in a study of alternative dry cleaning technologies. Some of the data was used in the ARB's evaluation of the dry cleaning industry. IRTA's study, the *Evaluation of New and Emerging Technologies for Textile Cleaning*, is available via IRTA's website (www.irta.us).

C. Data Collection Tools Used to Assist in Report Preparation

1. Dry Cleaning Surveys

ARB staff conducted several surveys, namely: the Facility Survey, Machine Manufacturer Survey, Solvent Manufacturers Survey, and Solvent Distributors Survey to gather information for the evaluation of the current Dry Cleaning ATCM. The Facility Survey was designed to collect information from the dry cleaning facilities. Many questions were asked on the Facility Survey to gather information concerning: operating information, facility information, potential future machine purchase/replacement, machine(s) type, solvent usage, waste produced, and maintenance information. The Facility Survey and the cover letter were also translated into Korean. The Machine Manufacturers Survey was developed to obtain the list price of the dry cleaning machines. The list prices were used to assess the cost of purchasing a new dry cleaning machine. The survey also, provided information on recommended maintenance schedules, maintenance costs, latest technologies available on the machines, and machine brochures. In addition, a Dry Cleaning Solvent Manufacturers Survey was sent to some of the alternative dry cleaning solvent manufacturers to obtain information on solvent formulation associated with hydrocarbon solvent cleaning (DF-2000, PureDry, EcoSolv, Shell 140, Stoddard), GreenEarth, Rynex 3, CO_2 cleaning, and water-based cleaning technologies. A Perc Solvent Distributors Survey (Distributors Survey) was also developed to assess the amount of Perc that is sold to the California dry cleaning industry. Information for years 2001, 2002, and 2003 were gathered from the distributors. More detailed discussion on the results of the surveys is available in Chapter IV of the Technical Assessment Report (CARB, 2006).

2. Sludge and Leak Detector Test

To support emission analysis of the dry cleaning processes, liquid sludge from Perc and DF-2000 machines was tested for solvent content. Based on observations during site visits and conversations with ARB training staff and local air districts, Perc facility operators do not use their HHD as often as they are required. The reason given for the infrequency is that most of the HHDs do not give quantitative results. Detailed discussion on sludge test and leak detector evaluation is presented in Chapter IV of the Technical Assessment Report (CARB, 2006).

3. Dry Cleaning Site Visits

ARB staff conducted numerous site visits to dry cleaning facilities in addition to obtaining some feedback on the Facility Survey. After the Facility Survey was mailed in September 2003, staff visited over 100 facilities around the State to get more detailed data. The facilities were located in 66 cities and covered the area over nine local air districts. The local air districts visited include: Bay Area AQMD, Butte County AQMD, San Diego County APCD, Sacramento Metro AQMD, San Joaquin Valley Unified APCD, Shasta County AQMD, South Coast AQMD, Ventura County APCD, and

Yolo/Solano AQMD. In addition, staff requested facility data from Monterey Bay Unified APCD and Santa Barbara County APCD. In all, 11 local air districts, encompassing about 97 percent of the facilities statewide, are represented in the site visit analysis. Detailed information on the site visits are presented in Chapter IV of the Technical Assessment Report (CARB, 2006).

4. Dry Cleaning Machines Update

ARB staff updated the data for the number and type of dry cleaning machines in operation based on input from the local air districts and industry in 2006. District staff from a majority of the 35 local air districts which represented an estimated 99 percent of the dry cleaning facilities located in California provided the number and type of dry cleaning machines that were in operation within the local air districts. Some of the facilities that operate with an alternative dry cleaning system are not required to obtain a permit from their local air districts. The number for each type of alternative dry cleaning machines in operation is provided by the industry.

5. Cost Update

Various cost data were updated in 2006. These included: list prices for the dry cleaning machines and solvent costs. New cost information was obtained to provide a more comprehensive comparison of the operating and maintaining costs for Perc and the dry cleaning alternatives. These included the costs of permit renewal and environmental training. The list prices for Perc and for the alternative dry cleaning technologies are updated based on communication with the machine manufacturers and distributors. The number for each type of alternative dry cleaning machines in operation is provided by the industry.

VII. ECONOMIC IMPACTS OF THE PROPOSED AMENDED ATCM

In this chapter, ARB staff presents the updated costs and economic impacts associated with implementation of the proposed amendments to the Dry Cleaning ATCM. As directed by the Board at its May 25, 2006 meeting, the proposed amendments to the Dry Cleaning ATCM, now focus on the phase out of Perc use in dry cleaning machines in California. The information presented in this chapter includes recent survey data of the number and type of dry cleaning machines in operation, and the operating and maintenance costs associated with the dry cleaning processes being used by most of the dry cleaners in California. The expected initial capital costs and annual recurrent costs for potential compliance options are discussed. The costs and associated economic impacts are given for private businesses, individuals, and governmental agencies.

A. Summary of the Economic Impacts

Staff estimates that the total statewide cost of the proposed amended Dry Cleaning ATCM to affected businesses will be approximately $41 million over 15 years. This corresponds to an average annual statewide cost of approximately $4 million for the 2,020 affected dry cleaning facilities that operate 2,120 machines. The cost of the proposed amended Dry Cleaning ATCM was estimated in 2006 dollars after accounting for the number of machines that will be required to be replaced each year. Other California businesses that will be impacted by the proposed amended Dry Cleaning ATCM (including those that sell Perc to dry cleaners) are estimated to experience minimal economic impact. The proposed amendments are not expected to impact dry cleaning facilities located in the South Coast AQMD, because South Coast AQMD already has a dry cleaning rule (Rule 1421) that will phase out the use of Perc in dry cleaning by December 2020.

The capital expenditure required by the proposed amendments is the incremental capital cost of purchasing an alternative technology compared to a Perc technology at the end of the useful life of the Perc machine. The useful life of a Perc machine, based on surveys of the industry, has been established to be 15 years. Because of the range of alternatives that are available, staff estimates the proposed amendments to the Dry Cleaning ATCM will require an increase in capital investment, compared to what would be required to purchase a Perc machine, ranging from $1,000 (water-based cleaning system) to $144,350 (Carbon Dioxide system) for a facility. When replacing a Perc machine with the most popular alternative technology, a high flash point hydrocarbon process, the additional capital investment will range from $18,500 to $24,350.

Incremental recurrent costs due to the proposed amendments are the cost differences in operating and maintaining the alternative dry cleaning processes compared to Perc dry cleaning processes. For high flash point hydrocarbon machines, staff estimates that the annual incremental recurring cost will range from $660 to $900 per year greater than for a Perc machine. The annual recurring costs for the other alternative technologies (GreenEarth, wet cleaning, and carbon dioxide) are generally similar to or slightly higher than the recurring costs for operating and maintaining a hydrocarbon machine. One of the key variables in recurring cost is labor costs which tend to be somewhat higher for the newer alternative technologies. However, with proper training, experience, and advances in the technologies, it is possible that the differences in labor costs will be significantly reduced in future years.

The economic impact analysis separates the Perc dry cleaning facilities into three categories: 1) co-residential facilities; 2) facilities that operate with a converted or a primary machine; and 3) facilities that operate with an add-on or an integral secondary control machine. Of the approximately 2,020 Perc facilities affected by the proposed amended Dry Cleaning ATCM, it is estimated that about 50 are co-residential facilities. Approximately 1130 Perc facilities are operating 50 converted and 1130 primary control machines. And, approximately 840 Perc facilities operate with 880 add-on or integral secondary control machines.

The proposed amended ATCM will require Perc machines in co-residential facilities and converted Perc machines be removed from service by July 1, 2010. In addition, starting on July 1, 2010, all dry cleaning facilities will need to remove their Perc machines from service when the machines are 15 years old. When the age of the Perc machine cannot be determined, it will need to be removed from service by July 1, 2010.

Two State agencies, ARB and the Department of Corrections, will be impacted by the proposed amendments. Because of the phase out of Perc machines, ARB will see a reduction of fees for the Hot Spots Program. The current statewide Hot Spots Program fee is $35 per year for a Perc facility, the total amount of fee reduction is estimated to be $355,000 for the lifetime of the proposed amendments. This fee may be offset if alternatives are required to report under the Hot Spots Program. The Department of Corrections operates twelve Perc dry cleaning machines at twelve correctional facilities throughout California. The twelve facilities will need to replace these dry cleaning machines when they are 15 years old. If the Department of Corrections chooses the most popular alternative technology of high flash point hydrocarbon, the cost impact during the first three years of implementation of the amendments is estimated to range from $169,500 to $522,000 and the eventual cost impact will range from $268,000 to $892,000 to comply with the proposed amendments over 15 years.

Profitability impacts for dry cleaning facilities were estimated by calculating the change in the return on owner’s equity (ROE) for a typical facility with average income. Assuming that all costs are absorbed by the affected businesses, the change in ROE was estimated. A decline in ROE of 10 percent or more is considered to indicate a significant adverse impact. Depending on the facility type, the machine type and the alternative technology that the facility owner chooses when the machine is 15 years old, the proposed amended Dry Cleaning ATCM is expected to result in ROE declines ranging from 18 percent to 264 percent.

The large range of estimated changes in ROEs reflects the differences in machine costs of the alternatives. Some alternatives, if chosen by a typical dry cleaner, are calculated to result in a decline of ROE of over 100 percent, meaning that the business will operate at a loss if cost is not passed on to its customer. For all of the alternatives available to the dry cleaner (except for possibly certain emerging technologies), the proposed amended Dry Cleaning ATCM is estimated to result in ROE declines that are higher than 10 and may have a significant adverse impact on the profitability of the operators of the dry cleaning businesses in California (e.g., facilities with marginal profitability).

It is important to note that some technologies may qualify for grants (e.g., non-toxic and non-smog forming grant administered by the ARB). For those who will receive grants, the profitability of the facility will improve accordingly. However, some of the marginal operators may still have difficulty securing the required capital to finance the purchase of the alternative dry cleaning equipment required by the proposed amendments. These businesses may choose to operate with a less costly alternative such as certain professional wet cleaning systems, the Green Jet® process, or the emerging hydrocarbon or GreenEarth technologies that can operate without distillation systems and/or refrigerated condensers, or cease their dry cleaning operations altogether. For those that cease their dry cleaning operations, a small number of employees could be adversely affected. Therefore, staff expects the proposed amendments to have a small impact on employment, business creation, and expansion. We do not expect the proposed amendments to have any significant impact on California interstate business competitiveness because these businesses operate locally and are not subject to competition with businesses in other states.

The primary customers of dry cleaning facilities are individual consumers. Most dry cleaning businesses are likely to pass their compliance costs onto their customers in the form of higher prices for their services. To the extent that dry cleaning businesses are able to pass all of the cost increase onto their customers, ARB estimated the potential cost increase to consumers based on the facility owners' recovery of their short term (five years) net cash outflow. For those facilities that replace their existing machine with a hydrocarbon machine when the existing machine is 15 years old, we estimate that the typical owner would have to charge an additional $0.56 per garment. The owners of co-residential facilities, because they are estimated to lose 3 years of useful life of their machines, would have to increase their cost per garment by about $0.63.

B. Economic Impacts Analysis on California Businesses as Required by the California Administrative Procedure Act (APA)

1. Legal Requirements

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed amended Dry Cleaning ATCM on California's jobs, business expansion, elimination or creation, and the ability of California businesses to compete with businesses in other states.

In addition, State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance. The estimate shall include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the State.

Section 57005 of the Health and Safety Code requires the ARB to perform an economic impact analysis of submitted alternatives to a proposed amended regulation before adopting any major regulation. The proposed amendments to the Dry Cleaning ATCM are considered to be a “major regulation”, because the estimated cost to California dry cleaners exceeds $10 million in 2010. Staff has conducted an economic analysis of two alternatives. The alternatives considered were: 1) phase out Perc machines and prohibit hydrocarbon usage in new dry cleaning machines, and 2) accelerate the phase out of Perc machines to 10 years of age instead of 15 years.

2. Affected Businesses

Any dry cleaning business with an operating Perc dry cleaning machine, any person or organization selling Perc (Perc distributor) to dry cleaners, businesses that remove or install Perc dry cleaning machines within California, and businesses that sell Perc machines within California, are affected by the proposed amended Dry Cleaning ATCM. Other potentially affected businesses include alternative solvent suppliers and businesses that supply alternative dry cleaning machines to the dry cleaning facilities. The focus of this analysis, however, will be on dry cleaning facilities and Perc distributors because these businesses would be most extensively affected by the proposed amendments while all the other businesses that will be impacted are estimated to experience minimal economic impact.

For the dry cleaning facilities, the economic impact analysis is separated into three categories: 1) co-residential facilities; 2) facilities that operate with a converted or a primary control machine; and 3) facilities that operate with an add-on or an integral secondary control machine. The reason for this separation is because the incremental costs for these facilities to comply with the requirements are different. The estimated number of Perc machines in operation in each type of dry cleaning facility is shown in Table VII-1.

As shown on Table VII-1, it is estimated that about 50 secondary control machines are in co-residential facilities and about 50 are converted machines. These machines will need to be phased out of Perc use by July 1, 2010. Out of the remaining operating Perc machines, it is estimated that there will be about 830 integral or add-on secondary control machines, and about 1190 primary control machines in operation. The facilities will need to replace these Perc machines when the machines reach the end of their useful life of 15 years. In all, it is estimated that there are about 2,120 Perc machines in operation at 2,020 dry cleaning facilities statewide outside of the South Coast AQMD.

Table VII-1. Estimates of Perc Dry Cleaning Machines Subject to the Proposed Amended ATCM[1]

Machine Type	Number of Machines[2]
Converted Machines	50
Primary Control Machines	1,190
Integral and add-on Secondary Control Machines	880
Perc machines in Co-residential Facilities	50
Total Amount of Machines Subject to the ATCM[3]	2,120

1. Values are rounded to the nearest ten.
2. Did not include machines within the South Coast AQMD.
3. Total number of machines is the sum of the first three rows because Perc machines in co-residential facilities are included in the count of machines in the three machine categories.

The dry cleaning alternative technologies in use today can be classified into five categories: 1) high flash point hydrocarbon, 2) GreenEarth, 3) water based cleaning systems, 4) carbon dioxide cleaning, and 5) other alternatives such as: Rynex™ (Rynex 3), other hydrocarbon solvents, and emerging technologies. Table VII-2 provides a summary of the estimated percentage of alternative dry cleaning technologies in use in 2003 and in 2006 based on input from the districts and industry representatives.

Table VII-2. Current Amount of Alternative Technology in Operation[1]

Type of Alternative Technology	Estimated Number of Machines (2003 Survey)	Estimated Number of Machines (2006 Survey)	Percent Increase in Alternatives (2003 to 2006)
High Flash Point Hydrocarbon	460	1110	82%
GreenEarth	90	190	13%
Water Based Cleaning Systems[2]	150	175	3%
Carbon Dioxide	3	12	1%
Other Alternatives[3]	70	80	1%

1. Values rounded.
2. Mostly professional wet cleaning systems and includes mixed shops (facilities that use wet cleaning together with another type of dry cleaning process).
3. Other alternatives may include: Rynex 3, other hydrocarbon, or emerging technologies.

There has been an increase in the use of the alternatives and the percent of increase attributed to each of the alternatives is calculated and tabulated in Table VII-2.

The calculated percent of increase of each alternative is then used to estimate the proportion of alternative technologies that will be chosen by dry cleaners to comply with the proposed amended Dry Cleaning ATCM and to estimate statewide cost of the proposed amendments.

3. Methodology for Determining the Potential Impacts on Profitability for Affected Businesses

The potential economic impact of the proposed amended Dry Cleaning ATCM on dry cleaning facilities is based on the following assumptions:

- Facilities that responded to the Facility Survey are representative of all affected California dry cleaning facilities.
- The Facility Survey results show that about 40 percent of the facilities have gross sales that are less than $100,000, about 55 percent of the facilities have gross sales in the range of $100,000 to $500,000, and about 5 percent of the facilities gross over $500,000.
- Based on the above Facility Survey information, we estimated a typical dry cleaner has an average gross sale of about $250,000 per year.
- Using three-year (2002-2004) Dunn and Bradstreet financial ratios, we estimated financial data at a typical dry cleaner (DB, 2006).
- The annual cost of compliance is estimated for the Perc dry cleaning facilities.
- The annual cost of compliance for a typical facility is adjusted for both federal and State taxes.
- These adjusted business costs are subtracted from net profit data and the results are used to recalculate the ROE.

The resulting ROE is then compared with the ROE before the subtraction of the adjusted costs to determine the impact on the profitability of the businesses. A reduction of more than 10 percent in profitability is considered to indicate a potential for significant adverse economic impacts. This threshold is consistent with the thresholds used by U.S. EPA and ARB in previous regulations. The impact on profitability was calculated for dry cleaners only because the economic impact on Perc distributors is anticipated to be relatively small.

4. Assumptions for Business Profitability Analysis

The business profitability ROE calculations were based on the following assumptions.

- All affected businesses are subject to federal and State tax rates of 35 percent and 9.3 percent, respectively.
- Affected businesses absorb the costs of the proposed amended Dry Cleaning ATCM instead of increasing the prices of their products or lowering their costs of doing business through cost-cutting measures.

5. Potential Economic Impacts for Individual Dry Cleaning Facilities

Because the proposed amended Dry Cleaning ATCM will phase out the use of Perc machines in dry cleaning processes, the economic impacts will depend on the type of alternative technology that the Perc facility owners choose and how that compares with costs of Perc operations. Costs of Perc operations are calculated assuming the facilities will purchase a new compliant Perc machine at the end of its useful life of 15 years. Costs associated with the change to alternative technologies and Perc machine replacement includes: costs of machines and machine installations, and recurrent costs due to the operation and maintenance of these machines. A general overview of capital and recurrent costs and estimation of potential economic impacts for the three facility types will be discussed below.

a. Capital and Recurrent Cost Estimations

Machine costs are based on manufacturer's input on list price of the machines and were updated in 2006. A summary of the installation and machine costs for selected dry cleaning processes to represent a range of available technologies is shown in Table VII-3. Costs shown in Table VII-3 are average costs; therefore, costs for a specific facility will vary. The machine cost for the professional wet cleaning systems reflect the average price of systems that have been placed in operation by 2004 AB 998 grant recipients. In addition, these costs do not reflect grants that are available to approved dry cleaners because not all technologies can qualify for the grants and the projected quantity of grants is limited.

For the purpose of comparing Perc operation to the alternatives, the annual recurrent costs associated with operating and maintaining Perc and hydrocarbon dry cleaning systems were estimated. The recurrent costs considered include: solvent cost, cost of detergent and spotting agents, gas and electricity cost, cost for applicable air permits, and other costs incurred to comply with the Dry Cleaning ATCM, licensing fees where applicable, maintenance cost, delta labor cost, and waste disposal cost. As with capital costs, recurrent costs for a specific facility may vary due to differences in operating and maintenance practices as well as the amount of garments dry cleaned. They may also vary as a function of time due to technology improvement.

Table VII-3. Updated Machine and Installation Cost Comparison[1]

Machine Type	Installation Cost[3]	Typical Machine or System Cost[2]	Machine and Installation Cost Difference Perc Primary Control to Alternative	Machine and Installation Cost Difference Perc Secondary Control to Alternative
Perc-Primary Control (40-lb. capacity)	$3,800	$44,000	-	-
Perc-Secondary Control (45-lb. capacity)	$3,800	$50,000	-	-
Hydrocarbon (50-lb. capacity)[4]	$4,300	$68,000	+$24,500	+$18,500
GreenEarth (50-lb. capacity)[4]	$4,300	$68,000	+$24,500	+$18,500
Professional Wet Cleaning System[5]	$3,800	$51,000	+$7,000	+$1,000
CO_2 (60-lb. capacity)[6]	$48,800	$143,000	+$144,000	+$138,000

1. Values are rounded to the nearest hundred and are updated in 2006.
2. Costs are based on average list prices and do not include cost for installation.
3. Installation cost is the calculated mid range of cost published in the Technical Assessment Report except as noted for the professional wet cleaning system.
4. Closed loop machine designed for high flash point hydrocarbon, GreenEarth, and Rynex3 solvents and include machines that operate with Tonsil™ or bleaching clay and without a distillation system.
5. Average cost of systems chosen by 2004 AB 998 grant recipients including washer, dryer and tensioning equipment.
6. Source: ARB, 2005c.

Table VII-4 shows the recurrent costs for Perc and for the most popular alternative dry cleaning process, the hydrocarbon process. The annual recurrent costs estimates shown in Table VII-4 are based on information contained in the Technical Assessment Report and additional information collected since the May 2006 hearing. The additions include: updated solvent costs, survey results of gas and electricity cost for Perc and alternative dry cleaning facilities, the inclusion of costs for appropriate air permit fees and compliance costs as required by the Dry Cleaning ATCM, the inclusion of delta labor cost, and updated waste disposal cost for Perc operations.

As shown in Table VII-4, the estimated annual recurrent costs for a typical hydrocarbon machine are $900 per year more than for a Perc secondary control machine and $660 per year more than for a Perc primary control machine. The two key areas of increased cost for the hydrocarbon machine are waste disposal cost and increased labor cost.

Staff collected data on the other three leading alternative technologies, GreenEarth, wet cleaning, and CO_2. Due to considerable variation in information collected for several cost categories, staff was unable to provide a detailed cost comparison for these three alternative technologies. However, based on the review of all available information staff believes that the annual recurrent costs for the alternatives will be about the same or up to 10 percent greater than the costs estimate for the hydrocarbon machine. For estimating economic impacts, we assumed that annual recurrent costs for all of the alternatives were the same as for a hydrocarbon machine.

Table VII-4. Comparison of Annual Recurrent Costs for Perc and Hydrocarbon Dry Cleaning [1]

Technology	Annual Solvent Cost[2]	Cost of Detergent/ Spotting Agents	Gas and Electricity Costs[3]	Permit and Other Costs[4]	Licensing Fee	Average Maintenance[5]	Delta Labor Cost[6]	Waste Disposal Cost[7]	Total Annual Recurrent Cost
Perc (Primary)	$1,600	$1,500	$12,710	$1,300	N/A	$700	N/A	$1,480	$19,330
Perc (Secondary)	$1,360	$1,500	$12,710	$1,300	N/A	$700	N/A	$1,480	$19,090
Hydrocarbon	$650	$1,500	$12,710	$560	N/A	$620	$1,300	$2,640	$19,980

1. Values are rounded and are normalized to overall average of 46,600 pounds of garment dry cleaned per year. Cost for a specific dry cleaning facility may vary due difference in the clothing volume, air district, and operation and maintenance.
2. Solvent costs are based on 2006 updated cost and solvent usage from Facility Survey.
3. Costs are based on phone survey shown in Appendix D.
4. Permit and other costs include average cost for air permits, cost for implementation of the hot spots program, and compliance costs including average environmental training costs, and estimated cost for recordkeeping, reporting, and operation and maintenance as required by the Dry Cleaning ATCM. See Appendix E for details
5. Costs include cost of filters.
6. Delta labor cost is the cost difference between Perc and the alternative processes.
7. Waste disposal cost accounts for waste water treatment units that are being used by Perc facilities to treat separator water.

b. Cost Impacts for Individual Facilities

Other factors that affect the economic impacts for individual dry cleaning facilities include: facility type, machine age, and whether the facility already has a spare set of gaskets and a spare lint filter on site. The economic impacts for each of the three facility types: co-residential facilities, facilities that operate with a converted machine or a primary control machine, and facilities that operate with an add-on secondary control machine or an integral secondary control machine are discussed.

i. Co-residential Facilities

Co-residential facilities are defined as facilities that share a wall, floor, or ceiling with a residence or are located in the same building with a residence. Most of these facilities are located in the Bay Area AQMD. The proposed amendments will require approximately 50 co-residential facilities to remove their Perc machines from service by July 1, 2010.

The potential capital costs for co-residential facilities include the incremental cost of the machine, purchase of a spare set of gaskets and a lint filter before removal of the Perc machine, and the possible loss of useful life of the Perc machine. The potential capital costs for the facilities are shown in Table VII-5. The total potential cost impacts were then calculated based on the applicable capital costs and the annual recurrent costs shown in Table VII-5 and VII-4 respectively.

Table VII-5. Potential Capital Costs for Co-residential Dry Cleaning Facilities[1]

Potential Actions	Capital Costs	
	Facility with Converted or Primary Control Machines	**Facility with Add-on or Integral Secondary Control Machines**
Switch to a New Hydrocarbon Machine[2]	$24,500	$18,500
Purchase a Spare Set of Gaskets and a Lint Filter	$0 to $350	$0 to $350
Loss of Useful Life of Machine[3]	$0 to $10,000	$0 to $10,000
Range of Total Capital Cost	$24,500 to $34,350	$18,500 to $28,350

1. Totals are rounded.
2. Assumed that co-residential facility owners will choose the most popular alternative.
3. Assumed maximum of 3 years.

Certain assumptions were made for cost impact and ROE calculations in addition to the discussions in subsections 3 and 4 of this chapter. Because of the small quantity of co-residential facilities, it is assumed that there is one dry cleaning machine in each co-residential facility and that the co-residential facility owners would choose to replace their machines with a high flash point hydrocarbon technology, the most popular alternative dry cleaning technology. Bay Area facilities had to comply with Bay Area's dry cleaning rule in 1998. Therefore, it is assumed that the co-residential facilities will lose a maximum of three years of useful life when their Perc machines are replaced in 2010. The actual cost impact for a co-residential facility will depend on the actual machine type (converted, primary control, add-on secondary or integral secondary control), machine age, and the alternative technology that is chosen by the facility owner to replace the Perc technology. The calculated annualized costs and the resulting decline in ROEs are shown in Table VII-6.

As shown in Table VII-6, total annual net cost for purchasing and operating a hydrocarbon machine compared to a secondary control machine is $2,680, with a calculated decline in ROE of 49 percent. If the facility loses three years of the useful life of the existing Perc machine, the total annual net cost would increase to $3,650, with a calculated decline in ROE of 66 percent. The net cost for facilities that are operating with a converted or primary control Perc machine would be higher compared with those that are operating with a secondary control machine. Therefore, the changes in the calculated ROEs are higher. In the cases considered, the declines in ROEs calculated are all greater than 10, ranging from 49 to 70 percent, indicating the potential for the proposed amendments to cause significant adverse economic impacts on co-residential facilities. Alternatively, the facility owner might consider choosing another alternative that can be lower in cost, i.e. the emerging hydrocarbon or GreenEarth machines that do not use distillation system and/or refrigerated condenser. Or, if it is deemed suitable for the facility, the facility owner might opt to choose professional wet cleaning systems.

Table VII-6. Decline in Return on Owner's Equity (ROE) for Co-residential Facilities[1]

Machine Type	Equipment Cost Due to Early Replacement of machine	Incremental Machine and Installation Cost[2]	Annualized Incremental Machine and Equipment Cost[3]	Delta Total Annual Recurrent Cost[4]	Total Annual Net Cost[5]	Percent Decline in ROE
Converted or Primary Control to Hydrocarbon	$0 to $8,800	$24,500	$2,360 to $3,210	$660	$3,020 to $3,870	55 to 70
Secondary Control to Hydrocarbon[6]	$0 to $10,000	$18,500	$1,780 to $2,750	$900	$2,680 to $3,650	49 to 66

1. Cost values rounded off to the nearest $10.
2. Cost differential between purchasing and installing a new hydrocarbon machine and a new primary control or a new secondary control machine.
3. The incremental machine and equipment cost were annualized based on a 15-year useful life and a real interest rate of five percent.
4. Delta total annual recurrent cost is the difference in the total annual recurring cost between the two dry cleaning technologies.
5. Total Annual Net Cost is the sum of Annualized Initial Cost and Total Annual Recurrent Cost.
6. Most likely machine type for a co-residential facility.

ii. Facilities that Operate a Converted or a Primary Control Machine

Based on the 2006 assessment of the dry cleaning machines in operation in California, there are 1,130 primary control machines and about 50 converted machines operating in facilities outside of the South Coast AQMD. Most of these facilities operate with a single machine. These facilities are required to remove their machines from service when they have been in service for 15 years starting on July 1, 2010. It is assumed that these facilities will choose to replace their Perc machines with an alternative technology and stay in operation.

The estimated capital costs for a facility that will replace a converted or a primary control machine depends largely on the dry cleaning alternative technology that the facility owner/operator will choose and, to a small extent, whether they will need to purchase a spare set of gaskets and a spare filter while they are operating their existing Perc machine. Because there is not a big used machine market for the dry cleaning machines, it is assumed that facility owners will be buying new machines. In addition, because most manufacturers are now producing machines that can be used for multiple solvents, including hydrocarbons, GreenEarth, and Rynex solvents, the machine cost for these solvents are grouped as the cost for a new multi-solvent machine. All potential capital costs are listed in Table VII-7. As shown in Table VII-7, the estimated capital costs for a facility range from $7,000 to $144,350.

Table VII-7. Potential Increase in Capital Costs for a Facility Replacing a Converted or a Primary Control Perc Machine[1]

Potential Actions	Capital Costs[2]
Switch to a New Multi-Solvent Machine[3]	$24,500
Switch to a New Professional Wet Cleaning System	$7,000
Switch to a Carbon Dioxide System	$144,000
Purchase a Spare Set of Gaskets and a Lint Filter	$0 to $350
Range of Total Initial Cost	$7,000 to $144,350

1. Totals are rounded.
2. Capital costs did not include grants that may be available to some dry cleaners and include both incremental machine and installation costs.
3. Multi-Solvent machines can be used for hydrocarbon, GreenEarth, and Rynex solvents and include machines that operate with Tonsil™ or bleaching clay and without a distillation system.

The estimated annual total net costs and the calculated ROEs, which indicate the potential impact on profitability of the proposed amendments, are shown for selected alternative technologies in Table VII-8. As shown in Table VII-8 all calculated ROEs are greater than 10 percent, with a 10 percent decline in ROE indicating a potential adverse economic impact. The typical costs associated with a switch to a professional wet cleaning technology results in the lowest decline in ROE of 24 percent. The highest decline in ROE of 264 percent occurs for the facilities that choose to operate with the carbon dioxide technology because of its high capital cost. A decline in ROE of greater than 100 percent means that the business will operate at a loss if cost is not passed on to its customer. The magnitude of ROE decline for switching to the carbon dioxide technology indicates that for a typical dry cleaner, switching to a carbon dioxide technology would be prohibitively expensive. Dry cleaners that have switched to carbon dioxide technology in California have high gross income compared to the typical dry cleaner.

It is important to note that certain technology types may qualify for grants (e.g. non-toxic and non-smog forming grant administered by the ARB, local air district's grant programs, and grants given by public utility companies). For those who will receive grants, the ROE will change accordingly. For example, with a $10,000 grant, the resulting decline in ROE for a typical professional wet cleaning facility is calculated to be 7 percent, and the resulting decline in ROE for a carbon dioxide facility is 246 percent.

Table VII-8. Decline in Return on Owner's Equity (ROE) for Facilities Replacing a Converted or a Primary Control Perc Machine[1]

Technology Type	Incremental Machine and Installation Cost[2]	Annualized Incremental Cost	Delta Total Annual Recurrent Cost/Savings[3]	Total Annual Net Cost/Savings[4]	Percent Decline in ROE
Hydrocarbon	$24,500	$2,360	$660	$3,020	55
GreenEarth	$24,500	$2,360	$660	$3,020	55
Professional Wet Cleaning System	$7,000	$670	$660	$1,330	24
Carbon Dioxide	$144,000	$13,870	$660	$14,530	264

1. Cost values rounded off to the nearest $10. Costs occur at time of purchase.
2. Cost differential between purchasing and installing a new primary control machine and a new alternative technology machine/system.
3. Delta total annual recurrent cost is the difference in total annual recurring cost between the use of Perc and that of the elected alternative technologies and is assumed to be the same as that of hydrocarbon.
4. Total Annual Cost is the sum of Annualized Initial Cost and Total Annual Recurrent Cost.

iii. Facilities that Operate a Secondary Control Machine

There are about 880 add-on or integral secondary control machines in California that are subject to the proposed amendments. These secondary control machines will need to be removed from service when they are 15 years old starting in 2010. The potential actions that a facility owner will take to comply with the proposed amended ATCM include the type of alternative technology that is chosen and whether a spare set of gaskets and a spare lint filter needs to be purchased. The potential capital costs associated with these potential actions for a facility with a secondary control machine are listed in Table VII-9. As shown in Table VII-9, the resulting increase in capital costs (compared to a Perc machine) ranges from $1,000 to $138,350.

Table VII-9. Potential Increase in Capital Costs for a Facility Replacing a Secondary Control Perc Machine[1]

Potential Actions	Capital Costs[2]
Switch to a New Multi-Solvent Machine[3]	$18,500
Switch to a New Professional Wet Cleaning System	$1,000
Switch to a Carbon Dioxide System	$138,000
Purchase a Spare Set of Gaskets and a Lint Filter	$0 to $350
Range of Total Initial Cost	$1,000 to $138,350

1. Totals are rounded.
2. Initial costs did not include grants that may be available to some dry cleaners and include both incremental machine and installation costs.
3. Multi-Solvent machines can use hydrocarbon, GreenEarth, and Rynex solvents.

The estimated annualized costs and the calculated ROE, indicating the potential impact of the proposed amendments on profitability, are shown for selected alternative technologies in Table VII-10.

Table VII-10. Decline in Return on Owner's Equity (ROE) for Facilities Replacing a Secondary Control Perc Machine[1]

Technology Type	Incremental Machine and Installation Cost[2]	Annualized Incremental Machine and Equipment Cost	Delta Total Annual Recurrent Cost/Saving[3]	Total Annual Net Cost/Saving[4]	Percent Decline in ROE
Hydrocarbon	$18,500	$1,780	$900	$2,680	49
GreenEarth	$18,500	$1,780	$900	$2,680	49
Professional Wet Cleaning System	$1,000	$100	$900	$1,000	18
Carbon Dioxide	$138,000	$13,380	$900	$14,280	259

1. Cost values rounded off to the nearest $10.
2. Cost differential between purchasing and installing a new primary control machine and a new alternative technology.
3. Delta total annual recurring cost is the difference in total annual recurring cost between the use of Perc and that of the selected alternative technologies. The total annual recurring cost is shown in Table VII-4.
4. Total Annual Cost is the sum of Annualized Initial Cost and Total Annual Recurring Cost.

As shown in Table VII-10, there is a decline in ROE for all technology types and the declines are all over 10. The typical costs associated with a switch to a professional wet cleaning technology results in the smallest decline of 18 percent. The largest decline in ROE occurs for the facilities that choose to operate with the carbon dioxide technology because of its high capital cost.

It is important to note that certain technology types may qualify for grants (e.g., non-toxic and non-smog forming grant administered by the ARB, local air district's grant programs, and grants given by public utility companies). For those who will receive grants, the ROE change accordingly. For example, with a $10,000 grant, the resulting decline in ROE for typical professional wet cleaning facilities is calculated to be about 1 percent, or minimal impact on profitability of the facility.

6. Assumptions for Facility Cost Estimates

Several assumptions were made for the facility cost estimates. For machine usage, we assumed that the owners of the co-residential facilities will choose to purchase and operate a hydrocarbon machine when they need to replace their Perc machines. For the co-residential facilities that will lose some of the useful life of their Perc machines, the loss was estimated using straight line depreciation. For the other facilities, it is assumed that the proportion of alternatives chosen will mirror the growth of the technologies between 2003 and 2006. The statewide costs of the proposed amendments were calculated in 2006 dollars and used the same assumptions as the facility cost calculations. Additional factors taken into consideration included: when costs are incurred, the number of facilities for each facility type, the number and age of the machines, and the number of spare gaskets and lint filters needed to be purchased.

We annualized non-recurring fixed costs using the Capital Recovery Method. Using this method, we multiplied the non-recurring fixed costs by the Capital Recovery Factor (CRF) to convert these costs into equal annual payments over a project horizon at a discount rate of 5 percent. The Capital Recovery Method for annualizing fixed costs is recommended by Cal/EPA (Cal/EPA, 1996), and is consistent with the methodology used in previous cost analyses for ARB regulations.

The CRF is calculated as follows*:*

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

where,

CRF	=	Capital Recovery Factor
i	=	discount interest rate (assumed to be 5 percent)
n	=	project horizon or useful life of equipment

All costs of equipment were annualized over 15 years, based on the expected lifetime of a dry cleaning machine. The total annual cost was obtained by adding the annual recurring costs to the annualized fixed costs derived by the Capital Recovery Method.

7. <u>Potential Impact on Perc Distributors and Manufacturers</u>

The economic impact analysis for Perc distributors is based on time needed for the recordkeeping and reporting requirements of the proposed amended ATCM. The recordkeeping keeping requirements include: the gallons of Perc purchased, the gallons of Perc sold to dry cleaners, and the contact information of the dry cleaners that bought Perc. The reporting requirements include: annual reporting of gallons of Perc sold to dry cleaners, initial reporting of contact information, and reporting of any change in contact information.

Perc distributors and manufacturers are required under the proposed amendments to keep records of their Perc purchases and Perc sales to dry cleaners. They are also required to report to ARB the annual Perc sales to dry cleaners if applicable and report to ARB the contact information of any new Perc distributor. Because record keeping is a routine part of doing business, staff anticipates this record keeping and reporting to incur minimal cost of approximately eight hours per year or less per Perc distributor and manufacturer.

Perc distributors and manufacturers will be losing revenue from the sale of Perc to dry cleaners as Perc machines are being phased out. Based on the 2006 survey of machines in operation, staff estimates that Perc dry cleaning facilities outside of the South Coast AQMD use about 159,000 gallons/year of Perc. Approximately 600 (about

28 percent) Perc machines are estimated having to be removed from service by July 1, 2010. Since most of these are primary control machines, it is estimated that there will be a decrease of about 48,000 gallons/year of Perc sales from July 1, 2010 to July 1, 2011, with the total decrease of 159,000 gallons/year on January 1, 2023. Because most, if not all, Perc distributors also sell other solvents, it is expected that the loss of revenue from Perc sales will be offset by increase in the sale of other solvents.

8. Potential Impact on Manufacturers of Dry Cleaning Machines and Related Equipment Required by the Proposed Amended ATCM

Many manufacturers or distributors of alternative dry cleaning machines are also manufacturers or distributors of Perc machines. Therefore, even though the proposed amendments will phase out the use of Perc machines and these manufacturers or distributors will cease to have business in the sale of Perc machines, they will have increase business selling alternative dry cleaning machines. Although the useful life of a dry cleaning machine has been recognized as 15 years, many facilities still operate with machines that are older than 15 years. Therefore, staff expects the proposed amendments will cause a net increase in new machine purchases and a net increase in business for the dry cleaning machine manufacturers or distributors.

9. Potential Impact on Consumers

The potential impact of the proposed amended Dry Cleaning ATCM on consumers depends upon the expected payback period for the cost incurred by the proposed amendments. Two types of calculations were made to estimate the potential cost recovery price increase. These are not predictions of actual price increases because actual increases are determined by economic “market” factors that would be affected only indirectly by the proposed regulation.

The first calculation for price increase assumes that the dry cleaning facilities will need to obtain a five year loan at ten percent interest for the purchase of new dry cleaning equipment. Therefore, a payback period of five years is used. This is a reasonable assumption because most dry cleaning businesses are small businesses. In addition, the potential impact calculation assumes the cost of the regulation to the dry cleaners will be passed on to their customers.

To completely offset the net cash outflow over the five years, a dry cleaner would have to increase its annual revenues by loan repayment, interest payment, additional tax due to price increase, cost (loss) of early replacement of machine if applicable, and accounting for tax deduction for equipment depreciation, interest payment and cost of operation. A depreciation of $25,000 a year is used based on the allowed equipment depreciation for year 2010. The calculation for price increase is based on the cost of the regulation for the three typical facilities divided by the median annual amount of material dry cleaned per facility. Table VII-11 shows a summary of the estimated price increase for the three facility types over the five-year loan period.

Table VII-11. Summary of Cost Recovery Price Increase for the Three Facility Types Over Loan Period[1]

Facility Type	Alternative Technology Chosen	Machine Cost[2]	Annual Machine Loan Cost[3]	Income Tax Savings[4]	Delta Total Annual Recurring Cost	Total Annual Net Cost	Revenue Increase Needed[5]	Cost of Loss of Useful Life[6]	Cost Recovery Price Increase ($/garment)
Co-residential (Secondary Control)	Hydrocarbon	$75,000	$19,790	($9,160)	$900	$11,520	$20,000	$2,000	$0.63
Facility with Converted, or Primary Control Machine	Hydrocarbon	$75,000	$19,790	($9,060)	$660	$11,390	$19,760	N/A	$0.56
	GreenEarth	$75,000	$19,790	($9,060)	$660	$11,390	$19,760	N/A	$0.56
	Professional Wet Cleaning	$57,000	$15,040	($7,360)	$660	$8,340	$14,240	N/A	$0.41
	Carbon Dioxide	$194,000	$51,180	($16,820)	$660	$35,010	$62,580	N/A	$1.79
Facility with Add-on or Integral Secondary Control machine	Hydrocarbon	$75,000	$19,790	($9,160)	$900	$11,520	$20,000	N/A	$0.57
	GreenEarth	$75,000	$19,790	($9,160)	$900	$11,520	$20,000	N/A	$057
	Professional Wet Cleaning	$57,000	$15,040	($7,470)	$900	$8,490	$14,480	N/A	$0.41
	Carbon Dioxide	$194,000	$51,180	($16,930)	$900	$34,990	$62,820	N/A	$1.80

1. Values are rounded. Cost recovery price increase is calculated using a median amount of material dry cleaned per facility of 35,000 lbs, assuming 1 lb per garment, and rounded.
2. Machine cost includes installation and removal costs assuming $1,000 for removal costs.
3. Assuming a 5-year loan at an interest rate of 10 percent.
4. Tax savings are due to deduction of depreciation, operating cost and loan interest and are averaged over the 5 yr period.
5. Revenue increase needed, or total annual net cost before tax, is the total annual net cost multiply by 1/(1-0.093)*1/(1-0.35) to account for a 9.3 percent State tax rate and a 35 percent federal tax rate after discounting costs to the year the loan is incurred.
6. Cost due to loss of useful life is for co-residential facilities only and is spread out evenly over the 5 year loan period.

As shown on Table VII-11, for the co-residential facilities that will lose three years of useful life of their existing secondary control Perc machine and will purchase, install, and maintain a hydrocarbon machine, the increase in price needed to offset the cost of the proposed amendment completely would be 63 cents per garment. For a facility that is operating with a primary control machine, the increase in price spanning the selected available alternatives would range from $0.41 to $1.79 per garment. For a facility that is operating with a secondary control machine, the price increase would similarly range from $0.41 to $1.80 per garment.

The estimation of cost recovery price increase shown in Table VII-11 is valid for the immediate economic effect on the dry cleaner but does not represent a facility's long-term cost or the true cost of the proposed amendments to the economy. The second estimation of cost recovery price increase due to the proposed amendments is calculated based on a 15-year lifetime of the machines, accounting for cost of reduced useful life when applicable and when various expenses are to occur. The statewide regulation cost is shown in Section E to be $41 million and do not include additional interest that a dry cleaner may have to pay for getting a loan. The cost recovery price increase is then calculated assuming all the dry cleaning facilities will need to recover the average amount of expense based on the total amount of material dry cleaned outside of the South Coast AQMD statewide. In this case, the theoretical resulting cost to the dry cleaning customers is about 7 cents ($0.07) per garment.

10. Potential Impact on Employment

We expect the proposed amended Dry Cleaning ATCM to have a minor impact on employment of the dry cleaning facilities. It is possible that some marginal dry cleaning businesses may not have the capital necessary to comply with the proposed amendments and may elect to close resulting in some employee lay-offs. Also, the proposed amended Dry Cleaning ATCM will likely result in increased business for alternative dry cleaning machine manufacturers, distributors, and waste water treatment unit manufacturers and distributors. In these cases, it may result in increased employment.

11. Potential Impact on Business Creation, Elimination, or Expansion

Assuming that the compliance costs of the proposed amended Dry Cleaning ATCM may be absorbed for most dry cleaning operators or passed on to their customers; the proposed amended Dry Cleaning ATCM will have no noticeable impact on the status of California businesses. Some marginal dry cleaning businesses may not have the capital necessary to comply with the proposed amendments. These businesses may choose to operate with a less costly alternative dry cleaning process or cease their dry cleaning operations altogether.

12. Potential Impact on Business Competitiveness

The proposed amended Dry Cleaning ATCM is not expected to have a significant impact on the ability of California businesses to compete with businesses from other states. Most dry cleaning businesses are independent operations that compete for local business within their region and rarely seek business from outside the State.

C. Costs to State Agencies

Section 39666 of the Health and Safety Code requires that after the adoption of the proposed amended Dry Cleaning ATCM by the Board, the local air districts must implement and enforce the ATCM or adopt an equally effective or more stringent regulation. Because the local air districts will have primary responsibility for implementing and enforcing the proposed amended Dry Cleaning ATCM, we evaluated the potential costs to the local air districts. We also evaluated the potential costs to local and State agencies. Two State agencies, the ARB and the Department of Corrections, will be impacted by the adoption of the proposed amended

Dry Cleaning ATCM. This section provides the conclusions we reached and the basis for those conclusions.

1. Costs to the Air Resources Board

The ARB recovers the cost to implement the Hot Spots Program through the fees from facilities that emit air toxics such as the Perc dry cleaning facilities. The current annual fee is $35 per facility. Due to the phase out of Perc machines, ARB will eventually not receive fees from the dry cleaning industry due to the use of Perc. The total amount of fee reduction, although no longer needed due to the phase out of Perc machines, is estimated to be about $355,000 for the lifetime of the proposed amendments. In addition, this fee may be offset if the alternative dry cleaning technologies are required to report under the Hot Spots Program.

2. Costs to the Department of Corrections

The Department of Corrections operates twelve Perc dry cleaning machines and one hydrocarbon dry cleaning machine at thirteen correctional facilities in California. The one facility that is operating a hydrocarbon dry cleaning machine will not be impacted by the proposed amendments. The remaining twelve Perc machines will need to be replaced according to the schedule specified by the proposed amendments. In addition, a spare set of gaskets and a spare lint filter will need to be purchased per operating Perc machine if the facilities do not have them. Table VII-12 shows the facilities at the Department of Corrections that have dry cleaning on-site, their machine type, and age.

The Department of Corrections may incur a capital cost for purchasing a spare set of gaskets and a spare lint filter while they are still operating their Perc machines and for replacing their Perc machines. During the first three years of implementation, a total of seven of the machines will need to be replaced because they will be 15 years old or older. The remaining five Perc machines will need to be replaced as they reach 15 years of age. Based on the machine and installation costs shown in Table VII-3 and assuming the Department of Corrections will replace the Perc machines with an alternative technology and choose the most popular alternative, the high flashpoint hydrocarbon process, the additional fiscal impact is estimated to range between $18,500 and $74,000 per machine purchased. The lower end of the range represents the cost of the proposed regulation and is the calculated incremental machine and installation cost between the Perc and the hydrocarbon processes. Assuming the Department of Corrections had allocated funding needed to replace the Perc machines, the lower range represents the additional funding needed per machine replacement due to the proposed amendments. The upper end of the range represents the total capital expenditure of machine purchase and installation and reflects an estimate of budget needed per machine replacement.

Table VII-12. List of Facilities at the Department of Corrections With Dry Cleaning Machines[1]

Facility Name	Machine Type		Machine Age (years)
	Solvent Type	# of Machines	
CA Correctional Center Susanville	Perc Primary	1	14
CA Correctional Institution Tehachapi	Perc Primary	1	Approx.10
CA Mens Colony San Luis Obispo	Hydrocarbon	1	Installed June 2005
CA Rehab. Center Norco	Perc Secondary	1	Installed Dec. 2005
CA State Prison San Quentin	Perc Primary	1	18
CA Substance Abuse Treatment Facility	Perc Secondary	1	8
Calipatria State Prison	Perc Secondary	1	13
Centinela State Prison	Perc Primary	1	9
Chuckawalla Valley State Prison Blythe	Perc Secondary	1	6
Correctional Training Facility Soledad	Perc Primary	1	12 to 15
Kern Valley State Prison	Perc Secondary	1	1
Mule Creek State Prison	Perc Primary	1	18
Valley State Prison for Women	Perc Primary	1	10

1. Information for the table was obtained between November 2005 and July 2006.

Alternatively, the Department of Corrections can also comply with the proposed amendments by replacing the Perc machines with an alternative dry cleaning technology that is lower in capital cost. In summary, the fiscal cost impact to the Department of Corrections during the first three years ranges from $169,500 to $522,000, and the total cost to comply with the proposed amendments over its lifetime ranges from $268,000 to $892,000. The estimated lower range of costs reflects additional funding required due to the proposed amendments if the Department of Corrections had allocated funds for Perc machine replacements. And, the upper range of costs reflect total budgetary requirement estimated for replacing the Perc machines with hydrocarbon machines. Table VII-13 lists the estimated cost impacts to the Department of Corrections.

Table VII-13. Cost Impacts to the Department of Corrections[1]

Time	Number and Type of Machines to be Replaced	Cost Impact Due to Change of Machines[2]	Cost for Extra Set of Gaskets and Filter[3]	Total Cost Impact[4]
First Year	0	$0	$4,000	$4,000
First Three Years	6 Primary, 1 Secondary	$165,500 - $518,000	$4,000	$169,500 - $522,000
Lifetime of the Regulation	7 Primary, 5 Secondary	$264,000 - $888,000	$4,000	$268,000 - $892,000

1. Costs rounded off to nearest $100.
2. Cost impact for switching to hydrocarbon process.
3. Assumed the Department of Corrections does not currently have extra sets of gaskets and lint filters for the Perc machines.
4. Total cost impact equals the sum of cost impact due to change of machines and purchase of gaskets and filters.

D. Costs to Local Air Districts

The dry cleaning facilities affected by the proposed amended Dry Cleaning ATCM are located in all but five local air districts. Four of the local air districts do not have dry cleaning facilities. The fifth, South Coast AQMD, has a rule that is generally equivalent to the proposed amended Dry Cleaning ATCM. Therefore, the dry cleaning facilities that are located in the South Coast AQMD are not expected to be impacted by this proposed amended Dry Cleaning ATCM. Over 95 percent of the rest of the dry cleaning facilities are located in the following six districts: Bay Area AQMD, Monterey Bay Unified APCD, Sacramento Metropolitan AQMD, San Diego County APCD, and San Joaquin Valley Unified APCD.

There is no additional enforcement cost associated with the proposed amendments because the proposed amendments do not require additional oversight from the local air districts. In fact, because the enforcement cost is directly proportional to the number of Perc facilities and/or equipment, as facilities discontinue the use of Perc equipment, there will be a decrease in the number of hours the local air district will have to spend on inspections and other oversight associated with Perc facilities. Based on input from local air districts, most districts conduct annual inspections of Perc dry cleaning facilities. These inspections last about four hours per facility. To verify the discontinued use of Perc machines, the local air districts might need to have a shortened inspection lasting about two hours per facility impacted.

In addition, because of the discontinued use of Perc machines in the dry cleaning facilities, the local air districts will lose fees that are being collected from the Perc facilities for the Hot Spots Program. Based on input from the local air districts, the weighted average of the Hot Spots Fee is $92. Table VII-14 shows the estimated net cost savings for the first three years and for the lifetime of the regulation for the local air districts. As shown on Table VII-14, there will be a net cost savings for the local air districts that range from $1,769,000 to $3,301,000 over the lifetime of the proposed regulation.

Table VII-14. Estimated Cost Savings for the Local Air Districts[1]

Time	Number of Facilities Impacted	Cost Savings Due to Reduced Facilities[2]	Reduced Revenue from Hotspots Fee[3]	Net Savings[2]
First Year	0	$0	$0	$0
First Three Yrs	624	$87,000 - $137,000	$57,000	$30,000 - $70,000
Lifetime of the Proposed Reg. (2008 to 2023)	2022	$2,577,000 - $4,109,000	$808,000	$1,769,000 - $3,301,000

1. Costs rounded off to nearest $1000.
2. Range due to range of labor cost.
3. Hotspots fees may be offset if the alternative dry cleaning technologies are required to report under the Hot Spots Program.

E. Total Cost of the Proposed Amendments

The statewide cost of the proposed amendments was calculated in 2006 dollars and used the same assumptions as the facility cost calculations. Other considerations and assumptions specific to the statewide cost estimate include: the number of machines impacted for each facility type, the number and age of the machines, and when costs are incurred.

The number of machines impacted is shown in Table VII-1. The age of the machines is assumed to be the same as what was obtained in the 2003 survey and published in the Technical Assessment Report and no machine purchases in 2006 and 2007. For the statewide cost calculation, it was assumed that: 1) cost of alternative machine purchase will occur when the Perc machines are required to be removed by the proposed amendments, 2) costs for switching to a professional wet cleaning system is the average of the cost range where applicable, and 3) that all Perc facilities would purchase a spare lint filter and a spare set of gaskets. Table VII-15 contains an overview of the annual costs of proposed amended Dry Cleaning ATCM without adjustment to time of machine purchase and cost for a spare lint filter and a spare set of gaskets and the total cost with all considerations discussed.

The calculated statewide cost of the amendments is $41 million over 15 years to private dry cleaning businesses. The annualized statewide cost of the amendments is $4 million per year. To the extent that dry cleaning facilities are unable to pass on the compliance costs of the proposed amendments to their customers, some may experience a significant adverse economic impact. The proposed amended Dry Cleaning ATCM will impact two State government agencies (ARB and Department of Corrections). ARB might experience about $355,000 reduction of fees from Perc facilities over the lifetime of the propose amendments. And, the Department of Corrections is estimated to incur an estimated maximum $892,000 in capital costs over the lifetime of the proposed amendments.

Table VII-15. Overview of the Total and Annual Costs of Proposed Amended ATCM by Machine and Facility Type[1]

Machine Type	Number of Machines	Incremental Machine Cost	Cost of Early Machine Replacement	Annualized Incremental Machine and Equipment Cost	Total Annual Recurrent Costs[3]	Total Annual Net Cost[4]	Percent Decline in ROE[5]
Co-res. Primary Control to Hydrocarbon	0	$24,500	$0 to $8,800	$2,360 to $3,210	$660	$3,020 to $3,870	55 to 70
Co-res. Secondary Control to Hydrocarbon	50	$18,500	$0 to $10,000	$1,780 to $2,750	$900	$2,680 to $3,650	49 to 66
Converted or Primary Control to Hydrocarbon[6]	1050	$24,500	N/A	$2,360	$660	$3,020	55
Converted or Primary Control to GreenEarth	160	$24,500	N/A	$2,360	$660	$3,020	55
Converted or Primary Control to Professional Wet Cleaning	20	$7,000	N/A	$670	$660	$1,330	24
Converted or Primary Control to Carbon Dioxide	10	$144,000	N/A	$13,870	$660	$14,530	264
Secondary Control to Hydrocarbon[6]	700	$18,500	N/A	$1,780	$900	$2,680	49
Secondary Control to GreenEarth	110	$18,500	N/A	$1,780	$900	$2,680	49
Secondary Control to Professional Wet Cleaning	10	$1,000	N/A	$100	$900	$1,000	18
Secondary Control to Carbon Dioxide	10	$138,000	N/A	$13,380	$900	$14,280	259
Sub-Total[7]	2120	N/A	N/A	N/A	N/A	41 million	N/A

1. Cost values are rounded and occur at time of purchase/use.
2. Other Equipment Cost is the cost of a spare set of gaskets and a spare lint filter.
3. Annual Recurring Cost is the cost due to reduced Perc usage, annual leak and drum concentration checks, and carbon replacement.
4. Total Annual Net Cost is the sum of Annualized Initial Cost and Total Annual Recurring Cost.
5. A negative decline in ROE means an increase in ROE.
6. Cost associated with operating “another” alternative is estimated to be the same as hydrocarbon.
7. Sub-total of total annual net cost discounts to 2006 dollars after consideration for when various costs are to occur.

Cost impact calculations may result in higher or lower estimates than that are actually realized because it was not possible to account for the dry cleaning facilities that had used Perc primary control machines when the latest update was conducted and have since voluntarily changed to either an alternative technology or to a secondary control machine.

F. Cost Effectiveness of the Amended ATCM

1. Estimated Benefits

All Californians will benefit from the adoption of the proposed amendments to the Dry Cleaning ATCM because of the nearly complete elimination of exposure to Perc, an identified toxic air contaminant, from dry cleaning operations. This will result in decreases in incidences of cancer, as well as Perc related noncancer adverse health effects including: headache, dizziness, rapid heartbeat, and liver and kidney damage. Implementation of the proposed amendments is estimated to produce a reduction of 650 tons/year. In terms of pounds (lbs) per year, the result is about 1.3 million lbs per year in Perc reduction.

2. Cost Effectiveness

The cost effectiveness analysis in this section compares the cost of the proposed amended ATCM to two other alternatives that will eliminate Perc use with dry cleaning machines upon full implementation of the alternatives. Each cost quoted below is in 2006 dollars using a 15 year of useful life for the machines. Two alternatives have been evaluated. Alternative 1 would phase out Perc use and prohibit hydrocarbon usage in new dry cleaning machines. Alternative 2 would shorten the time before a Perc machine is phase out from the proposed 15 years to 10 years. In addition, the cost effectiveness of the proposed amended ATCM is compared with three other major ARB regulations.

a. Cost Effectiveness of the Amended Dry Cleaning ATCM

The cost effectiveness of the proposed amended Dry Cleaning ATCM is evaluated by calculating the cost per pound of Perc reduced. Assuming no facility closures due to economic hardship and all the facilities that operate with Perc would continue to do so absent this rulemaking, the amended ATCM will reduce Perc emission by about 1.3 million lbs per year from all impacted facilities by January 1, 2023, when all the dry cleaning facilities are in full compliance of the proposed amended Dry Cleaning ATCM. The cost effectiveness of the proposed amended Dry Cleaning ATCM can then be calculated by dividing the annualized cost of the regulation of $4 million by the 1.3 million lbs of Perc reduced per year. The result is about $3.10 per pound of Perc reduced.

b. Cost Effectiveness of Alternative 1

Alternative 1 would phase out Perc as staff is proposing and would also prohibit the use of hydrocarbon solvents in new dry cleaning machines. This option would provide the maximum protection from emissions of Perc while preventing an increase in volatile organic compound (VOC) emissions from hydrocarbon solvents. To the extent that the facilities are financially able, this option might result in a total of 2120 machines being replaced with non-smog-forming technologies such as GreenEarth, water-based cleaning, and Carbon Dioxide. Based on the trend shown in Table VII-2, the relative percentage of the three technologies is shown in Table VII-16.

Based on the percentages shown on Table VII-16, the potential statewide cost for alternative 1 was calculated to be $48 million over 15 years, with the annualized cost being $4.6 million. This alternative will reduce Perc emission by about 1.3 million lbs per year from all impacted facilities. The cost effectiveness of alternative one is then calculated to be $3.60 per pound of Perc reduced. If the amount of VOC reduced of 0.5 million lbs is taken into account, then the cost effectiveness will be lowered to $2.60 per pound of Perc and VOC reduced.

Table VII-16. Projected Percentage of Non-Smog-Forming Technologies[1]

Non-Smog-Forming Technologies	Percent Increase in Alternatives (2003 to 2006)	Projected Percentage
GreenEarth	13%	76%
Water Based Cleaning Systems[2]	3%	18%
Carbon Dioxide	1%	6%

1. Values rounded.
2. Mostly professional wet cleaning systems and includes mixed shops (facilities that use wet cleaning together with another type of dry cleaning process).

Although ARB staff expects that, under this option, most facilities would migrate toward GreenEarth, there could be a considerable number of facilities that choose water-based cleaning. The motivation for such a move may reflect the unresolved toxicity of GreenEarth and the availability of grant programs, such as AB 998, which provide monetary resources to switch from Perc. If this is the case, it is likely that many may not receive adequate training required for successful operation of the professional wet cleaning systems and may need to out-source 10 percent or more of their garment stream and experience the associated reduction in gross sales. This is based on experience of some owner/operators that have participated in a demonstration program by the Pollution Prevention Education and Research Center and therefore have proper training. The cost impact in this case is hard to estimate but is likely to be higher than $4.6 million per year.

c. <u>Cost Effectiveness of Alternative 2</u>

Alternative 2 would shorten the time before the phase out of Perc machine from the proposed 15 years to 10 years. The proposed 15 years of useful life of a Perc machine is based on results of dry cleaning facility survey, site visits conducted by ARB staff, discussions with local district staff and committees, and discussions with the Dry cleaning ATCM workgroup. Therefore, the accelerated phase out will incur additional cost due to the lost of five years of useful life. The statewide cost impact of this alternative is calculated by using straight line appreciation method to estimate the cost due to the lost of useful life.

The potential statewide cost for alternative 2 was calculated to be $59 million over 15 years, with the annualized cost being $5.7 million. This alternative will reduce Perc emission by about 1.3 million lbs per year from all impacted facilities. The cost effectiveness of alternative one is then calculated to be $4.40 per pound of Perc reduced.

d. Cost Effectiveness Comparison

The cost effectiveness of the proposed amended ATCM and the two alternatives are shown in Table VII-17. As shown in Table VII-17, the two alternatives will be more costly.

Table VII-17. Cost Effectiveness Comparison of the Proposed Amended ATCM and the Selected Alternatives[1]

	Annualized Cost ($)	Cost Effectiveness ($/ lb of Perc reduced)
Proposed Amended ATCM	4.0 million	3.1
Alternative 1	4.6 million	3.6
Alternative 2	5.7 million	4.4

1. Values are rounded.

The cost effectiveness of the proposed amended ATCM is also compared with two other major ARB regulations in Table VII-18. These other regulations include the Amendments to the California Aerosol Coating Products, Antiperspirants, and Deodorants, and Consumer Products Regulations, Test Method 310, and Airborne Toxic Control Measure for Para-Dichlorobenzene Solid Air Fresheners, and Toilet/Urinal Care Products ATCM and the Proposed Amendments to the California Consumer Products Regulation and the Aerosol Coatings Regulation. As shown in Table VII-18, the cost effectiveness of the proposed amended ATCM is similar to these ARB regulations.

Table VII-18. Cost-Effectiveness Comparison – Dry Cleaning ATCM Proposed Amendments and Three Other Major Regulations

Regulation	Cost-Effectiveness
Proposed Amended ATCM	\$3.10 per pound of Perc reduced
Amendments to the California Aerosol Coating Products, Antiperspirants, and Deodorants, and Consumer Products Regulations, Test Method 310, and Airborne Toxic Control Measure for Para-Dichlorobenzene Solid Air Fresheners, and Toilet/Urinal Care Products ATCM (2004)	\$2.01 to \$2.34 per pound of VOC reduced
Proposed Amendments to the California Consumer Products Regulation and the Aerosol Coatings Regulation (2006)	\$2.35 per pound of VOC reduced

Source: ARB, 2004b; ARB, 2006d

VIII. ENVIRONMENTAL IMPACTS OF THE PROPOSED AMENDED DRY CLEANING ATCM

The intent of the proposed amended ATCM is to protect public health by reducing the public's exposure to potentially harmful emissions of Perc. An additional consideration is the impact that the proposed amended ATCM may have on other areas of the environment.

This chapter describes the potential impacts that the proposed amended ATCM may have on wastewater, groundwater contamination, hazardous waste disposal, soil, flammability, energy usage, and other air pollution impacts. The ARB staff expects that the only significant adverse environmental impact should occur in air pollution due to the expected increase in the use of solvents containing VOCs.

A. 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. Since 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 Initial Statement of Reasons for a rulemaking in lieu of preparing an environmental impact report or negative declaration. In addition, the ARB will respond in writing to significant environmental issues 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 ATCM.

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 ATCM. 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.

B. Potential Wastewater Impacts

Sanitation districts have been concerned about the amount of chlorinated compounds found in the waste effluent at treatment plants and the potential for illegal disposal of Perc dry cleaning wastes down the sewers. Many treatment plants do not have the equipment necessary to process industrial wastes such as chlorinated solvents that have been detected at elevated levels at some facilities. The impact of influent concentrations of Perc from the dry cleaning industry appears to be low due to the changes in dry cleaning operations and the implementation of environmental regulations (NC, 2001). It should be noted that spotting chemicals can also be a source of Perc in wastewater. Based on information gathered from the Dry Cleaning Facility Survey, dry cleaning facilities using Perc either use a wastewater treatment unit to recycle their Perc or they have their wastewater picked up by a registered hazardous waste transporter. (Note: In California, all hazardous waste must be managed offsite by a transporter that is registered with DTSC.) ARB staff has determined that there will be nearly 100 percent reduction of Perc to wastewater due to the more stringent proposed amended ATCM which will, in time, eliminate the use of Perc dry cleaning machines.

In general, it is prudent to check with the local publicly owned treatment works in the State before discharging any wastewater into the sewer. However, potential wastewater impacts of the alternative solvents were assessed based on available information. The CO_2 cleaning process does not generate wastewater and would not have an impact. Dry cleaners that use other alternative solvents, including GreenEarth, hydrocarbon, and glycol ethers, can release the solvents to water, mainly in the form of separator water. Separator water was analyzed in a project conducted by the IRTA and the Los Angeles County Sanitation District (LACSD). Separator water from three facilities, each using one of the alternative solvents mentioned, was analyzed for certain metals, toxic organics, and aquatic toxicity (IRTA, 2005). In all cases, the metal concentrations and the toxic organic concentrations were below health-protective detection limits. Additionally, in all three cases, the separator water did not exhibit aquatic toxicity (IRTA, 2005).

In addition, IRTA and LACSD analyzed the wash and rinse effluents from four wet cleaning facilities for certain metals, toxic organics, and aquatic toxicity. None of the samples contained metal concentrations that exceeded hazardous waste levels that are set by title 22 of the California HSC. Perc and/or trichloroethylene (TCE) were found in the effluent from three of the wet cleaning facilities. In some cases, the concentrations of these toxics exceeded hazardous waste levels. The origin of the TCE and at least some of the Perc is most likely spotting chemicals that are used to pre-spot garments. A few of the facilities had both wet cleaning and Perc machines and the Perc may have also been entrained in garments cleaned in the wet cleaning machine. The analysis indicated that effluent samples from all four facilities did not exhibit aquatic toxicity despite the presence of Perc and/or TCE (IRTA, 2005).

C. Potential Groundwater Contamination Impacts

One of the concerns with the use of Perc is groundwater contamination. Perc is known to pass through porous surfaces, such as building walls, sewer lines, and cement floors (ARB, 1993). Therefore, Perc usage poses a significant threat to the safety of groundwater. Perc has been detected in both wastewater and groundwater in the South Coast Air Basin, with some levels in excess of the current drinking water standard of five parts per billion (South Coast, 2002). Perc has also been detected in 968 wells or approximately ten percent of the 9,500 wells tested in California as of March 1996. Cleanup cost for these wells have been estimated at $3 billion dollars (CFCA, 2002). The implementation of this dry cleaning regulation and resulting changes in the dry cleaning industry will eliminate the use of Perc dry cleaning machines and provide nearly 100 percent reduction in the potential impact on groundwater contamination from Perc.

Based on information available for the alternative solvents, groundwater contamination is not as large an issue compared to Perc. When DF-2000, the more commonly used hydrocarbon solvent, is released into the environment, volatilization from water to the air is calculated to occur at a relatively rapid rate, i.e., a few days. Non-volatized product in the natural environment will biodegrade at a moderate rate and not persist (ExxonMobil, 2003). Other high flash point hydrocarbon solvents are expected to behave similarly.

The GreenEarth solvent is unlikely to leach into groundwater because it is not very soluble in water and readily sticks to soil particles (GreenEarth, 2003). Based on test data with other silicone materials, if spilled on the ground, D_5 is expected to decompose to carbon dioxide, silicon dioxide (sand), and water. According to a study conducted by the International Fabricare Institute (IFI), GreenEarth solvent has low solubility in water (<100 parts per billion (ppb)) and is very close in density to water; therefore, if it is discharged to water, it will initially form a surface film and then will rapidly evaporate into the air. The half-life for GreenEarth in surface water is estimated at between one to five days. Acute studies with trout, daphnia, and algae show no significant effects at the highest doses prescribed by the test methodology. If larger amounts of GreenEarth solvent are kept in contact with soil, it will also be expected to decompose to carbon dioxide, silicon dioxide (sand), and water (IFI, 2002).

Groundwater contamination is not a concern using the CO_2 process. At room temperature, CO_2 can exist as a liquid if kept in a closed system at an elevated pressure. The cleaning systems used for CO_2 are able to efficiently convert CO_2 from a gas to a liquid. One of these systems permits 98 percent of the CO_2 to be recycled (U.S. EPA, 1999). In general, only a nominal amount of CO_2 is then vented to the atmosphere.

Environmental fate on the Rynex 3 solvent is not readily available, but the Rynex 3 formulation is a type of propylene glycol ether. Proplylene glycol ethers are known to be biodegradable. All propylene glycol ethers are liquid at room temperature and all are water-soluble. Propylene glycol ethers are unlikely to persist in the environment. Two specific types of glycol ethers, proplylene methyl ether and propylene glycol methyl ether acetate, have shown rapid biodegradation in soil (SIDS, 2003).

D. Potential Hazardous Waste Impacts

Hazardous waste is regulated in California by a federally authorized State program under the responsibility of DTSC. Under this program, Perc is classified as hazardous waste. In California, all hazardous waste at a facility must be transported off-site by a registered hazardous waste transporter. In general, it is the facility owner's responsibility to determine whether the waste from the facility is hazardous.

Waste generated by the use of Perc in dry cleaning includes the still bottoms from solvent distillation and the spent cartridge filters used to remove lint and insoluble soil from the extracted Perc. Cartridge filters are typically replaced every six months or less, depending on workload and manufacturer recommendation. Reusable spin disc filters are also used and the removed lint and dirt from the spin disc filters generate perc-contaminated waste (JE, 2004).

According to the Facility Survey, the change in the amount of waste generated from hydrocarbon and GreenEarth technologies is relatively small compared to Perc. In terms of waste volume, the CO_2 and Rynex 3 cleaning processes are expected to generate the least amount of waste compared to Perc and the other alternative technologies. In general, wastes from the mentioned alternative processes include spent filters and still bottoms. The still bottoms from four dry cleaning facilities that used hydrocarbon solvents, GreenEarth, Rynex 3 and CO_2, were analyzed in a study IRTA conducted with LACSD. The results of these tests showed excess levels of lead for one of the still bottom samples and three out of four of the still bottom samples exhibited aquatic toxicity (IRTA, 2005). Given that the solvents do not contain lead and are not expected to exhibit aquatic toxicity, the results indicate that the spotting chemicals and detergents used may alter the characteristics of the waste streams. Alternately, waste streams from alternative processes can be handled as hazardous waste. Currently, registered hazardous waste transporters remove the wastes from hydrocarbon dry cleaning facilities as hazardous waste (ARB, 2004i).

The water-based cleaning technologies also generate spent filters. Again, in the absence of contamination from hazardous compounds, handling as municipal solid waste is an option. Additionally, the detergents that are used are biodegradable and designed for discharge via the sanitary sewer. These detergents should be readily removed at the local treatment plant (JE, 2004).

E. Potential Soil Impacts

Soil contamination has been a problem with Perc use. According to one report, Perc is found in more than 50 percent of the Superfund sites in the United States (CFCA, 2002). The DTSC identified Perc as a solvent that has contaminated one out of every ten public drinking water wells in California, creating a need for a state cleanup effort. Concern for soil contamination is ongoing in all dry cleaning processes. Soil contamination can occur through accidental releases, such as spills, or during the distillation process from a boil-over. Although federal, state, and local environmental regulations have been developed to help minimize soil contamination, dry cleaners should take all necessary steps to contain spills and clean them up quickly. Again, these impacts will be reduced significantly due to the results of this regulation.

F. Potential Flammability of Alternative Solvents

The use of alternative solvents may cause a potential fire hazard to the environment. Flammable or combustible liquids are listed in different classes. The combustible liquids used in the dry cleaning industry are listed under classifications based on their flash point. Flash point is defined as the temperature at which a flame will ignite the solvent vapors. The vapor burns, not the liquid itself. The range at which a liquid produces flammable vapors depends upon its vapor pressure. The vaporization rate increases as the temperature increases. Therefore, flammable and combustible liquids are more hazardous at elevated temperatures than at room temperature (UCSD, 2005). The combustible liquids used in dry cleaning are classified as Class II, Class IIIA, or Class IIIB in accordance with the National Fire Protection Association (NFPA). The use of these combustible liquids may require the issuance of fire permits. Class II liquids, like the Stoddard solvent, have a flash point at or above 100 degrees Fahrenheit (°F) and below 140°F. Class IIIA liquids have a flash point at or above 140°F and below 200°F. The hydrocarbon solvents are an example of the Class IIIA liquids. Class IIIB liquids, like the Rynex 3 solvent, have a flash point at or above 200°F. Class IV liquids, such as Perc, are considered noncombustible and, therefore, are not potential fire hazards (JE, 2004).

In the past, Stoddard was a popular dry cleaning solvent that saw a significant decrease in usage due to fire hazard concerns. As mentioned above, this solvent is classified as a Class II liquid and has a flash point of 110°F. The flash point hazard encouraged the petroleum industry to develop a new group of solvents that have a higher flash point. The newer solvents are classified as Class IIIA and IIIB liquids and have a flash point above 140°F. It is important to know that these hydrocarbon solvents are still considered hazardous materials by CAL/OSHA standards because they are classified as combustible liquids. This group of solvents includes DF-2000, PureDry, Shell 140, and EcoSolv (South Coast, 2002). The solvent DF-2000, with a flash point of 147°F, is currently the most popular hydrocarbon solvent being used.

A few more alternative solvents are being used in the garment industry today. They are GreenEarth, Rynex 3, and CO_2. The GreenEarth solvent is classified as a Class IIIA liquid and has a flash point of 170°F. Like the hydrocarbon solvents, GreenEarth is considered a combustible liquid. Rynex 3, which has a flash point greater than 200°F, is classified as a Class IIIB liquid, which is also considered a combustible liquid (JE, 2004). Based on a study conducted by the North Carolina Department of Environment and Natural Resources, CO_2 is a weak solvent; therefore, a detergent mixture is used as a supplement to the base solvent. Some of the detergent mixtures contain hydrocarbon chemicals in order to dissolve certain soils. The hydrocarbon compounds used in these detergent mixtures have a flash point above 140°F and are classified as a Class IIIA liquid. While the CO_2/detergent mixture is not expected to be a fire safety hazard, the detergent mixture by itself could be a potential fire safety hazard (NC, 2001).

The water-based cleaning processes use detergents that are not considered a fire hazard. Therefore, there is no potential flammability risk associated with these processes. For comparison purposes, Table VIII-1 below gives you a summary of the flash points and classifications of the commonly used solvents in the dry cleaning industry.

Table VIII-1. Summary of Flash Points and Classification for Commonly Used Solvents[1]

Solvent	Flash Point	Classification[5]
Perc	N/A	IV
Stoddard (hydrocarbon)	110°F	II
DF-2000 (hydrocarbon)	147°F	IIIA
PureDry[2] (hydrocarbon)	350°F	IIIB/IIIA
Shell 140 (hydrocarbon)	>143°F	IIIA
EcoSolv (hydrocarbon)	>140°F	IIIA
Rynex 3	>200°F	IIIB
GreenEarth[3]	170°F	IIIA
CO_2[4]	N/A	N/A

1. Source: Material Safety Data Sheet, unless otherwise noted.
2. Dry cleaners and vendors have reported that the flash point can decline to the 140°F range during use because of the perfluorocarbon that is in the Pure Dry mixture. If this is the case, it is classified as a IIIA solvent.
3. Source: Cleaners Family, Volume 4.
4. The detergent mixture used as a supplement with the CO_2 solvent is a hydrocarbon and is classified as a IIIA solvent, but when used together with the CO_2 it is not considered a fire hazard.
5. Source: UCSD, 2005.

G. Potential Energy Usage Impacts

According to a report prepared by Jacobs Engineering for the City of Los Angeles, the overall amount of electricity used by a shop running either a new Perc system or a solvent-based technology (hydrocarbon, GreenEarth, Rynex 3) is about 1,100 Kilowatt-hour (kWh) per month. For water-based technologies, tests conducted by the Pollution Prevention Education and Research Center (PPERC) at a facility that switched from Perc to professional wet cleaning found a reduction in electricity use (to approximately 600 kWh per month). The CO_2 system requires a 70 to 150-amp service to operate the refrigeration system necessary to maintain the CO_2 in a liquid state. Peak load for the pumps and compressor could be up to 20 kWh. This is twice the peak load reported for the other alternative technologies and it could result in increased peak load demand charges. Therefore, the assumption is made that a CO_2 shop will utilize 30 percent more power than a shop using Perc. Based on available information, Table VIII-2 shows monthly energy usage for Perc dry cleaning and alternatives (JE, 2004).

Table VIII-2. Estimated Monthly Electricity Usage[1]

Process	Electricity Usage (kWh)
Perc	1,100
DF-2000	1,100
GreenEarth	1,100
Wet Cleaning	600
CO_2	1,430

1. Source: JE, 2004.

More recently, staff conducted a phone survey of multiple dry cleaning facilities for each technology type to better assess current gas and electricity costs for typical Perc and alternative technology dry cleaning facilities. Because of overlaps in the cost ranges of both the gas and electricity costs regardless of technology type, a statistical analysis (analysis of variance) was done to determine whether the resulting averages properly represent each technology type. The analysis of variance results showed that the data do not demonstrate systematic differences in the energy requirements for the different technologies. Therefore, it is reasonable and appropriate to assume that the energy usage in the different technologies do not appear to be much different.

H. Potential Air Pollution Impacts

1. Impacts on VOC Emissions and Global Warming

Ground level ozone formation requires the mixing of ozone-forming chemicals, also known as VOCs, with nitrogen oxides and sunlight. Any reduction in VOC emissions is expected to provide a beneficial environmental impact on air quality by reducing ozone formation. Since the proposed amended ATCM will phase out Perc dry cleaning machines, there may be an increase in the use of solvents that contain VOCs. The hydrocarbon solvents, as well as the Rynex 3 solvent, used in the dry cleaning industry are classified as VOCs. An increase in the usage of these solvents may cause an adverse environmental impact. If we assume, as a result of the South Coast Rule and full implementation of the proposed amendments to the Dry Cleaning ATCM, in a worse-case scenario where all of the Perc dry cleaning machines convert to hydrocarbon solvents, there would be a total significant increase of about 1.2 tons per day of VOCs statewide. Although the State would see this significant increase in VOCs, the South Coast Rule and the proposed amendments would also lead to 3.0 tons per day reduction in Perc emissions statewide at full implementation.

Greenhouse gases, which alter the amount of heat, or infrared radiation, that can escape the Earth's surface, have been linked to a gradual warming of the Earth's surface and lower atmosphere. While CO_2 has been the traditional focus of greenhouse gas concerns, the CO_2 used in the dry cleaning process is an industrial by-product from other industrial operations and contributes a nominal amount to global warming. In the United States, the largest source of greenhouse gas emissions is from fossil fuel combustion, which accounted for approximately 84 percent of greenhouse emissions in 2005 (USDE, 2006).

2. Impacts on the State Implementation Plan for Ozone

The Federal Clean Air Act amendments of 1990 require an ozone attainment plan from every state unable to meet the national ambient air quality standard for ozone. California's State Implementation Plan (SIP) for ozone fulfills this requirement. State law provides ARB the legal authority to develop regulations affecting a variety of mobile sources, fuels, and consumer products. The regulations that have already been adopted and measures proposed for adoption constitute ARB's portion of the SIP. The SIP serves as a road map to guide California to attain and maintain the national ambient air quality standard for ozone.

On October 23, 2003, the ARB adopted the Proposed 2003 State and Federal Strategy for the California SIP, 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. It also sets into motion a concurrent initiative to identify longer-term solutions to achieve the full scope of emissions reductions needed to meet federal air quality standards in the South Coast and San Joaquin Valley.

On June 15, 2004, the new eight-hour ozone standards became effective, causing a transition from the one-hour ozone standard, 0.12 ppm, to the more health-protective eight-hour ozone standard, 0.08 ppm (averaged over 8 hours). Strategies to meet this new standard will be due in 2007. ARB expects that California will need to reduce emissions beyond the existing commitments.

In the updated California SIP, Perc is not considered a VOC; therefore, if a VOC-based dry cleaning technology is substituted for Perc dry cleaning under the proposed ATCM amendments, we expect an increase of approximately 0.7 tons per day of VOCs outside of the South Coast. This shortfall will need to be addressed in the next comprehensive revisions of the California SIP.

In December 2002, the South Coast AQMD adopted amendments to its Perc dry cleaning rule. Based on these amendments the South Coast AQMD staff estimated that the more likely scenario would result in an average increase in VOC emissions of 0.8 tons per day in the South Coast in 2018.

As a result of both the South Coast AQMD adopted Rule and the proposed ARB Dry Cleaning ATCM amendments the expected increase statewide of VOC's would be 1.2 tons per day.

3. Workplace Exposure

The CAL/OSHA regulates the concentration of many toxic air contaminants and VOCs in the workplace environment through the establishment of PELs. The PEL is the maximum, eight-hour, time-weighted average concentration for occupational exposure based on indoor workplace exposures which are typically higher than outside ambient exposures. CAL/OSHA has established a PEL for several of the dry cleaning compounds. Perc has a PEL of 25 ppm and Stoddard has a PEL of 100 ppm. Although the remaining solvents do not have PELs, Table VIII-3 gives a summary of any known acute and chronic health impacts. The ARB staff expects a near 100 percent reduction of Perc emissions in the workplace due to the proposed amended Dry Cleaning ATCM requirements.

Table VIII-3. Potential Health Impacts and Permissible Exposure Limit (PEL)

Solvent	Acute	Chronic	PEL
Perc	central nervous system; irritation to eyes, skin, and respiratory tract	kidney, liver, and gastrointestinal system	25 ppm
Stoddard	central nervous system; irritation to eyes, skin, nose, and throat[1]	Unknown	100 ppm
DF2000	central nervous system; irritation to eyes, skin, and respiratory tract[2]	unknown	N/A
PureDry	central nervous system; irritation to eyes, skin, nose, throat, and respiratory tract[2]	unknown	N/A
EcoSolv	central nervous system; irritation to eyes, skin, and respiratory tract[2]	unknown	N/A
Shell 140	central nervous system; irritation to skin, nose, throat, and respiratory tract[2]	unknown	N/A
GreenEarth (D_5)	mild eye irritation	increase in liver weight[3]	N/A
Rynex 3	headaches; irritation to eyes, nose, and throat[1]	unknown	N/A
CO_2	irritation to skin and eyes,[4] frostbite[5]	unknown	N/A

1. Source: U.S. EPA, 1998.
2. Information taken from Material Safety Data Sheets.
3. CARB, 2006.
4. Due to exposure to detergents used with the CO_2 process.
5. Due to exposure to liquid CO_2.

4. Other Air Pollution Impacts

There is also evidence of phosgene formation from the photooxidation of chloroethylenes in air such as Perc and TCE. Phosgene is a byproduct of the thermal decomposition of chlorinated hydrocarbons such as Perc. Phosgene is a toxic, colorless, gas or volatile liquid with a suffocating odor that is similar to decaying fruit or moldy hay. It is slightly soluble in water and freely soluble in benzene, toluene, glacial acetic acid, chloroform, and most liquid hydrocarbons. Phosgene is noncombustible but can decompose into hydrochloric acid (HCl) and CO_2 when wetted. As a result, wet phosgene is corrosive and poses an additional hazard from pressure buildup in closed containers. The density of phosgene is more than three times that of air, which means that its concentrated emission plumes tend to settle to the ground and collect in low areas. Phosgene is listed as a TAC and a federal HAP (ARB, 2000).

The acute non-cancer affects of phosgene are of the most concern. Phosgene is extremely irritating to the lungs, and can cause severe respiratory effects, including pulmonary edema. Symptoms of acute exposure include choking, chest constriction, coughing, painful breathing, and bloody sputum. Acute phosgene poisoning may affect the heart, brain, and blood. Symptoms may be delayed up to 24 hours after exposure. Chronic inhalation exposure has been shown to result in some tolerance to acute effects noted in humans, but irreversible emphysema and pulmonary fibrosis may occur. The U.S. Occupational Safety and Health Administration (OSHA) also list a PEL of 0.1 ppm.

The implementation of the proposed amended ATCM will nearly eliminate the potential for phosgene formation in the presence of flame or heat sources thereby extending a greater level of worker and public health protection and safety.

I. Reasonably Foreseeable Feasible Mitigation Measures

As previously discussed, ARB is required to do an analysis of reasonably foreseeable feasible mitigation measures. The ARB has determined that the only significant adverse environmental impact should occur in air pollution due to the expected increase in the use of solvents containing VOCs. ARB's plan to account for such VOC increases is discussed in Section H of this chapter.

J. Reasonably Foreseeable Alternative Means of Compliance with the Amended ATCM

The ARB is required to do an analysis of reasonably foreseeable alternative means of compliance with the ATCM. Alternatives to the proposed amended ATCM are discussed in Chapter II. Based on the discussion in Chapter II, ARB staff has concluded that implementation of the proposed amendments to the ATCM will nearly eliminate the public's exposure to Perc. The ATCM is enforceable with the least burdensome approach to eliminate public health impacts from Perc dry cleaning facilities.

K. Environmental Justice

ARB is committed to evaluating community impacts of proposed regulations including environmental justice concerns. Because some communities experience higher exposure to toxic pollutants, it is a priority of ARB to ensure that full protection is afforded to all Californians. The proposed ATCM is not expected to result in significant negative impacts in any community. The proposed ATCM is designed to eliminate emissions of Perc to residents and off-site workers living or working in communities near the affected facilities.

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Appendix A

Proposed Amended Regulation Order

Proposed Amendments to the Airborne Toxic Control Measure for Emissions of Perchloroethylene Associated With Dry Cleaning Operations And Proposed Adoption of Requirements for Manufacturers And Distributors of Perchloroethylene

PROPOSED REGULATION ORDER

PROPOSED AMENDMENTS TO THE AIRBORNE TOXIC CONTROL MEASURE FOR EMISSIONS OF PERCHLOROETHYLENE ASSOCIATED WITH DRY CLEANING OPERATIONS AND PROPOSED ADOPTION OF REQUIREMENTS FOR MANUFACTURERS AND DISTRIBUTORS OF PERCHLOROETHYLENE

Amend section 93109, title 17, California Code of Regulations, to read as follows:

[NOTE: Section 93109 is proposed for amendment. For ease of review, the amended text is shown in two parts: first as proposed new text, and second as proposed deleted text. Strikeout and underline have been omitted as authorized by title 2, California Code of Regulations, section 8.]

Section 93109. Airborne Toxic Control Measure for Emissions of Perchloroethylene from Dry Cleaning and Water-Repelling Operations.

(a) Purpose.

The purpose of this control measure is to phase-out the use of perchloroethylene (Perc) from dry cleaning and water-repelling operations. Eliminating these emissions will further protect the public health, especially for Californians who live or work near dry cleaning and water-repelling facilities.

(b) Applicability.

This section applies to any person who sells or distributes Perc to California dry cleaners or who sells, distributes, installs, owns, or operates dry cleaning equipment in California that uses any solvent that contains Perc.

(c) Severability.

Each part of this section is deemed severable, and in the event that part of this section is held to be invalid, the remainder of this section shall continue in full force and effect.

(d) Definitions. The definitions in Health and Safety Code division 26, part 1, chapter 1, commencing with section 39010, shall apply, with the following additions:

(1) *"Add-on secondary control machine"* means a closed-loop machine with a secondary control system that is designed or offered as a separate retrofit system for use on multiple machine makes and models.

(2) *"Adsorptive cartridge filter"* means a replaceable cartridge filter that contains diatomaceous earth or activated clay as the filter medium.

(3) *"Carbon adsorber"* means an air cleaning device that consists of an inlet for exhaust gases from a dry cleaning machine; activated carbon in the form of a fixed bed, cartridge, or canister, as an adsorbent; an outlet for exhaust gases; and a system to regenerate or reclaim saturated adsorbent.

(4) *"Cartridge filter"* means a replaceable cartridge filter that contains one of the following as the filter medium: paper, activated carbon, or paper and activated carbon. A cartridge filter contains no diatomaceous earth or activated clay. Cartridge filters include, but are not limited to: standard filters, split filters, "jumbo" filters, and all carbon polishing filters.

(5) *"Closed-loop machine"* means dry cleaning equipment in which washing, extraction, and drying are all performed in the same single unit (also known as dry-to-dry) and which recirculates Perc-laden vapor through a primary control system with or without a secondary control system with no exhaust to the atmosphere during the drying cycle. A closed-loop machine may allow for venting to the ambient air through a fugitive control system after the drying cycle is complete and only while the machine door is open. A closed-loop machine includes a primary control machine, an add-on secondary control machine, or an integral secondary control machine.

(6) *"Co-residential"* means sharing a common wall, floor, or ceiling with a residence or located within the same building.

(7) *"Contact information"* means name, mailing address, facility location, phone number, and if applicable, email address and fax number.

(8) *"Converted machine"* means an existing vented machine that has been modified to be a closed-loop machine by eliminating the aeration step, installing a primary control system, and providing for recirculation of the Perc-laden vapor with no exhaust to the atmosphere or workroom during the drying cycle. A converted machine may allow for venting to the ambient air through a fugitive control system after the drying cycle is complete and only while the machine door is open.

(9) *"Cool-down"* means the portion of the drying cycle that begins when the heating mechanism deactivates and the refrigerated condenser continues to reduce the temperature of the air recirculating through the drum to reduce the concentration of Perc in the drum.

(10) *"Desorption"* means regeneration of an activated carbon bed, or any other type of vapor adsorber by removal of the adsorbed solvent using hot air, steam, or other means.

(11) *“Dip tank operations"* means the immersion of materials in a solution that contains Perc, for purposes other than dry cleaning, in a tank or container that is separate from the dry cleaning equipment.

(12) *“District”* means an air pollution control or air quality management district as defined in Health and Safety Code section 39025.

(13) *"Drum"* means the rotating cylinder or wheel of the dry cleaning machine that holds the materials being cleaned.

(14) *"Dry cleaning"* means the process used to remove soil, greases, paints, and other unwanted substances from materials with Perc.

(15) *"Dry cleaning equipment"* means any machine, device, or apparatus that uses Perc to dry clean materials or to remove residual solvent from previously cleaned materials. Dry cleaning equipment may include, but is not limited to a transfer machine, a vented machine, a self-service machine, a converted machine, a closed-loop machine, a reclaimer, a drying cabinet, or a dip tank.

(16) *"Dry cleaning machine"* means any dry cleaning equipment that is used to dry clean materials. A dry cleaning machine may include, but is not limited to a transfer machine, a vented machine, a self-service machine, or a closed-loop machine.

(17) *"Dry cleaning system"* means all of the following equipment, devices, or apparatus associated with any dry cleaning process: dry cleaning equipment; filter or purification systems; waste holding, treatment, or disposal systems; solvent supply systems; dip tanks; pumps; gaskets; piping, ducting, fittings, valves, or flanges that convey Perc vapors; and control systems.

(18) *"Drying cabinet"* means a housing in which materials previously cleaned with Perc are placed to dry and which is used only to dry materials that would otherwise be damaged by the heat and tumbling action of the drying cycle.

(19) *"Drying cycle"* means the process used to actively remove the Perc remaining in the materials after washing and extraction. For closed-loop machines, the heated portion of the cycle is followed by cool-down and may be extended beyond cool-down by the activation of a control system. The drying cycle begins when heating coils are activated and ends when the machine ceases rotation of the drum for a converted or primary control machine, or at the end of the adsorption cycle for a secondary control machine.

(20) *"Environmental training program"* means an initial course or a refresher course of the environmental training program for Perc dry cleaning operations that has been authorized by the Air Resources Board according to the requirements of title 17, California Code of Regulations, section 93110.

(21) *"Existing facility"* means any facility that operated dry cleaning equipment prior to January 1, 2008.

(22) *"Facility"* means an establishment where dry cleaning equipment is operated.

(23) *"Fugitive control system"* means a device or apparatus that collects fugitive Perc vapors from the machine door, button and lint traps, still, or other intentional openings of the dry cleaning equipment and routes those vapors to a device that reduces the mass of Perc prior to exhaust of the vapor to the atmosphere.

(24) *"Gallons of perchloroethylene purchased"* means the volume of Perc, in gallons, purchased for use with the dry cleaning equipment.

(25) *"Halogenated-hydrocarbon detector"* means a portable device capable of detecting vapor concentrations of Perc of 25 ppmv or less and indicating an increasing concentration by emitting an audible signal or visual indicator that varies as the concentration changes.

(26) *"Integral secondary control machine"* means a closed-loop machine that is designed and offered with an integral secondary control system.

(27) *"Integral secondary control system"* means a carbon adsorber, or an equivalent device that is designed and offered as an integral part of a production package with a specific make and model of dry cleaning machine and primary control system.

(28) *"Liquid leak"* means a leak of liquid containing Perc of more than 1 drop every 3 minutes.

(29) *"Materials"* means wearing apparel, draperies, linens, fabrics, textiles, rugs, leather, and other goods that are dry cleaned.

(30) *"Muck cooker"* means a device for heating Perc-laden waste material to volatilize and recover Perc.

(31) *"New distributor"* means any person who begins the sale of Perc, directly or indirectly, to dry cleaners in California after January 1, 2008.

(32) *"New facility"* means a facility that did not operate any dry cleaning equipment prior to January 1, 2008. Facilities that are relocated to another district shall be considered new facilities for the purposes of this control measure.

(33) *"Perc distributor"* means any person who, directly or indirectly, sells Perc or recycled Perc to California dry cleaners.

(34) *"Perc manufacturer"* means any person who produces and sells Perc for use in California.

(35) *"Perchloroethylene (Perc)"* means the substance with the chemical formula 'C_2Cl_4', also known by the name 'tetrachloroethylene', which has been identified by the Air Resources Board and listed as a toxic air contaminant in title 17, California Code of Regulations, section 93000.

(36) *"Pounds of materials cleaned per load"* means the total dry weight, in pounds, of the materials in each load dry cleaned at the facility, as determined by weighing each load on a scale prior to dry cleaning and recording the value.

(37) *"Primary control machine"* means a closed loop machine used for dry cleaning that is equipped with a primary control system.

(38) *"Primary control system"* means a refrigerated condenser, or an equivalent closed-loop vapor recovery system that reduces the concentration of Perc in the recirculating air.

(39) *"Reasonably available"*, as it applies to a course for the environmental training program, means that the course is offered within 200 miles of the district boundaries and that all such courses have a capacity, in the aggregate, that is adequate to accommodate at least one person from each facility in the district required to certify a trained operator at that time.

(40) *"Reclaimer"* means a machine, device, or apparatus used only to remove residual Perc from materials that have been previously cleaned in a separate piece of dry cleaning equipment.

(41) *"Recycled Perc"* means Perc solvent that is recovered after initial use.

(42) *"Refrigerated condenser"* means a closed-loop vapor recovery system into which Perc vapors are introduced and recovered by cooling below the dew point of the Perc.

(43) *“Relocated facilities”* means a facility that moves from one location to another location within the boundaries of the same district.

(44) *"Remove from service"* means remove from the facility or render the dry cleaning equipment inoperable.

(45) *“Residence”* means any dwelling or housing which is owned, rented, or occupied by the same person for a period of 180 days or more, excluding short-term housing such as a motel or hotel room rented and occupied by the same person for a period of less than 180 days.

(46) *"Secondary control system"* means a device or apparatus (typically a carbon adsorber), that reduces the concentration of Perc in the recirculating air at the end of the drying cycle beyond the level achievable with a refrigerated condenser alone.

(47) *“Self-service machine”* means a dry cleaning machine that is loaded, activated, or unloaded by the customer.

(48) *"Separator"* means any device used to recover Perc from a water-Perc mixture.

(49) *“Solvent”* means a liquid substance other than water used in dry cleaning equipment.

(50) *"Trained operator"* means the owner, the operator, or an employee of the facility, who holds a record of completion for the initial course of an environmental training program and maintains her/his status by successfully completing the refresher courses as required.

(51) *"Transfer machine"* means a combination of dry cleaning equipment in which washing and extraction are performed in one unit and drying is performed in a separate unit.

(52) *"Vapor adsorber"* means a bed of activated carbon or other adsorbent into which Perc vapors are introduced and trapped for subsequent desorption.

(53) *"Vapor leak"* means an emission of Perc vapor from unintended openings in the dry cleaning system, as indicated by a rapid audible signal or visual signal from a halogenated-hydrocarbon detector or a concentration of Perc exceeding 50 ppmv as Perc as indicated by a portable analyzer.

(54) *"Vented machine"* means dry cleaning equipment in which washing, extraction, and drying are all performed in the same single unit and in which fresh air is introduced into the drum in the last step of the drying cycle and exhausted to the atmosphere, either directly or through a control device.

(55) *"Wastewater treatment unit"* means a device that treats Perc-contaminated wastewater through the addition of thermal or chemical energy, or through physical action, such as carbon or another type of adsorbent filtration system.

(56) *"Water-repelling operations"* means the treatment of materials with a Perc-containing solution for the purpose of making the material water resistant or water-repelling.

(57) *"Workday"* means any consecutive 24-hour period commencing at the same time each calendar day as defined in California Labor Code section 500(a).

(e) Prohibitions.

(1) No person shall sell, offer for sale, or initiate a new lease of any Perc dry cleaning machine for use in California on or after January 1, 2008.

(2) Transfer, vented, and self service Perc machines shall remain prohibited as they have been since November 1998.

(f) Requirements for New Facilities.

No person shall install or operate any Perc dry cleaning machine or engage in Perc water-repelling operations at a new facility on or after January 1, 2008.

(g) Relocated Facilities.

Upon approval by the district, existing facilities may relocate their Perc dry cleaning equipment for the purpose of moving from one location to another location within the boundaries of the same district.

(h) Requirements for Existing Facilities. The owner/operator of each existing facility shall meet the following applicable requirements as follows and as shown in Table 1.

(1) By January 1, 2008, drying cabinets and dip tanks shall not be used for Perc dry cleaning.

(2) By July 1, 2010, existing facilities shall remove from service all Perc converted machines.

(3) By July 1, 2010, existing facilities shall remove from service all Perc dry cleaning machines at co-residential locations.

(4) By July 1, 2010, or 15 years after the date of manufacture, whichever comes later, existing facilities shall remove from service all Perc closed-loop machines including primary control, add-on secondary control, and integral secondary control machines. If the age of the machine cannot be obtained, the machine shall be removed from service by July 1, 2010.

(5) By January 1, 2023, existing facilities shall remove from service all Perc dry cleaning machines, if not required to be removed from service earlier.

(i) Required Good Operating Practices. No person shall operate Perc dry cleaning equipment unless all of the following requirements are met:

(1) *Environmental training requirements*. Each Perc facility shall have one or more trained operators.

(A) A trained operator shall be the owner, the operator, or another employee of the facility, who successfully completes the initial course of an environmental training program to become a trained operator. Evidence of successful completion of the initial course shall be the original record of completion issued pursuant to title 17, California Code of Regulations, Section 93110.

(B) The trained operator shall be on site while the dry cleaning equipment is in operation.

(C) Each trained operator shall successfully complete the refresher course of an environmental training program at least once every three years. Evidence of successful completion of each refresher course shall be the date of the course and the instructor's signature on the original record of completion.

(D) If the Perc facility has only one trained operator and the trained operator leaves the employ of the facility, the facility shall:

1. Notify the district in writing within 15 days of the departure of the trained operator; and

2. Obtain certification for a replacement trained operator within 3 months.

3. If the district determines that the initial course of an environmental training program is not reasonably available,

the district may extend the certification period for a replacement trained operator until 1 month after the course is reasonably available.

(2) *Operation and maintenance requirements*. The trained operator shall operate and maintain all components of the Perc dry cleaning system in accordance with the requirements of this section and the conditions specified in the facility's operating permit. For operations not specifically addressed, the components shall be operated and maintained in accordance with the manufacturer's recommendations.

(A) The district shall provide an operation and maintenance checklist to the Perc facility. Each operation and maintenance function and the date performed shall be recorded on the checklist. The operation and maintenance checklist shall include, at a minimum, the following requirements:

1. Refrigerated condensers shall be operated to ensure that exhaust gases are recirculated until the air-vapor stream temperature on the outlet side of the refrigerated condenser, downstream of any bypass, is less than or equal to 45ºF (7.2ºC).

i. Refrigerated condensers shall have a graduated or digital thermometer with a minimum range from 0ºF (-18ºC) to 150ºF (66ºC), which measures the temperature of the outlet vapor stream, downstream of any bypass of the condenser, and is easily visible to the operator.

2. Vapor adsorbers used as a primary control system or a secondary control system shall be operated to ensure that exhaust gases are recirculated at the temperature specified by the district, based on the manufacturer's recommendations for optimum adsorption. These vapor adsorbers shall be desorbed according to the conditions specified by the district in the facility's operating permit, including a requirement that no Perc vapors shall be routed to the atmosphere during routine operation or desorption.

3. Cartridge filters and adsorptive cartridge filters shall be handled using one of the following methods:

i. Drained in the filter housing, before disposal, for no less than: 24 hours for cartridge filters and 48 hours for adsorptive cartridge filters. If the filters are then transferred to a separate device to further reduce the volume of Perc, this treatment shall be done in a system that routes any vapor to a primary control system, with no exhaust to the atmosphere or workroom; or

ii. Dried, stripped, sparged, or otherwise treated, within the sealed filter housing, to reduce the volume of Perc contained in the filter.

4. A still, and any muck cooker, shall not exceed 75 percent of its capacity, or an alternative level recommended by the manufacturer. A still, and any muck cooker, shall cool to 100ºF (38ºC) or less before emptying or cleaning.

5. Button and lint traps shall be cleaned and inspected for damage each workday and the lint placed in a tightly sealed container.

6. The facility owner/operator shall keep on site a spare set of gaskets for the loading door, still, lint trap, button trap, and water separator.

7. The facility owner/operator shall keep on site a spare lint filter.

8. All parts of the dry cleaning system where Perc may be exposed to the atmosphere or workroom shall be kept closed at all times except when access is required for proper operation and maintenance.

9. Wastewater treatment units shall be operated to ensure that no liquid Perc or visible emulsion is allowed to vaporize.

10. Carbon adsorbers in secondary control machines must be stripped or desorbed in accordance with manufacturer's instructions or at least weekly, whichever is more frequent.

(3) *Leak check and repair requirements*. The trained operator shall inspect the Perc dry cleaning system for vapor leaks. The district shall provide a leak inspection checklist to the Perc facility. The trained operator shall record the status of each component on the checklist.

(A) *Weekly Leak Checks*. The Perc dry cleaning system shall be inspected at least once per week for both liquid leaks and vapor leaks, using one of the following techniques:

1. A halogenated-hydrocarbon detector; or

2. A portable gas analyzer or an alternative method approved by the district.

(B) *Annual Leak Checks*. The Perc dry cleaning system shall be inspected at least once per calendar year for liquid and vapor leaks using a portable detector which gives quantitative results with less than ten (10) percent uncertainty at 50 ppmv of Perc. Upon request, a district may approve an annual leak check extension of 12 months or less.

(C) Any liquid leak or vapor leak that has been detected by the operator shall be noted on the checklist and repaired according to the requirements of this subsection. If the leak is not repaired at the time of detection, the leaking component shall be physically marked or tagged in a manner that is readily observable by a district inspector.

(D) Any liquid leak or vapor leak detected by the district, which has not been so noted on the checklist and marked on the leaking component of the dry cleaning system, shall constitute a violation of this section. For enforcement purposes, the district shall identify the presence of a vapor leak by determining the concentration of Perc with a portable analyzer according to ARB Test Method 21 (title 17, California Code of Regulations, section 94124).

(E) Any liquid leak or vapor leak shall be repaired immediately upon detection. For the purposes of this section a business day shall mean Monday through Friday, except holidays, as provided in Government Code of Regulation section 6700 and following.

1. If repair parts are not available at the facility, the parts shall be ordered within the next business day of detecting such a leak. Such repair parts shall be installed within two business days after receipt. A facility with a leak that has not been repaired by the end of the 7^{th} business day after detection shall not operate the dry cleaning machine, until the leak is repaired, without a leak-repair extension from the district.

2. A district may grant a leak-repair extension to a facility, for a single period of 30 days or less, if the district makes the following findings:

i. The delay in repairing the leak could not have been avoided by action on the part of the facility;

ii. The facility used reasonable preventive measures and acted promptly to initiate the repair;

iii. The leak would not significantly increase exposure to Perc near the facility; and

iv. The facility is in compliance with all other requirements of this section and has a history of compliance.

(j) Recordkeeping Requirements.

(1) The following records shall be retained by all Perc facilities for at least 5 years:

(A) For each dry cleaning machine, a log showing the date and the pounds of materials cleaned per load;

(B) Purchase and delivery receipts for the dry cleaning solvent indicating the volume in gallons;

(C) For add-on or integral secondary control machine operations: the start time and finish time of each regeneration; and the temperature of chilled air on the outlet side of the refrigerated condenser;

(D) The operation and maintenance checklists required by subsection (i)(2)(A) and the completed leak inspection checklists required by subsection (i)(3); and

(E) For liquid leaks or vapor leaks that were not repaired at the time of detection, a record of the leaking component(s) of the dry cleaning system awaiting repair and the action(s) taken to complete the repair. The record shall include copies of purchase orders or other written records showing when the repair parts were ordered and/or service was requested.

(2) The manufacturer's operating manual for all components of the dry cleaning system shall be retained for the life of the equipment.

(3) The original record of completion of the environmental training program for each trained operator shall be retained during the employment of that person. A copy of the record of completion shall be retained for an additional period of two years beyond the separation of that person from employment at the facility.

(4) All records, or copies thereof, shall be maintained in English and shall be accessible at the facility at all times.

(k) Reporting Requirements.

(1) The owner or operator of each Perc facility shall prepare an annual report which covers the period of January 1 through December 31 of each year. The facility owner or operator shall furnish this annual report to the district by the date specified by the district. The annual report shall include the following information:

(A) A copy of the record of completion of the environmental training program for each trained operator;

(B) The total of the pounds of materials cleaned;

(C) The gallons of solvent purchased in the reporting period;

(D) The make, model, serial number, and date of manufacture of the dry cleaning machine;

(2) A district may exempt a source from subsection (k)(1) if the district maintains current equivalent information on the facility.

(l) Water-repelling Operations.

No person shall perform Perc water-repelling operations unless all materials are treated in a converted, primary control, add-on secondary control, or integral secondary control machine. The machines used shall comply with the prohibitions and requirements in subsections (e), (f), (g), and (h).

(m) Violations.

Any violation of this section may carry civil or administrative penalties as specified in state law and regulation, including, but not limited to, a penalty of up to $10,000 for each day in which the violation occurs under Health and Safety Code section 39674.

NOTE: Authority cited: Sections 39600, 39601, 39650, 39655, 39656, 39658, 39659, 39665 and 39666, Health and Safety Code; Sections 7412 and 7416, Title 42, United States Code.

Reference: Sections 39650, 39655, 39656, 39658, 39659, ~~and~~ 39666, and 39674, Health and Safety Code; Sections 7412 and 7414, Title 42, United States Code; and Sections 63.14, 63.99, 63.320, 63.321, 63.322, 63.323 and 63.324, Title 40, Code of Federal Regulation.

Table 1. Summary of Perc Equipment Compliance Times for Existing Facilities

FACILITY OR EQUIPMENT TYPE	DATE OF COMPLIANCE[1]
Drying Cabinet, or Dip Tank	January 1, 2008
Converted Machine	July 1, 2010
Dry Cleaning Machines at Co-residential Facility	July 1, 2010
Closed-loop Machines: Primary Control Machine; Add-on Secondary Control Machine; or Integral Secondary Control Machine	July 1, 2010 or 15 years after the date of manufacture, whichever comes later. July 1, 2010 if age of machine cannot be determined.
All Perc Dry Cleaning Machines	January 1, 2023

1. Final date(s) by which equipment shall be removed from service or use.

Adopt section 93109.1, title 17, California Code of Regulations, to read as follows:

Section 93109.1. Requirements for Perc Manufacturers.

(a) Recordkeeping Requirement.

Perc manufacturers shall keep monthly sales records (with invoices) of the gallons of Perc sold for use in dry cleaning in California. These records shall be retained for at least 5 years and shall be made available to ARB or the district upon request.

(b) Reporting Requirement.

By January 1, 2008, Perc manufacturers shall report to ARB contact information for all their distributors who sell Perc for use in dry cleaning in California. If there are changes to their list of distributors, Perc manufacturers shall report the change(s) to ARB within 30 calendar days after the change has occurred.

(c) Violations.

Any violation of this section may carry civil or administrative penalties as specified in state law and regulation, including, but not limited to, a penalty of not more than $35,000 under Health and Safety Code section 42402.4.

(d) The provision of title 17, California Code of Regulation, section 93109, paragraphs (a), (b), (c), and (d) shall apply to this section.

NOTE: Authority cited: Sections 39600, 39601 and 41998, Health and Safety Code.

Reference: Sections 41998 and 42402.4, Health and Safety Code.

Adopt section 93109.2, title 17, California Code of Regulations, to read as follows:

Section 93109.2. Requirements for Perc Distributors.

(a) Recordkeeping Requirements.

(1) The following records shall be retained for at least 5 years and shall be made available to the ARB or the district upon request.

(A) For each dry cleaning facility, Perc distributors shall keep monthly sales records (with invoices) of the gallons of Perc and recycled Perc sold for use in dry cleaning in California.

(B) Perc distributors shall keep monthly purchase records (with invoices) of the gallons of Perc purchased for use in dry cleaning in California.

(C) Perc distributors shall keep contact information for each California dry cleaner that purchased Perc and recycled Perc.

(D) Perc distributors shall keep contact information for all their distributors who sell Perc and recycled Perc in California.

(b) Reporting Requirements.

(1) By January 1, 2008, Perc distributors shall report to ARB their contact information and, if applicable, the contact information for all their distributors who sell Perc and recycled Perc in California.

(2) Perc distributors shall report to ARB any change(s) in their contact information reported under (b)(1) above within 30 calendar days.

(3) By January 31 of each year, Perc distributors shall report to ARB the annual gallons of Perc and recycled Perc sold to California dry cleaners from January 1 through December 31 of the previous year.

(c) No later than 30 days after the issuance of an invoice from ARB, Perc distributors shall pay fees, based on the fee invoice schedule shown in Table 2.

(d) Violations.

Any violation of this section may carry civil or administrative penalties as specified in state law and regulation, including, but not limited to, a penalty of not more than $35,000 under Health and Safety Code section 42402.4.

(e) The provision of title 17, California Code of Regulation, section 93109, paragraphs (a), (b), (c), and (d) shall apply to this section.

NOTE: Authority cited: Sections 39600, 39601 and 41998, Health and Safety Code.

Reference: Sections 41998 and 42402.4, Health and Safety Code.

Table 2. Perc Fee Invoice Schedule

Year	Perc Fee per Gallon Sold (in U.S. Dollars)	Invoice Cycle	Approximate Invoice Date
2004	$3.00	August 16, 2004 *through* December 31, 2004	January 2005
2005	$4.00	January 1, 2005 *through* June 30, 2005	July 2005
		July 1, 2005 *through* December 31, 2005	January 2006
2006	$5.00	January 1, 2006 *through* December 31, 2006	January 2007
2007	$6.00	January 1, 2007 *through* December 31, 2007	February 2008
2008	$7.00	January 1, 2008 *through* December 31, 2008	February 2009
2009	$8.00	January 1, 2009 *through* December 31, 2009	February 2010
2010	$9.00	January 1, 2010 *through* December 31, 2010	February 2011
2011	$10.00	January 1, 2011 *through* December 31, 2011	February 2012
2012	$11.00	January 1, 2012 *through* December 31, 2012	February 2013
2013	$12.00	January 1, 2013 *through* December 31, 2013	February 2014
2014-2022	$12.00	January 1, 2014 *through* December 31, 2014, and each subsequent calendar year *through* 2022	February 2015 and each February thereafter *through* February 2023

FINAL REGULATION ORDER

AIRBORNE TOXIC CONTROL MEASURE FOR
EMISSIONS OF PERCHLOROETHYLENE FROM
DRY CLEANING OPERATIONS

APPROVED BY THE OFFICE OF ADMINISTRATIVE LAW ON MAY 4, 1994

CONTENTS

FINAL REGULATION ORDER

AIRBORNE TOXIC CONTROL MEASURE FOR EMISSIONS OF PERCHLOROETHYLENE FROM DRY CLEANING OPERATIONS

Adopt new section 93109, Titles 17 and 26, California Code of Regulation, to read as follows:

17 CCR, Section 93109. Perchloroethylene Airborne Toxic Control Measure--Dry Cleaning Operations.

(a) Definitions. For the purposes of this section, the following definitions shall apply:

(1) "Adsorptive cartridge filter" means a replaceable cartridge filter that contains diatomaceous earth or activated clay as the filter medium.

(2) "Cartridge filter" means a replaceable cartridge filter that contains one of the following as the filter medium: paper, activated carbon, or paper and activated carbon. A cartridge filter contains no diatomaceous earth or activated clay. Cartridge filters include, but are not limited to: standard filters, split filters, "jumbo" filters, and all carbon polishing filters.

(3) "Closed-loop machine" means dry cleaning equipment in which washing, extraction, and drying are all performed in the same single unit (also known as dry-to-dry) and which recirculates perchloroethylene-laden vapor through a primary control system with no exhaust to the atmosphere during the drying cycle. A closed-loop machine may allow for venting to the ambient air through a fugitive control system after the drying cycle is complete and only while the machine door is open.

(4) "Co-located with a residence" means sharing a common wall, floor, or ceiling with a residence. For the purposes of this definition, "residence" means any dwelling or housing which is owned, rented, or occupied by the same person for a period of 180 days or more, excluding short-term housing such as a motel or hotel room rented and occupied by the same person for a period of less than 180 days.

(5) "Converted machine" means an existing vented machine that has been modified to be a closed-loop machine by eliminating the aeration step, installing a primary control system, and providing for recirculation of the perchloroethylene-laden vapor with no exhaust to the atmosphere or workroom during the drying cycle. A converted machine may allow for venting to the ambient air through a fugitive control system after the drying cycle is complete and only while the machine door is open.

(6) "Cool-down" means the portion of the drying cycle that begins when the heating mechanism deactivates and the refrigerated condenser continues to reduce the

temperature of the air recirculating through the drum to reduce the concentration of perchloroethylene in the drum.

(7) "Date of compliance" means the time from the effective date of this control measure in the district until a facility must be in compliance with the specific requirements of this control measure.

(8) "Desorption" means regeneration of an activated carbon bed, or any other type of vapor adsorber by removal of the adsorbed solvent using hot air, steam, or other means.

(9) "Dip tank operations" means the immersion of materials in a solution that contains perchloroethylene, for purposes other than dry cleaning, in a tank or container that is separate from the dry cleaning equipment.

(10) "District" means the local air pollution control district or air quality management district.

(11) "Drum" means the rotating cylinder or wheel of the dry cleaning machine that holds the materials being cleaned.

(12) "Dry cleaning equipment" means any machine, device, or apparatus used to dry clean materials with perchloroethylene or to remove residual perchloroethylene from previously cleaned materials. Dry cleaning equipment may include, but is not limited to, a transfer machine, a vented machine, a converted machine, a closed-loop machine, a reclaimer, or a drying cabinet.

(13) "Dry cleaning system" means all of the following equipment, devices, or apparatus associated with the perchloroethylene dry cleaning process: dry cleaning equipment; filter or purification systems; waste holding, treatment, or disposal systems; perchloroethylene supply systems; dip tanks; pumps; gaskets; piping, ducting, fittings, valves, or flanges that convey perchloroethylene-contaminated air; and control systems.

(14) "Drying cabinet" means a housing in which materials previously cleaned with perchloroethylene are placed to dry and which is used only to dry materials that would otherwise be damaged by the heat and tumbling action of the drying cycle.

(15) "Drying cycle" means the process used to actively remove the perchloroethylene remaining in the materials after washing and extraction. For closed-loop machines, the heated portion of the cycle is followed by cool-down and may be extended beyond cool-down by the activation of a control system. The drying cycle begins when heating coils are activated and ends when the machine ceases rotation of the drum.

(16) "Environmental training program" means an initial course or a refresher course of the environmental training program for perchloroethylene dry cleaning operations that has been authorized by the Air Resources Board according to the requirements of 17 CCR, Section 93110.

(17) "Equivalent closed-loop vapor recovery system" means a device or combination of devices that achieves, in practice, a perchloroethylene recovery performance equal to or exceeding that of refrigerated condensers.

(18) "Existing facility" means any facility that operated dry cleaning equipment prior to the effective date of this control measure in the district. Facility relocations, within the same district, shall be considered existing facilities for the purposes of this control measure.

(19) "Facility" means any entity or entities which: own or operate perchloroethylene dry cleaning equipment, are owned or operated by the same person or persons, and are located on the same parcel or contiguous parcels.

(20) "Facility mileage" means the efficiency of perchloroethylene use at a facility, expressed as the pounds of materials cleaned per gallon of perchloroethylene used, and calculated for all dry cleaning machines at the facility over a specified time period.

(21) "Fugitive control system" means a device or apparatus that collects fugitive perchloroethylene vapors from the machine door, button and lint traps, still, or other intentional openings of the dry cleaning system and routes those vapors to a device that reduces the mass of perchloroethylene prior to exhaust of the vapor to the atmosphere.

(22) "Full-time employee" means any person who is employed at the dry cleaning facility and averages at least 30 hours per week in any 90-day period.

(23) "Gallons of perchloroethylene used" means the volume of perchloroethylene, in gallons, introduced into the dry cleaning equipment, and not recovered at the facility for reuse on-site in the dry cleaning equipment, over a specified time period.

(24) "Halogenated-hydrocarbon detector" means a portable device capable of detecting vapor concentrations of perchloroethylene of 25 ppmv or less and indicating an increasing concentration by emitting an audible signal or visual indicator that varies as the concentration changes.

(25) "Liquid leak" means a leak of liquid containing perchloroethylene of more than 1 drop every 3 minutes.

(26) "Materials" means wearing apparel, draperies, linens, fabrics, textiles, rugs, leather, and other goods that are dry cleaned.

(27) "Muck cooker" means a device for heating perchloroethylene-laden waste material to volatilize and recover perchloroethylene.

(28) "New facility" means a facility that did not operate any dry cleaning equipment prior to the effective date of this control measure in the district. Facility relocations, within the same district, shall not be considered new facilities for the purposes of this control measure.

(29) "Perceptible vapor leak" means an emission of perchloroethylene vapor from unintended openings in the dry cleaning system, as indicated by the odor of perchloroethylene or the detection of gas flow by passing the fingers over the surface of the system. This definition applies for an interim period of 18 months only, beginning on the effective date of this control measure in the district.

(30) "Perchloroethylene (Perc)" means the substance with the chemical formula 'C2Cl4', also known by the name 'tetrachloroethylene', which has been identified by the Air Resources Board and listed as a toxic air contaminant in 17 CCR, Section 93000.

(31) "Perchloroethylene dry cleaning" or "dry cleaning" means the process used to remove soil, greases, paints, and other unwanted substances from materials with perchloroethylene.

(32) "Pounds of materials cleaned per load" means the total dry weight, in pounds, of the materials in each load dry cleaned at the facility, as determined by weighing each load on a scale prior to dry cleaning and recording the value.

(33) "Primary control system" means a refrigerated condenser, or an equivalent closed-loop vapor recovery system approved by the district.

(34) "Reclaimer" means a machine, device, or apparatus used only to remove residual perchloroethylene from materials that have been previously cleaned in a separate piece of dry cleaning equipment.

(35) "Reasonably available", as it applies to an initial course for the environmental training program, means that the course is offered within 200 miles of the district boundaries and that all such courses have a capacity, in the aggregate, that is adequate to accommodate at least one person from each facility in the district required to certify a trained operator at that time.

(36) "Refrigerated condenser" means a closed-loop vapor recovery system into which perchloroethylene vapors are introduced and trapped by cooling below the dew point of the perchloroethylene.

(37) "Secondary control system" means a device or apparatus that reduces the concentration of perchloroethylene in the recirculating air at the end of the drying

cycle beyond the level achievable with a refrigerated condenser alone. An "integral" secondary control system is designed and offered as an integral part of a production package with a single make and model of dry cleaning machine and primary control system. An "add-on" secondary control system is designed or offered as a separate retrofit system for use on multiple machine makes and models.

(38) "Self-service dry cleaning machine" means a perchloroethylene dry cleaning machine that is loaded, activated, or unloaded by the customer.

(39) "Separator" means any device used to recover perchloroethylene from a water-perchloroethylene mixture.

(40) "Still" means a device used to volatilize and recover perchloroethylene from contaminated solvent removed from the cleaned materials.

(41) "Trained operator" means the owner, the operator, or an employee of the facility, who holds a record of completion for the initial course of an environmental training program and maintains her/his status by successfully completing the refresher courses as required.

(42) "Transfer machine" means a combination of perchloroethylene dry cleaning equipment in which washing and extraction are performed in one unit and drying is performed in a separate unit.

(43) "Vapor adsorber" means a bed of activated carbon or other adsorbent into which perchloroethylene vapors are introduced and trapped for subsequent desorption.

(44) "Vapor leak" means an emission of perchloroethylene vapor from unintended openings in the dry cleaning system, as indicated by a rapid audible signal or visual signal from a halogenated-hydrocarbon detector or a concentration of perchloroethylene exceeding 50 ppmv as methane as indicated by a portable analyzer. This definition applies beginning 18 months after the effective date of this control measure in the district.

(45) "Vented machine" means dry cleaning equipment in which washing, extraction, and drying are all performed in the same single unit and in which fresh air is introduced into the drum in the last step of the drying cycle and exhausted to the atmosphere, either directly or through a control device.

(46) "Waste water evaporator" means a device that vaporizes perchloroethylene-contaminated waste water through the addition of thermal or chemical energy, or through physical action.

(47) "Water-repelling operations" means the treatment of materials with a water-repellent solution that contains perchloroethylene.

(b) Applicability. Any person who owns or operates perchloroethylene dry cleaning equipment shall comply with Section 93109.

(c) Initial Notification. The owner/operator shall provide the district with all of the following information, in writing:

(1) By the applicable date shown in column 2 of Table 1.

(A) The name(s) of the owner and operator of the facility.

(B) The facility name and location.

(C) Whether or not the facility is co-located with a residence.

(D) The number, types, and capacities of all dry cleaning equipment.

(E) Any control systems for each dry cleaning machine.

(F) For existing facilities only, the gallons of perchloroethylene purchased by the facility during the previous calendar year.

(2) A district may exempt a source from item (1) of this subsection if the district maintains current equivalent information on the facility.

(d) Recordkeeping. The owner/operator shall maintain records for the specified time period, beginning on the applicable date shown in column 3 of Table 1. These records, or copies thereof, shall be accessible at the facility at all times.

(1) All of the following records shall be retained for at least 2 years or until the next district inspection of the facility, whichever period is longer.

(A) For each dry cleaning machine, a log showing the date and the pounds of materials cleaned per load.

(B) Purchase and delivery receipts for perchloroethylene.

1. For only those facilities with solvent tanks that are not directly filled by the perchloroethylene supplier upon delivery, the date(s) and gallons of perchloroethylene added to the solvent tank of each dry cleaning machine.

(C) The completed leak inspection checklists required by subsection (f)(2) and the operation and maintenance checklists required by subsection (f)(1)(A).

(D) For liquid leaks, perceptible vapor leaks, or vapor leaks that were not repaired at the time of detection, a record of the leaking component(s) of the dry cleaning system awaiting repair and the action(s) taken to complete the repair.

The record shall include copies of purchase orders or other written records showing when the repair parts were ordered and/or service was requested.

(2) For dry cleaning equipment installed after the effective date of this control measure in the district, the manufacturer's operating manual for all components of the dry cleaning system shall be retained for the life of the equipment.

(3) The original record of completion for each trained operator shall be retained during the employment of that person. A copy of the record of completion shall be retained for an additional period of two years beyond the separation of that person from employment at the facility.

(e) Annual Reporting. The owner/operator shall maintain an annual report. At the district's discretion, the facility owner or operator shall furnish this annual report to the district by the date specified by the district. The annual report shall include all of the following:

(1) A copy of the record of completion for each trained operator.

(2) The total of the pounds of materials cleaned per load and the gallons of perchloroethylene used for all solvent additions in the reporting period.

(3) The average facility mileage, determined from all solvent additions in the reporting period, as follows:

$$\frac{\text{The Total of the Pounds of Materials Cleaned Per Load}}{\text{The Total of the Gallons of Perchloroethylene Used}}$$

(f) Good Operating Practices. The owner/operator shall not operate dry cleaning equipment after the applicable dates shown in column 5 and column 6 of Table 1, unless all of the following requirements are met:

(1) Operation and maintenance requirements. The trained operator, or his/her designee, shall operate and maintain all components of the dry cleaning system in accordance with the requirements of this section and the conditions specified in the facility's operating permit beginning on the applicable date specified in column 5 of Table 1. For operations not specifically addressed, the components shall be operated and maintained in accordance with the manufacturer's recommendations.

(A) The district shall provide an operation and maintenance checklist to the facility. Each operation and maintenance function and the date performed shall be recorded on the checklist. The operation and maintenance checklist provided by the district shall include, at a minimum, the following requirements:

1. Refrigerated condensers shall be operated to ensure that exhaust gases are recirculated until the air-vapor stream temperature on the outlet side of the refrigerated condenser, downstream of any bypass, is less than or equal to 45^{o} F (7.2^{o} C).

2. Primary control systems, other than refrigerated condensers, shall be operated to ensure that exhaust gases are recirculated until the perchloroethylene concentration in the drum is less than or equal to 8,600 ppmv at the end of the drying cycle, before the machine door is opened and any fugitive control system activates.

3 Vapor adsorbers used as a primary control system or secondary control system shall be operated to ensure that exhaust gases are recirculated at the temperature specified by the district, based on the manufacturer's recommendations for optimum adsorption. These vapor adsorbers shall be desorbed according to the conditions specified by the district in the facility's operating permit, including a requirement that no perchloroethylene vapors shall be routed to the atmosphere during routine operation or desorption.

4. During the interim period between compliance with this subsection and compliance with the requirements of subsection (g), an existing facility with a transfer machine or a vented machine shall operate any existing carbon adsorber, which functions during the drying cycle, to meet the following requirements:

   i. Desorption shall be performed periodically, at the frequency specified by the district. The frequency, at a minimum, shall be each time all dry cleaning equipment exhausted to the device has cleaned a total of three pounds of materials for each pound of activated carbon. Desorption shall be performed with the minimum steam pressure and air flow capacity specified by the district.

   ii. Once desorption is complete, the carbon bed shall be fully dried according to the manufacturer's instructions.

   iii. No vented perchloroethylene vapors shall bypass the carbon adsorber to the atmosphere.

5. Cartridge filters and adsorptive cartridge filters shall be handled using one of the following methods.

i. Drained in the filter housing, before disposal, for no less than: 24 hours for cartridge filters and 48 hours for adsorptive cartridge filters. If the filters are then transferred to a separate device to further reduce the volume of perchloroethylene, this treatment shall be done in a system that routes any vapor to a primary control system, with no exhaust to the atmosphere or workroom.

ii. Dried, stripped, sparged, or otherwise treated, within the sealed filter housing, to reduce the volume of perchloroethylene contained in the filter.

6. A still, and any muck cooker, shall not exceed 75 percent of its capacity, or an alternative level recommended by the manufacturer. A still, and any muck cooker, shall cool to 100° F (38° C) or less before emptying or cleaning.

7. Button and lint traps shall be cleaned each working day and the lint placed in a tightly sealed container.

8. All parts of the dry cleaning system where perchloroethylene may be exposed to the atmosphere or workroom shall be kept closed at all times except when access is required for proper operation and maintenance.

9. Waste water evaporators shall be operated to ensure that no liquid perchloroethylene or visible emulsion is allowed to vaporize.

(2) Leak check and repair requirements. The trained operator, or her/his designee, shall inspect the dry cleaning system for liquid leaks and perceptible vapor leaks beginning on the applicable date shown in column 5 of Table 1. The trained operator, or her/his designee, shall inspect the dry cleaning system for vapor leaks instead of perceptible vapor leaks beginning 18 months after the effective date of this control measure in the district. The district shall provide a leak inspection checklist to the facility. The trained operator, or her/his designee, shall record the status of each component on the checklist.

(A) The dry cleaning system shall be inspected at least once per week for liquid leaks and:

1. For perceptible vapor leaks, beginning on the applicable date shown in column 5 of Table 1 until 18 months after the effective date of this control measure in the district.

2. For vapor leaks, beginning 18 months after the effective date of this control measure in the district, using one of the following techniques:

i. A halogenated-hydrocarbon detector.

ii. A portable gas analyzer or an alternative method approved by the district.

(B) Any liquid leak, perceptible vapor leak, or vapor leak that has been detected by the operator shall be noted on the checklist and repaired according to the requirements of this subsection. If the leak is not repaired at the time of detection, the leaking component shall be physically marked or tagged in a manner that is readily observable by a district inspector.

(C) Any liquid leak, perceptible vapor leak, or vapor leak detected by the district, which has not been so noted on the checklist and marked on the leaking component of the dry cleaning system, shall constitute a violation of this section. For enforcement purposes, the district shall:

1. Identify the presence of a perceptible vapor leak based on the odor of perchloroethylene or the detection of gas flow by passing the fingers over the surface of the system.

2. Identify the presence of a vapor leak by determining the concentration of perchloroethylene with a portable analyzer:

   i. According to ARB Test Method 21 (17 CCR, Section 94124, March 28, 1986).

   ii. Measured 1 cm. away from the dry cleaning system.

(D) Any liquid leak or vapor leak shall be repaired within 24 hours of detection.

1. If repair parts are not available at the facility, the parts shall be ordered within two working days of detecting such a leak. Such repair parts shall be installed within five working days after receipt. A facility with a leak that has not been repaired by the end of the 15th working day after detection shall not operate the dry cleaning equipment, until the leak is repaired, without a leak-repair extension from the district.

2. A district may grant a leak-repair extension to a facility, for a single period of 30 days or less, if the district makes these findings:

   i. The delay in repairing the leak could not have been avoided by action on the part of the facility.

   ii. The facility used reasonable preventive measures and acted promptly to initiate the repair.

iii. The leak would not significantly increase Perc exposure near the facility.

iv. The facility is in compliance with all other requirements of this section and has a history of compliance.

(3) Environmental training requirements. The facility shall have one or more trained operators beginning on the applicable date shown in column 6 of Table 1.

(A) A trained operator shall be the owner, the operator, or another employee of the facility, who successfully completes the initial course of an environmental training program to become a trained operator. Evidence of successful completion of the initial course shall be the original record of completion issued pursuant to 17 CCR, Section 93110. The trained operator shall be a full-time employee of the facility. Except for the provisions of subsection (f)(3)(C)2., one person cannot serve as the trained operator for two or more facilities simultaneously.

(B) Each trained operator shall successfully complete the refresher course of an environmental training program at least once every three years. Evidence of successful completion of each refresher course shall be the date of the course and the instructor's signature on the original record of completion.

(C) If the facility has only one trained operator and the trained operator leaves the employ of the facility, the facility shall:

1. Notify the district in writing within 30 days of the departure of the trained operator.

2. Obtain certification for a replacement trained operator within 3 months, except that a trained operator who owns or manages multiple facilities may serve as the interim trained operator at two of those facilities simultaneously for a maximum period of 4 months, by which time each facility must have its own trained operator.

3. If the district determines that the initial course of an environmental training program is not reasonably available, the district may extend the certification period for a replacement trained operator until 1 month after the course is reasonably available.

(g) Equipment. The owner/operator shall not operate dry cleaning equipment after the applicable date shown in column 7 of Table 1, unless the following requirements are met:

(1) Prohibited Equipment. The owner/operator shall not operate any of the following types of dry cleaning equipment after the applicable date shown in column 7 of Table 1.

(A) A transfer machine, including any reclaimer or other device in which materials that have been previously dry cleaned with perchloroethylene are placed to dry, except a drying cabinet that meets the requirements of item (4)(A) of this subsection.

(B) A vented machine.

(C) A self-service dry cleaning machine.

(2) Required Equipment. The owner/operator of each new or existing facility shall meet the applicable requirements of Table 1 as follows:

(A) For an existing facility:

1. Within 12 months of the effective date of this control measure in the district, choose either Option 1 or Option 2 of Table 1 and notify the district of her/his choice.

2. Comply with the requirements of Option 2, notwithstanding her/his choice of Option 1, if the facility does not meet the applicable requirements for Option 1 within 18 months of the effective date of this control measure in the district.

3. Install, operate, and maintain the required equipment for the option chosen, as shown in column 1 of Table 1 for existing facilities.

(B) A new facility shall install, operate, and maintain the required equipment shown in column 1 of Table 1 for new facilities. The applicable requirements shall be determined based on the date the facility commences operation of the dry cleaning equipment.

(3) Specifications for Required Equipment. Required equipment shall meet the following specifications:

(A) A primary control system shall:

1. Operate during both the heated and cool-down phases of the drying cycle to reduce the mass of perchloroethylene in the recirculating air stream.

2. Not exhaust to the atmosphere or workroom.

3. Not require the addition of any form of water to the primary control system that results in physical contact between the water and perchloroethylene.

4. For refrigerated condensers only:

   i. Be capable of achieving an outlet vapor temperature, downstream of any bypass, of less than or equal to 45^{o} F (7.2^{o} C) during cool-down; and

   ii. Have a graduated thermometer with a minimum range from 0^{o} F (-18^{o} C) to 150^{o} F (66^{o} C), which measures the temperature of the outlet vapor stream, downstream of any bypass of the condenser, and is easily visible to the operator.

5. For equivalent closed-loop vapor recovery systems:

   i. Use a technology that has been demonstrated, pursuant to the requirements of subsection (h), to achieve a perchloroethylene concentration of 8,600 ppmv or less in each test.

   ii. Have a device that measures the perchloroethylene concentration, or a demonstrated surrogate parameter, in the drum at the end of each drying cycle, before the machine door is opened and any fugitive control system activates, and indicates if the concentration is above or below 8,600 ppmv. This device shall be installed such that the reading is easily visible to the operator.

(B) A converted machine shall meet all of the following requirements, as demonstrated on-site to the district, either upon conversion or prior to compliance with the requirements of subsection (g)(2)(A):

1. All process vents that exhaust to the atmosphere or workroom during washing, extraction, or drying shall be sealed.

2. The converted machine shall use an appropriately-sized primary control system to recover perchloroethylene vapor during the heated and cool-down phases of the drying cycle.

   i. A refrigerated condenser shall be considered appropriately sized, for a machine converted on or after the date that this section is filed with the Secretary of State, if all of the following conditions are met:

      a. The water-cooled condensing coils are replaced with refrigerant-cooled condensing coils.

b. The compressor of the refrigerated condenser shall have a capacity, in horsepower (hp) that is no less than the minimum capacity, determined as follows:

$$\text{Minimum Capacity (hp)} = \frac{\text{Capacity of the Machine (lbs)}}{12}$$

ii. A refrigerated condenser shall be considered appropriately sized, for a machine converted prior to the date that this section is filed with the Secretary of State, if the conditions a., or b. below are met:

a. The refrigerated condenser shall meet the specifications for new conversions in subsection (g)(3)(B)2.i.

b. The refrigerated condenser shall achieve, and maintain for 3 minutes, an outlet vapor temperature, measured downstream of the condenser and any bypass of the condenser, of less than or equal to 45^{o} F (7.2^{o} C) within 10 minutes of the initiation of cool-down.

iii. An equivalent closed-loop vapor recovery system shall be appropriately sized for the conversion of a vented machine if the system does not extend the total drying time by more than five minutes to meet the specifications of subsection (g)(3)(A)5.

3. The converted machine shall operate with no liquid leaks and no vapor leaks. Any seal, gasket, or connection determined to have a liquid leak or vapor leak shall be replaced.

(C) A secondary control system shall:

1. Be designed to function with a primary control system or be designed to function as a combined primary control system and secondary control system that meets all of the applicable requirements of this section.

2. Not exhaust to the atmosphere or workroom.

3. Not require the addition of any form of water to the secondary control system that results in physical contact between the water and perchloroethylene.

4. Use a technology that has been demonstrated, pursuant to the requirements of subsection (h), to achieve a perchloroethylene concentration in the drum of 300 ppmv or less in each test.

5. Have a holding capacity equal to or greater than 200 percent of the maximum quantity of perchloroethylene vapor expected in the drum prior to activation of the system.

6. For add-on secondary control systems only, the system shall be sized and capable of reducing the perchloroethylene concentration in the drum from 8,600 ppmv or greater to 300 ppmv or less in the maximum volume of recirculating air in the dry cleaning machine and all contiguous piping.

(4) Specifications for Other Equipment.

(A) A drying cabinet shall:

1. Be fully enclosed.

2. Be exhausted via one of the following methods:

i. To a control system that has been demonstrated, pursuant to the requirements of subsection (h), to achieve a perchloroethylene concentration of 100 ppmv or less in each test, measured at the outlet without dilution.

ii. To a control system that reduces the concentration of perchloroethylene in a closed system with no exhaust to the atmosphere or workroom.

(h) Equipment Testing. For a given design, a single test program shall be conducted, in accordance with the following procedures, to meet the specifications in subsections (g)(3) and (g)(4). The person or organization conducting the test program shall prepare a written test plan that describes, in detail, the dry cleaning machine and control systems being tested, the test protocol, and the test method.

(1) Test Program and Scope. A minimum of three tests shall be conducted for each test program on each control system design. All tests for a single test program shall be conducted on a single dry cleaning machine.

(A) Test results for a primary control system design, or an add-on secondary control system design, may be applied to a different make/model of dry cleaning machine if the equipment designer or facility demonstrates, to the satisfaction of the district, that:

1. The test results would be representative of the performance of the control system design on the different make/model of dry cleaning machine.

2. The control system design is properly sized for the maximum volume of recirculating air in the dry cleaning machine during the drying cycle.

(B) Test results for an integral secondary control system design may not be applied to a different make/model of dry cleaning machine.

(2) Test Conditions. Testing shall be conducted under normal operating conditions, unless otherwise specified.

(A) For primary control systems and secondary control systems, each test shall be conducted during the cleaning of one load of materials.

1. The machine shall be filled to no less than 75 percent of its capacity with materials for each test.

2. The weight of materials shall be recorded for each test.

(B) A primary control system shall be tested on a closed-loop machine, or a converted machine, without a secondary control system.

(C) A secondary control system shall be tested on a closed-loop machine.

1. An integral secondary control system shall be tested with the primary control system operating normally.

2. An add-on secondary control system shall be tested independent of a primary control system and the initial perchloroethylene concentration in the drum shall be 8,600 ppmv or greater.

(D) For a control system on the exhaust of a drying cabinet, each test shall be conducted following the placement of materials cleaned with perchloroethylene in the drying cabinet. The materials shall be transferred to the drying cabinet and testing shall begin no later than 15 minutes after the end of the washing and extraction process.

1. The drying cabinet shall be filled to no less than 50 percent of its capacity with materials for each test.

2. The weight of materials shall be recorded for each test.

(3) Test Method. Equipment shall be tested in accordance with the following methods.

(A) For primary control systems and secondary control systems:

1. The temperature of the air in the drum shall be measured and recorded continuously during the entire drying cycle, including the operation of the secondary control system.

2. Sampling shall be conducted as follows:

i. For primary control systems and integral secondary control systems, sampling shall begin at the end of the drying cycle and be completed within 5 minutes.

ii. For add-on secondary control systems, sampling shall be done when the concentration of perchloroethylene is 8,600 ppmv or greater and again when the concentration reaches 300 ppmv or less.

iii. Sampling shall be completed prior to the opening of the machine door and activation of any fugitive control system.

3. The perchloroethylene concentration in the drum shall be determined by one of the following methods:

i. A sampling port and valve shall be appropriately placed to draw a sample from the interior of the drum or the lint filter housing. The sampling port shall be connected to a gas chromatograph by one-quarter (1/4-) inch, outside diameter, Teflon tubing. Any sampling pump shall have Teflon diaphragms. The gas chromatograph shall measure the concentrations of perchloroethylene in accordance with ARB Method 422 (17 CCR, Section 94132, December 31, 1991) or NIOSH Method 1003 (NIOSH Manual of Analytical Methods, U.S. Department of Health and Human Services, August 15, 1987).

ii. A sampling port and valve shall be appropriately placed to draw a sample from the interior of the drum or the lint filter housing. The sampling port shall be connected by one-quarter (1/4-) inch outside diameter Teflon tubing to a Tedlar bag. Any sampling pump shall have Teflon diaphragms. The concentration of perchloroethylene in the air sampled shall be measured in accordance with ARB Method 422 (17 CCR, Section 94132, December 31, 1991) or NIOSH Method 1003 (NIOSH Manual of Analytical Methods, U.S. Department of Health and Human Services, August 15, 1987) within 24 hours of sampling. If an independent laboratory is contracted to perform the analysis of the samples, the chain of custody procedures contained in ARB Method 422 or NIOSH Method 1003 shall be followed.

(B) For a control device on the exhaust of a drying cabinet, sampling and analysis shall be conducted using ARB Method 422 (17 CCR, Section 94132, December 31, 1991) or NIOSH Method 1003 (NIOSH Manual of Analytical Methods, U.S. Department of Health and Human Services, August 15, 1987).

(C) An alternative test method deemed acceptable by the Air Pollution Control Officer or Executive Officer of the district and the Executive Officer of the Air Resources Board.

(4) All test plans and test results shall be made available to the district and the Executive Officer of the California Air Resources Board upon request.

(i) Water-repelling and Dip Tank Operations. No person shall perform water-repelling or dip tank operations, after the applicable date shown in column 8 of Table 1, unless all of the following requirements are met:

(1) All materials to be treated with perchloroethylene water-repelling solutions shall be treated in a closed-loop machine, a converted machine, or a dip tank.

(2) For dip tank operations:

(A) The dip tank shall be fitted with a cover that prevents the escape of perchloroethylene vapors from the tank and shall remain covered at all times, except when materials are placed in and removed from the dip tank or while the basket is moved into position for draining.

(B) After immersion, the materials shall be drained within the covered dip tank until dripping ceases.

(C) All materials removed from a dip tank shall be immediately placed into a closed-loop machine or a converted machine for drying and not removed from the machine until the materials are dry.

(j) Compliance. A facility shall comply with all provisions of this section as follows:

(1) By the applicable dates of compliance specified in column 1 through column 8 of Table 1.

(2) For compliance with subsection (f)(3) "Environmental Training Requirements", an alternative date of compliance shall apply if the district determines that the initial course of an environmental training program for perchloroethylene dry cleaning operations is not reasonably available.

(A) For existing facilities in the district, if the initial course is not reasonably available within 12 months of the effective date of this control measure in the district, the alternative date of compliance for subsection (f)(3) only shall be 6 months from the date the district determines that the initial course is reasonably available.

(B) For each new facility in the district, if the initial course is not reasonably available within the period from 3 months prior to 2 months following commencement of operation, the alternative date of compliance for subsection (f)(3) only shall be 1 month from the date the district determines that the initial course is reasonably available.

Authority cited: Sections 39600, 39601, 39650, 39655, 39656, 39658, 39659, 39665, and 39666, Health and Safety Code; Sections 7412 and 7416, Title 42, United States Code.

Reference: Sections 39650, 39655, 39656, 39658, 39659, and 39666, Health and Safety Code; Sections 7412 and 7414, Title 42, United States Code; Sections 63.320, 63.321, 63.323, and 63.324, Title 40, Code of Federal Regulations.

TABLE 1

Equipment Requirements and Summary of Compliance Times for Existing and New Facilities

Facility Type	EQUIPMENT REQUIREMENTS		**DATE OF COMPLIANCE** (after the effective date of this control measure in the district)						
		Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
	Compliance Option(s)	Required Dry Cleaning Equipment	Initial Notification	Recordkeeping	Annual Reporting	Leak Check and Repair, Operation & Maintenance Requirements	Environmental Training Requirements	Equipment Requirements	Water-Repelling and Dip Tank Requirements
EXISTING FACILITIES	Option 1	Converted Closed-Loop Machine with Primary Control System	60 days	60 days	Specified by district	60 days	18 months	18 months	18 months
	or								
	Option 2	Closed-loop Machine with Primary Control System	60 days	60 days	Specified by district	60 days	18 months	48 months	18 months
NEW FACILITIES Commencing Operations prior to 18 months After the Effective Date of This Control Measure in the District									
		Closed-loop Machine with a Primary Control System	On application for permit	Upon commencement of operation	Specified by district	Upon commencement of operation	3 months following commencement of operation	Upon commencement of operation	Upon commencement of operation
NEW FACILITIES Commencing Operations 18 months or Later After the Effective Date of This Control Measure in the District									
		Closed-loop Machine with a Primary Control System and a Secondary Control System	On application for permit	Upon commencement of operation	Specified by district	Upon commencement of operation	3 months following commencement of operation	Upon commencement of operation	Upon commencement of operation

Appendix B

Health Risk Assessment Methodology for Dry Cleaning Operations

Appendix B

Health Risk Assessment Methodology for Dry Cleaning Operations

A. Introduction

This appendix presents the methodology used to estimate the potential cancer and noncancer health impacts from exposure to Perc emitted during dry cleaning activities. Also included are results from the four meteorological data sets.

As discussed in Chapter IV, the assumptions used to determine the potential health impacts are based on a selection of generic modeling scenarios for routine dry cleaning operations throughout the state. The generic facilities were created from the evaluation of over 1,600 responses to a facility survey, information obtained during over 100 site visits, and input from draft industry-specific reports, industry representatives, and from Air Pollution Control or Air Quality Management Districts staff regarding dry cleaning operations. The generic release scenarios used in the HRA are presented in Section B of this appendix. This assessment uses meteorological data sets from four locations in California. Those locations are Anaheim, Fresno, Oakland (port), and San Diego (Miramar). Emissions, source release parameters, and modeling inputs are discussed in the sections which follow.

B. Emission Estimates

Emissions for the risk assessment were based on generic unit emission rates of 100 gallons per year (1,350 pounds per year) for annual emissions and 0.1 gallons per hour (1.35 pounds per hour) for hourly emissions. Since risk assessment results are based on generic emission rates, they can be easily adjusted to reflect any emission rate scenario. Tables B-3 to B-6 use the generic emission rates.

Table B-1 shows the average and high-end (90^{th} percentile) annual Perc emission rates that were used in Chapter IV of this report for dry cleaners with converted machines, primary controls, and secondary control. According to the facility survey results and our site visits, approximately 90 percent of dry cleaners emit below the high-end annual emission rate. The purpose for showing these two emission rates is to provide a perspective for Perc emissions at dry cleaning facilities in California. Hourly emissions are also shown for the three machines. The hourly emissions are based on the 10^{th} percentile of mileage and 90^{th} percentile for machine capacity from our survey results.

Table B-1. Emissions Rates

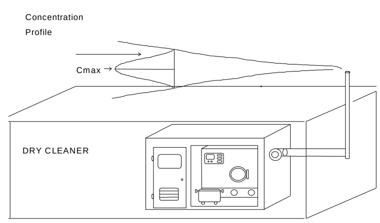
Scenario	Annual (gallons/year)		Hourly (gallons/hour)
	High-End Emissions [1]	Average Emissions	
Converted Machine	113	76	0.45
Primary Control	94	52	0.13
Secondary Control	61	34	0.06

1. High–end emissions are defined by the 90^{th} percentile of emissions.

C. Generic Dry Cleaner Configurations

Eight generic dry cleaner scenarios were used for the air dispersion modeling. The generic release scenarios used in the HRA are presented below in Figures (a) – (f).

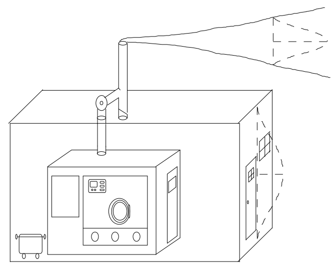
Figure (a) FULL VAPOR BARRIER ROOM (FVR)



For modeling purposes, assume: 100% capture by vapor barrier room (VBR), all emission modeled as point source.

POINT SOURCE:
Q = 1000 CFM; V = 15 m/s.
Stack Height = 5 feet + building ht. = 17 feet (5.18 m).
Diameter = 0.2 meters (8 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

Figure (b) PARTIAL VAPOR BARRIER ROOM (PVR)

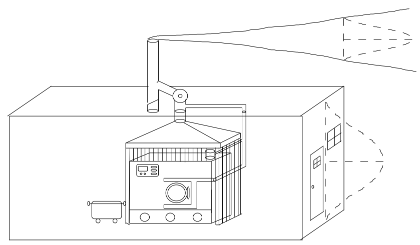


For modeling purposes, assume: 95% capture by PVR, 95% of emissions modeled as point source, 5% of emissions are treated as fugitive and modeled as volume source.

POINT SOURCE:
Q = 1000 CFM; V = 15 m/s.
Stack Height = 5 feet + building ht. = 17 feet (5.18 m).
Diameter = 0.2 meters (8 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

VOLUME SOURCE:
σ_{yo} = Length/4.3.
σ_{zo} = Height/ 2.15.
Building Height = 12 feet.
Release Ht = 0.5 Shop Ht = 6 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

Figure (c) LOCAL VENTILATION (L-VENT)

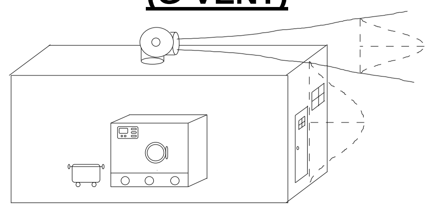


For modeling purposes, assume for typical system: 80% of emissions captured by fan and modeled as a point source, 20% of emissions are fugitive & modeled as volume source.

POINT SOURCE:
Q = 2500 CFM; V = 15 m/s.
Stack Height = 5 feet + building= 17 feet (5.18 m).
Diameter = 0.3 meters (12 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

VOLUME SOURCE:
σ_{yo} = Length/4.3.
σ_{zo} = Height/ 2.15.
Building Height = 12 feet.
Release Ht = 0.5 Shop Ht = 6 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

Figure (d) GENERAL VENTILATION (G-VENT)

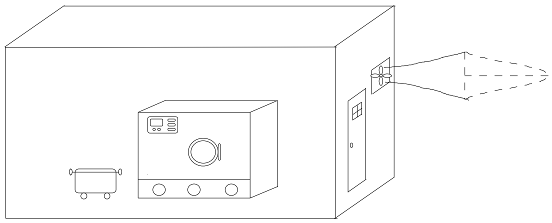


For modeling purposes, assume for typical system (< 1 change per 5 minutes): 60% capture of emissions by fan and modeled as horizontal point source, 40% of emissions are fugitive & modeled as volume source.

POINT SOURCE:
Q = 2500 CFM; V = 0.001 m/s (Exit velocity is 0.001 m/s and Q to 0.154 acfm to simulate horizontal flow, stack tip downwash off).
Stack Height = 1.5 feet + building= 13.5 feet (4.11 m).
Diameter = 0.3 meters (12 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).
<u>Scenario (B):</u>
Stack Height = 1.5 feet + building= 19.5 feet (5.94 m).
Diameter = 0.3 meters (12 inches).
Building Height = 18 feet.
Shop Size = Approximately 2500 ft^2.
Building Width = 15 meters (49.2 ft.).
Building Length = 15 meters (49.2 ft.).

VOLUME SOURCE:
σ_{yo} = Length/4.3.
σ_{zo} = Height/ 2.15.
Building Height = 12 feet.
Release Ht = 0.5 Shop Ht = 6 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).
<u>Scenario (B):</u>
Building Height = 18 feet.
Release Ht = 0.5 Shop Ht = 9 feet.
Shop Size = Approximately 2500 ft^2.
Building Width = 15 meters (49.2 ft.).
Building Length = 15 meters (49.2 ft.).

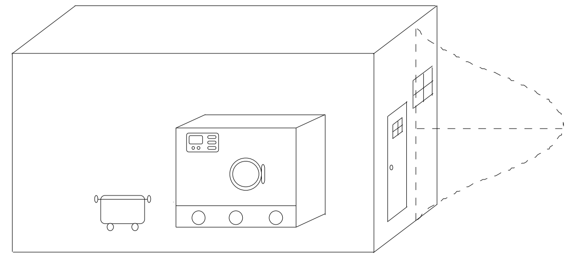
Figure (e) WINDOW FAN (WIN FAN)



For modeling purposes, assume: 100% of the emission are modeled as a horizontal point source.

POINT SOURCE:
Q = 5000 CFM, V = 0.001 m/s (Exit velocity is 0.001 m/s and Q to 0.154 acfm to simulate horizontal flow, stack tip downwash off).
Fan Height = 8 feet.
Diameter = 0.3 meters (12 inches).
Building Height = 12 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).

Figure (f) NATURAL VENTILATION (N-VENT)



For modeling purposes, assume: 100% of emissions are fugitive & modeled as volume source.

VOLUME SOURCE:
σ_{yo} = Length/4.3.
σ_{zo} = Height/ 2.15.
Scenario A:
Building Height = 12 feet.
Release Ht = 0.5 Shop Ht = 6 feet.
Shop Size = Approximately 1100 ft^2.
Building Width = 10 meters (32.8 ft.).
Building Length = 10 meters (32.8 ft.).
Scenario (B):
Building Height = 18 feet.
Release Ht = 0.5 Shop Ht = 9 feet.
Shop Size = Approximately 2500 ft^2.
Building Width = 15 meters (49.2 ft.).
Building Length = 15 meters (49.2 ft.).

For all of the dry cleaner scenarios, stack releases are modeled as a point source and fugitive releases are modeled as a volume source. The dimensions of the volume source are assumed to be the size of the dry cleaning shop (not the size of the entire building). For those configurations with a stack that simulates the presence of a rain cap or which are vented horizontally, these facilities were modeled according to OEHHA and U.S. EPA guidance. In summary, that guidance states that stack gas exit velocity, gas temperature, and stack diameter are used to estimate plume rise based on the greater of thermal buoyancy or momentum. In the presence of a rain cap or horizontal vent, then the momentum plume rise is negated. Since a window fan and a general ventilation system do not have a vertical component to the exit velocity, the momentum component of plume rise equations should not be used. In addition, since the exhaust gas from the facility is near to ambient conditions, the thermal buoyancy portion of the plume rise equations should not be used either.

To simulate these conditions with a point source release with the ISCST3 air dispersion model, the exit velocity is set to 0.001 m/s (meters per second) and stack tip downwash is turned off, as recommended in *The Air Toxics Hot Spots Risk Assessment Guidelines; Part IV; Exposure Assessment and Stochastic Analysis Technical Support Document*, September 2000, (OEHHA, 2000b) and the U.S. EPA Model Clearinghouse Memo, July 9, 1993 (U.S. EPA, 1993). Also recommended in the guidelines is to reduce the stack height by three stack diameters (this is for the maximum stack-tip downwash effect). However, this would reduce the stack tip to a level below the roof-top, which is physically impossible. Therefore, the stack height is not adjusted.

C. Air Dispersion Modeling

The model that was used during this HRA was the Hot Spots Analysis and Reporting Program (HARP) (ARB, 2005h). HARP includes an air dispersion model, ISCST3. U.S. EPA recommends the ISCST3 model for refined air dispersion modeling (U.S. EPA, 1995). HARP is a recommended tool for risk analysis in California and can be used for most source types (e.g., point, area, and volume sources) and is currently used by the ARB, districts, and other states.

The eight generic dry cleaning scenarios and modeling inputs presented Section B were used for the risk assessment. This data was used in the air dispersion modeling analysis to estimate downwind concentrations. This assessment uses meteorological data sets from four locations in California. Those locations are Anaheim (81), Fresno (85-89), Oakland (port) (98-00), and San Diego (Miramar) (67-71). The year(s) of meteorological data used at each location are listed in the parenthesis. Eight-hour emission rate scalars were used when modeling the generic scenarios. All scenarios used urban dispersion, flat terrain, and building downwash.

D. Risk Assessment Results

Tables B-3 to B-6 provide an overview of the potential cancer risk between 20 and 400 meters for residential and (off-site) worker receptors exposed to the emissions of Perc from generic dry cleaners using secondary control. The potential health impacts are presented for generic facilities; therefore, the potential health impacts at an actual facility may vary due to that facility's individual characteristics. For any receptor located closer than 20 meters from a dry cleaner, it is possible that their potential health impacts may be either higher or lower than the results presented in this report. Factors that may contribute to this variation include meteorology (wind and weather) and the individual release characteristics at each facility. Currently, 20 meters is the minimum air dispersion modeling distance used by the ARB in their Air Toxics Program. Since 1997, the districts have used 20 meters as the minimum modeled distance in the industrywide risk assessment guidelines for sources in the Air Toxics Hot Spots Program. The impacts at other distances are presented to provide perspective for the potential health impacts at distances further away from a dry cleaner.

These tabulated results address each dry cleaner scenario presented in Section B and are broken down by meteorological data set. The results are presented assuming a unit emission rate of 1,350 pound per year (100 gallons per year). The results for residential receptors are presented using the high-end (393 L/kg-day), 80^{th} percentile (302 L/kg-day), and average (271 L/kg-day) breathing rate point estimates under a 70-year exposure duration. The off-site worker scenario uses the worker breathing rate point estimate (149 L/kg-day) and a 40-year exposure duration. This risk assessment used the Tier 1 methodology outlined in the OEHHA Guidelines (OEHHA, 2003a). In conjunction with the OEHHA Guidelines, staff also followed the ARB's Interim Risk Management Policy (ARB, 2003a).

Each table shows the potential cancer risk to a distance of 400 meters. Potential cancer risks at distances beyond this point are no larger than one chance per million. Because the tables have spacing restraints, all scenario types are abbreviated. These abbreviations are defined in Table B-2.

Table B-2. Scenario Abbreviations for Tables B-3 to B-6

Full Name	Abbreviation
Window Fan	WinFan
Natural Ventilation	N-Vent
Natural Ventilation (B)	N-Vent B
General Ventilation (60/40)	G-Vent (60/40)
General Ventilation (B) (60/40)	G-Vent B (60/40)
Local Ventilation (80/20)	L-Vent (80/20)
Partial Vapor Barrier Room (95/5)	PVR (95/5)
Full Vapor Barrier Room	FVR

Table B-3. Potential Cancer Risk at Residential and Off-site Worker Receptors from Generic Dry Cleaners Using Secondary Control and Anaheim Meteorological Data[1, 2]

Scenario	CANCER RISK (chances per million)															
	Distance (meters)[3]															
	20	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**120**	**140**	**160**	**180**	**200**	**300**	**400**
Resident – High-End Breathing Rate																
WinFan	205	117	73	51	39	30	24	20	17	12	10	8	6	5	2	2
N-Vent	160	98	67	46	37	29	24	20	16	12	9	7	6	5	2	2
N-Vent B[4]	112	70	51	38	30	24	20	17	14	11	8	7	6	5	2	1
G-Vent (60/40)[5]	164	100	65	47	36	29	23	19	16	12	9	7	6	5	2	2
G-Vent B[4] (60/40)[5]	108	73	51	38	29	23	19	16	14	10	8	7	6	5	2	1
L-Vent (80/20)[5,6]	61	44	33	27	22	18	15	13	11	8	7	5	4	4	2	1
PVR (95/5)[5,6]	72	54	41	32	26	21	17	14	12	9	7	6	5	4	2	1
FVR[6]	68	52	40	32	25	20	17	14	12	9	7	6	5	4	2	1
Resident – 80th Percentile Breathing Rate																
WinFan	158	90	56	39	30	23	18	15	13	9	7	6	5	4	2	1
N-Vent	123	75	51	35	28	22	18	15	12	9	7	6	5	4	2	1
N-Vent B[4]	86	54	39	29	23	18	15	13	11	8	6	5	4	4	2	1
G-Vent (60/40)[5]	126	77	50	36	28	22	18	15	12	9	7	6	5	4	2	1
G-Vent B[4] (60/40)[5]	83	56	39	29	22	18	15	12	11	8	6	5	4	4	2	1
L-Vent (80/20)[5,6]	47	34	25	21	17	14	12	10	8	6	5	4	3	3	2	1
PVR (95/5)[5,6]	55	41	32	25	20	16	13	11	9	7	5	4	4	3	2	1
FVR[6]	52	40	31	25	19	15	13	11	9	7	5	4	4	3	2	1
Resident – Average Breathing Rate																
WinFan	141	81	50	35	27	21	17	14	12	8	7	5	4	3	2	1
N-Vent	110	68	46	32	26	20	17	14	11	8	6	5	4	3	2	1
N-Vent B[4]	77	48	35	26	21	17	14	12	10	8	6	5	4	3	2	1
G-Vent (60/40)[5]	113	69	45	32	25	20	16	13	11	8	6	5	4	3	2	1
G-Vent B[4] (60/40)[5]	74	50	35	26	20	16	13	11	10	7	6	5	4	3	2	1
L-Vent (80/20)[5,6]	42	30	23	19	15	12	10	9	8	6	4	4	3	3	1	1
PVR (95/5)[5,6]	50	37	28	22	18	14	12	10	8	6	5	4	3	3	2	1
FVR[6]	47	36	28	22	17	14	12	10	8	6	5	4	3	3	2	1
Off-site Worker																
WinFan	131	75	46	32	25	19	15	13	11	8	6	5	4	3	2	1
N-Vent	102	62	43	29	24	18	15	13	10	8	6	5	4	3	2	1
N-Vent B[4]	71	45	32	24	19	15	13	11	9	7	5	4	4	3	1	1
G-Vent (60/40)[5]	104	64	41	30	23	18	15	12	10	8	6	5	4	3	2	1
G-Vent B[4] (60/40)[5]	69	46	32	24	18	15	12	10	9	6	5	4	4	3	1	1
L-Vent (80/20)[5,6]	39	28	21	17	14	11	10	8	7	5	4	3	3	2	1	1
PVR (95/5)[5,6]	46	34	26	20	17	13	11	9	8	6	4	4	3	3	1	1
FVR[6]	43	33	25	20	16	13	11	9	8	6	4	4	3	3	1	1

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology. Results are presented using a Perc unit emission rate of 1,350 pounds per year (100 gallons /yr).
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. This risk assessment is based on the methodology outlined in The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA Guidelines) (OEHHA, 2003a) and the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a).
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet. Other scenarios use a building approximately 1,100 square feet.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.
6. Denotes an enhanced ventilation scenario.

Table B-4. Potential Cancer Risk at Residential and Off-site Worker Receptors from Generic Dry Cleaners Using Secondary Control and Fresno Meteorological Data[1, 2]

Scenario	CANCER RISK (chances per million) Distance (meters)[3]															
	20	30	40	50	60	70	80	90	100	120	140	160	180	200	300	400
Resident – High-End Breathing Rate																
WinFan	103	63	41	29	21	16	13	10	9	6	5	4	3	2	1	<1
N-Vent	90	54	36	26	19	15	12	10	8	6	5	4	3	2	1	<1
N-Vent B[4]	62	40	28	21	16	13	10	9	7	5	4	3	3	2	1	<1
G-Vent (60/40)[5]	83	53	36	26	20	15	12	10	8	6	5	4	3	2	1	<1
G-Vent B[4] (60/40)[5]	53	37	28	21	16	13	11	9	7	6	4	3	3	2	1	<1
L-Vent (80/20)[5,6]	48	34	25	19	15	12	10	8	7	5	4	3	3	2	1	<1
PVR (95/5)[5,6]	50	37	27	21	16	13	11	9	8	6	4	3	3	2	1	<1
FVR[6]	48	36	27	20	16	13	10	9	7	6	4	3	3	2	1	<1
Resident – 80th Percentile Breathing Rate																
WinFan	79	48	32	22	16	12	10	8	7	5	4	3	2	2	1	<1
N-Vent	69	41	28	20	15	12	9	8	6	5	4	3	2	2	1	<1
N-Vent B[4]	48	31	22	16	12	10	8	7	6	4	3	3	2	2	1	<1
G-Vent (60/40)[5]	64	41	28	20	15	12	9	8	6	5	4	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	41	28	22	16	12	10	8	7	6	4	3	3	2	2	1	<1
L-Vent (80/20)[5,6]	37	26	19	15	12	9	8	6	5	4	3	3	2	2	1	<1
PVR (95/5)[5,6]	38	28	21	16	12	10	8	7	6	4	3	3	2	2	1	<1
FVR[6]	37	28	21	15	12	10	8	7	6	4	3	3	2	2	1	<1
Resident – Average Breathing Rate																
WinFan	71	43	28	20	14	11	9	7	6	4	3	3	2	2	1	<1
N-Vent	62	37	25	18	13	10	8	7	6	4	3	2	2	2	1	<1
N-Vent B[4]	43	28	19	14	11	9	7	6	5	4	3	2	2	2	1	<1
G-Vent (60/40)[5]	57	37	25	18	14	10	8	7	6	4	3	2	2	2	1	<1
G-Vent B[4] (60/40)[5]	37	26	19	14	11	9	8	6	5	4	3	2	2	2	1	<1
L-Vent (80/20)[5,6]	33	23	17	13	10	8	7	6	5	4	3	2	2	2	1	<1
PVR (95/5)[5,6]	34	26	19	14	11	9	8	6	5	4	3	2	2	2	1	<1
FVR[6]	33	25	19	14	11	9	7	6	5	4	3	2	2	2	1	<1
Off-site Worker																
WinFan	66	40	26	18	13	10	8	6	6	4	3	2	2	2	1	<1
N-Vent	57	34	23	17	12	10	8	6	5	4	3	2	2	2	1	<1
N-Vent B[4]	39	25	18	13	10	8	6	5	5	3	3	2	2	1	1	<1
G-Vent (60/40)[5]	53	34	23	17	13	10	8	6	5	4	3	2	2	2	1	<1
G-Vent B[4] (60/40)[5]	34	24	18	13	10	8	7	6	5	4	3	2	2	1	1	<1
L-Vent (80/20)[5,6]	31	22	16	12	10	8	6	5	5	3	3	2	2	1	1	<1
PVR (95/5)[5,6]	32	24	17	13	10	8	7	6	5	4	3	2	2	1	1	<1
FVR[6]	31	23	17	13	10	8	6	6	5	4	3	2	2	1	1	<1

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology. Results are presented using a Perc unit emission rate of 1,350 pounds per year (100 gallons /yr).
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. This risk assessment is based on the methodology outlined in The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA Guidelines) (OEHHA, 2003a) and the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a).
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet. Other scenarios use a building approximately 1,100 square feet.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.
6. Denotes an enhanced ventilation scenario.

Table B-5. Potential Cancer Risk at Residential and Off-site Worker Receptors from Generic Dry Cleaners Using Secondary Control and Oakland (port) Meteorological Data[1, 2]

Scenario	CANCER RISK (chances per million)															
	Distance (meters)[3]															
	20	30	40	50	60	70	80	90	100	120	140	160	180	200	300	400
Resident – High-End Breathing Rate																
WinFan	109	67	43	30	22	17	14	11	9	7	5	4	3	3	1	<1
N-Vent	92	55	37	26	20	15	12	10	8	6	5	4	3	2	1	<1
N-Vent B[4]	64	41	29	21	16	13	11	9	7	6	4	3	3	2	1	<1
G-Vent (60/40)[5]	87	56	38	27	20	16	13	10	9	6	5	4	3	2	1	<1
G-Vent B[4] (60/40)[5]	55	39	29	22	17	14	11	9	8	6	4	4	3	2	1	<1
L-Vent (80/20)[5,6]	50	37	27	21	16	13	11	9	8	6	4	4	3	2	1	<1
PVR (95/5)[5,6]	53	40	29	22	17	14	11	10	8	6	5	4	3	3	1	<1
FVR[6]	51	39	29	22	17	14	11	9	8	6	5	4	3	3	1	<1
Resident – 80th Percentile Breathing Rate																
WinFan	84	51	33	23	17	13	11	8	7	5	4	3	2	2	1	<1
N-Vent	71	42	28	20	15	12	9	8	6	5	4	3	2	2	1	<1
N-Vent B[4]	49	32	22	16	12	10	8	7	6	4	3	3	2	2	1	<1
G-Vent (60/40)[5]	67	43	29	21	15	12	10	8	7	5	4	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	42	30	22	17	13	11	8	7	6	4	3	3	2	2	1	<1
L-Vent (80/20)[5,6]	38	28	21	16	12	10	8	7	6	4	3	3	2	2	1	<1
PVR (95/5)[5,6]	41	31	22	17	13	11	8	7	6	5	4	3	2	2	1	<1
FVR[6]	39	30	22	17	13	11	8	7	6	5	4	3	2	2	1	<1
Resident – Average Breathing Rate																
WinFan	75	46	30	21	15	12	10	8	6	5	3	3	2	2	1	<1
N-Vent	63	38	26	18	14	10	8	7	6	4	3	3	2	2	1	<1
N-Vent B[4]	44	28	20	14	11	9	8	6	5	4	3	2	2	2	1	<1
G-Vent (60/40)[5]	60	39	26	19	14	11	9	7	6	4	3	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	38	27	20	15	12	10	8	6	5	4	3	2	2	2	1	<1
L-Vent (80/20)[5,6]	34	26	19	14	11	9	8	6	5	4	3	2	2	2	1	<1
PVR (95/5)[5,6]	37	28	20	15	12	10	8	7	6	4	3	3	2	2	1	<1
FVR[6]	35	27	20	15	12	10	8	6	6	4	3	2	2	2	1	<1
Off-site Worker																
WinFan	69	43	27	19	14	11	9	7	6	4	3	2	2	2	1	<1
N-Vent	59	35	24	17	13	10	8	6	5	4	3	2	2	2	1	<1
N-Vent B[4]	41	26	18	13	10	8	7	6	5	4	3	2	2	1	1	<1
G-Vent (60/40)[5]	55	36	24	17	13	10	8	6	6	4	3	2	2	2	1	<1
G-Vent B[4] (60/40)[5]	35	25	18	14	11	9	7	6	5	4	3	2	2	2	1	<1
L-Vent (80/20)[5,6]	32	24	17	13	10	8	7	6	5	4	3	2	2	2	1	<1
PVR (95/5)[5,6]	34	25	18	14	11	9	7	6	5	4	3	2	2	2	1	<1
FVR[6]	32	25	18	14	11	9	7	6	5	4	3	2	2	2	1	<1

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology. Results are presented using a Perc unit emission rate of 1,350 pounds per year (100 gallons /yr).
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. This risk assessment is based on the methodology outlined in The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA Guidelines) (OEHHA, 2003a) and the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a).
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet. Other scenarios use a building approximately 1,100 square feet.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.
6. Denotes an enhanced ventilation scenario.

Table B-6. Potential Cancer Risk at Residential and Off-site Worker Receptors from Generic Dry Cleaners Using Secondary Control and San Diego (Miramar) Meteorological Data[1, 2]

Scenario	CANCER RISK (chances per million)															
	Distance (meters)[3]*															
	20	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**120**	**140**	**160**	**180**	**200**	**300**	**400**
Resident – High-End Breathing Rate																
WinFan	108	61	40	29	22	17	14	11	9	7	5	4	3	3	1	<1
N-Vent	85	52	36	26	20	16	13	11	9	7	5	4	3	3	1	<1
N-Vent B[4]	61	38	27	20	16	13	11	9	8	6	5	4	3	3	1	<1
G-Vent (60/40)[5]	85	51	35	26	20	16	13	11	9	7	5	4	3	3	1	<1
G-Vent B[4] (60/40)[5]	58	38	25	20	16	13	11	9	8	6	5	4	3	3	1	<1
L-Vent (80/20)[5,6]	47	32	23	17	14	11	9	7	6	5	4	3	3	2	1	<1
PVR (95/5)[5,6]	47	34	25	19	14	11	9	8	7	5	4	3	3	3	1	<1
FVR[6]	45	33	24	18	14	11	9	7	6	5	4	3	3	2	1	<1
Resident – 80th Percentile Breathing Rate																
WinFan	83	47	31	22	17	13	11	8	7	5	4	3	3	2	1	<1
N-Vent	65	40	28	20	15	12	10	8	7	5	4	3	3	2	1	<1
N-Vent B[4]	47	29	21	15	12	10	8	7	6	4	3	3	2	2	1	<1
G-Vent (60/40)[5]	65	39	27	20	15	12	10	8	7	5	4	3	3	2	1	<1
G-Vent B[4] (60/40)[5]	45	29	19	15	12	10	8	7	6	4	4	3	2	2	1	<1
L-Vent (80/20)[5,6]	36	25	18	13	11	8	7	6	5	4	3	2	2	2	1	<1
PVR (95/5)[5,6]	36	26	19	15	11	8	7	6	5	4	3	3	2	2	1	<1
FVR[6]	35	25	18	14	11	8	7	6	5	4	3	3	2	2	1	<1
Resident – Average Breathing Rate																
WinFan	74	42	28	20	15	12	10	8	6	5	4	3	2	2	1	<1
N-Vent	59	36	25	18	14	11	9	8	6	5	4	3	2	2	1	<1
N-Vent B[4]	42	26	19	14	11	9	8	6	5	4	3	3	2	2	1	<1
G-Vent (60/40)[5]	59	35	24	18	14	11	9	8	6	5	4	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	40	26	17	14	11	9	8	6	5	4	3	3	2	2	1	<1
L-Vent (80/20)[5,6]	32	22	16	12	10	8	6	5	4	3	3	2	2	2	1	<1
PVR (95/5)[5,6]	32	23	17	13	10	8	6	5	4	4	3	2	2	2	1	<1
FVR[6]	31	23	17	12	10	8	6	5	4	3	3	2	2	2	1	<1
Off-site Worker																
WinFan	69	39	25	18	14	11	9	7	6	4	3	3	2	2	1	<1
N-Vent	54	33	23	17	13	10	8	7	6	4	3	3	2	2	1	<1
N-Vent B[4]	39	24	17	13	10	8	7	6	5	4	3	2	2	2	1	<1
G-Vent (60/40)[5]	54	32	22	17	13	10	8	7	6	4	3	3	2	2	1	<1
G-Vent B[4] (60/40)[5]	37	24	16	13	10	8	7	6	5	4	3	2	2	2	1	<1
L-Vent (80/20)[5,6]	30	20	15	11	9	7	6	5	4	3	2	2	2	1	1	<1
PVR (95/5)[5,6]	30	22	16	12	9	7	6	5	4	3	3	2	2	2	1	<1
FVR[6]	29	21	15	11	9	7	6	5	4	3	3	2	2	2	1	<1

1. All results are rounded and represent generic dry cleaning scenarios using secondary control technology. Results are presented using a Perc unit emission rate of 1,350 pounds per year (100 gallons /yr).
2. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. Results are for the inhalation pathway. Residents assume a 70-year exposure duration and use the high-end, 80th percentile, and average point estimate breathing rates. The worker breathing rate and a 40-year exposure duration is used for the off-site worker receptor. This risk assessment is based on the methodology outlined in The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003 (OEHHA Guidelines) (OEHHA, 2003a) and the ARB's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a).
3. Distances are presented from the building edge.
4. Building is approximately 2,500 square feet. Other scenarios use a building approximately 1,100 square feet.
5. Values identified within the parenthesis identify the ratio that emissions are modeled from a point and volume source.
6. Denotes an enhanced ventilation scenario.

The chronic hazard indices under the high-end (90th percentile) emissions scenario are less than 0.4 at residential receptor locations and less than 1.5 at adjacent worker locations (20 meters). The adjacent worker scenario has a higher hazard index than the residential receptor since it is assumed the adjacent worker's schedule is coincident with dry cleaning operations. The adjacent workers' hazard index decreases to less than 1.0 within 30 meters of the dry cleaner. Under the average emissions scenario, chronic hazard indices are less than less than 0.2 at residential receptor locations and less than or equal to 0.8 at adjacent worker locations. The acute hazard indices are less than 0.2 at any receptor location. Generally, hazard indices less than 1.0 are not considered to be a concern to public health. All noncancer health impacts would be virtually eliminated under the proposed amendments.

REFERENCES FOR APPENDIX B

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U.S. EPA, 1995. ISCST3 Model User's Guide, EPA-454/B-95-003a. United States Environmental Protection Agency (U.S. EPA). Research Triangle Park, North Carolina. September 1995.

Appendix C

Summary of the Differences between the Current and Proposed Amended Airborne Toxic Control Measure

Appendix C

Summary of the Differences Between the Current and Proposed Amended ATCM

	Current Dry Cleaning ATCM	**Proposed Revised ATCM**
Applicability	Owner/operator of Perc dry cleaning equipment	Person who sells or distributes Perc and who sells, distributes, installs, owns, or operates dry cleaning machine that uses any solvent that contains Perc.
Severability	Not addressed	Each part of this section is deemed severable, and in the event that part of this is held to be invalid, the remainder of this section shall continue in full force and effect.
Definitions		• 16 new definitions • 15 amended • 7 deleted
Prohibitions	Owner/operator shall not operate a transfer machine, vented machine, or a self-service dry cleaning machine	In addition to the existing prohibitions, no person shall sell, or initiate a new lease of any Perc dry cleaning machines. Also, prohibits existing facilities to operate any Perc dry cleaning machine with the exception of a converted, primary or secondary control machine but are required to comply with a phase out compliance schedule.
Initial Notification	Provide district in writing with name of owner and operator of facility; name and location of facility; whether facility is co-located with a residence; number, types, and capacities of dry cleaning machines; existing facilities only shall provide the annual gallons of Perc purchased.	No requirements.
New Facilities	Shall install, operate, and maintain a closed-loop machine with primary control and secondary control.	No person shall install or operate any Perc dry cleaning machine or engage in Perc water-repelling operations at a new facility on or after January 1, 2008.
Relocated Facilities	None	Upon approval by the district, existing facilities may relocate their Perc dry cleaning machine for the purpose of moving from one location to another within the boundaries of the same district.
Existing Facilities	Shall install, operate, and maintain either a converted closed-loop machine with primary control; or a closed-loop machine with a primary control system.	All existing facilities that operate converted Perc dry cleaning machines shall remove their machine by July 1, 2010. Existing facilities that operate any

Existing Facilities (con't)		dry cleaning machines using Perc shall comply with the following schedule: • Facilities must remove from service their Perc dry cleaning machine by July 1, 2010, or when the machine is 15 years of age, whichever comes later. If the age of the machine cannot be obtained, the machine must be removed from service by July 1, 2010. • All facilities that have not already done so under the above requirement, must remove from service their Perc dry cleaning machine by January 1, 2023.
Co-residential Facilities	No provisions	Existing co-residential facilities shall remove from service any currently installed Perc dry cleaning machine by July 1, 2010.
Specifications for Required Equipment	Outlined specific requirements for primary control systems, converted machines, add-on secondary control, integral secondary control machines, and drying cabinets.	No Requirements
Good Operating Practices	*Environmental Training Requirements*: The facility shall have one or more trained operators. The trained operator shall be a full time employee including the owner, operator, or another employee of the facility, who successfully completed the initial course pursuant to 17 CCR, section 93110. Each trained operator shall successfully complete a refresher course every three years. If the facility has only one trained operator and the trained operator leaves the facility shall notify the district within 30 days of departure; obtain a replacement trained operator within 3 months, except that a trained operator who owns or manages multiple facilities may serve as the interim trained operator at two of those facilities simultaneously for a max period of 4 months. If an initial course is not reasonable available, the district may extend the certification period for a replacement trained operator until 1 month after the course is reasonably available.	Same requirement, however, the length of time to notify the district when a trained operator leaves the employ of the facility has been reduced from 30 days to 15 days of the departure. The exception of allowing a trained operator who owns multiple facilities serve as the interim trained operator at two of those facilities has been deleted. The trained operator shall be an owner/employee of the facility and shall be on site while the dry cleaning machine is in operation.

Good Operating Practices (con't)	*Operation and Maintenance Requirements*: The trained operator shall operate and maintain the dry cleaning system in accordance to this section and conditions on the facility's operating permit. Operations not specifically addressed shall be operated and maintained in accordance with the manufacturer's recommendations. The district shall provide an operation and maintenance checklist. Each operation and maintenance function and the date performed shall be recorded on the checklist. Refrigerated condensers shall be operated to ensure exhaust gases are recirculated until the air-vapor stream temp. on the outlet side of the condenser, downstream of any bypass, is less than or equal to 45°F. Desorption of carbon adsorbers shall be performed at the frequency specified by the district. At a minimum it shall be each time all dry cleaning equipment exhausted to the device has cleaned a total of three pounds of materials for each pound of activated carbon. Desorption shall be performed with the minimum steam pressure and air flow capacity specified by the district. After desorption the carbon bed shall be fully dried according to the manufacturers instructions.	Same requirement, however, since transfer and vented machines are no longer permitted, any thing pertaining to these machines has been deleted. In addition to the existing requirements, facility owner/operator shall keep on site a spare set of gaskets for the loading door, still, lint trap, button trap and water separator; and a spare lint filter. Also, carbon adsorbers in integral secondary control systems must be must be stripped or desorbed in accordance with manufacturer's instructions or at least weekly, whichever is more frequent.
	Leak Check and Repair Requirements: The dry cleaning system shall be inspected weekly for liquid and vapor leaks with either a halogenated-hydrocarbon detector; PID; or an alternative method approved by the district. Any detected leak shall be noted on the checklist provided by the district and repaired within 24 hours. If repair parts are not available, then leaks shall be repaired within 15 working days. If the leak is not repaired at the time of detection, the leaking component shall be clearly marked or tagged. A 30 day extension can be granted by the district.	Requirements remain the same however the timeframe to repair a leak has been reduced. Liquid leaks or vapor leaks shall be repaired immediately upon detection. If a facility with a leak does not have parts available, the parts need to be ordered within the next business day of detecting the leak and the part installed within 2 business days after receipt. A facility with a leak that has not been repaired by the end of the 7th business day after detection shall not operate the dry cleaning machine until the leak is repaired. An additional requirement would be that the dry cleaning system shall be inspected at least once a year

Good Operating Practices (con't		for liquid and vapor leaks using a portable detector which gives quantitative results with less than ten percent uncertainty at 50 ppmv of Perc.
Recordkeeping Requirements	Must retain the following records for at least 2 years of until district inspection of facility, whichever period is longer. • Log showing date and lbs. of material cleaned/load. • Purchase and delivery receipts for Perc. • For facilities with solvent tanks that are not directly filled by the Perc supplier upon deliver, the date and gallons of Perc added to solvent tank. • Completed leak inspection checklists and the operation and maintenance checklists • For liquid or vapor leaks not repaired at time of detection, a record of leaking component awaiting repair and action taken to complete repair. Record shall include copies of purchase orders or written records showing repair parts were ordered and/or service requested. • Manufacturer's operating manual • Original record of completion for each trained operator. • All records shall be accessible at the facility	All records must be retained for at least 5 years. Requirements are the same with the addition of the following: • Purchase and delivery receipts for the dry cleaning solvent; • For add-on or integral secondary control machines: - the start and end time of each regeneration, and temperature of chilled air; • All records shall be maintained in English and be accessible at the facility.
Reporting Requirements	Maintain annual report which includes: • Copy of certificate of completion for trained operator. • Total lbs. of material cleaned/load and gallons of Perc used for all solvent additions. • Average facility mileage.	Owner or operator shall prepare an annual report which covers the period of January 1 through December 31 of each year. The annual report shall cover the same requirements with the exception of the facility mileage. However, in addition the facility must include the make, model, serial number, and date of manufacture of the dry cleaning machine. The owner/operator shall furnish this annual report to the district by the date specified by the district.
Testing & Certification of Secondary Control	*Test Program and Scope*: For a given design a single test program shall be conducted. A test plan that describes, in detail, the dry cleaning machine and control system being tested, the test protocol and test method shall be	No requirements.

Testing & Certification of Secondary Control (con't)	prepared. A minimum of three tests shall be conducted for each test program on each control system design. All tests for a single test program shall be conducted on a single dry cleaning machine. Test results may not be applied to a different make/model machine.	
	Test Conditions: Testing shall be conducted under normal operating conditions. • Primary and Secondary - shall be filled to no less than 75 percent of its capacity. Weight of materials shall be recorded. • Primary - shall be tested on a closed-loop machine, or a converted machine, without secondary control. • Secondary - shall be tested on a closed-loop machine. • Integral secondary - shall be tested with primary control operating normally. • Add-on secondary - shall be tested independent of primary and initial Perc concentration in drum shall be 8600 ppmv or greater. • Drying Cabinet – Materials shall be transferred to the drying cabinet and testing shall begin no later than 15 minutes after the end of the washing and extraction process. The drying cabinet shall be filled 50 percent of its capacity. The weight of the material shall be recorded.	No requirements
	Test Method: Primary and secondary control • Temperature in the drum shall be measured and recorded continuously during the entire drying cycle. • Sampling: - For primary control and integral secondary control shall begin at the end of the drying cycle and completed within five minutes. - For add-on secondary control systems shall be done when the concentration of Perc is 8,600 ppmv or greater and again when	No requirements.

Testing & Certification of Secondary Control (con't)	the concentration reaches 300 ppmv or less. • Perc concentration in the drum shall be determined by the following methods: - A sampling port and valve shall be appropriately placed to draw samples from the interior of the drum or lint filter housing. Sampling port shall be connected to a gas chromatograph by ¼", outside diameter, Teflon tubing. Any sampling pump shall have Teflon diaphragms. The gas chromatograph shall measure the concentrations of Perc in accordance to Method 422 or NIOSH Method 1003. - A sampling port and valve shall be appropriately placed to draw samples from the interior of the drum or lint filter housing. Sampling port shall be connected by ¼" outside diameter Teflon tubing to a Tedlar bag. Any sampling pump shall have Teflon diaphragms. The concentration of Perc in the air samples shall be measured in accordance with ARB Method 422 or NIOSH Method 1003 within 24 hours of sampling. If an independent lab is contracted to perform analysis of the samples, the chain of custody procedures in Method 422 or NIOSH 1003 shall be followed. • An alternative test method deemed acceptable by the APCO or EO of the district and the EO of the ARB.	
	Certification Procedures: Detailed description of the dry cleaning system including control device; the test protocol; and the test method.	No requirements.
Wastewater Treatment	Wastewater evaporators shall be operated to ensure that no liquid Perc or visible emulsion is allowed to vaporize.	No requirements.
Water-repelling Operations	No person shall perform water-repelling or dip tank operations unless all materials to be treated with Perc water-repelling are treated in a closed-	All materials to be treated with Perc water-repelling can only be treated in a converted, primary control, add-on secondary control, or

Water-repelling Operations (con't)	loop machine, a converted machine or a dip tank.	integral secondary control machine and shall comply with the requirements in subsections (e), (f), (g), and (h).
Violations	Not specified.	Any violation to this section may carry civil or administrative penalties as specified in state law, including, but not limited to, a penalty of not more than $10,000 per day.
New Section: Requirements for Perc Manufacturers		
Recordkeeping Requirements	No requirements.	Perc manufacturers shall keep monthly sales records (with invoices) of the gallons of Perc sold for use in dry cleaning in California. These records shall be retained for at lest 5 years and made available to ARB or the district upon request.
Reporting Requirements	No requirements.	By January 1, 2008, Perc manufacturers shall report to ARB contact information for all their distributors who sell Perc in California. Changes to their list of distributors shall be reported to ARB within 30 calendar days after the change has occurred.
Violations	No requirements.	Any violation to this section may carry civil or administrative penalties as specified in state law, including, but not limited to, a penalty of not more than $35,000.
New Section: Requirements for Perc Distributors		
Recordkeeping Requirements	No requirements.	Perc distributors shall keep the following records for 5 years and made available to ARB or the district upon request: • For each dry cleaning facility, monthly sales records (with invoices) of the gallons of Perc and recycled Perc sold for the use of dry cleaning in California. • Monthly purchase records (with invoices) of the gallons of Perc purchased for the use of dry cleaning in California. • Contact information for each California dry cleaner that purchased Perc and recycled Perc. • Contact information for all their distributors who sell Perc and recycled Perc in California. Any violation of this section may carry civil or administrative

		penalties as specified in state law and regulation, including, but not limited to, a penalty of not more than $35,000 under Health and Safety Code section 42402.4.
Reporting Requirements	No requirements.	Perc distributors shall report to ARB the following information: • By January 1, 2008 their contact information and, if applicable, contact information for all their distributors who sell Perc and recycled Perc in California. • Changes in their contact information reported under the above requirement, within 30 calendar days. • By January 31st of each year, the annual gallons of Perc and recycled Perc sold to California dry cleaners from January 1 through December 31 of the previous year.
Payment of Fees	No requirements.	No later than 30 days after the issuance of an invoice from ARB, Perc distributors shall pay fees, based on the fee schedule shown in Table 2 of the regulation, to ARB.
Violations	No requirements.	Any violation to this section may carry civil or administrative penalties as specified in state law, including, but not limited to, a penalty of not more than $35,000.

Appendix D

Summary of Gas and Electricity Cost Survey

Table D-1. Summary of Gas and Electricity Cost Survey[1]

Machine Type	Age Of Machine (yr)	Average Monthly Gas Cost ($)	Normalized Annual Gas Cost[2] ($)	Average Monthly Electricity Cost ($)	Normalized Annual Electricity Cost[2] ($)	Amount of material dry cleaned (lbs/year)
GreenEarth	4	1300	10356	650	5178	70200
GreenEarth	3.5	750	13529	325	5863	31000
GreenEarth	3	550	6326	475	5463	48620
GreenEarth	1.5	400	5735	400	5735	39000
GreenEarth	3	1000	11949	500	5974	46800
GreenEarth	2	750	10754	550	7886	39000
Perc 2nd	2	400	4863	250	3039	46000
Perc 2nd	1.5	600	3910	850	5540	85800
Perc 2nd	4	700	8699	600	7456	45000
Perc 2nd	4	600	5592	450	4194	60000
Perc 2nd	10	330	6031	260	4751	30600
Perc prim	9	400	6717	275	4618	33300
Perc prim	11	529	6431	313	3806	46000
Perc prim	15	400	7169	250	4481	31200
Perc prim	10	750	10485	300	4194	40000
Wet Cleaning	1.5	600	7821	200	2607	42900
Wet Cleaning	2	225	2765	225	2765	45500
Wet Cleaning	1	600	7169	250	2987	46800
Wet Cleaning	4	280	4015	270	3871	39000
Wet Cleaning	2	380	7821	195	4013	27170
Wet Cleaning	1	660	7098	750	8065	52000
DF2000	6	780	8724	620	6934	50000
DF2000	2 and 15	880	7010	310	2469	70200
DF2000	3.5 and 3.5	1530	3943	1020	2628	217000
DF2000	5,3	569	6357	582	6503	50050
DF2000	6	750	12905	500	8603	32500
DF2000	3	578	10774	466	8677	30000
Overall Average[3]	**5**		**7591**		**5122**	**51690**

1. Result of randomly chosen dry cleaning facilities
2. Costs were normalized to 46,600 lbs of material dry cleaned assuming direct correlation of cost to pounds of material dry cleaned.
3. Analysis of variance indicates no systematic differences between machine types in costs and therefore the overall average results were used.

Appendix E

Compliance Cost Estimate of Proposed Amended Dry Cleaning ATCM

TALBLE E-1. COMPLIANCE COST ESTIMATE OF PROPOSED AMENDED DRY CLEANING ATCM

ENVIRONMENTAL TRAINING		
Refresher Course Tuition	$100	
Mileage (200 miles, 40 cent/mile)	$80	
Labor (6 hr x $10/hr)	$60	
	$240 every 3 years	= $80/yr
RECORDKEEPING		
(Weighting and recording pounds of clothes every load)		
0.5 hr/wk x 52 wk/yr x $10/hr		= $260/yr
(Weekly poundage)		
0.5 hr/wk x 52 wk/yr x $10/hr		= $260/yr
REPORTING		
(Fill out district annual report)		
8 hr/yr x $10/hr		= $80/yr
OPERATION AND MAINTENANCE		
Weekly leak check:		
0.25 hr/wk x 52 wk/yr x $10/hr		= $130/yr
Annual enhanced leak check[1]:		
2 hr/yr x $10/hr		= $20/yr
(leak check arrangement include borrowing and using), and/or		
$10		= $10/yr
(group purchase cost)		
	Total	= $840/yr

[1] Annual enhanced leak check requirement might be met by group purchase of a Perc detector that gives quantitative results, reliance on district inspection, or borrowing of a quantitative detector. The lowest cost of a qualified detector is about $600. Cost of Perc quantitative detector and group purchase assumes purchase of least costly detector, 5 years of useful life and groups of 12 facilities per purchase.

Table E-2. Summary of Air District Permit Renewal Fees[1]

District	Perc Permit Renewal Fees	HC Permit Renewal Fees
Ventura	1250	1700
Sacramento	567	572
Santa Barbara	593	593
San Joaquin	89	89
San Diego	600	500
El Dorado	365	365
Placer	298	298
MD & AV	172	172
Bay Area	246	0
Weighted Average[2]	380	300

1. Fees are for year 2006.
2. Weighted average assuming 45% of the dry cleaning facilities is in the Bay Area and 55% is distributed evenly across the other districts. Values are rounded.

Table E-3. Summary of Hot Spot (AB2588) Fees[1]

District	District Fee	State Fee	Total
Bay Area	125	35	160
Sacramento	60	35	95
Santa Barbara	0	35	35
Placer County	90	35	125
San Joaquin	85	35	115
Ventura	50	35	85
San Diego	101	35	136
Weighted Average[2]	**90**	**35**	**125**

1. Fees are for year 2006.
2. Weighted average assuming 45% of the dry cleaning facilities is in the Bay Area and 55% is distributed evenly across the other districts. Values are rounded

Appendix F

Glossary of Definitions, Selected Terms, and Acronyms

Appendix F

Glossary of Definitions, Selected Terms, and Acronyms

Definitions

Acute Exposure: One or a series of short-term exposures generally lasting less than 24 hours.

Acute Health Effects: A health effect that occurs over a relatively short period of time (e.g., minutes or hours). The term is used to describe brief exposures and effects which appear promptly after exposure.

Adverse Health Effect: A health effect from exposure to air contaminants that may range from relatively mild temporary conditions, such as eye or throat irritation, shortness of breath, or headaches, to permanent and serious conditions, such as birth defects, cancer or damage to lungs, nerves, liver, heart, or other organs.

Agency Shop: Same as drop off shop. A facility with no dry cleaning machine on-site.

Air Dispersion Model: A mathematical model or computer simulation used to estimate the concentration of toxic air pollutants at specific locations as a result of mixing in the atmosphere.

Air District or District: The Air Pollution Control and Air Quality Management Districts, as defined in Health and Safety Code section 39025, are the political bodies responsible for managing air quality on a regional or county basis. California is currently divided into 35 air districts.

Airborne Toxic Control Measure: Section 39655 of the Health and Safety Code, defines an "Airborne Toxic Control Measure" means either of the following:

1) Recommended methods, and, where appropriate, a range of methods, that reduce, avoid, or eliminate the emissions of a toxic air contaminant. Airborne toxic control measures include, but are not limited to, emission limitations, control technologies, the use of operational and maintenance conditions, closed system engineering, design equipment, or work practice standards, and the reduction, avoidance, or elimination of emissions through process changes, substitution of materials, or other modifications.
2) Emission standards adopted by the U.S. Environmental Protection Agency pursuant to section 112 of the federal act (42 U.S.C. Sec. 7412).

Asthma: A chronic inflammatory disorder of the lungs characterized by wheezing, breathlessness, chest tightness, and cough.

Bioaccumulation: The concentration of a substance in a body or part of a body or other living tissue in a concentration higher than that of the surrounding environment.

California Air Resources Board (ARB): The State's lead air quality management agency consisting of an eleven-member board appointed by the Governor. The ARB is responsible for attainment and maintenance of the state and federal air quality standards, and is fully responsible for motor vehicle pollution control. It oversees county and regional air pollution management programs.

California Air Pollution Control Officers Association (CAPCOA): A non-profit association of the air pollution control officers from all 35 air quality districts throughout California. CAPCOA was formed in 1975 to promote clean air and to provide a forum for sharing knowledge, experience, and information among the air quality regulatory agencies around the state.

Cancer Potency Factor (CPF): The theoretical upper bound probability of extra cancer cases occurring in an exposed population assuming a lifetime exposure to the chemical when the chemical dose is expressed in exposure units of milligrams/kilogram-day (mg/kg-d).

Chronic Exposure: Long-term exposure, usually lasting one year to a lifetime.

Chronic Health Effect: An adverse non-cancer health effect that develops and persists (e.g., months or years) over time after long-term exposure to a substance.

Developmental Toxicity: Adverse effects on the developing organism that may result from exposure prior to conception (either parent), during prenatal development, or postnatally to the time of sexual maturation. Adverse developmental effects may be detected at any point in the life span of the organism. Major manifestations of developmental toxicity include: death of the developing organism; induction of structural birth defects; altered growth; and functional deficiency.

Dose: A calculated amount of a substance estimated to be received by the subject, whether human or animal, as a result of exposure. Doses are generally expressed in terms of amount of chemical per unit body weight; typical units are mg/kg-day.

Dose-response Assessment: The process of characterizing the relationship between the exposure to an agent and the incidence of an adverse health effect in exposed populations.

Drop off Shop: Same as agency shop. A facility with no dry cleaning machine on-site.

Endpoint: An observable or measurable biological or biochemical event including cancer used as an index of the effect of a chemical on a cell, tissue, organ, organism, etc.

Epidemiology: The study of the occurrence and distribution of a disease or physiological condition in human populations and of the factors that influence this distribution.

Exposure: Contact of an organism with a chemical, physical, or biological agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, digestive tract) and available for absorption.

Exposure Pathway: A route of exposure by which xenobiotics enter the human body (e.g., inhalation, ingestion, dermal absorption).

Flash Point: The lowest temperature at which a liquid can form an ignitable mixture in air near the surface of the liquid. The lower the flash point, the easier it is to ignite the material.

Hazard Identification: The process of determining whether exposure to an agent can cause an increase in the incidence of an adverse health effect including cancer

Hazard Index (HI): The sum of individual acute or chronic hazard quotients (HQs) for each substance affecting a particular toxicological endpoint.

Hazardous Air Pollutant (HAP): A substance that the U.S. Environmental Protection Agency has listed in, or pursuant to, section 112 subsection (b) of the federal Clean Air Act Amendments of 1990 (42 U.S. Code, section 7412(b)).

Health Risk Assessment: A health risk assessment (HRA) is an evaluation or report that a risk assessor (e.g., Air Resources Board, district, consultant, or facility operator) develops to describe the potential a person or population may have of developing adverse health effects from exposure to a facility's emissions. Some health effects that are evaluated could include cancer, developmental effects, or respiratory illness. The pathways that can be included in an HRA depend on the toxic air pollutants that a person (receptor) may be exposed to, and can include inhalation (breathing), the ingestion of soil, water, crops, fish, meat, milk, and eggs, and dermal exposure.

Hot Spots Analysis and Reporting Program (HARP): A single integrated software package designed to promote statewide consistency, efficiency, and cost-effective implementation of health risk assessments and the Hot Spots Program. The HARP software package consists of modules that include: emissions inventory, air dispersion modeling, risk analysis, and mapping.

HSC: Health and Safety Code of the State of California.

Industrial Source Complex Dispersion Model (ISC3): Air modeling software that incorporates three previous programs into a single program. These are the short-term model (ISCST), the long term model (ISCLT), and the complex terrain model (COMPLEX).

Meteorology: The science that deals with the phenomena of the atmosphere especially weather and weather conditions. In the area of air dispersion modeling, *meteorology* is used to refer to climatological data needed to run an air dispersion model including: wind speed, wind direction, stability class and ambient temperature.

Mixed Shop: A dry cleaning facility that employs more than one type of dry cleaning process.

Multipathway Substance: A substance or chemical that once airborne from an emission source can, under environmental conditions, be taken into a human receptor by inhalation and by other exposure routes such as after deposition on skin or after ingestion of soil contaminated by the emission.

Noncarcinogenic Effects: Noncancer health effects which may include birth defects, organ damage, morbidity, and death.

Office of Environmental Health Hazard Assessment (OEHHA): An office within the California Environmental Protection Agency that is responsible for evaluating chemicals for adverse health impacts and establishing safe exposure levels. OEHHA also assists in performing health risk assessments and developing risk assessment procedures for air quality management purposes.

Permissible Exposure Limit (PEL): The maximum amount or concentration of a chemical that a worker may be exposed to under the Occupational Safety and Health Administration (OSHA) regulations.

Potency: The relative effectiveness, or risk, of a standard amount of a substance to cause a toxic response.

Potency Slope: A value used to calculate the probability or risk of cancer associated with an estimated exposure, based on the assumption in cancer risk assessments that risk is directly proportional to dose and that there is no threshold for carcinogenesis. It is the slope of the dose-response curve estimated at low exposures.

Proposition 65: The Safe Drinking Water and Toxic Enforcement Act of 1986, also known as Proposition 65. This Act is codified in California Health and Safety Code Section 25249.5, et seq. No person in the course of doing business shall knowingly discharge or release a chemical known to the state to cause cancer or reproductive toxicity into water or into land where such chemical passes or probably will pass into any source of drinking water, without first giving clear and reasonable warning to such individual.

Reference Exposure Level (REL): An exposure level at or below which no noncancer adverse health effect is anticipated to occur in a human population exposed for a specific duration. An REL is virtually the same as the terms Reference Concentration (RfC) for inhalation or Reference Dose (RFD) used by U.S. EPA, only it may be for varying amounts of time rather than lifetime only. It has been given a different name so that the values estimated by the State Office of Environmental Health Hazard Assessment can easily be distinguished from those developed by the U.S. EPA. RELs are used to evaluate toxicity endpoints other than cancer.

Reproductive Toxicity: Harmful effects on fertility, gestation, or offspring, caused by exposure of either parent to a substance.

Risk: The (characterization of the) probability of potentially adverse effects to human health, in this instance from the exposure to environmental hazards.

Risk Assessment: The characterization (in the present context) of the probability of potentially adverse health effects to people from exposure to environmental chemical hazards.

Scientific Review Panel on Toxic Air Contaminants (SRP): A nine-member panel appointed to advise the Air Resources Board and the Department of Pesticide Regulation in their evaluation of the adverse health effects toxicity of substances being evaluated as Toxic Air Contaminants.

Threshold, Nonthreshold: A threshold dose is the minimally effective dose of any chemical that is observed to produce a response (e.g., enzyme change, liver toxicity, death). For most toxic effects, except carcinogenesis, there appear to be threshold doses. Nonthreshold substances are those substances, including nearly all carcinogens, that are known or assumed to have some risk of response at any dose above zero.

TIF Detector: Halogen leak detector made by TIF™ Instruments, Inc.

Toxic Air Contaminant (TAC): An air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health (HSC Section 39655(a)). Substances, which have been identified by the United States Environmental Protection Agency as hazardous air pollutants are also identified by the Board as toxic air contaminants.

United States Environmental Protection Agency (U.S. EPA): The Federal agency charged with setting policy and guidelines, carrying out legal mandates, for the protection, and national interests in environmental resources.

Variability: The ability to have different numerical values of a parameter, such as height or weight.

Volatile Organic Compound (VOC): Means any compound containing at least one atom of carbon, including carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and excluding the following:

(A) methane, methylene chloride (dichloromethane), 1,1,1-trichloroethane (methyl chloroform), trichlorofluoromethane (CFC-11), dichlorodifluoromethane (CFC-12), 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-13), 1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-14), chloropentafluoroethane (CFC-115), chlorodifluoromethane (HCFC-22), 1,1,1-trifluoro-2,2-dichloroethane (HCFC-123), 1,1-dichloro-1-fluoroethane (HCFC-141b), 1-chloro-1,1-difluoroethane (HCFC-142b), 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124), trifluoromethane (HFC-23), 1,1,2,2-tetrafluoroethane (HFC-134), 1,1,1,2-tetrafluoroethane (HFC-134a), pentafluoroethane (HFC-125), 1,1,1-trifluoroethane (HFC-143a), 1,1-difluoroethane (HFC-152a), cyclic, branched, or linear completely methylated siloxanes, the following classes of perfluorocarbons:

1. cyclic, branched, or linear, completely fluorinated alkanes;
2. cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;
3. cyclic, branched, or linear completely fluorinated tertiary amines with no unsaturations; and
4. sulfur-containing perfluorocarbons with no unsaturations and with the sulfur bonds to carbon and fluorine, and

(B) the following low-reactive organic compounds which have been exempted by the U.S. EPA: acetone, ethane, methyl acetate, parachlorobenzotrifluoride (1-chloro-4-trifluoromethyl benzene), perchloroethylene (tetrachloroethylene).

Acronyms

APA	California Administrative Procedure Act
APCD	Air Pollution Control District
APCO	Air Pollution Control Officer
AQMD	Air Quality Management District
ARB	California Air Resources Board
ATCM	Airborne Toxic Control Measure
BACT	Best Available Control Technology
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
CAPB	Cocamidopropyl Betaine
CAPCOA	California Air Pollution Control Officers Association
CAS	Chemical Abstract Service
CEQA	California Environmental Quality Act
CG	Cellulose Gum
CO_2	Carbon Dioxide
CPF	Cancer Potency Factor
CAS	Chemical Abstract Service
CRF	Capital Recovery Factor
CTSI	U.S. EPA's <u>Cleaner Technologies Substitute Assessment: Professional Fabricare Processes</u>
D_5	Decamethylcyclopentasiloxane
DfE	Design for the Environment
DHS	California Department of Health Services
Districts	Local Air Pollution Control and Air Quality Management Districts
DOF	California Department of Finance
DPNB	Dipropylene Glycol Normal Butyl Ether
DTSC	California Department of Toxics Substances Control
$^{\circ}$F	Degrees Fahrenheit
FVR	Full Vapor Barrier Room
HAP	Hazardous Air Pollutant
HHD	Halogenated Hydrocarbon Detector
HSC	Health and Safety Code
HARP	Hot Spots Analysis and Reporting Program
HRA	Health Risk Assessment
HSIA	Halogenated Solvent Industry Alliance
IARC	International Agency for Research on Cancer
IFI	International Fabricare Institute
IRTA	Institute for Research and Technical Assistance
ISOR	Initial Statement of Reasons
KB	Kauri Butanol
Kg	Kilogram
kWh	Kilowatt-hour
Lauramide DEA	Luric Acid Diethanolamide
LOC	Local Ventilation System

m^3	Cubic Meter
MDL	Minimum Detection Limit
$\mu g/m^3$	Microgram per Cubic Meter
MSDS	Material Safety Data Sheets
NAICS	North American Industrial Classification System
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OEHHA	Office of Environmental Health Hazard Assessment
OEL	Occupational Exposure Level
OSHA	Occupational Safety and Health Administration
P-20	Ethoxylated Sorbitan Monodecanoate
PVR	Partial Vapor Barrier Room
PEL	Permissible Exposure Limit
Perc	Perchloroethylene
pH	A Logarithmic Measure of Hydrogen Ion Concentration
PID	Photoionization Detector
POTW	Publicly Owned Treatment Works
PPERC	Pollution Prevention Education and Research Center
ppm	Parts per Million
ppmv	Parts per Million by Volume
psi	Pound per Square Inch
PVR	Partial Vapor Barrier Room
REL	Reference Exposure level
ROE	Return on Owner’s Equity
SEHSC	Silicones Environmental, Health & Safety Council of North America
SIC	Standard Industrial Classification Code
SLI	Sodium Lauryl Isethionate
SLS	Sodium Laureth Sulfate
SRP	Scientific Review Panel on Toxic Air Contaminants
TAC	Toxic Air Contaminant
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act of 1976
TWA	Time-weighted Average
UCLA	University of California, Los Angeles
URF	Unit Risk Factor
U.S.	United States
U.S. EPA	United States Environmental Protection Agency
VBR	Vapor Barrier Room
VOC	Volatile Organic Compound