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

Stationary Source Division
Emissions Assessment Branch

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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

To be considered by the Air Resources Board on May 25, 2006 at:

California Environmental Protection Agency
Byron Sher Auditorium
1001 I Street
Sacramento, California

Air Resources Board
P.O. Box 2815
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State of California
AIR RESOURCES BOARD

PROPOSED AMENDMENTS TO THE CONTROL MEASURE FOR PERCHLOROETHYLENE DRY CLEANING OPERATIONS

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STAFF REPORT: INITIAL STATEMENT OF REASONS FOR THE PROPOSED AMENDMENTS TO THE CONTROL MEASURE FOR PERCHLOROETHYLENE DRY CLEANING OPERATIONS

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State of California
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Staff Report: Initial Statement of Reasons for the Proposed Amendments to the Control Measure for Perchloroethylene Dry Cleaning Operations

Executive Summary

I. INTRODUCTION

This Executive Summary presents 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). The proposed amendments are designed to further protect public health by reducing Perc emissions from dry cleaning operations in California. The staff will be presenting these proposed amendments to the Board for consideration on May 25, 2006. 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 performed 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 is proposing amendments to the Dry Cleaning ATCM. The proposed amendments are designed to further protect public health by requiring a 300 foot separation between new Perc facilities and a sensitive receptor, phasing out the use of Perc in co-residential facilities, phasing out the use of the more emissive Perc technologies in existing facilities, restricting the substitution of other TACs, and requiring enhanced ventilation for new and existing facilities that use Perc.

The proposed amendments are not expected to impact Perc dry cleaners in the South Coast Air Quality Management District (South Coast AQMD). In 2002, the South Coast AQMD amended Rule 1421, Control of Perchloroethylene Emissions from Dry Cleaning Systems (Rule 1421), to prohibit new Perc dry cleaning facilities and to completely phase out the use of Perc for dry cleaning by December 1, 2020. However, if the Board adopts alternatives to the proposed amendments, those amendments could impact dry cleaners in the South Coast AQMD.

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. <u>What would the proposed amended Dry Cleaning ATCM require</u>?

The proposed amended Dry Cleaning ATCM has specific requirements depending on whether the facility is existing or new. A summary of the major requirements of the proposed amendments is shown in Table ES-1. For existing co-residential facilities (facilities that share a wall with, or are located in the same building as, a residence), the proposed amendments require that Perc machines be phased out of operation by July 1, 2010. For all other existing facilities, the proposed amendments require that the more emissive Perc technologies (i.e., converted, primary, and add-on secondary machines) be replaced with integral secondary machines. The phase out of these machines is to begin July 1, 2009, for all machines that are 15 years old or older (manufactured in 1994 or earlier). For each subsequent year, Perc machines must be replaced with an integral secondary machine (or non-Perc alternative) as they become 15 years old. However, if the Perc facility is within 100 feet (30 meters) of a sensitive receptor, the Perc machine must be replaced with an integral secondary machine (or non-Perc alternative) when it is 10 years old or by July 1, 2010, whichever is later. By July 1, 2016, only integral secondary Perc machines will be allowed. In addition, existing facilities are required to install one of three types of enhanced ventilation systems. These enhanced ventilation systems include a local ventilation system, a partial vapor barrier room, or a full vapor barrier room. The compliance date for enhanced ventilation installation is July 1, 2009, if the facility is within 100 feet from a sensitive receptor. If the facility is 100 feet or greater from a sensitive receptor, the compliance date for enhanced ventilation is July 1, 2010.

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

Applicability	Facility Type	Requirements
Applies to any person who owns, operates, manufactures or distributes dry cleaning equipment in California that uses Perc or any other dry cleaning solvent that contains a TAC.	**Co-residential Facility** (Any facility that shares a wall with a residence or is located within the same building.)	No co-residential facility shall install any dry cleaning equipment which uses Perc. Perc machines will need to be phased out by July 1, 2010.
	Existing Facility (Any facility that operated Perc dry cleaning equipment prior to July 1, 2007.)	Converted, primary and add-on secondary Perc machines: • If the facility is 100 feet or more from a sensitive receptor - Replace with integral secondary control machines (or non-Perc alternative) by July 1, 2010, or when the machine is 15 years old, whichever is later; • If the facility is within 100 feet of a sensitive receptor - Replace with integral secondary control machines (or non-Perc alternative) by July 1, 2009, or when the machine is 10 years old, whichever is later; • Complete phase out of all converted, primary, and add-on secondary machines by July 1, 2016. Installation of enhanced ventilation according to the following schedule: - By July 1, 2009, if the facility is within 100 feet from a sensitive receptor. - By July 1, 2010, if the facility is 100 feet or greater from a sensitive receptor.
	New Facility (A facility that did not operate any dry cleaning equipment using Perc or any solvent that contains a TAC prior to July 1, 2007. Facility relocations shall be considered new facilities.)	Use of BACT for Perc operations - integral secondary control machine and enhanced ventilation. Must be at least 300 feet from a sensitive receptor, and must be outside of and at least 300 feet from the boundary of a residential zone. Facilities that use a solvent that contains a TAC other than Perc will need to install, operate and maintain BACT as required by applicable local air district rules or regulations or achieve reductions in risks associated with the TAC's usage that equals or exceeds the reductions for Perc if there is no local air district rule or regulation.

For new co-residential facilities, the proposed amendments prohibit the use of Perc. For all other new Perc facilities, the proposed amendments will require the use of best available control technology (BACT). For new Perc facilities, BACT is proposed to be an integral secondary control machine that operates with an enhanced ventilation system. New Perc facilities also need to have a 300-foot separation zone (see Table ES-1). Facilities that use a solvent that contains a TAC other than Perc will need to install, operate, and maintain BACT as required by applicable local air district rules or regulations. In the absence of a local air district rule or regulation, the facility will need to submit and have approved by the district a control method or methods that achieve reductions in risk equal to or exceeding the reductions that would be required for a Perc facility under the proposed ATCM. Good operating practices and recordkeeping and reporting requirements are included for both new and existing facilities.

III. OVERVIEW OF THE DRY CLEANING INDUSTRY

Typically, dry cleaners are considered small businesses and most employ fewer than five employees. More than 50 percent employ two or less as full-time employees. Dry cleaners are typically located in shopping centers. Perc is the solvent most widely used by the dry cleaning industry in California. The 2003 ARB survey results indicate that there are about 5,000 dry cleaning facilities in the State and about 4,300 of them use Perc as the solvent and about two percent are co-residential facilities. More than 95 percent of the cleaning facilities have only one dry cleaning machine. About 40 percent of the Perc machines will be 15 years old or older (manufactured on or before 1994) in 2009. The remaining 60 percent are less than 15 years old.

1. <u>What types of dry cleaning technologies are used</u>?

Over 85 percent of dry cleaning facilities use Perc as the cleaning solvent. There are three types of Perc dry cleaning machines in use: machines converted from vented to closed-loop (converted), closed-loop machines with primary control (primary control), and secondary control machines. Secondary control machines are separated into primary machines that added on secondary controls (add-on secondary control) and closed-loop machines with integral primary and secondary controls (secondary control or integral secondary control). In this proposal, BACT is an integral secondary control machine with enhanced ventilation for both new and existing facilities.

The second most common solvents in use are high flash point synthetic hydrocarbon solvents manufactured by ExxonMobil (DF-2000™ Fluid) and by Chevron (EcoSolv® Fluid). Other hydrocarbon solvents being used include: PureDry® (PureDry), Shell Sol 140 HT (Shell 140), and Stoddard Solvent (Stoddard). The most advanced hydrocarbon machines may use any of the hydrocarbon solvents mentioned. ARB staff estimated that about 400 dry cleaners in California are currently using hydrocarbon solvents. All hydrocarbon solvents are classified as volatile organic compounds (VOCs).

In addition to hydrocarbon solvents, dry cleaners are also using other technologies such as decamethylcyclopentasiloxane (D_5), Rynex™(Rynex 3), Carbon Dioxide Cleaning (CO_2), Professional Wet Cleaning (wet cleaning), and Green Jet® (Green Jet). Volatile methyl siloxane or D_5 is an odorless, colorless liquid. It is present in the GreenEarth® (GreenEarth) dry cleaning solvent. GreenEarth solvent is mostly used in hydrocarbon machines and is not classified as a VOC. The Office of Environmental Health Hazard Assessment (OEHHA) is currently evaluating the toxicity testing data submitted by GreenEarth. Rynex 3 is a mixture of substituted aliphatic glycol ethers with limited toxicity data. It is also classified as a VOC.

Wet cleaning, an alternative to dry cleaning that was first introduced in 1991, differs from commercial laundering in several aspects. Wet cleaning uses computer-controlled washers and dryers with detergents that have been specially formulated for the process. 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.

Cleaning with CO_2 is a process that operates within a pressurized, and therefore relatively costly, 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.

Finally, the Green Jet machine cleans and dries garments in a single computer-controlled unit using a mist of water and detergent to clean the garments. The process is more suitable for lightly-soiled garments. Table ES-2 shows the number of facilities that are using Perc and alternative technologies based on ARB's 2003 facility survey. Table ES-3 shows an updated number of facilities that are using non-toxic and non-smog forming technologies.

Table ES-2. Number of Dry Cleaning Facilities Statewide and Existing Technologies

Statewide Facility Estimates	Number of Facilities[1]	Percent (%)[2]
Dry cleaning facilities	5,040	n/a
Perc dry cleaning facilities	4,290	85
Mixed facilities (Perc + Alternative)	190	4
Non-Perc facilities	550	11
DF-2000 (hydrocarbon)	400	8
GreenEarth	90	2
Others (PureDry, Rynex 3, Stoddard, and other high flash point hydrocarbon solvent)	60	1

1. Values are generally rounded to the nearest 10 and are based on 2003 Facility Survey.
2. Values are generally rounded to the nearest integer.

Table ES-3. Number of Dry Cleaning Facilities Statewide Using Non-Toxic and Non-Smog Forming Technologies

Non-Toxic and Non-Smog Forming Facilities[1]	Number of Facilities[1]	Percent (%)[2]
Water-based Cleaning including Professional Wet Cleaning	49	~1
Professional Wet Cleaning Demonstration Facilities	20	<1
CO_2 Cleaning	5	<1

1. Based on 2006 information. Professional wet cleaning demonstration facilities may also be included in water-based cleaning.

Since the Rule 1421 amendments and district grant program have been in effect in the South Coast AQMD, there were about 80 percent new hydrocarbon machines, about 10 percent new GreenEarth machines, and about 10 percent wet or CO_2 cleaning installed in the South Coast. Most of the wet and CO_2 cleaning facilities received grants.

2. How effective are the current dry cleaning technologies?

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 and surfactants), the use of spotting agents, and process considerations (e.g., time, temperature, and mechanical actions). Most of the dry cleaning technologies can handle delicate garments and clean oil-based and water-soluble stains. Table ES-4 provides a comparison of cleaning performance for the various dry cleaning solvents.

Table ES-4. 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. What types of ventilation control technologies are available?

The type of ventilation system used in a dry cleaning facility has a significant impact on the concentration of Perc emissions in the area near the facility. Most dry cleaning facilities use natural ventilation, window fans, or general ventilation. Natural ventilation relies on an open door and window for air circulation. Other facilities use window fans or general ventilation with large capacity fans on the roof of the facility to vent fugitive emissions.

Enhanced ventilation systems provide for better capture and dispersion of the Perc emissions, reducing the nearby outdoor concentrations. Three enhanced ventilation types have been used in the industry that are more effective in capturing fugitive emissions, at rates between 70 to 99 percent, and are required by the proposed amendments. The ventilation systems include local ventilation systems, partial vapor barrier rooms, and full vapor barrier rooms. A local ventilation system is one that uses a high capacity fan and exhaust apparatus, such as a fume hood, to vent fugitive emissions. A partial vapor barrier room is a room that encloses the back of the dry cleaning machine and has a high capacity fan to draw fugitive vapors through a stack for release outside. A full vapor barrier room is a room that completely surrounds a dry cleaning machine and is constructed of material resistant to diffusion of solvent vapors. A high capacity fan collects virtually all of the fugitive emissions and vents them through a stack above the building.

IV. POTENTIAL EMISSIONS AND RISK

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

The amount of Perc being emitted by a typical dry cleaning facility differs depending on machine type. An average dry cleaner cleans about 47,000 pounds of material per year. Based on this, ARB staff estimates that a typical converted dry cleaning machine emits about 1,100 pounds of Perc in one year. Similarly, a typical primary machine emits about 800 pounds of Perc in one year and a typical secondary machine emits about 400 pounds of Perc in one year. Statewide, the dry cleaning industry uses 378,000 gallons and emits 222,000 gallons or about 3 million pounds of Perc per year. Dry cleaners use a majority of the Perc in California. Based on an estimate from the Perc manufacturers, about 80 percent of the Perc sold in California is used for 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 performed an extensive assessment of the potential health effects of Perc. Reviewing available health effects data, 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. There are noncancer health effects from exposure to Perc that 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 U.S. EPA has classified Perc in Group B2/C, as a probable human carcinogen. The International Agency for Research on Cancer (IARC) has classified Perc in Group 2A, as a probable human carcinogen.

3. <u>What are the potential health impacts to individuals from existing PERC dry cleaning operations</u>?

To assess potential health impacts at 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). 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). This policy was developed in consultation with OEHHA.

Table ES-5 provides estimates of the potential cancer risk for a resident living at 20, 30, or 100 meters from a Perc dry cleaning facility. Risk estimates are presented for converted machines and primary control machines with general ventilation and for secondary control machines with enhanced ventilation. Staff assumed an emission rate that would include 90 percent of all dry cleaners. The potential cancer risk levels for converted and primary machines are what we would expect for source complying with the current ATCM. The potential cancer risk level for secondary machines with enhanced ventilation are what we would expect for a source complying with the proposed ATCM.

Table ES-5. 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 Enhanced Ventilation
20 (66)	75	60	23
30 (100)	45	40	15
100 (330)	8	6	3

1. Assuming 90th percentile Perc usage and emissions (Perc emissions rates of 113 gallons per year for converted, 94 gallons per year for primary, and 61 gallons per year for secondary machines). The table includes results from three meteorological data sets (Fresno, Oakland (port), and San Diego (Miramar)). Results are for the inhalation pathway. Calculations assume a 70-year exposure duration and use the 80th percentile daily breathing rate. Enhanced ventilation is defined as a local ventilation system, a partial vapor barrier room, or a full vapor barrier room. All results are rounded.
2. Distances are presented from the building edge.

Table ES-6 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.

Table ES-6. Percent of Perc Machines at Various Distances from Residences

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

Combining the information provided in Tables ES-5 and ES-6, shows that after implementation of the proposed amended ATCM, about 22 percent of the facilities would have potential cancer risks in the 20 to 25 in a million range, 14 percent of the facilities would have potential cancer risks in the 15 to 25 in a million range, and 30 percent of the facilities would have potential cancer risks of 5 to 15 in million range, and 34 percent of the facilities would have cancer risks of 5 in a million or less.

V. IMPACTS OF THE PROPOSED AMENDMENTS

1. <u>What are the environmental impacts of the proposed Dry Cleaning ATCM</u>?

The proposed amendments will significantly reduce Perc emissions from dry cleaning operations. The ARB staff estimates that, with full implementation of the proposed amended Dry Cleaning ATCM, Perc emissions from facilities will be reduced on average by about 40 percent or about 1 ton per day.

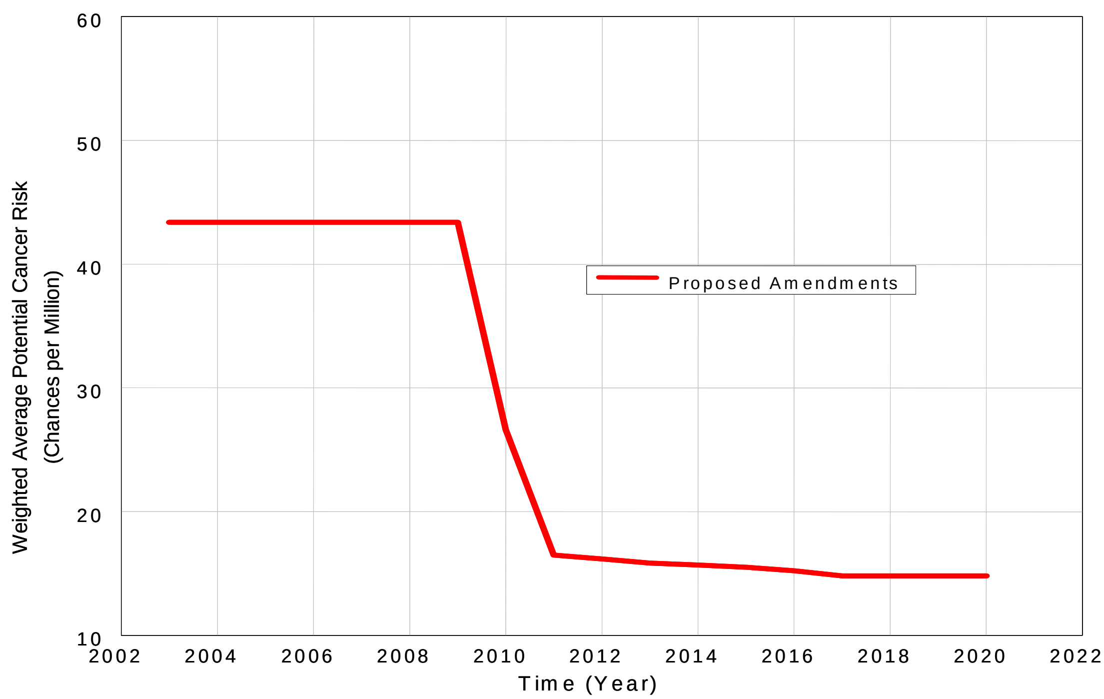
The proposed amendments also restrict the substitution of other dry cleaning solvents that contain a TAC. In addition to the Perc emission reductions, the amount of hazardous waste produced and the potential for soil and water contamination will also be reduced. It is estimated that, with full implementation, there will likely be an increase in VOCs due to the increase in use of hydrocarbon solvents. In order to comply with the proposed ATCM, the only situation where Perc cannot be used is in co-residential facilities. If only co-residential facilities switch to hydrocarbon as a result of the proposed ATCM, an increase in hydrocarbon emissions of about 0.02 tons per day (40 pounds per day) would occur.

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

The proposed amended Dry Cleaning ATCM will require a 300 foot separation between new Perc facilities and a sensitive receptor, phase-out the older Perc technologies, require the installation of enhanced ventilation for all Perc facilities, and phase-out the use of Perc in co-residential facilities. Figure ES-1 shows the current and projected average potential cancer risk after implementation of the proposed amended Dry Cleaning ATCM for facilities that use Perc in California. The figure uses potential risk results for a receptor at 20 meters.

Risk levels near facilities using conventional machines will be reduced by 70 percent. For facilities using primary machines risk levels will be reduced by 62 percent. For facilities using integral secondary control machines with enhanced ventilation emissions will be reduced by approximately 50 percent. Risk levels near co-residential facilities will be reduced by 100 percent. As shown in Figure ES-1, the overall weighted average risk reduction is expected to be about 65 percent.

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



1. Figure is based on potential risk estimates at 20 meters.

Staff looked at the impact of the proposed amendments on statewide exposure to Perc outside of the South Coast AQMD because South Coast AQMD is applying its own measure to prohibit Perc use in dry cleaning. On a regional basis, the proposed ATCM would reduce dry cleaning Perc emissions by about 40 percent. Based on recent monitoring data (2004), the average population weighted cancer risk from exposure to

Perc is estimated between 1 and 2 chances per million. When this reduction is added to the other Perc control actions adopted by the Board, an overall reduction of Perc emissions from the 2004 levels of approximately 66 percent is expected. 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.

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

The proposed amendments, unless modified by the Board, are not expected to impact the dry cleaners in the South Coast Air Quality Management District (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. 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 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.

4. What are the potential health impacts to individuals from Perc alternatives?

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. However, there is relatively little health data available on some of the other alternatives to Perc and no California health values have been adopted. 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. However, the regulation addresses the use of TACs as 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 is linked to adverse health effects including respiratory irritation, asthma, and premature death.

5. 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 16 million dollars over 15 years. This corresponds to an annualized cost (in 2005 dollars) of 1.6 million dollars per year from 2007 through 2021. This corresponds to an annual cost of about $680 per year over 15 years for the

2,300 affected facilities. The statewide costs are based on 2005 dollars and represent the capital cost of new equipment, good operating practices, and Perc savings from 2007 through 2021.

The cost for a typical business to comply with the proposed amendments varies depending on the facility type, machine age, distance to sensitive receptors and the extent that the facility is already in compliance with the proposed amendments. The total annual net cost over a 15-year period ranges from $380 to $2,420.

Cost-effectiveness is expressed in terms of control costs (dollars) per unit of Perc reduced (pounds). The cost-effectiveness for the proposed amendments is determined by dividing the total capital costs plus the annual recurring costs by the total pounds of Perc reduced during years 2007 to 2021. All costs are in 2005 equivalent expenditure dollars. Therefore, by dividing the annualized cost of 1.6 million dollars by the reduction in Perc of approximately 0.6 million pounds per year, staff estimates the overall cost-effectiveness of the proposed amendments to be about $2.60 per pound of Perc reduced.

6. <u>Are these economic impacts considered to be significant to individual dry cleaners</u>?

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. Depending on the extent that a facility is already in compliance with the proposed amendments and the facility type, the proposed amended Dry Cleaning ATCM is expected to result in a decline of ROE ranging from 7 to 35 percent. For example, for a facility that already operates an integral secondary machine and only needs to add enhanced ventilation, the ROE is estimated to decline from 7 to 10 percent. A facility that must replace their dry cleaning machine with an integral secondary machine and enhanced ventilation (at the end of its useful life) is estimated to experience an ROE decline ranging from 10 to 35 percent. A facility that replaces Perc with other hydrocarbon technologies is estimated to experience an ROE decline ranging from 22 to 35 percent. This range of decline in ROE assumes no change in total sales and that the owner does not increase the cost they charge for cleaning to cover their costs. Based on this information, staff believes that the proposed amendments could have a significant adverse impact on the profitability of operators of dry cleaning businesses that are currently operating on marginal profitability if they are not able to pass their costs on to their customers.

For those facilities that replace their existing machine with a secondary machine when the existing machine is 15 years old, we estimate that the typical owner would have to charge an additional $0.65 (65 cents) per garment to recover the cost of the new secondary machines and enhance ventilation system within 5 years. For the same situation, except assuming the existing machine needs to be replaced when it is 10 years old, the additional charge per garment would be around $75 (75 cents). The owners of co-residential facilities would have to increase their cost per garment by about $0.90 (90 cents). 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.

7. Is there financial assistance for dry cleaners who would like to replace their Perc dry cleaning systems?

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 objective of the grant program is to provide financial assistance ($10,000) to California dry cleaners who pay for a portion of the cost to 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. 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.

The grant program for the dry cleaning industry began in April 2005. To date, ARB has awarded 14 grants to eligible dry cleaning recipients which total $140,000 in grant awards. The grant guidelines and application package are made available to all dry cleaners annually. Staff anticipates being able to fund approximately 20 grants per year.

VI. REGULATORY ALTERNATIVES

After considering the proposed amendments, the 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 are discussed below.

1. Take No Action

This alternative would be to take no action to amend the Dry Cleaning ATCM. This alternative would continue the current situation where the public would continue to be exposed to current levels of Perc emissions.

2. Prohibit Use of Perc in Dry Cleaning Operations

This alternative would prohibit Perc use in dry cleaning by a specific date, either as has been done in the South Coast AQMD rule or through a more effective option. This approach would virtually eliminate the potential cancer risk from Perc dry cleaning. However, the alternative would likely result in significant increases in hydrocarbon emissions. Staff estimated that this approach would result in a more than doubling in the cost of the regulation. We estimate that the cost to clean a garment for a typical facility would have to increase by about $0.90 (90 cents) to recover the compliance cost.

3. <u>Prohibit Use of Machines that Emit Toxic and Smog-forming Emissions</u>

This alternative would prohibit Perc uses by a specific date as in Alternative 2 and also prohibit the use of machines that emit smog-forming emissions. Non-toxic and non-smog forming alternatives that are available include water-based cleaning and carbon dioxide cleaning. The cost impact of this alternative would be somewhat greater than Alternative 2 – more than seven times the proposed ATCM. We estimate that the cost to clean a garment for a typical facility would have to increase by an average of $1.40 to recover the compliance costs.

4. <u>Shorten the Dates for Compliance with Amendment Requirements</u>

This alternative would shorten the time frames in the regulation which require certain emission control requirements to be in place by specified dates. Shortening the time frames in the regulation would increase the cost of compliance. The amount of the increase would depend on what 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 with integral secondary machines.

5. <u>Use a Risk-Based Threshold Requirement to Achieve Emission Reductions</u>

This alternative would establish risk-based thresholds that Perc dry cleaning facilities would have to meet. This could be similar to the South Coast AQMD requirements in Rule 1401 and 1402 that apply to dry cleaning facilities. This approach is administratively more challenging than the proposed ATCM. It would also require additional costs for facilities and the local air districts to implement this regulation.

VII. PUBLIC OUTREACH AND 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, held 12 workgroup meetings, attended two evening meetings with the Northern California Korean Dry Cleaners-Laundry Association, and conducted four public workshops.

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. <u>How does the proposed amended Dry Cleaning ATCM relate to ARB's goals on Environmental Justice</u>?

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 reduce Perc emissions by requiring a 300 foot separation between new Perc facilities and a sensitive receptor, phasing out Perc operations in co-residential facilities, requiring the use of BACT (integral secondary control machines with enhanced ventilation for existing and new facilities), and requiring siting criteria for new facilities. 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.

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 this compound 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, section 93109. The Dry Cleaning ATCM sets forth the equipment, operations and maintenance, recordkeeping, and reporting requirements for dry cleaning operations.

Since 1993, ARB staff, in its tracking of the Dry Cleaning ATCM, has evaluated the effectiveness of the Dry Cleaning ATCM and has found that more can be done to reduce emissions of Perc from dry cleaning operations.

B. Purpose

The 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.

In 2003, ARB began a technical evaluation of the existing Dry Cleaning ATCM. The purpose of the assessment was to determine whether the Dry Cleaning ATCM continues to be adequately protective of public health. The technical assessment is available under separate cover, entitled California Dry Cleaning Industry Technical Assessment Report (Technical Assessment Report) and was released February 2006.

This staff 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.

The 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.

This Initial Statement of Reasons (ISOR) for the proposed amendments to the existing Dry Cleaning ATCM presents information on the current status of 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. Summary of Changes to the Existing Dry Cleaning ATCM

Most significantly, the proposed changes to the existing Perc Dry Cleaning ATCM will impact the type of equipment being used in Perc dry cleaning facilities. Additionally, the proposed amendments will expand the applicability of the ATCM to include facilities that switch to a solvent that contains a TAC. The existing Perc Dry Cleaning ATCM prohibited the use of transfer, vented, and self-service machines. The proposed amended Dry Cleaning ATCM will include additional prohibitions for the use of new primary control machines, secondary control dry cleaning machines that have not been certified by the ARB, drying cabinets, and dip tank operations in Perc dry cleaning facilities. Also, new co-residential Perc facilities will be prohibited. Co-residential facilities will be required to phase out their Perc dry cleaning machines and existing facilities will be required to use best available control technology (BACT), which is proposed to be an integral secondary control dry cleaning machine or an alternative (non-Perc) cleaning system. New facilities will also be required to use integral secondary control dry cleaning machines, but in addition, these facilities will also have to comply with a siting requirement.

All Perc dry cleaning facilities will be required to install enhanced ventilation systems. Facilities will be given a choice to install one of the following: a local ventilation system; a partial vapor barrier room; or a full vapor barrier room. Each of these enhanced ventilation systems are more effective than what is required in the existing Dry Cleaning ATCM. Wastewater treatment also requires BACT. Facilities are given the choice to have their wastewater hauled away by a registered hazardous waste transporter, which is regulated in California by a federally authorized State program under the responsibility of the California Department of Toxic Substances Control (DTSC), or treated in a wastewater treatment unit that meets specific requirements.

The proposed changes to the existing Perc Dry Cleaning ATCM will also require some additional recordkeeping and reporting, good operating practices, testing, and manufacturer certification for secondary control systems. A more detailed discussion on the changes to the existing Perc Dry Cleaning ATCM can be found in Chapter II of this report.

D. 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. To date, ARB has awarded 14 grants to eligible dry cleaning recipients for a total of $140,000. Among these grants, 12 dry cleaners replaced their Perc machines with water-based cleaning systems and 2 dry cleaners installed CO_2 cleaning systems. The 2006 grant guidelines and application package is now available to all dry cleaners to apply for the grant. The application deadline is May 5, 2006.

Due to insufficient funding from Perc fee collections for the first year, ARB was unable to implement the demonstration program. Currently, ARB is in the process of establishing the program to showcase non-toxic and non-smog forming dry cleaning technologies. Soon, interested stakeholders can submit demonstration proposals to ARB for consideration. The information for both the grant and demonstration program is available on our website at *www.arb.ca.gov/toxics/dryclean/ab998.htm*.

E. 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.

F. 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. AB 2588 "Hot Spots" Program

Assembly Bill 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 a statewide air toxics inventory, notification of people exposed to a significant health risk, and facility plans to reduce these risks.

Under the Hot Spots Program, stationary sources are required to report the types and quantities of certain substances that their facilities routinely release into the air. Senate Bill 1731 (SB 1731), which amends the Hot Spots Program, requires ARB to provide assistance to smaller businesses to develop and apply risk reduction techniques. The goal of the Hot Spots Program is to collect emissions data indicative of routine predictable releases of toxic substances to the air, identify facilities having localized impacts, evaluate health risks from exposure to the emissions, notify nearby residents of significant risks, and, due to SB 1731, reduce risk below the local air district established level of significance.

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 Assembly Bill 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, more effective than, the federal dry cleaning regulation. As a result, dry cleaning in California need only comply with the California Dry Cleaning ATCM. Currently, U.S. EPA is accepting comments on a proposed rule to revise their 1993 standards to limit emissions of Perc from existing and new dry cleaning facilities. Based on the preliminary proposals, staff is confident that the emissions-related requirements of the proposed amended Dry Cleaning ATCM are more stringent than U.S. EPA's proposed rule.

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. Local Agencies

a. Local Air Districts

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 and South Coast AQMDs both have rules that are notably more stringent when compared to ARB's existing Dry Cleaning ATCM.

The Bay Area AQMD's Regulation 11, Rule 16 has expanded their requirements to include dry cleaners that use other synthetic solvents, like the hydrocarbon solvents. 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 are required to install enhanced ventilation. Although, the Bay Area AQMD's rule is more stringent compared to the Dry Cleaning ATCM, it will not be as stringent as the ARB proposed Dry Cleaning ATCM as amended.

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. The ARB's proposed amendments to the Dry Cleaning ATCM may require additional recordkeeping and reporting requirements.

b. <u>Local Publicly-Owned Treatment Works</u>

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. The complete text of the proposed Dry Cleaning ATCM is 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.

In 2003, an evaluation of the Dry Cleaning ATCM was conducted 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 that alternatives to Perc dry cleaning are available and viable. The proposed amendments to the Dry Cleaning ATCM will further reduce potential health impacts for residents and off-site workers living or working near dry cleaning facilities by reducing Perc emissions from dry cleaning operations, limiting the potential use of any identified TAC as an alternative dry cleaning solvent, and requiring enhanced ventilation for Perc dry cleaning operations.

To further reduce Perc emissions and risks, ARB staff is proposing amendments to the Dry Cleaning ATCM. The proposed amendments will require the phase out of Perc in co-residential dry cleaning. For existing Perc dry cleaning facilities, the proposed amendments will require the use of better control equipment, that is, integral secondary controls. The proposed amendments will also require enhanced ventilation systems for all Perc facilities. New Perc dry cleaning facilities will need to meet siting criteria that assure they are not located in residential areas. For new dry cleaning operations that use a solvent that contains a TAC other than Perc, the proposed regulation will require facilities to install, operate, and maintain BACT as required by applicable air pollution control or air quality management district (local air district) rules or regulations. If there is no local air district rule or regulation, the facilities will be required to submit to and have approved by the local air district a control method or methods that achieve reductions in the risk associated with the TAC that equal or exceed the reductions for Perc.

B. Changes to the Existing Dry Cleaning ATCM

There are additional requirements for each type of facility (i.e., co-residential, existing, and new). Elevated Perc levels in residential areas have been attributed to co-residential Perc facilities (those that share a common wall, floor, or ceiling with a residence, or located within the same building with a residence). For existing co-residential facilities, the proposed amendments will phase out Perc dry cleaning technologies by July 1, 2010. This phase out of Perc dry cleaning equipment will virtually eliminate the Perc risk from co-residential facilities.

For existing facilities (those that started Perc dry cleaning operations before July 1, 2007), the proposed amendments will phase out the more emissive Perc machines (i.e., converted machines, primary machines, and add-on secondary machines) and require installation of enhanced ventilation systems (i.e., local ventilation system, partial vapor barrier room, or full vapor barrier room). If the existing facilities are 100 feet or more from a sensitive receptor, all machines that are 15 years or older (manufactured in 1995 or earlier) will need to phase out of these machines by July 1, 2010. For each subsequent year, these more emissive Perc machines must be replaced with integral secondary control machines (or non-Perc alternatives) as they become 15 years old. However, if the Perc facility is within 100 feet (30 meters) from a sensitive receptor, the Perc machine must be replaced with an integral secondary control machine (or non-Perc alternative) when it is 10 years old or by July 1, 2009, whichever is later. By July 1, 2016, all Perc facilities shall install an integral secondary control machine (or a non-Perc alternative). In addition, existing facilities are required to install one of three types of enhanced ventilation systems: local ventilation systems, partial vapor barrier rooms, or full vapor barrier rooms.

For new co-residential facilities (those that start operations on or after July 1, 2007), the proposed amendments will prohibit the use of Perc. For all other new Perc facilities, the proposed amendments will require the use of BACT. For new Perc facilities, BACT is proposed to be an integral secondary control machine that operates with an enhanced ventilation system. New Perc facilities must also be located at least 300 feet from a sensitive receptor or an area designated for residential use. Facilities that use a solvent that contains a TAC other than Perc will need to install, operate, and maintain BACT as required by applicable local air district rules or regulations or achieve reductions in the risk associated with the TAC’s usage that equals or exceeds the reductions for Perc if there is no local air district rule or regulation.

New and existing facilities will also be required to perform annual leak checks using a Perc detector that gives a quantitative result, install sampling ports on secondary machines and conduct subsequent annual measurements of Perc concentrations within the drum. These facilities must also have a spare lint filter and a spare set of gaskets on site, and meet the specific requirements for wastewater treatment units if they choose to use a wastewater treatment unit.

Good operating practices and recordkeeping and reporting requirements are included for both new and existing facilities that use Perc or another TAC.

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 to the Dry Cleaning ATCM apply to any person who owns, operates, manufactures, or distributes dry cleaning equipment that uses Perc or an identified TAC. A TAC means an air contaminant that has been identified by the Air Resources Board under sections 93000 and 93001 of title 13, California Code of Regulations, or under title 42, United States Code, section 7412(b) and its implementing federal regulations. A list of TACs can be found in Appendix D.

2. Prohibitions

Under the proposed amendments to the Dry Cleaning ATCM, the owner/operator of a facility shall not operate any of the following types of equipment related to Perc dry cleaning operations: a transfer machine, including 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 converted machine or a primary control machine installed after July 1, 2007; a drying cabinet; and a secondary control system that has not been certified by the ARB. In addition, the owner/operator of a facility may no longer perform dip tank operations with Perc.

The Perc dry cleaning machines that are prohibited have been shown to be more emissive compared to integral secondary control machines (CARB, 2006). The use of drying cabinets and dip tank operations are prohibited because they involve the transfer of Perc-laden material which contributes to fugitive Perc emissions. In addition, a secondary control system that has not been certified by the ARB was prohibited to ensure proper performance of secondary control machines.

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 existing co-residential facilities, the proposed amendments will phase out Perc dry cleaning technologies by July 1, 2010. For new co-residential facilities (those that start operation on or after July 1, 2007), the proposed amendments will prohibit the use of Perc. In addition, all co-residential facilities are required to follow good operating practices as specified in the proposed regulation and outlined in Part 8 of this section.

4. New Facilities

A new facility is defined as a facility that did not operate any dry cleaning equipment using Perc or any solvent that contains a TAC prior to July 1, 2007. Facility relocations will be considered new facilities for the purposes of the proposed regulation.

For all new Perc facilities, the proposed amendments will require the use of BACT. For these facilities, BACT is proposed to be an integral secondary control machine that operates with an enhanced ventilation system. The enhance ventilation system can be a local ventilation system, a partial vapor barrier room, or a full vapor barrier room. In addition, all new Perc facilities must be located at least 300 feet from a sensitive receptor, and located outside of and at least 300 feet from the boundary of an area zoned for residential use. Sensitive receptor means any residence; any educational resource for minors including, but not limited to, schools or preschools for kindergarten through twelfth grade or early childhood education; and any facility licensed under Health and Safety Code division 2, commencing with section 1200, for health care or community care including, but not limited to, hospitals, clinics, skilled nursing, long-term care, adult day care, foster and small family homes, child care centers, and family day care homes.

All new facilities that use a solvent that contains a TAC other than Perc will need to install, operate, and maintain BACT as required by applicable local air district rules or regulations or achieve reductions in the risk associated with the TAC’s usage that equals or exceeds the reductions for Perc if there is no local air district rule or regulation. In addition, all new Perc facilities are required to follow the good operating practices outlined in Part 8 of this section.

5. Requirements for Existing Facilities

An existing facility is defined as any facility that operated Perc dry cleaning equipment prior to July 1, 2007.

For existing facilities, the proposed amendments require that the more emissive technologies (i.e., converted, primary, and add-on secondary machines) be replaced with integral secondary control machines. For existing facilities that do not have an integral secondary control machine, the compliance schedule is as follows:

- If the facility is 100 feet or more from a sensitive receptor, the facility shall install an integral secondary control machine (or non-Perc alternative) by July 1, 2010, or when the primary, converted, or add-on secondary control machine is 15 years of age, whichever comes later.

- If the facility is within 100 feet or more from a sensitive receptor, the facility shall install an integral secondary control machine (or non-Perc alternative) by July 1, 2009, or when the primary, converted, or add-on secondary control machine is 10 years of age, whichever comes later.

- All facilities that have not already done so because of the two requirements above shall install an integral secondary control machine (or non-Perc alternative) by July 1, 2016.

In addition, all existing facilities will be required to install an enhanced ventilation system which includes a local ventilation system, a partial vapor barrier room, or a full vapor barrier room. The compliance date for enhanced ventilation installation is July 1, 2009, if the facility is within 100 feet from a sensitive receptor. If the facility is 100 feet or more from a sensitive receptor, the compliance date for enhanced ventilation is July 1, 2010. Existing facilities will also be required to follow the good operating practices outlined in the Part 8 of this section.

6. Enhanced Ventilation

ARB staff has determined that ventilation technologies exist today that are more effective at reducing the public's Perc exposure than those technologies that existed at the time the original Dry Cleaning ATCM was approved and implemented. Therefore, the proposed amended ATCM requires new and existing facilities to install enhanced ventilation systems, such as a local ventilation system, a partial vapor barrier room, or a full vapor barrier room, as part of BACT to further reduce residual risk and protect public health. Enhanced ventilation systems have been demonstrated to be effective in capturing fugitive emissions. Based on testing, they have been shown to capture 70 to 99 percent of the fugitive emissions and are currently in use at co-residential and other facilities in the Bay Area AQMD (AVES, 2000). More detailed information on enhanced ventilation can be found in Chapter III of this report.

7. Integral Secondary Control Systems

Under the proposed amended ATCM, BACT for use with Perc is defined as operation with an enhanced ventilation system and using a machine with an integral secondary control system or secondary control machine. An integral secondary control system is a device or apparatus that is designed and offered as an integral part of the dry cleaning machines when they are produced and sold. A secondary control system in the industry today is typically a carbon adsorber composed of an activated carbon bed contained in a housing. The secondary control system reduces the concentration of Perc in the recirculating air at the end of the drying cycle to 300 ppmv or below, beyond the level achievable with a refrigerated condenser alone. All Perc machines in new facilities and all Perc machines in existing facilities will need to have integral secondary control systems.

The manufacturer must test all secondary control systems to determine if they meet all of the applicable requirements listed in the proposed amendments (Appendix A). These are the same requirements that are required by the Dry Cleaning ATCM. However, to ensure proper performance of all certified machines, when testing a particular dry cleaning machine model that is available in various capacities and carbon weights, the proposed amended ATCM requires that testing to be conducted on the configuration with the largest ratio of drum capacity to weight of the carbon. The ratio calculation is included in the proposed amended regulation. Also, test results may not be attributed to a replacement dry cleaning machine that has been reconfigured.

Test conditions for primary control, add-on secondary control, and drying cabinets are proposed to be deleted because the amended regulation would no longer approve dry cleaning equipment in these categories. The amendments require that integral secondary control systems shall be tested by the manufacturer on closed-loop machines with the primary control system operating normally. The following procedures are proposed to be added to better reflect possible operating conditions in the industry. The weight of materials shall be recorded for each test. Each test shall be conducted during the cleaning of one load of materials, after running 80 percent of the manufacturer’s recommended number of loads before carbon regeneration. The machine shall be filled to no less than 85 percent of its capacity for each test. Also, at least 70 percent of the load to be cleaned must consist of woolen or absorbent padded material.

Revisions to the certification procedures for the manufacturers of integral secondary control systems are proposed to ensure proper documentation, to improve processing of the certification, and to promote statewide consistency.

8. 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, leak check requirements, and Perc concentration testing in the machine drum for secondary control machines.

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 employ of the facility has been reduced from 30 days to 15 days of the departure. To ensure proper equipment operation, the allowance for a trained operator, who owns multiple facilities, to serve as the interim trained operator at two of those facilities has been deleted. 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. A new requirement is that the 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. See Chapter III for a discussion of Perc detectors.

d. Machine Testing of the Perc Concentration in the Drum

The proposed amended ATCM requires facility operators to test the Perc concentration in the drum annually for secondary control machines to ensure proper performance of the secondary control machines. Facility operators are required to perform annual drum concentration testing by installing two sampling ports as specified by the proposed amendments. The sampling needs to be done using a detector that gives quantitative results with less than ten percent uncertainty at 50 ppmv of Perc. The concentration of Perc in the drum, as represented by the reading from the sample port upstream of the carbon bed, needs to be less than 500 ppmv at the end of the drying cycle (after the adsorption cycle) for a new machine during the initial start-up period and less than 1000 ppmv at the end of the drying cycle during normal operation after the initial start-up period. Also, the Perc concentration at the downstream of the carbon bed needs to be less than 100 ppmv while the secondary control system is operating.

9. Recordkeeping Requirements

Recordkeeping requirements have been amended to include the new items listed below. This additional information should help the facility meet the requirements of the proposed amended ATCM.

- The wastewater disposal method being used. If a wastewater treatment unit is being used, then report the make and model of unit;
- For secondary control machines:
    - i. The start and end time of each regeneration, and temperature of the chilled air;
    - ii. The Perc concentration measured at the upstream and downstream locations at the end of the drying cycle; and
- The type of enhanced ventilation system installed.

10. 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 estimated distances of the facility to the nearest sensitive receptor and nearest business; the make, model, serial number, estimated age of the dry cleaning machine; the method of wastewater disposal; and, if applicable, the facility's enhanced ventilation type in their report. The owner/operator shall furnish this annual report to the local air district by February 2nd of each year. The local air districts shall report to ARB the annual Perc purchases of permitted facilities by April 2nd of each year or an alternate date agreed upon by the local air district and ARB. This information will be used by ARB staff to facilitate implementation of AB 998.

11. Wastewater Treatment

Based on site visit results, ARB staff are aware that some facilities are using homemade wastewater treatment devices that have no emission controls (CARB, 2006). This can lead to fugitive emissions to the air and to accidental discharge to the sewer or surface water. In order to protect the public from the accidental discharges to the sewer and to the water and the workers and nearby residents from fugitive emissions, we are strengthening the requirements. If a facility does not have their wastewater hauled away by a waste hauler they must use a wastewater treatment unit. All wastewater shall be placed in a wastewater treatment unit that has adequate processing capacity for the facility as approved by the local air district and the unit shall be equipped with a separator that has a settling chamber and carbon or another type of adsorbent filtration system that the wastewater cycles through.

12. Water-repelling Operations

All materials to be treated with Perc water-repelling solutions can only be treated in a closed-loop machine.

D. Regulatory Alternatives

The Board may choose to adopt these amendments or alternative requirements or any combination thereof. The alternative approaches to the proposed amendments to the dry cleaning regulation 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. Take No Action

One alternative to the proposed amendments would be to take no action to amend the Dry Cleaning ATCM, that is, to maintain the *status quo*. This alternative would continue the current situation where the public is likely to continue to be exposed to current levels of Perc emissions.

Although the current Dry Cleaning ATCM has furthered the reduction of Perc emissions from dry cleaning operations, air monitoring and modeling studies show that there continues to be potential public health risks under with the current ATCM. Furthermore, technology to future reduce the potential risk from exposures is proven and readily available.

2. Total Phase Out of Perc

A total phase out of Perc would prohibit the installation of new Perc machines and require existing Perc machines to be phased out over a specific time period. This option would virtually eliminate the potential cancer risk from Perc dry cleaning but would have far greater economic impacts on the dry cleaning industry. This option would also most likely result in a large-scale conversion to hydrocarbon solvents which would likely make attainment of state and national Ambient Air Quality Standards for ozone more difficult. Migration to other alternatives such as GreenEarth, water-based cleaning, and CO_2 would be expected to occur to a much lesser extent.

South Coast AQMD's 2002 grant program issued grants to dry cleaners in the Los Angeles area who replaced their existing Perc systems with either hydrocarbon, GreenEarth, wet cleaning, or CO_2 (GreenEarth was later removed from the program due to unresolved issues regarding its toxicity). To date, SCAQMD has awarded grants to 37 dedicated professional wet cleaning facilities, 41 mixed professional wet cleaning facilities, 5 CO_2 cleaning systems, 130 hydrocarbon cleaning systems, and 11 GreenEarth cleaning systems. Under ARB's 2005 grant program, which offers grants to dry cleaners statewide for switching from Perc to either CO_2 or wet cleaning, 12 grants were issued for wet cleaning and 2 grants were issued for CO_2. Many prospective applicants to ARB's grants program expressed concern about ARB grants not being made available for hydrocarbon systems. Currently, very few cleaners are moving toward wet cleaning in the absence of grant funds or other non-loan subsidies.

The behavior seen in the grant programs, which is supported by ARB's survey results, indicates that hydrocarbon is the alternative solvent of choice. GreenEarth is likely to be the second most popular. There are issues with each of the alternatives. Hydrocarbon solvents are volatile organic compounds (VOCs). VOCs are linked to ozone formation, which has been linked to smog, asthma, and premature death. GreenEarth is a silicone-based dry cleaning solvent which, although not a VOC, is being reviewed by OEHHA to determine if there is evidence of other possible toxic effects.

Wet cleaning and CO_2 are the two most environmentally-friendly alternatives. Currently, wet cleaning is not popular in the industry because many dry cleaners believe that it is not suitable for cleaning a wide range of garments and that it is a fundamentally different process. Many dry cleaners have also expressed liability concerns given that garments are labeled as "dry clean only" and do not indicate if the use of wet cleaning systems is appropriate. Additionally, if cleaners are not properly trained to use wet cleaning systems, they may experience an increase in customer complaints as well as a loss of business. ARB staff expects that few cleaners will migrate at this time toward CO_2 due to its high cost compared to the other alternatives. For this option, ARB staff estimates that the cost of a garment for a typical facility would have to increase by about 90 cents to recover the compliance costs.

More information regarding the non-Perc alternatives can be found in Chapters III, V, and VII.

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

This option is the same as discussed in Part 2 of this section (total phase out of Perc) except that it would include a provision to prohibit the use of hydrocarbon solvents. This option would also provide the maximum the protection from emissions of Perc while preventing an increase in VOC emissions from hydrocarbon solvents. This option would have greater economic impacts than the previous alternatives and result in a conversion to non-smog-forming technologies such as GreenEarth, wet cleaning, and CO_2. For this option, the ARB staff estimates that the cost of a garment for a typical facility would have to increase by an average of $1.40 to recover the costs.

Although ARB staff expects that, under this option, most facilities would migrate toward GreenEarth, there could be a considerable number of facilities that choose wet cleaning. The motivation for such a move may come from the unresolved toxicity of GreenEarth and the availability of grant programs, such as AB 998, which provide monetary resources to switch from Perc.

4. Phase Out of Existing Perc Units in Residential Zones

Under the staff proposal, any new facility wanting to use Perc would be required to use an integral secondary control machine and install an enhanced ventilation system. Siting criteria would also apply requiring a new facility to be located at least at a specified distance from a sensitive receptor and outside of and a specified distance from the boundary of any area zoned for residential land use. This alternative would apply the same siting criteria to existing Perc facilities. Any existing facility which did not meet the siting criteria would be phased out over a specified time period and would have the option of either switching to a non-Perc alternative or relocating to an area where the siting criteria for could be met. This option would eventually result in both new and existing facilities being held to the same standard. New Perc co-residential facilities would be prohibited and existing Perc co-residential facilities would be phased out over a specified time period.

This alternative would have a significant adverse economic impact on existing operations but would, in most cases, reduce the potential cancer risk to less than five chances per million. Additionally, this option would most likely result in a large-scale conversion to hydrocarbon solvents thereby significantly increasing statewide VOC emissions. Migration to other non-Perc alternatives such as GreenEarth, water-based cleaning, and CO_2 would be expected to occur to a much lesser extent.

5. Only Address New and Co-residential Facilities

Another alternative is to amend the ATCM to focus only on new facilities and co-residential facilities. No action would be proposed for existing facilities. Under this option, BACT for new Perc facilities would be updated (integral secondary control machines) prohibiting the installation of older, more-emissive technologies (converted, primary, an add-on secondary control machines). This option would also address new co-residential facilities by prohibiting co-residential facilities from installing Perc systems. Existing co-residential facilities would be required to phase out their Perc systems within a specified time period. Although this option would most likely represent a relatively low economic burden to California dry cleaners, it would also provide a lower level of public health protection than the other alternatives primarily because action on existing facilities is not included.

A potential benefit to not including existing facilities is that additional time is provided for ARB staff to further evaluate alternative technologies and collect additional information regarding which alternative technologies the industry is most likely to support (and to what extent). Such information is expected to come from the implementation of South Coast AQMD's Rule 1421, which will require many Perc dry cleaning facilities in the Los Angeles area to start considering non-Perc alternatives as soon as the November 2007 time frame. This benefit would have to be balanced with the reduction in public health protection.

6. Increase the Phase Out Period for Converted, Primary Control, and Add-On Secondary Control Machines

The proposed amendments phase out the more emissive converted, primary control, and add-on secondary control machines based on machine age. Under the proposed amendments, an existing facility will be required at the earliest date to install, operate and maintain an integral secondary control machine by July 1, 2009 or when the primary, converted, or add-on secondary control machine is 15 years of age, whichever comes later. The proposed amendments also limit the time given to replace machines that are 10 years of age in facilities that are located close to sensitive receptors. 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.

7. Decrease the Phase Out Period for Converted, Primary Control, and Add-On Secondary Control Machines

This alternative would shorten the time frames in the regulation which require certain emission control requirements to be in place by specified dates. 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 what requirement is adjusted and how significant the change 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 integral secondary control machines.

8. Performance Inspections of Primary Control Machines Before Phase Out

Some dry cleaners have suggested that the efficiency of a dry cleaning machine is dependent on operation and maintenance practices, amount and frequency of usage, and machine design. Therefore, a machine phase out based on age may potentially phase out machines that are operating efficiently.

Based on staff's evaluation and discussions with industry representatives, it is well established that the performance of a primary control machine is less than that of a secondary control machine. For example, the concentration of Perc in the machine drum for a primary control machine after the drying cycle, operating at its highest efficiency, can be as high as 8600 ppmv. In contrast, the drum concentration for a secondary control machine after the drying cycle, operating with the same high efficiency, is 300 ppmv or lower.

9. Use a Risk-based Threshold Requirement to Achieve Emission Reductions

Finally, the Board could consider specifying risk thresholds above which Perc dry cleaning facilities could not operate, similar to the South Coast AQMD requirements. Currently, the South Coast AQMD requires all existing Perc dry cleaners to use secondary control and comply with its Control of Toxic Air Contaminants from Existing Sources (Rule 1402) which limits the lifetime cancer risk from an existing facility to no more than 25 in a million. In addition, 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 South Coast AQMD's New Source Review of Toxic Air Contaminants (Rule 1401) which limits the lifetime cancer risk from a facility to less than 10 in a million. This approach is administratively more challenging than the proposed ATCM. It would also require additional costs for the air pollution control districts to implement this regulation.

III. SUMMARY OF THE DRY CLEANING INDUSTRY

Typically, dry cleaners are considered small businesses and most employ less than 5 employees. More than 50 percent employ two or less as full time employees. Dry cleaners are typically located in shopping centers. Perc solvent is the most widely used by the dry cleaning industry in the State of California. ARB survey (2003) indicates that there are about 5,040 dry cleaning facilities in the State and that 4,290 of them use Perc as the solvent and about 2 percent are co-residential facilities. More than 95 percent of the cleaning facilities have only one dry cleaning machine. There are approximately 190 facilities that use Perc and one of the other alternatives such as hydrocarbon, GreenEarth, Rynex 3, water-based cleaning including wet cleaning, and CO_2 cleaning technology. Of the 550 non-Perc facilities, 400 use one of the alternative hydrocarbons called DF-2000, 90 used the GreenEarth technology, and the remaining 60 use one of the other hydrocarbons or one of the other alternatives.

A. Dry Cleaning Technologies

1. Types of Cleaning Technologies

Perc is the most widely used dry cleaning solvent in California. Perc is also used in other industry sectors including degreasing operations, paints and coatings, and industrial and 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 have been phased out 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. DF-2000™ Fluid

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. This solvent works well in closed-loop machines.

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 alternative to Perc dry cleaning. ARB staff estimates that about 400 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 5 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 to consider 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).

The Kauri Butanol (KB) number is used to estimate the degreasing efficiency or cleaning ability of a solvent. High KB values generally indicate a strong cleaning ability, whereas a low KB value indicates a weaker cleaning ability. Table III-1 summarizes the cleaning performance for Perc and the alternatives. Evaluation of KB values and alternative technologies are discussed in Chapter VIII of the Technical Assessment Report (CARB, 2006).

3. Emerging Cleaning Technologies

There are four 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, and 4) Hydroclene Fluids. 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 are described in Chapter II of the Technical Assessment Report (CARB, 2006).

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.

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

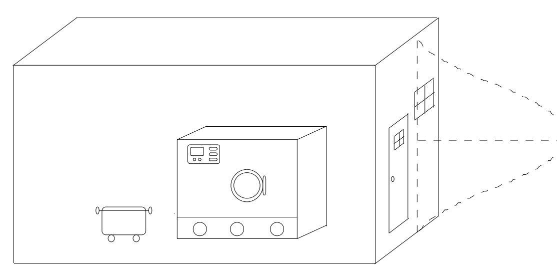
There are different types of ventilation systems at dry cleaning facilities. Ventilation affects the dispersion of solvent vapors and other airborne compounds in the facility and impacts the potential health risk to nearby residences and businesses. In many cases, the type of ventilation system found 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.

An enhanced ventilation system is required by the proposed amendments for all new and existing 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.

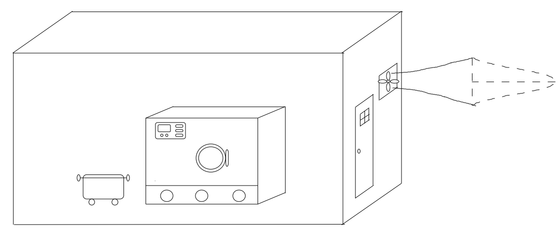
Figure III-2. Natural Ventilation



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.

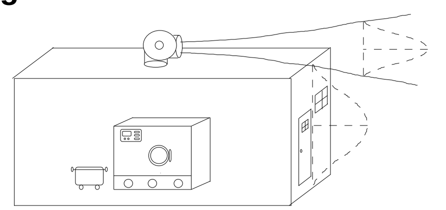
Figure III-3. Window Fan



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.

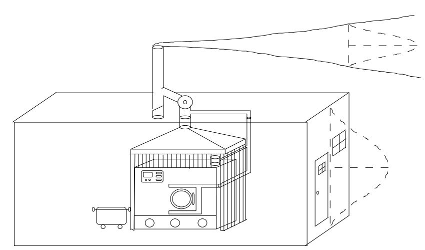
Figure III-4. General Ventilation



d. Local Ventilation System

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.

Figure III-5. Local Ventilation

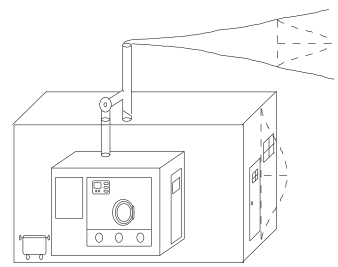


The ventilation duct or fan intake should be placed near the ceiling directly above the back of the machine or at the rear of the local ventilation system. Walls or plastic strip curtains should extend at least 3 feet in front and back of the machine. The exhaust fan should be mounted above or behind 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 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

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.

Figure III-6. Partial Vapor Barrier Room

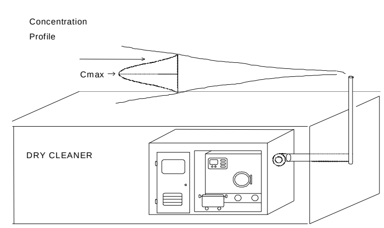


The ventilation duct or fan intake should be placed near the ceiling directly above the back of the machine or at the rear of the partial vapor barrier rooms. The stack should extend at least 5 feet above the building's roofline or any adjacent roof and at least 30 feet from any air intake or window. 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

Improving on partial vapor rooms, full vapor barrier rooms are the most efficient vapor capture systems. 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.

Figure III-7. Full Vapor Barrier Room



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 rooms. 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 open (plastic strips covering doorway will enhance capture). An air change rate of once a minute is recommended (for a small 10' X 10' room a 1,000 CFM fan has 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).

1. Dry Cleaning Facility Survey Results

The Facility Survey was conducted in 2003 and designed to collect information from dry cleaning facilities. The Facility Survey was used to gather information concerning: operating information, facility information, potential future machine purchase/replacement, machine(s) type, solvent usage, waste produced, and maintenance information. Because of the large percentage of Korean dry cleaners, the Facility Survey and the cover letter were also translated into Korean.

Approximately 5,800 Facility Surveys were mailed out and the response rate was 32 percent. A total of 1,634 Facility Surveys were returned from dry cleaning facilities with dry cleaning machine(s) on-site. There were 265 responses from drop off or agency shops (no dry cleaning on-site). Assuming the 14 percent proportion of drop off shops to dry cleaning plants is the same for those that did not return the Facility Survey, ARB staff estimated that there are about 5,040 dry cleaning plants and 816 drop off shops in the State.

Dry cleaners in California are mostly small businesses employing less than five employees. After equating 40 part-time hours worked by part-time employees to one equivalent full time employee, it is estimated that over half of the dry cleaners employ two or less equivalent full time employees. Dry cleaners are usually independently owned and often are operated by the owner and/or their spouse.

The majority of the dry cleaning facilities operate a single dry cleaning machine. Based on the Facility Survey results, the average number of machines per facility was approximately 1.1. Using this value, we estimate that there are about 5,500 dry cleaning machines in California. Most of these dry cleaning machines use Perc as the solvent. In addition to Perc, the second and the third solvent of choice are DF-2000 and GreenEarth. Table III-2 summarizes the current technologies used by California dry cleaners. Table III-3 shows the number of dry cleaning facilities that are using non-toxic and non-smog forming technologies.

Table III-2. Statewide Estimates - California Dry Cleaning Industry[1]

Statewide Facility Estimates	Number of Facilities[2]	Percent (%)[3]
Dry cleaning facilities	5,040	n/a
Perc dry cleaning facilities	4,290	85
Mixed facilities (Perc + Alternative)	190	4
Non-Perc facilities	550	11
DF-2000 (hydrocarbon)	400	8
GreenEarth	90	2
Others (PureDry, Rynex 3, Stoddard, and other high flash point hydrocarbon solvent)	60	1

1. Source: 2003 Facility Survey.
2. Values are generally rounded to the nearest 10.
3. Values are generally rounded to the nearest integer.

Table III-3. Number of Dry Cleaning Facilities Statewide Using Non-Toxic and Non-Smog Forming Technologies

Non-Toxic and Non-Smog Forming Facilities[1]	Number of Facilities[1]	Percent (%)[2]
Water-based Cleaning including Professional Wet Cleaning	49	~1
Professional Wet Cleaning Demonstration Facilities	20	<1
CO_2 Cleaning	5	<1

1. Based on 2006 information. Professional wet cleaning demonstration facilities may also be included in water-based cleaning.

Of the 5,500 dry cleaning machines, there are four types of machines in use: transfer machines, machines converted from vented to closed-loop (converted), closed-loop machines with primary control (primary), and closed-loop machines with both primary and secondary controls (secondary). Transfer machines in use today are for wet cleaning or for cleaning with hydrocarbon solvent, mainly Stoddard. Wet cleaning machines may either be transfer or closed-loop. The percentage of converted machines is about 2 percent (or 110 machines), about 62 percent (or 3,410 machines) of the machines in operation are primary machines and about 28 percent (or 1,540 machines) of the machines are secondary and 2 percent (or 110 machines) are wet cleaning. The remaining 5 percent did not provide answers to the machine type.

Based on the current dry cleaning technology information, alternative technologies are being introduced gradually in the dry cleaning industry. Therefore, the percentages of Perc usages may no longer be as high as shown in Table III-2. In 2002, the South Coast AQMD administered the *Financial Incentive Grant Program* to assist dry cleaners in purchasing non-Perc alternative technologies. The program covered dry cleaners located in South Coast air basin and initially provided funding to dry cleaners that have purchased and installed one of the following qualifying non-perc technologies: 1) Professional Wet Cleaning System, 2) CO_2 Cleaning System, 3) Hydrocarbon Cleaning System and 4) GreenEarth Cleaning System. To date, they have awarded grants to 37 dedicated professional wet cleaning, 41 mixed facilities (combination of Perc machines and alternative technologies), 5 CO_2 cleaning systems, 130 hydrocarbon cleaning systems, and 11 GreenEarth cleaning systems. However, with the uncertainty in the health effects of the silicone-based dry cleaning solvent used in GreenEarth cleaning systems, the South Coast AQMD has discontinued awarding grants for GreenEarth cleaning systems. OEHHA is currently reviewing the toxicity data for the silicone-based solvent used in this system. In addition to SCAQMD grants, AB 998 grants provided 12 professional wet cleaning and 2 CO_2 cleaning systems in 2005.

When comparing machine age of the three types of Perc machines, the average age of Perc converted machines is 16 years, primary machines is 10 years, and the secondary machines is 4 years. In regards to machine capacity, there is a slight increase in capacity when comparing Perc secondary machines to Perc primary machines; the median capacity for Perc secondary machines is 45 pounds while that for the Perc primary machines is 40 pounds. DF-2000 machines are generally slightly larger than the Perc secondary machines with a median capacity of 50 pounds.

One of the tools used to estimate potential health impacts at dry cleaning facilities is air dispersion modeling. Information needed for dispersion modeling includes physical dimensions of the facilities, as well as emission estimates and emission release parameters. Based on the Facility Survey, the average area of the facilities is 1,900 square feet, and the average height is 14 feet. The median facility area is 1,600 square feet, and the median facility height is 12 feet.

Information on whether there are people living above or next to a dry cleaning facility (co-location information) and receptor distances to facilities were obtained from the Facility Survey. The type of receptors included businesses, residences, schools, day care facilities, hospitals, and senior communities. About 2 percent of the facilities are co-located, with about one percent having people living next to and one percent having people living above the dry cleaning facilities. Also, about 56 percent (2,822) of the facilities are within 20 feet of the nearest business indicating that many facilities are most likely located in strip malls. In contrast, about 4 percent (202) of the facilities are within 20 feet of the nearest resident, and about 85 percent (4,284) of the facilities are over 50 feet from the nearest resident. The number of facilities that are less than 100 feet away from schools, day care facilities, hospitals, and senior communities is 2 percent or less. Additional details on the facility survey, dry cleaning business information, operating information, machine information, facility size, receptor distance, maintenance information, and future machine purchase are discussed in Chapter IV of the Technical Assessment Report (CARB, 2006).

2. Other Surveys Results

ARB staff visited over 100 facilities around the State to get more detailed data. The facilities were located in 66 cities and covered 9 districts. During the site visits, staff measured receptor distances, gathered information regarding ventilation types, and gathered general information from the machine operator, owner, and/or worker. The Machine Manufacturers Survey provided staff with current information on machine and maintenance costs, recommended maintenance schedule/practices, and latest technologies available on the machines.

To ensure that our health and environmental impact assessment is based on the correct chemical(s), a Dry Cleaning Solvent Manufacturers Survey (2003) was sent to some of the alternative dry cleaning solvent manufacturers. Staff obtained formulation information associated with petroleum solvent cleaning (DF-2000, PureDry, EcoSolv, Shell 140, Stoddard), volatile methyl siloxane cleaning (GreenEarth), glycol ether cleaning (Rynex 3), CO_2 cleaning, and water-based cleaning systems. Several manufacturers also provided health and environmental impact data. Information gathered was used in our health/environmental impact evaluation.

Additionally, a Perc Solvent Distributors Survey (Distributors Survey) was 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. In general, there is a continuing decrease in usage of Perc in dry cleaning industry. This is most likely due to regulations that are in place and improved processes. The detailed information about the site visits, machine manufacturers survey, solvent manufacturers survey, and the solvent distributors survey are discussed in Chapter IV of the Technical Assessment Report (CARB, 2006).

3. Leak Detector Evaluation

Based on observations during site visits and conversations with ARB training staff and 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, were evaluated. 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).

In all cases, the PID detectors with an internal pump 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. A summary of the results is shown on Table III-4.

Table III-4. Summary of Leak Detector Evaluation

Model and (Manufacturer)	Detection Principle	Sample Delivery	Display	ResponseTime[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[3] (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[4]	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. Laboratory testing done after the memorandum in Appendix H was written.
4. No response to calibrated standards, may require humidified gas sample.

4. Emissions from Dry Cleaning Operations

Emissions from dry cleaning operations are calculated based on a material balance approach. The amount of solvent that is consumed by a dry cleaning operation is either emitted into the air or is embedded in the waste or in clothes that are removed from the facility. Equation 1 shows the material balance relationship.

(1) $$\mathbf{Solv_e = Solv_c - Solv_w - Solv_{clothes}}$$

where:

$Solv_e$ = volume in gallons of solvent emitted to the atmosphere from a dry cleaning facility,

$Solv_c$ = volume in gallons of solvent consumed in a dry cleaning facility,

$Solv_w$ = volume in gallons of solvent that exit a dry cleaning facility in the waste products, such as still bottoms, separator water, and used cartridge filters, and

$Solv_{clothes}$ = volume in gallons of solvent that exit a dry cleaning facility in clothes.

Table III-5 shows the amount of solvent consumed, three-year average of clothes dry cleaned, solvent consumed, still bottoms generated, and the number of filters used for facilities that used Perc primary machines, Perc secondary machines, and DF-2000 machines. As shown in Table III-5, there are three types of cartridge filters that are used in the machines. These are standard, split, and jumbo cartridge filters. A majority of the machines that use cartridge filters only use standard cartridges. Some of the machines have a combination of the three types of cartridge filters and they are designated as such on the table. In addition to cartridge filters, a portion of the machines have spin-disk filters. There are two types of spin-disk filters, powdered and non-powdered. As shown on Table III-5, less than half of a percent of the Perc machines have both a powdered and a non-powered spin-disk. The machines that have cartridge filters may also have spin-disk filters; therefore, the sum of all the values on Table III-5 under proportion of filters used is greater than 100 (CARB, 2006).

Table III-5. Facility Survey Summary for Emission Analysis

Emission Analysis Information	**Perc Facilities** Primary Machines	Secondary Machines	**DF-2000 Facilities**
Amount of clothes cleaned	**Pounds**[1]	**Pounds**[1]	**Pounds**[1]
Average	44,000	52,000	53,000
Yearly solvent usage and waste produced	**Gallons**[2,3]	**Gallons**[2,3]	**Gallons**[2,4]
Solvent consumed	80	68	89
Average Still Bottom Removed	75	88	90
Average Separator Water Produced	141	191	210
Amount of Filters Used Per Year	**Count**[2,3]	**Count**[2,3]	**Count**[2,4]
Average number of Standard cartridge used	15	10	7
Average number of Split cartridges used	13	7	11
Average number of Jumbo cartridges used	7	5	9
Proportion of Filters Used	**Percent**[3,5]	**Percent**[3,5]	**Percent**[4,5]
Machine using Standard cartridge only	58	46	39
Machine using Split cartridge only	7	11	4
Machine using Jumbo cartridge only	5	10	6
Machine using a combination of Standard, Split, and Jumbo cartridges	4	8	9
Machine using non-powdered spin-disk	31	55	42
Machine using powdered spin-disk	13	11	27
Combo (non-powdered and powdered)	<0.5	<0.5	None

1. Values are rounded off to the nearest thousand. Based on annual average data over three years period (2000, 2001 and 2002)
2. Values are rounded off to the nearest integer, unless it is less than one.
3. Values are averaged from three years of data, excluding newly purchased Perc machines.
4. Value is obtained from 2002 data excluding data for machines purchased in 2002.
5. Values are rounded off to the nearest integer unless they are less than one and may not add up to 100 because of combined usage of spin-disk and cartridge filters.

As shown in Table III-6, Perc emissions calculated for the converted machines are the highest, with primary machines having lower emissions, and the secondary machines emitting the least amount of Perc for the same amount of clothes cleaned. When comparing primary machines, there is a distinct difference in emissions between machines that use spin disk filters and a combination of spin disk and cartridge filters versus those that use cartridge filters only. Primary machines that operate with only cartridge filters emit about 41 percent more Perc when compared with those that have a spin disk filter. The difference in emissions between filter types for secondary machines is relatively small. Comparing average Perc secondary machines to DF-2000 machines shows that the weight percent of solvent emitted is very close, with 50 percent and 49 percent, respectively. However, the actual amount in pounds per year emitted is higher for the Perc secondary machines when compared to DF-2000 machines (410 pounds per year versus 230 pounds per year) because Perc has a greater density.

Table III-6. Emissions Comparison[1]

Machine Type	Percent of Machine in Category	Solvent Usage (gal/yr)	Sludge Amt (gal/yr)	Amt Solvent in Sludge (Wt %)	No. of Filter	Solvent Emitted (gal/yr)	Solvent Emitted (Wt %)	Solvent Ems (lb/yr)
Converted	100	106	46	45	22	79	75	1073
Primary (Spin Disk Only)	28	73	86	45	0	44	60	589
Primary (Cartridge Only)	55	97	65	45	18	66	68	889
Primary (Combo)	17	79	78	45	14	45	57	613
Primary (Average)	100	86	74	45	10	56	65	759
Secondary (Spin Disk Only)	32	65	90	46	0	28	48	383
Secondary (Cartridge Only)	29	60	67	46	10	35	55	469
Secondary (Combo)	39	59	85	46	6	17	34	227
Secondary (Average)	100	61	81	46	5	30	50	410
DF-2000	100	78	79	42	4	36	46	230

1. Values are normalized to 46,600 pounds of material cleaned per year and rounded off to the nearest integer.

5. Statewide Estimates of Emissions from Dry Cleaning Operations

Statewide estimates are made based on usage and emission information obtained. The 4,670 Perc machines currently in operation statewide are estimated to use 378,000 gallons of Perc and emit 220,000 gallons of Perc annually. These numbers are calculated based on current estimates of machine types and amount of material dry cleaned.

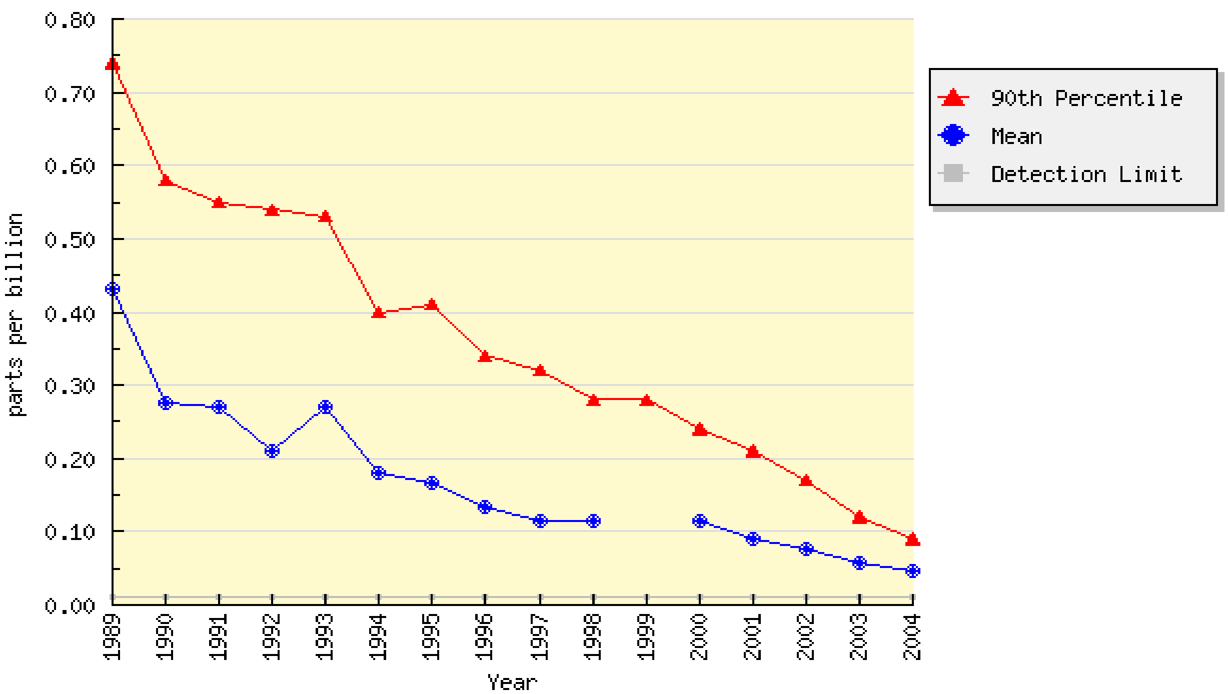
Upon full implementation of the proposed amendments and assuming for the phase out of Perc due to the effects of the South Coast AQMD's Rule 1421, it is estimated that the total reduction in Perc emissions can be up to 4.3 tons per day statewide. This corresponds to about a 90 percent reduction in Perc emissions from dry cleaning facilities.

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 2002 to 2004 is 0.06 ppb (ARB, 2006c). This data shows that the ambient levels of Perc have decreased approximately 80 percent. Figure III-8 shows that, overall, there has been a downward trend in the statewide annual averages for Perc.

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.

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 by up to 4.3 tons per day from the dry cleaning industry. 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 ATCM would reduce dry cleaning Perc emissions by about 40 percent. Based on recent monitoring data (2004), the average population weighted cancer risk from exposure to Perc is estimated between 1 and 2 chances per million[1]. When the dry cleaning reduction is added to the other Perc control actions adopted by the Board, an overall reduction of Perc emissions from the 2004 levels of approximately 66 percent is expected. 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 it's own measure.

IV. POTENTIAL HEALTH IMPACTS OF DRY CLEANING WITH PERCHLOROETHYLENE

A. Overview of Health Risk Assessment

A health risk assessment (HRA) is an evaluation that a risk assessor (e.g., ARB, 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. <u>Hazard Identification</u>

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. <u>Dose-Response Assessment</u>

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 ATCM will phase-out the use of Perc in co-residential facilities, phase out the more emissive Perc technologies, and require the installation of enhanced ventilation for all Perc facilities, on-site worker exposure to Perc at those facilities will be reduced.

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 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 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, 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 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 95^{th} 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. Cancer

The OEHHA staff has performed an extensive assessment of the potential health effects of Perc, reviewing available carcinogenicity data. OEHHA concluded that Perc is a potential human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified Perc as a TAC in October 1991 (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. Noncancer

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 Using Secondary Control

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).

In general, the potential cancer risk at any receptor ((i.e., resident or off-site (adjacent) worker)) ranges between approximately 139 chances per million at 20 meters and 1 chance per million at 100 meters for a majority of existing dry cleaners using converted machines, primary control, and secondary control.

Table IV-3 provides estimates of the potential cancer risk for a resident living at 20, 30, or 100 meters from a sample of Perc dry cleaning facilities. Risk estimates are presented for converted machines and primary control machines with general ventilation and for secondary control machines with enhanced ventilation. Staff used emission rates that will likely include 90 percent of the Perc facilities. The potential cancer risk levels for converted and primary machines are what we would expect for source complying with the current ATCM. The potential cancer risk level for secondary machines with enhanced ventilation are what we would expect for source complying with the proposed ATCM.

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 the 100 meter distance is identified to provide perspective for the potential health impacts at 300 feet, which is distance listed in the regulation for siting criteria. Noncancer health effects are not considered to be an issue as all chronic and acute hazard indices are less than 1.0 and are not considered to be a concern to public health.

Table IV-3. Potential Cancer Risk for the Generic Dry Cleaning Scenarios [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 Enhanced Ventilation
20 (66)	75	60	23
30 (100)	45	40	15
100 (330)	8	6	3

1. Assuming Perc emissions rates of 113 gallons per year for converted, 94 gallons per year for primary, and 61 gallons per year for secondary machines. The table includes results from three meteorological data sets (Fresno, Oakland (port), and San Diego (Miramar)). Results are for the inhalation pathway. Calculations assume a70-year exposure duration and use the 80th percentile daily breathing rate. An enhanced ventilation system includes local ventilation, a partial vapor barrier room, or a full vapor barrier room. 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.

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%

Combining the information provided in Table IV-3 and IV-4, shows that after implementation of the proposed amended ATCM, about 22 percent of the facilities would have potential cancer risks in the 20 to 25 in a million range, 14 percent of the facilities would have potential cancer risks in the 15 in a million range, and 64 percent of the facilities would have potential cancer risks of 5 in million or less.

Table IV-5 presents a summary of the potential health impacts from the generic scenarios across the four meteorological data sets. 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.

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 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 are less than 0.4 at all receptor locations under the high-end (90th percentile) emissions scenario and less than 0.2 at all receptor locations under the average emissions scenario. The acute hazard indices are less than 0.2 at all receptor locations for dry cleaners with secondary control. Generally, hazard indices less than 1.0 are not considered to be a concern to public health.

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
Window Fan	48-96	19-34	10-18	6-11	4-8	3-6	27-54	10-19	5-10	3-6	2-4	2-3
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
Window Fan	40-80	16-28	8-15	5-9	3-7	2-5	22-44	9-16	5-8	3-5	2-4	1-3
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.

F. Comparison of Potential Cancer Risk at Dry Cleaning Facilities Using Converted Machines, Primary Control, and Secondary Control

Table IV-6 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 various machines or controls. 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. Under the high-end (90^{th} percentile) and the average emissions scenarios, when a converted machine is replaced by a machine with secondary control, the residential receptor potential cancer risk is anticipated to be reduced by approximately 45 and 55 percent, respectively. When a machine with primary control is replaced with a machine with secondary control, then the residential receptor potential cancer risk is anticipated to be reduced by approximately 35 percent under both the high-end (90^{th} percentile) and average emission scenarios.

Table IV-6. Comparison of Potential Cancer Risk from Dry Cleaning Operations Using Converted Machines, Primary Control, or Secondary Control [1, 2]

Source Types	Potential Cancer Risk (chances per million)					
	(Based on High-end Emissions)[3]			(Based on Average Emissions)[4]		
	Converted	Primary	Secondary	Converted	Primary	Secondary
Window Fan	178	148	96	120	82	54
Natural Ventilation	139	116	75	93	64	42
Natural Ventilation (B)[5]	97	81	53	65	45	29
General Ventilation (60/40)[6]	142	118	77	96	66	43
General Ventilation (B)[5] (60/40)[6]	94	78	51	63	43	28
Local Ventilation (80/20)[6]	53	44	29	36	24	16
Partial Vapor Barrier Room (95/5)[6]	63	52	34	42	29	19
Full Vapor Barrier Room	59	49	32	40	27	18

1. All results are rounded and are presented for the point of maximum impact (e.g., 20 meters) using generic dry cleaner configurations and the Anaheim meteorological data set.
2. Results are for the inhalation pathway and calculated for a residential receptor with a 70-year exposure duration and 80th percentile daily breathing rate.
3. The high-end (90th percentile) emissions of Perc equate to approximately 113, 94, and 61 gallons per year for converted machines, primary control, and secondary control, respectively.
4. The average emissions of Perc equate to approximately 76, 52, and 34 gallons per year for converted machines, primary control, and secondary control, respectively.
5. 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.
6. 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 ATCM

A. Emissions and Risk Reduction Benefits

The proposed amended ATCM, which excludes facilities in South Coast AQMD, will reduce the emissions of Perc from dry cleaning facilities by approximately one ton per day, from approximately 2.0 tons per day to 1.0 tons per day. This emission reduction will lead to reductions in exposure and decrease the potential health impacts from Perc exposure.

The proposed amendments will phase-out the more emissive Perc technologies, require the installation of enhanced ventilation for all Perc facilities, and phase-out the use of Perc in co-residential facilities. An overview of the potential cancer risk for any receptor ((i.e., resident or off-site (adjacent) worker)) located outside of South Coast AQMD ranges between approximately 80 chances per million at 20 meters and 1 chance per million at 100 meters for a majority of existing dry cleaners using converted machines, primary control, and secondary control. In general for a majority of dry cleaners, an individual's exposure to Perc under the proposed amended ATCM may be reduced by up to approximately 80 percent through the use of improved technology and enhanced ventilation. Table V-1 provides an overview of the estimated reductions in potential cancer risk that may result from implementation of the proposed amended ATCM.

Under the current ATCM, higher use Perc facilities could continue to emit Perc at rates that result in lifetime potential cancer risks of approximately 80 chances per million at 20 meters[1], and approaching ten chances per million at 100 meters, approximately two-thirds of an average city block. With full implementation of the proposed controls, near source lifetime potential cancer risks would be reduced to no more than approximately 25 chances in a million for very close-by residents (those at 20 meters) living near a high use facility. Risks would be at or below ten chances per million for those living 50 meters or further from the facility. Potential risks to residents very near an average emitting facility would be lower, and are estimated to be below 15 chances in a million at 20 meters and below ten chances in a million at 30 meters.

On a regional basis, the proposed ATCM would reduce dry cleaning Perc emissions by about 40 percent. Based on recent monitoring data (2004), the average population weighted cancer risk from exposure to Perc is estimated between 1 and 2 chances per million[2]. When this reduction is added to the other Perc control actions adopted by the Board, an overall reduction of Perc emissions from the 2004 levels of approximately 66 percent is expected. 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 one chance per million.

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[1] Risk levels using meteorological data sets from Fresno, Oakland, and San Diego, and excluding those from SCAQMD, which is implementing its own Perc control measure.

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

Table V-1. Summary of Estimated Reductions in Potential Cancer Risk at an Individual Dry Cleaning Facility from Implementation of the Proposed Amendments [1]

Type of Action	Estimated Potential Reduction
Replacement of more emissive technologies [2]	Up to 55 percent
Using enhanced ventilation[3] rather than using other emission release scenarios	Up to 63 percent
Replacement of Perc machines in co-residential facilities	Up to 100 percent[4]
Total reduction from proposed amendments to the ATCM	Up to 80 percent[5]

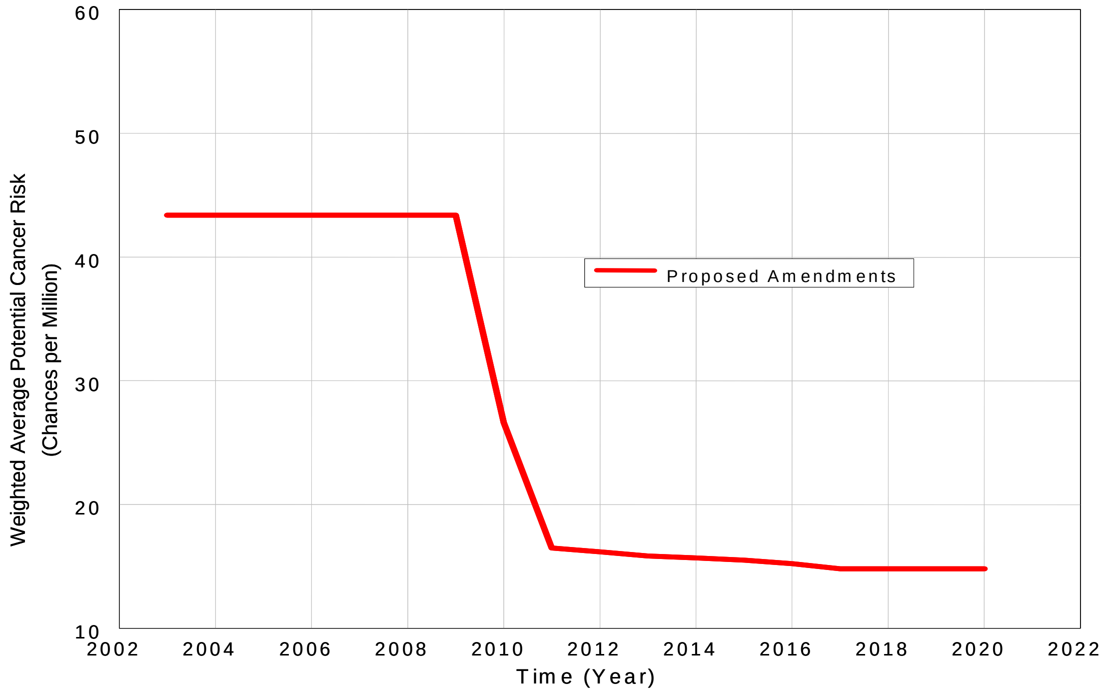
1. All figures are rounded and may be less at an actual dry cleaning facility.
2. Covers the change from converted machine and primary control machine to a secondary control machine.
3. Enhanced ventilation is local ventilation, partial vapor barrier room, or full vapor barrier room
4. Primarily applies to the removal of Perc machines; however, spotting agents that contain Perc may still be utilized.
5. Scenario includes the potential change in risk for a dry cleaner that installs a combination of new machine technology and enhanced ventilation. This scenario does not include co-residential facilities.

An individual's exposure to Perc under the proposed amended ATCM may be reduced by as much as 55 percent when the more emissive technologies (primary control and converted machines) in existing facilities are replaced by dry cleaning machines with secondary control. An additional 63 percent reduction in exposure may be achieved by using enhanced ventilation (i.e., local ventilation, partial vapor barrier rooms, and full vapor barrier rooms) in place of other emission release scenarios. Exposure will be almost entirely eliminated when Perc is phased-out for dry cleaning machines located in co-residential facilities. 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 weighted average potential cancer risk after implementation of the proposed amended Dry Cleaning ATCM for facilities in California. The figure uses potential risk results for a receptor at 20 meters. As shown in Figure V-1, the overall weighted risk reduction is expected to be about 65 percent.

In general for a majority of dry cleaners outside South Coast, public exposure to Perc under the proposed amended ATCM may be reduced by up to approximately 80 percent through the use of improved machine technology and enhanced ventilation. Potential risk estimates for impacted facilities from the proposed amendments were derived by weighting the potential risk based on survey results for machine type.

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



1. 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 an article *A Proposed Methodology for Setting Occupational Exposure Limits for Hydrocarbon Solvents* in the Journal of Occupational and Environmental Hygiene, October 2005. (JOEH, 2005). Information on calculating OELs and guidance values for other substance groups can be found in the 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 $5.2x10^{-7}$ $(\mu g/m^3)^{-1}$, 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^{TM}, 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-2 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

Table. V-2. Summary of Interim Health Values

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

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.

the RELs will result in lower chronic hazard indices. As presented in Chapter IV and Appendix B, both the chronic and acute hazard indices are less than 0.4 at all receptor locations for dry cleaners with secondary control. Generally, hazard indices less than 1.0 are not considered to be a concern to public health. 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.

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, 2004j). 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 four public workshops and participated in two 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.

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 six public workshops in the following areas: Sacramento, the San Francisco Bay Area, and Southern California. 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 air districts. 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). 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 air districts informed of our activities through the California Air Pollution Control Officers Association's (CAPCOA). This work has included telephone calls to the 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 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 the 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 such as: 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 systems. 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 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 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).

VII. ECONOMIC IMPACTS OF THE PROPOSED AMENDED ATCM

In this chapter, ARB staff presents the estimated costs and economic impacts associated with implementation of the proposed amendments to the Dry Cleaning ATCM. The expected initial capital costs and annual recurring 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 affected businesses the total statewide cost of the proposed amended Dry Cleaning ATCM to affected businesses will be approximately $16 million dollars over 15 years. This corresponds to an average annual statewide cost of approximately $680 for the 2,290 affected facilities that operate 2,490 machines. The cost of the proposed amended Dry Cleaning ATCM was estimated in 2005 dollars after accounting for when various costs would be incurred and the number of businesses that are required to phase out Perc machines, phase out the more emissive Perc machine, install enhanced ventilation, and purchase a spare lint filter, a spare set of gaskets, a wastewater treatment unit, and cost due to early equipment replacement for some of the facilities. The proposed amendments are not expected to impact dry cleaning facilities located in the South Coast AQMD, because South Coast AQMD has a dry cleaning rule (Rule 1421) that will phase out the use of Perc in dry cleaning by December 2020.

The initial investments and expenditures required by the proposed amendments include the incremental capital cost of purchasing a hydrocarbon machine or a secondary control Perc machine, capital cost to purchase enhanced ventilation, and cost associated with loss of useful life. Depending on the extent to which that a facility is already in compliance with the proposed amendments, staff estimates the proposed amendments to the Dry Cleaning ATCM will require an initial investment ranging between $3,740 and $35,400 for most facilities. Recurring costs due to the proposed amendments include annual leak testing and drum concentration checks, and changes in recurring costs due to machine requirements. Depending on the extent a facility is already in compliance with the machine requirements, its annual recurring expenditures due to the proposed amendments are anticipated to range from a $20 expenditure to an annual savings of $1,060. The major contributor to an annual cost savings is the difference in solvent cost. Hydrocarbon solvent is lower in cost compared to Perc and a secondary control machine uses less Perc compared to a primary control machine.

The economic impact analysis separates the dry cleaning facilities into three categories: 1) co-residential facilities; 2) facilities that operate with a converted, primary control, or add-on secondary control machine; and 3) facilities that operate with an integral secondary control machine. The analysis separates the facility types because the requirements for the dry cleaning equipment at these facilities are different. Of the approximately 2,290 facilities affected by the proposed amended Dry Cleaning ATCM, it is estimated that about 48 are co-residential facilities that will need to phase out of Perc operation (replacing a Perc dry cleaning machine with a non-Perc machine) by July 1, 2010, independent of age. The number of facilities and machines in each of the three categories are shown in Table VII-1 on page VII-5.

Approximately 1,490 dry cleaning facilities are operating with either converted, primary control, or add-on secondary control machines. These facilities are required to replace their machines with either an integral secondary control machine or an alternative non-Perc machine. The third group includes approximately 800 facilities that operate with integral secondary control machines. Integral secondary control machines are allowed under the proposed amendments. In addition, all facilities that continue to use Perc will be required to install enhanced ventilation and address all other operation and maintenance requirements specified in the proposed amendments.

As presented in Table VII-2, the ARB estimates that approximately 2,090 facilities will need to install enhanced ventilation. In order to minimize the economic impact to these facilities, there is either a two or three year compliance period established for enhanced ventilation installation based on their distance from a sensitive receptor. For many of the facilities that will need to replace their machines (including converted machines, primary control machines, and add-on secondary control machines), a replacement period was established which allows dry cleaners to maximize the remaining useful life of their existing dry cleaning machines and reduce potential economic burden. Replacement is to occur by July 1, 2009 or when the machines are at the end of their useful life of 15 years if the facility is over 100 feet from a sensitive receptor. Otherwise, replacement is to occur by July 1, 2010 or when the machines are at 10 years of age. All non-BACT machines will need to be replaced by July 1, 2016.

Some of the fundamental assumptions used when calculating the impacts of the proposed amendments are summarized here. Costs for co-residential facilities are calculated assuming the owners of those facilities will choose the most popular alternative dry cleaning process (a hydrocarbon machine) when they are required to replace their machine. Costs for existing facilities are based on the assumption that these facilities will replace their converted machine, primary control machine, or add-on secondary control machines with integral secondary control machines. For estimating the cost associated with early replacement of a machine, we used straight line depreciation and a useful life of 15 years. The cost for installing enhanced ventilation was calculated assuming the facilities will choose to install a local ventilation system, the least costly enhanced ventilation system.

One State agency, the Department of Corrections, will be impacted by the proposed amendments. The Department of Corrections operates nine Perc dry cleaning machines at nine correctional facilities throughout California. The nine facilities will need to install enhanced ventilation within the first three years. Two of the nine Perc machines are secondary control machines and sampling ports will need to be installed on these machines. Seven of the Perc machines are primary control machines and will need to be replaced. The Department of Corrections can choose to comply with the requirements of the proposed amendments by replacing the primary control machines with Perc secondary control machines or to install alternative dry cleaning machines. If the Department of Corrections chooses to continue using the Perc dry cleaning process, the cost impact during the first three years of implementation of the amendments is estimated to range from $58,000 to $209,600 and the eventual cost impact range from $76,300 to $341,600 to comply with the proposed amendments over the next 15 years.

Profitability impacts were estimated by calculating the decline 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. Assuming that all costs are absorbed by the affected businesses, the change in ROE was estimated for a typical business. Depending on the extent that a facility might already be in compliance with the proposed amendments and the facility type, the proposed amended Dry Cleaning ATCM is expected to result in an decline in ROE ranging from 7 to 10 percent for facilities with a secondary control machine, ranging from 10 to 35 percent for facilities with a converted, primary control, or add-on secondary control machine, and from 22 to 35 percent for co-residential Perc facilities. Therefore, the proposed amended Dry Cleaning ATCM may have a significant adverse impact on the profitability of the operators of the dry cleaning businesses in California (e.g., co-residential facilities or facilities with marginal profitability).

The proposed amended Dry Cleaning ATCM may significantly alter the profitability of some of the businesses. Some of the marginal operators may have difficulty securing the required capital to finance the purchase of the dry cleaning equipment and enhanced ventilation required by the proposed amendments. These businesses may choose to operate with a less costly alternative dry cleaning process such as a newly developed hydrocarbon cleaning with tonsil or the Green Jet process or cease their dry cleaning operations altogether. If this occurs, 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 on 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 secondary machine when the existing machine is 15 years old, we estimate that the typical owner would have to charge an additional $0.65 per garment. For the same situation, except assuming the existing machine needs to be replaced when it is 10 years old, the additional charge per garment would be around $0.75. The owners of co-residential facilities would have to increase their cost per garment by about $0.90. Lastly, the owners of those facilities that already have a secondary machine will have to charge an additional $0.05 under the proposed amendments because they are already in compliance with the equipment requirements of the proposed amendments.

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 amended Dry Cleaning ATCM is not considered to be a "major regulation", because the estimated cost to California business enterprises does not exceed $10 million in any single year.

2. Affected Businesses

Any dry cleaning business operating a Perc dry cleaning machine outside of the South Coast AQMD is affected by the proposed amended Dry Cleaning ATCM. Other potentially affected businesses include those that remove and install dry cleaning machines, and businesses that supply dry cleaning machines, enhanced ventilation systems, Perc detectors, or sampling ports to the dry cleaning facilities. The focus of this analysis, however, will be on dry cleaning facilities because these businesses would be directly affected by the proposed amendments.

Table VII-1 provides a summary of the number of dry cleaning facilities statewide and those subject to the proposed amended Dry Cleaning ATCM. Based on ARB's 2003 Facility Survey, there are about 4,670 dry cleaning machines that use Perc as the cleaning solvent (Perc machines) at 4,290 dry cleaning facilities statewide. None of the facilities use a solvent that contains an identified TAC other than Perc. During the time of the Facility Survey, about 47 percent (approximately 2,180) of the dry cleaning machines were located in the South Coast AQMD. The proposed amendments are not anticipated to impact Perc dry cleaning facilities located in the South Coast AQMD because South Coast AQMD's Rule 1421 will phase out the use of Perc in dry cleaning operations by year 2020. The number of Perc dry cleaning facilities that are outside of the South Coast AQMD is approximately 2,290.

The economic impact analysis separates the dry cleaning facilities into three categories: 1) co-residential facilities; 2) facilities that operate with a converted, a primary control or an add-on secondary control machine; and 3) facilities that operate with an integral secondary control machine. The reason for this separation is because the requirements for the dry cleaning equipment at these facilities are different. Of the approximately 2,290 facilities affected by the proposed amended Dry Cleaning ATCM, it is estimated that about 48 are co-residential facilities and they will need to phase out of Perc operation by July 1, 2010.

Approximately 1,490 dry cleaning facilities are operating with converted, primary control, or add-on secondary control machines. Many of these facilities are required to replace their machines with either an integral secondary control machine or an alternative dry cleaning machine by July 1, 2009, or when their machines are 15 years old, whichever is later. However, if the facility is located within 100 feet or less of a sensitive receptor, they will have to replace their machines at 10 years of age or by July 1, 2010; whichever is later. In addition, all converted, primary control, and add-on secondary control machines will need to be replaced by July 1, 2016, regardless of age. Approximately 800 facilities currently operate integral secondary control machines. These facilities could continue to operate this equipment. All facilities that continue to use Perc dry cleaning equipment will be required to install enhanced ventilation and address all other operation and maintenance requirements specified in the proposed amendments. The number of Perc dry cleaning machines and facilities in each of the categories are shown in Table VII-1.

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

Facility Description	Number of Facilities	Number of Machines
Facilities with Converted, Primary Control, and add-on Secondary Control	1,490	1,630
Facilities with Integral Secondary Control	800	860
Co-residential Facilities	48	48[2]
Total Facilities Subject to the ATCM[3]	2,290	2,490
Total Facilities in South Coast	N/A	2,180[4]
Total Statewide Perc Dry Cleaning Facilities	4,290	4,670

1. Values are rounded to the nearest ten.
2. Machine to facility ratio is assumed to be one.
3. Total number of facilities is not the sum of the first three rows because co-residential facilities are included in the count for facilities with various machine types in the first two rows.
4. Based on 2003 facility survey.

Table VII-2 provides a summary of the anticipated actions that dry cleaners will take to address the proposed amended Dry Cleaning ATCM. Of the approximately 2,290 facilities affected by the proposed amended Dry Cleaning ATCM, ARB estimates that approximately 2,090 facilities will need to install enhanced ventilation. In order to minimize the economic impact to these facilities, there is either a two-or three-year compliance period established for enhanced ventilation installation based on their distance from a sensitive receptor. About 395 facilities (430 machines) will be impacted by loss of useful life. This early replacement of machines will occur due to receptor distance, if not replaced earlier, the final date for all replacement of July 1, 2016.

Table VII-2. Overview of Anticipated Dry Cleaner Actions from the Proposed Amended ATCM[1]

Action	Number of Facilities
Facilities Acquiring a New Integral Secondary Control Machine	1,480
Facilities Adding Enhanced Ventilation	2,090
Facilities Assumed to be Purchasing a Wastewater Treatment Unit	350
Facilities Losing One to Five Years of Useful Life for Their Converted, Primary, or Add-on Secondary Machine(s)	395

1. Values rounded to the nearest ten.

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

The potential economic impact of the proposed amended Dry Cleaning ATCM on California businesses is based on the following assumptions:

- Facilities that responded to the Facility Survey are representative of all affected 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 dry cleaning facilities that are affected by the proposed amended Dry Cleaning ATCM.
- 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 fees 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.

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

The requirements of the proposed amended Dry Cleaning ATCM are dependant on many variables. Therefore, the actual economic impacts will depend on facility type, location, and the extent that the facility is already in compliance with the proposed amendments. As mentioned previously, three facility types have been identified. They are: 1) co-residential facilities; 2) facilities that operate with a converted machine, a primary control machine, or an add-on secondary control machine; and 3) facilities that operate with an integral secondary control machine.

a. 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. The proposed amendments will require approximately 48 co-residential facilities to replace their Perc operation by July 1, 2010. It is assumed that owners of co-residential facilities will choose to operate using the most popular alternative solvent, a high flash point hydrocarbon solvent (i.e., DF-2000, or EcoSolv). Additionally, it is assumed that there is one dry cleaning machine in each co-residential facility. Since a majority of the co-residential facilities are in the Bay Area, it is also assumed in the statewide cost impacts that these facilities already have installed enhanced ventilation and will be changing from secondary control Perc machines to a machine that uses hydrocarbon solvent. Bay Area facilities had to compile with Bay Area's dry cleaning rule in 1998; therefore, it is assumed that all the co-residential facilities will lose three years of useful life when their Perc machines are replaced in 2010. The actual cost impact to the facility will depend on the actual machine type (primary control or secondary control) at the facility. Table VII-3 shows the potential initial costs for a co-residential facility.

Table VII-3. Potential Initial Costs for Co-residential Dry Cleaning Facilities[1]

Facility Action	Cost (Dollars)
Differential Cost for a New Hydrocarbon Machine[2]	$17,100 or $23,100
Enhanced Ventilation	$3,700 to $8,500
Wastewater Treatment Unit	$1,335[3]
Spare Set of Gaskets and a Lint Filter	$334
Lost of Useful Life of Machine[4]	$0 to $8,780
Range of Total Initial Cost[5]	$22,469 to $37,249

1. Totals are rounded.
2. High end of range is cost to switch from primary controlled machine to hydrocarbon machine.
3. Average cost of available units.
4. Assumed to be 3 years of an integral secondary machine for majority of co-residential facilities.
5. Assumes a local ventilation system is installed. Local ventilation system cost about $3,700.

Table VII-4 shows the total annual recurring costs or the cost of operation and maintenance for operating a Perc primary control machine, a Perc secondary control machine, and a hydrocarbon machine. As shown on Table VII-4 the key recurring costs for operating a Perc primary control machine, a Perc secondary control machine, and a hydrocarbon machine are solvent use, maintenance, filters, and waste disposal. Additional recurring costs for secondary controlled Perc machines include the cost of complying with the annual leak testing and the annual drum concentration check. The annual leak test and the annual drum concentration check require a leak check device that can provide quantitative (i.e., numeric) results.

Table VII-4. Comparison of Recurring Costs for a Primary Control, Secondary Control, and Hydrocarbon Machine[1]

Technology	Solvent Costs	Cost of Detergent/ Spotting Agents	Electricity Cost	Gas Cost[2]	Average Maintenance	Filters	Cost to Replace Gaskets	Waste Disposal Cost	Total Annual Recurring Cost
Perc (Primary)	$1,673[3]	$1,500	$850	$3,580	$375	$320	$500	$2,500	$11,298
Perc (Secondary)	$1,203[3]	$1,500	$850	$3,580	$375	$320	$500	$2,500	$10,828
Hydrocarbon	$546	$1,500	$850	$3,580	$250	$371	$500	$2,640	$10,237

1. Values (except for Gas and Solvent cost) are from the Technical Assessment Report.
2. Gas costs are based on IRTA report and PPERC report.
3. Solvent cost for a Perc primary control machine is based on average usage as found in the Technical Assessment Report and normalized to overall average 46,600 pounds.

Table VII-5 illustrates the potential cost impacts of the proposed amendments to co-residential facilities at two hypothetical facilities. The biggest cost impact due to the proposed amendments is the cost of purchasing a hydrocarbon machine compared to a Perc machine. The incremental machine cost or the cost difference between a hydrocarbon machine and a primary control machine is $23,100; whereas, the cost between a hydrocarbon machine and a secondary control machine is $17,100 (CARB, 2006).

The total annual net cost for switching from a secondary control machine to a hydrocarbon machine ranges from $1,900 to $2,420. This value is obtained by adding the annualized incremental equipment cost which ranges from $2,490 to $3,010 (depending on how much a co-residential facility is already in compliance with the amendments during the remaining life of the Perc machine) to the annual cost savings of $590 from operation and maintenance. In the same way, the calculated total annual net cost for switching from a primary control machine to a hydrocarbon machine is ranges from $1,170 to $1,680. The cost of the proposed amendments for the co-residential facilities over its lifetime can be calculated assuming a 15-year useful life. For the statewide cost analysis, ARB is assuming that all 48 co-residential facilities are currently using secondary control Perc machines and most would already have enhanced ventilation. The decline in ROE for a co-residential facility is shown in Table VII-5.

Table VII-5. Decline in Return on Owner's Equity (ROEs) for Co-residential Facilities[1]

Machine Type	Equipment Cost Due to Early Replacement of machine	Incremental Machine Cost[2]	Other Potential Equipment Cost	Annualized Incremental Machine and Equipment Cost	Total Annual Recurring Savings	Total Annual Net Cost[3]	Percent Decline in ROE
Primary Control to Hydrocarbon	0	$23,100	$0	$2,230	-$1,060	$1,170	22
Secondary Control to Hydrocarbon[4]	$8,780	$17,100	$0	$2,490	-$590	$1,900	35

1. Cost values rounded off to the nearest $10.
2. Cost differential between purchasing a new hydrocarbon machine and a new primary control or a new secondary control machine.
3. Total Annual Net Cost is the sum of Annualized Initial Cost and Total Annual Recurring Cost.
4. Most likely machine type for a co-residential facility.

b. Facilities that Operate a Converted, Primary Control, or an Add-on Secondary Control Machine

Based on 2003 survey data, there are an estimated 3,000 primary control machines and about 80 converted machines in California. There are approximately 1,610 primary control machines and converted machines and about 19 add-on secondary control machines at 1,490 facilities outside of the South Coast AQMD (see Table VII-1). These facilities are required to replace their machines with either an integral secondary control machine or an alternative (non-Perc) cleaning system. It is estimated that about 700 machines will need to be replaced by July 1, 2009. In each subsequent year about 100 machines will need to be replaced as they reach 15 years old. Owners of about 430 machines will incur an additional cost due to losing part of the useful life of the machines because of the facility's distance to sensitive receptors or the 2016 requirement to replace all non-BACT machine replacements independent of machine age.

The potential initial costs for a facility that will replace a converted, a primary control, or a secondary control machine are listed in Table VII-6. The proposed amendments require all facilities with Perc converted machines, primary control machines and secondary control machines to replace their machines with either a secondary control machine or an alternative dry cleaning technology at specified times. If the facilities owners choose to replace their machines with a secondary control machine, these facilities will incur on average an additional $6,000. This $6,000 figure is the cost difference between purchasing a new primary control machine that would be replaced at the end of the average useful life of the machine and a new integral secondary control machine.

Table VII-6. Possible Initial Costs Options for a Facility Replacing a Converted Machine or a Primary Control Machine[1]

Facility Action	Cost of Option Going to Integral Secondary Control Machine (Dollars)	Cost of Option Going to Hydrocarbon Machine (Dollars)
Switch to a Hydrocarbon Machine	N/A	$23,100
Cost Differential to Switch to Integral Secondary Control Machine From Primary Control Machine	$6,000	N/A
Enhanced Ventilation	$3,700 to $8,500	$0 to $8,500
Wastewater Treatment Unit	$0 to $1,340[2]	$0 to $1,340[2]
Spare Set of Gaskets and a Lint Filter	$0 to $330	$0 to $330
Install Two Sampling Ports in Secondary Control machine	$115 (w/labor) $40 (w/o labor)	N/A
Lost of Useful Life of Machine[3]	$0 to $12,630	$0 to $12,630
Range of Total Initial Cost[4]	$9,740 to 24,120	$23,100 to $41,100

1. Totals may be rounded. N/A means not applicable to analysis
2. Average cost of available units.
3. Lost of useful life for the machine being replaced ranges from 1 year to 5 years for some facilities.
4. Assumes a local ventilation system is installed. Local ventilation system cost about $3,700.

Table VII-7 illustrates the potential cost impacts of the proposed amendments to dry cleaning facilities with a converted machine, primary control machine, or an add-on secondary control machine. The total cost figure is calculated assuming that all of these facilities will choose to replace their machine with an integral secondary control machine. These facilities will incur on average an additional $6,000 of initial cost to purchase a secondary control machine. Some of these facilities will incur a cost due to early replacement of their machines. The number of years of useful life lost due to early replacement ranges from one year to five years and the cost associated with this loss is estimated using straight line depreciation method (equal loss of value over time). This corresponds to a loss ranging from $2,530 to $12,630. Other possible initial costs for complying with the proposed amendments include installation of enhanced ventilation, a spare set of gaskets, a spare lint filter, installation of two sampling ports, and possibly a wastewater treatment unit.

The total initial cost for a facility, in addition to machine cost and cost due to early replacement of existing non-BACT machines, will depend on the equipment needs at each particular facility. Based on Facility Survey results, about 350 facilities may be using a wastewater treatment unit that does not meet the criteria of the proposed amendments. For the cost analysis, it is assumed that the impacted facilities will choose to purchase a new wastewater treatment unit, and a typical facility will choose to install the least expensive type of enhanced ventilation, a local ventilation system. The range of initial cost, excluding machine or other equipment costs, is from $3,740 to $5,480.

The recurring costs of complying with the proposed amendments include the costs of the annual leak testing and the annual drum Perc concentration check for secondary control machines. ARB staff estimates that the majority of dry cleaning facilities will choose to arrange for their local air districts to perform this check during the district's annual inspection. Therefore, the facility operator will incur the cost of two man-hours, or $20, to assist district staff with this process. Most operation and maintenance costs are assumed to be the same between a primary control and a secondary control machine (see Table VII-4). The additional annual ongoing cost for the facilities that do not already have an integral secondary control machine is determined from cost savings due to reduced Perc usage and the cost of replacing the carbon for the secondary control. The ROE range for facilities that operate a primary or converted machine is shown in Table VII-7.

Table VII-7. Decline in Return on Owner's Equity (ROEs) for Facilities with an Add-On Secondary, Primary, or Converted Machine[1]

Machine Type	Equipment Cost Due to Early Replacement of machine	Incremental Machine Cost[2]	Other Equipment Cost[3]	Annualized Incremental Machine and Equipment Cost[4]	Total Annual Recurring Savings[5]	Total Annual Net Cost[6]	Percent Decline in ROE
Converted, Primary Control, or Add-on Secondary Control to Secondary Control	$0 to $12,630	$6,000	$3,740 to $5,480	$940 to $2,320	-$390	$550 to $1,930	10 to 35

1. Cost values rounded off to the nearest $10. Costs occur at time of purchase or use and reflect 2005 purchase.
2. Cost differential between purchasing a new secondary control machine and a new primary control machine assuming that a primary control machine has a useful life of 15 years.
3. Other Equipment Cost is the sum of all of the most likely initial costs besides machine (including local ventilation systems, wastewater treatment units, spare gaskets, spare lint filters, and installation of sample ports).
4. Lower end of the annualized incremental machine and equipment cost do not include cost due to early replacement of machine because not all facilities will incur this cost.
5. Annual Recurring Savings include cost savings due to reduced Perc usage, annual leak and drum concentration check cost, and annualized cost for carbon replacement.
6. Total Annual Cost is the sum of Annualized Initial Cost and Total Annual Recurring Cost.

c. <u>Facilities that Operate a Secondary Control Machine</u>

There are about 860 secondary control Perc machines in California, outside of the South Coast AQMD, that are subject to the proposed amendments. These 860 secondary control Perc machines are used in approximately 800 facilities. The potential initial costs for a facility with secondary control are listed in Table VII-8.

Table VII-8. Possible Initial Costs Options for a Facility with a Secondary Control Machine[1]

Facility Action	Cost of Option Going to Integral Secondary Control Machine (Dollars)	Cost of Option Going to Hydrocarbon Machine (Dollars)
Switch to a Hydrocarbon Machine	N/A	$17,100
Enhanced Ventilation	$0 to $8,500	$0 to $8,500
Wastewater Treatment Unit	$1,340[2]	$0 to $1,340[2]
Spare Set of Gaskets and a Lint Filter	$330	$0 to $330
Install Two Sampling Ports in Secondary Control machine[3]	$0 to $115	N/A
Range of Total Initial Cost[4]	$0 to $5,480	$17,100 to $22,469

1. Totals may be rounded. N/A means not applicable to analysis
2. Average cost of available units.
3. Where applicable, cost for installing two sampling ports is $40 without labor, and $155 with labor
4. Assumes a local ventilation system is installed. Local ventilation system cost about $3,700.

Other possible initial costs from complying with the proposed amendments are the same as those for facilities which operate a converted, primary control, or add-on secondary control machine and include installation of enhanced ventilation, a spare set of gaskets, a spare lint filter and possibly a wastewater treatment unit. The cost for enhanced ventilation ranges from $3,700 to $8,500. A summary of the initial costs for the impacted facilities are shown in Table VII-8.

The total initial costs for a facility, in addition to machine cost, will depend on the equipment needs at each of the particular facility. Based on Facility Survey results, some facilities may be using a wastewater treatment unit that does not meet the criteria of the proposed amendments. For the cost analysis, it is assumed that these facilities will choose to purchase a new wastewater treatment unit. Also, for the cost analysis, it is assumed that a typical facility will choose to install the least expensive type of enhanced ventilation, a local ventilation system. The range of initial costs excluding machine, or other equipment costs, is from $0 to $5,480.

Annual recurring costs or the cost of operation and maintenance for operating a Perc secondary control machine are shown on Table VII-4. The only recurring cost resulting from the proposed amendments is the cost of complying with the annual leak testing. ARB staff estimates that the majority of dry cleaning facilities will choose to arrange for their local air districts to perform this check testing during their annual inspection. Therefore, the facility operator will incur the cost of a two man-hours, or $20, to assist district staff with this process. The additional annual ongoing cost for the facilities that do not already have an integral secondary control machine is determined from cost savings due to reduced Perc usage and the cost of replacing the carbon for the secondary control. The decline in ROE and the total annual cost for complying with the regulation are shown in Table VII-9.

Table VII-9. Decline in Return on Owner's Equity (ROEs) for Facilities with a Secondary Control Machine[1]

Machine Type	Number of Machines in Cost Calculation	Incremental Machine Cost	Other Equipment Cost[2]	Annualized Incremental Machine and Equipment Cost	Total Annual Recurring Costs[3]	Total Annual Net Cost[4]	Percent Decline in ROE
Secondary Control	860	N/A	$3,700 to $5,480	$360 to $530	$20	$380 to $550	7 to 10

1. Cost values rounded off to the nearest 10, costs occur at time of purchase or use and reflect 2005 purchases.
2. Other Equipment Cost is the sum of all of the most likely initial costs besides machine (including local ventilation system, wastewater treatment unit, spare gaskets, spare lint filter, and installation of sample ports).
3. Annual Recurring Cost is the cost associated with annual leak and drum concentration checks.
4. Total Annual Cost is the sum of Annualized Initial Cost and Total Annual Recurring Cost.

6. <u>Assumptions for Facility Cost Estimates</u>

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 phase out of Perc operation. We assumed that owners of facilities with the more emissive Perc machines would choose to purchase a secondary control machine when they need to replace their machines. For the facilities that will lose some of the useful life of the non-BACT machines, the loss was estimated using straight line depreciation discussed in Part 5. For enhanced ventilation, we assumed that owners would install a local ventilation system, the least costly type of enhanced ventilation. Regarding wastewater units, it is assumed that these facilities will choose to purchase a new wastewater treatment unit. We also assumed that half of the facilities will choose to put in the sampling ports themselves, and all of the impacted facilities will need to purchase a spare set of gaskets and a spare lint filter. The statewide costs of the proposed amendments were calculated in 2005 dollars and used the same assumptions as the facility cost calculations. Additional factors taken into considerations included: when cost incurred, the number of facilities for each facility type, the number and age of the machines, and the number of wastewater treatment units that need to be replaced.

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

We expect the proposed amendments may increase business for the manufacturers or distributors of 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. We expect the proposed amendments would lead to an increase in new machine purchases. The manufacturers of dry cleaning machines in turn may incur some minor expense in the machine certification process due to changes in the proposed amendments. Staff estimated the additional cost due to changes in the certification process based on the increased number of loads before certification testing and the associated increase in labor, electricity, and gas costs. The additional cost is estimated to range from $609 to $3,379. Staff estimates that there will be about 3 new certifications per year. Because dry cleaning machine manufacturers are not located in California and the total cost is comparably insignificant, this cost would not impact California business.

We expect a slight increase in the sales of Perc detectors and wastewater treatment units due to the proposed amendments. These cost benefits are not factored into the cost calculations.

8. 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. First, the price increase is estimated assuming that the dry cleaning facilities will need to obtain a loan for the purchase of new dry cleaning equipment, 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 onto their customers.

To completely offset the net cash outflow over the five years, a dry cleaner would have to increase its annual revenues by the amount of the loan repayment, additional tax due to price increase, and, if applicable, cost (loss) of early replacement of machine. For the co-residential facilities that will lose three years of useful life of their existing Perc machine and will purchase, install, and maintain a hydrocarbon machine, the increase in price would be about $0.90 per garment. For the typical facility that is required to purchase, install, and maintain an integral secondary control machine, with a maximum of five years of loss in useful life, the average increase in price would be between $0.65 and $0.75 per garment. For the facility that already has an integral secondary control machine, the price increase would be about $0.05 per garment.

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. The dry cleaning industry estimates that each garment weighs approximately one pound, (CARB, 2006). Table VII-10 shows a summary of the estimated price increase for the three facility types over the five-year loan period.

Table VII-10. Summary of Cost Recovery Price Increase for the Three Facility Types Over Loan Period

Facility Type	Machine Cost[1]	Maximum Potential Equipment Cost[2]	Annual Machine and Equipment Loan Cost[3] (Over 5 years)	Total Annual Recurring Savings	Total Annual Net Cost	Total Annual Net Cost[4] (before tax)	Cost of Loss of Useful Life[5]	Cost Recovery Price Increase[6] ($/garment)
Co-residential	$68,000	$0	$17,940	-$590 to -$1,060	$16,870 to $17,350	$28,690 to $29,430	$1,800	$0.90
Facility with Converted, Primary Control, or Add-On Secondary Control	$48,400	$3,740 to $5,480	$ 13,750 to $14,210	-$390	$13,360 to $13,820	$2,670 to $2,350	$0 to $2,530	$0.65 to $0.75
Facility with Integral Secondary Control machine	N/A	$3,740 to $5,480	$1,450	$20	$1,010 to $1,470	$1,710 to $2,490	$0	$0.05

1. Machine cost includes installation and removal costs.
2. Maximum Equipment Cost is the sum of all of the most likely initial costs besides machine (including local ventilation system, wastewater treatment unit, spare gaskets, spare lint filter, and installation of sample ports).
3. Assuming a 5-year loan at an interest rate of 10 percent.
4. Total annual net cost before tax is the total annual net cost divided 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.
5. Cost due to loss of useful life is spread out evenly over the 5 year loan period. Facilities with converted, primary control, or add-on secondary control, a range is provided to reflect years of useful life lost.
6. Cost recovery price increase is calculated using a median amount of material dry cleaned per facility of 35,000 lbs and rounded.

The estimation of cost recovery price increase shown in Table VII-10 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 16 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 2 cents ($0.02) per garment.

9. <u>Potential Impact on Employment</u>

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 dry cleaning machine manufacturers, distributors, and installers, enhanced ventilation manufacturer, distributors, and installers, and waste water treatment unit manufacturers and distributors. In these cases, it may result in increased employment.

10. 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.

11. 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. This section provides the conclusions we reached and the basis for those conclusions.

The Department of Corrections operates nine Perc dry cleaning machines and one hydrocarbon dry cleaning machine at ten correctional facilities in California. The one facilities that is operating a hydrocarbon dry cleaning machine will not be impacted by the proposed amendments. The remaining nine Perc machines and will need enhanced ventilation and installation of sampling ports to the secondary control machines. Two of the nine Perc machines are secondary control machines and are not impacted by the proposed amendments for equipment. The remaining seven dry cleaning machines are primary control machines and need to be phased out when they are 15 years old. Table VII-11 shows the facilities at the Department of Corrections that have dry cleaning on-site, their machine type, age, and whether or not they have a wastewater treatment unit (WWTU).

The Department of Corrections may incur a capital cost for replacing their primary machines, installing enhanced ventilation and sampling ports. During the first three years of implementation, a total of four of the primary control machines will need to be replaced because they will be 15 years old or older and a total of nine enhanced ventilation systems will need to be installed. Secondary control machines cost about $6,000 more than a primary control machine. The capital cost of a secondary control machine is about $43,900. The additional fiscal impact is, thus, estimated to be between $6,000 and $43,900 per machine purchased.

Table VII-11. List of Facilities at the Department of Corrections With Dry Cleaning Machines and Wastewater Treatment Units[1]

Facility Name	Machine Type		Machine Age (years)	WWTU	
	Solvent Type	# of Machines		Yes	No
CA Correctional Center Susanville	Perc Primary	1	14	X	
CA Correctional Institution Tehachapi	Perc Primary	1	approx. 10	X[2]	
CA Mens Colony San Luis Obispo	Hydrocarbon	1	Installed June 2005	N/A	N/A
CA Rehabilitation Center Norco	Perc Secondary	1	Installed Dec. 2005		X[2]
CA State Prison San Quentin	Perc Primary	1	18		X[2]
Centinela State Prison	Perc Primary	1	9		X[2]
Chuckawalla Valley State Prison Blythe	Perc Secondary	1	6	X	
Correctional Training Facility Soledad	Perc Primary	1	12 to 15		X[2]
Mule Creek State Prison	Perc Primary	1	18		X[2]
Valley State Prison for Women	Perc Primary	1	10	X	

N/A means not applicable.
1. Information for the table was obtained in 2005.
2. Hazardous waste is hauled away.

For the cost of enhanced ventilation, it is assumed that the Department of Corrections will choose to install local ventilation systems, the least costly type of enhanced ventilation. The cost of a local ventilation system is approximately $3,700 and the total cost for the nine facilities is about $33,300. For the cost of installing sampling ports, it is assumed that the labor cost for installing the ports is $75. Parts for the two sampling ports cost approximately $40. Therefore, the total cost of installing sampling ports for a secondary control machine is $115.

Alternatively, the Department of Corrections can also comply with the proposed amendments by replacing the Perc machines with an alternative dry cleaning technology when their primary machines are 15 years old. Depending on the type of technology that is chosen, this can result in higher or lower costs to the State. In summary, the fiscal cost impact to the Department of Corrections during the first three years ranges from $58,000 to $209,600, and the total cost to comply with the proposed amendments over its lifetime ranges from $76,300 to $341,600. Table VII-12 lists the estimated cost impacts to the Department of Corrections.

Table VII-12. Cost Impacts to the Department of Corrections[1]

Time	Cost Impact Due to Change of Machines[2]	Cost for Installing Sampling Ports	Enhanced Ventilation Cost	Total Cost Impact[3]
First Year	$0	$200	$0	$200
First Three Years	$24,000 - $175,600	$700	$33,300	$58,000 - $209,600
Life Time of the Regulation	$42,000 - $307,300	$1000	$33,300	$76,300 - $341,600

1. Costs rounded off to nearest $100.
2. Cost impact for switching to secondary machine.
3. Total cost impact equals the sum of cost impact due to change of machines and enhanced ventilation cost.

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 local air districts do not have dry cleaning facilities. The fifth, South Coast AQMD, has a rule that is more stringent compared 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 an estimated increase in reporting and enforcement cost of $931,000 to $1,463,000 for the districts for the first three years. These costs were estimated based on input from local air districts on time and labor costs of enforcement of the proposed amendments and the Perc purchase reporting requirement. The local air districts estimate that approximately four hours per facility will be required to enforce the phase out of primary control, converted, and add-on secondary control machines. An additional four hours would be required to enforce the installation of enhanced ventilation systems. Also, 4.8 hours are required per year for reporting facility Perc purchases to ARB. Table VII-13 shows the estimated cost increase for the first three years for the local air districts.

Local air district responsibilities under the proposed amended Dry Cleaning ATCM can be fully financed from the fee provisions authorized by HSC sections 42311 and 40510. The proposed amended regulation does not have provisions for reimbursement from the state to the districts pursuant to section 6 of Article XIII B of the California Constitution because the local air districts have the authority to levy service charges, fees, or assessments sufficient to pay for the program or level of service within the meaning of section 17556 of the Government Code.

Table VII-13. Estimated Cost Increase for the Local Air Districts

	Total Hours for Equip. Enforcement[1] (hrs)	Number of facilities for Equipment Change	Total Hours for Vent. Enforcement[1] (4 hr/facility)	Number of Facilities for Vent.	Reporting Time (hrs/year)	Total Cost (Based on $70/hour)[2]	Total Cost (Based on $110/hour)[2]
First year	0	0	0	0	168	$ 12,000	$ 19,000
Second year	2,908	727	4,644	1,161	168	$ 540,000	$ 849,000
Third year	1,288	322	3,960	990	168	$ 379,000	$ 596,000
Total (first three years)	4,196	1049	8,604	2,151	504	$ 931,000	$ 1,463,000

1. Based on district input of 4 four hours per facility for equipment enforcement and the same amount of time for ventilation requirement enforcement.
2. Values for total cost are rounded off to the nearest thousand.

E. Total Cost of the Proposed Amendments

The statewide cost of the proposed amendments was calculated in 2005 dollars and used the same assumptions as the facility cost calculations. Additional considerations taken included: when cost incurred, the number of facilities for each facility type, the number and age of the machines, and the number of wastewater treatment units that need to be replaced. Additional assumptions were that half of the facilities will choose to put in the sampling ports themselves, and all of the impacted facilities will need to purchase a spare set of gaskets and a spare lint filter. Table VII-14 provides a summary of the assumptions used in the cost estimates for equipment as other than a machine.

Table VII-14. Assumptions Used in the Cost Estimates for Equipment "Other Than a Machine"

Required Equipment	Percent of Impacted Facilities
Local Ventilation System[1]	93%
Wastewater treatment units	16%
Spare set of gaskets and a lint filter	100%
Install two sampling ports in secondary control machine (with labor and w/o labor)	50% (w/ labor) 50% (w/o labor)

1. Assumes facilities will choose to install a local ventilation system for enhanced ventilation.

Table VII-15 contains an overview of the total and annual costs of proposed amended Dry Cleaning ATCM. The calculated statewide cost of the amendments is $16 million over 15 years to private dry cleaning businesses. The annualized statewide cost of the amendments is $1.6 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, they could experience a significant adverse economic impact. The

ARB staff estimates the total capital cost of the proposed amended Dry Cleaning ATCM to State government agencies that operate dry cleaning machines to be approximately $341,600.

Cost impact calculations may be resulting in higher or lower estimates than that are actually realized because it was not possible to account for the dry cleaning facilities that have used Perc primary control machines while the Facility Survey was being conducted or voluntarily changed to either an alternative technology or to a secondary control machine.

F. Cost Effectiveness of the Amended 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 are allowed to operate with Perc will continue to do so, the amended ATCM will reduce Perc emission by 1 ton per day (from 2.6 tons per day to 1.6 tons per day) from all impacted facilities when all the dry cleaning facilities are in full compliance of the proposed amended Dry Cleaning ATCM. This was calculated by multiplying the number of secondary control machines by the normalized average emissions for a secondary machine (CARB, 2006). In terms of pounds (lbs) per year, the result was about 604,000 lbs per year in Perc reduction.

The cost effectiveness of the proposed amended Dry Cleaning ATCM can then be calculated by dividing the annualized cost of the regulation of $1.6 million by the 604,000 lbs of Perc reduced per year. The result is about $2.60 per pound of Perc reduced.

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	Other Equipment Cost[2]	Cost of Early Machine Replacement	Annualized Incremental Machine and Equipment Cost	Total Annual Recurring Costs[3]	Total Annual Net Cost[4]	Percent Decline in ROE
Co-res. Primary Control to Hydrocarbon	0	$23,100	$0	0	$2,230	-$1,060	$1,170	22
Co-res. Secondary Control to Hydrocarbon	48	$17,100	$0	$8,780	$2,490	-$590	$1,900	35
Converted, Primary Control or Add-on Secondary to Integral Secondary Control	1,630	$6,000	$3,740 to $5,484	$0 to $12,630	$940 to $2,320	-$390	$550 to $1,930	10 to 35
Integral Secondary Control	860	N/A	$3,700 to $5,484	0	$356 to $528	$20	$376 to $548	7 to 10
Sub-Total from Private Facilities[5]	2538	N/A	N/A	N/A	N/A	N/A	16 million	N/A
Sub-Total from State Facilities	9	N/A	N/A	N/A	N/A	N/A	$341,600	N/A

1. Cost values rounded. Values reflect 2005.
2. Other Equipment Cost is the sum of the most likely initial costs besides machine (including a local ventilation system, a wastewater treatment unit, spare gaskets, a spare lint filter, and installation of sample ports).
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. Sub-Total from State Facilities is estimated from the costs shown for the different machine types with consideration for when the costs occurred.

VIII. ENVIRONMENTAL IMPACTS OF THE PROPOSED AMENDED AIRBORNE TOXIC CONTROL MEASURE

The intent of the proposed amended ATCM is to protect the 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 a slight reduction of Perc to wastewater due to the reduction of Perc use and more stringent controls in the proposed amended ATCM.

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 reduce the amount of Perc used and provide at least a proportional 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 forf 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.

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.

H. Potential Air Pollution Impacts

1. Impacts on VOC Emissions and Global Warming

Tropospheric ozone ("bad" ozone) formation requires the mixing of ozone-forming chemicals, also known as VOCs, with nitrogen oxides, oxygen, and sunlight. Any reduction in VOC emissions is expected to provide a beneficial environmental impact on air quality by reducing tropospheric ozone formation. Since the proposed amended ATCM will phase out Perc dry cleaning technologies in co-residential facilities as well as phase out the use of primary, converted and add-on secondary control 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 implementation of the proposed amendments to the Dry Cleaning ATCM, in a worse-case scenario where all of the converted and primary machines and all of the co-residential Perc machines convert to hydrocarbon solvents, there would be a total significant increase of about 1.4 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 4.3 tons per day reduction in Perc emissions statewide.

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 81 percent of greenhouse emissions in 1996 (JE, 2004).

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 0.6 tons per day of VOCs in all the SIP areas combined. 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 1.4 tons per day.

3. <u>Workplace Exposure</u>

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 reduction of Perc emissions in the workplace due to the proposed amended Dry Cleaning ATCM requirements for the use of best available control technology and enhanced ventilation. As a result, an increase in workplace exposure to Perc emissions is not expected.

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 minimize 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 further reduce the public's exposure to Perc. The ATCM is enforceable with the least burdensome approach to reducing 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 further reduce 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

Airborne Toxic Control Measure for Emissions of Perchloroethylene From Dry Cleaning Operations

DRAFT REGULATION ORDER

PROPOSED AMENDMENTS TO THE AIRBORNE TOXIC CONTROL MEASURE FOR EMISSIONS OF PERCHLOROETHYLENE FROM DRY CLEANING OPERATIONS

[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.]

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

Section 93109. Airborne Toxic Control Measure for Emissions of Toxic Air Contaminants from Dry Cleaning Operations.

(a) Purpose.

The purpose of this control measure is to reduce emissions of toxic air contaminants (TACs), including perchloroethylene (Perc), from dry cleaning operations. Reducing these emissions will further protect the public health, especially for Californians who live or work near dry cleaning facilities.

(b) Applicability.

This section applies to any person who owns, operates, manufactures, or distributes dry cleaning equipment in California that uses any solvent that contains Perc or an identified TAC.

(c) 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, activated carbon, 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, including but not limited to, paper, activated carbon, clay, paper and clay, or paper and activated carbon. 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.

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

(7) *"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.

(8) *"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.

(9) *"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.

(10) *"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.

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

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

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

(14) *"Dry cleaning equipment"* means any machine, device, or apparatus that uses a solvent to dry clean materials or to remove residual solvent from previously cleaned materials. Dry cleaning equipment may include, but is not limited to, a converted machine, a closed-loop machine, a reclaimer, a drying cabinet; a primary control machine, primary control machine with a secondary control system; or an integral secondary control machine.

(15) *"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 or other TAC vapors; and control systems.

(16) *"Drying cabinet"* means a housing in which materials previously cleaned with Perc or another solvent containing a TAC 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.

(17) *"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.

(18) *“Enhanced ventilation system”* means a ventilation system that is specifically designed to capture fugitive emissions from a dry cleaning machine. Types of enhanced ventilation systems include local ventilation systems, partial vapor barrier rooms, and full vapor barrier rooms.

(19) *"Environmental training program"* means an initial course or a refresher course of the environmental training program for 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.

(20) *“Executive Officer of the Air Resources Board”* means the executive officer of the California Air Resources Board or his or her delegate.

(21) *"Existing facility"* means any facility that operated Perc dry cleaning equipment prior to July 1, 2007.

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

(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) *"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.

(25) *"Full vapor barrier room"* means a room that completely surrounds a closed loop machine and is constructed of material resistant to diffusion of solvent vapors. Fugitive emissions are vented through a stack above the building. According to specifications, the exhaust fan may be installed inside the full vapor barrier room or near the ceiling at the back of the machine or outside the facility on a wall or on the roof. The fan should be of a high pressure (1-3 inches of water) design with a minimum capacity of 1,000 cubic feet per minute; and it should be in continuous operation (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. A control interlock must be installed to interrupt power to the dry cleaning machine if the ventilation fan is not operating. 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). 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 cubic feet per minute.

(26) *"Gallons of perchloroethylene purchased"* means the volume of Perc, 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.

(27) *"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.

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

(29) *“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 single make and model of dry cleaning machine and primary control system.

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

(31) *“Local ventilation system”* means a ventilation system with a high capacity fan, exhaust stack, and physical apparatus/structures (such as fume hoods, shrouds, flexible walls – vertical plastic strips), near the closed-loop machine, that are designed and constructed of materials resistant to diffusion of solvent vapors. A minimum of 1,000 cubic feet per minute airflow with a capture velocity greater than 100 feet per minute is required for the ventilation fan. The fan should be in operation whenever the dry cleaning machine and related equipment are operated. A control interlock must be installed to interrupt power to the dry cleaning machine if the ventilation fan is not operating. In addition, for stand-alone buildings, there should be one air exchange rate every 5 minutes. Walls or plastic strip curtains should extend at least 3 feet in front and back of the machine. The exhaust point should be at least 5 feet above the building or adjacent building and 30 feet from any window or air intake.

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

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

(34) *"New facility"* means a facility that did not operate any dry cleaning equipment using Perc or any solvent that contains a TAC prior to July 1, 2007. Facility relocations shall be considered new facilities for the purposes of this control measure.

(35) *“Partial vapor barrier room”* means a room that encloses the back of a closed-loop machine using materials resistant to diffusion of solvent vapors, with the front panel and loading door exposed for convenient loading and unloading. A high capacity fan within the room draws fugitive vapor through a stack for release outside. 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 room. The fan should be in operation whenever the dry cleaning machine and related equipment are operated. A control interlock must be installed to interrupt power to the dry cleaning machine if the ventilation fan is not operating. In addition, there should be one air exchange rate every 5 minutes. The stack should extend at least 5 feet above the building roofline or any adjacent roof and at least 30 feet from

any air intake or window. Emissions must be exhausted vertically (no rain caps). The diameter of the stack should generally be 8 to 14 inches with an air flow rate of 1,000 to 2,500 cubic feet per minute.

(36) *"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 TAC in title 17, California Code of Regulations, section 93000.

(37) *"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.

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

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

(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) *"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.

(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) *“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.

(44) *"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.

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

(46) *“Sensitive receptor”* means any residence; any educational resource for minors including, but not limited to, schools or preschools for kindergarten through twelfth grade (K-12) or early childhood education; and any facility licensed under Health and Safety Code division 2, commencing with section 1200, for health care or community care including, but not limited to, hospitals, clinics, skilled nursing, long-term care, adult day care, foster and small family homes, child care centers, and family day care homes.

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

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

(49) *“Substantial use of an authority to construct”* means one or more of the following: (A) the equipment that constitutes the source has been purchased or acquired; (B) construction activities, other than grading or installation of utilities or foundations, have begun and are continuing; or (C) a contract to complete construction of the source within one year has been entered into.

(50) *“TAC” or “toxic air contaminant”* means an air contaminant that has been identified by the California Air Resources Board under sections 93000 and 93001 of title 13, California Code of Regulations, or under title 42, United States Code, section 7412(b) and its implementing federal regulations.

(51) *"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.

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

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

(54) *"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.

(55) *"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.

(56) *"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.

(57) *"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.

(58) *“Workday”* means any consecutive 24-hour period commencing at the same time each calendar day as defined in the California Code of Regulations, Labor Code section 500(a).

(59) *“Zoned for residential use”* means that a local land-use ordinance or other government requirement allows residences as a permitted use.

(d) Prohibitions. The owner/operator of a facility shall not operate any of the following types of equipment related to Perc dry cleaning:

(1) A transfer machine, including any reclaimer or other device in which materials that have been previously dry cleaned with Perc are placed to dry;

(2) A vented machine;

(3) A self-service dry cleaning machine;

(4) A primary control or converted machine installed after July 1, 2007;

(5) A drying cabinet;

(6) Dip tank operations; and

(7) A secondary control system that has not been certified pursuant to subsection (l).

(e) Requirements for Co-residential Facilities.

(1) No co-residential facility shall install any dry cleaning equipment which uses solvents that contain Perc.

(2) Existing co-residential facilities shall remove any currently installed Perc dry cleaning machine by July 1, 2010.

(f) Requirements for New Facilities.

(1) No person shall operate a new facility which uses Perc unless the following conditions are met:

(A) The facility is located at least 300 feet from a sensitive receptor;

(B) The facility is located outside of and at least 300 feet from the boundary of an area that is zoned for residential use;

(C) An enhanced ventilation system has been installed; and

(D) Facilities using Perc shall install, operate, and maintain an integral secondary control machine.

(2) No person shall operate a new facility which uses a TAC other than Perc unless the following conditions are met:

(A) The facility shall install, operate, and maintain best available control technology as required by applicable district rules or regulations; or

(B) In the absence of applicable district rules or regulations, the owner or operator of a new facility shall submit to and have approved by the district a control method or methods that achieve reductions in the risk associated with the TAC that equal or exceed the reductions for Perc under this section.

(3) A new facility shall be deemed to meet the requirement specified in subsection (f)(1)(A) and (B) if one of the following criteria is met, even if the new facility does not meet the requirement at the time of initial startup (e.g., because of a zoning change that occurs after the authority to construct is issued):

(A) If it meets the requirement at the time it is issued an authority to construct by the permitting agency, and substantial use of the authority to construct takes place within one year after it is issued; or

(B) If it meets the requirement at the time it is issued an authority to construct by the permitting agency, and substantial use of the authority to construct takes place before any zoning change occurs that affects the operation's ability to meet the standard at the time of initial startup.

(g) Requirements for Existing Facilities.

(1) All existing facilities that operate any dry cleaning equipment using Perc shall use an integral secondary control machine. For existing facilities that operated Perc dry cleaning equipment prior to July 1, 2007, and that do not have an integral secondary control machine, the compliance schedule is as follows:

(A) If the facility is 100 feet or more from a sensitive receptor, the facility shall install an integral secondary control machine (or non-Perc alternative) by July 1, 2010, or when the primary, converted, or "add-on" secondary control machine is 15 years of age, whichever comes later.

(B) If a facility is within 100 feet of a sensitive receptor, the facility shall install an integral secondary control machine (or non-Perc alternative) by July 1, 2009, or when the primary, converted, or "add-on" secondary control machine is 10 years of age, whichever is later.

(C) All existing facilities that have not already done so under (A) or (B) above, shall install an integral secondary control machine (or non-Perc alternative) by July 1, 2016.

(D) An existing primary control machine that is designed to accept a secondary control system will qualify as an integral secondary control machine if the following conditions are met:

1. The existing primary control machine is less than five years old on July 1, 2007;

2. The secondary control system has been designed for the make and model of the existing primary control machine;

3. The secondary control system has been demonstrated, pursuant to the requirements of subsection (l), to achieve a Perc concentration in the drum of 300 ppmv or less in each test; and

4. The secondary control system is installed by the machine manufacturer or distributor by July 1, 2008.

(2) All existing facilities shall install an enhanced ventilation system. Compliance shall be according to the following:

(A) By July 1, 2009, if a sensitive receptor is within 100 feet of the facility as of July 1, 2007; or

(B) By July 1, 2010, if a sensitive receptor is 100 feet or greater from the facility as of July 1, 2007.

(h) Specifications for Integral Secondary Control Systems. An integral 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 Perc;

(4) Have a holding capacity equal to or greater than 200 percent of the maximum quantity of Perc vapor expected in the drum prior to activation of the system; and

(5) Use a technology that has been demonstrated, pursuant to the requirements of subsection (l), to achieve a Perc concentration in the drum of 300 ppmv or less in each test.

(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 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) One person cannot serve as the trained operator for two or more facilities simultaneously.

(C) The trained operator shall be an owner or employee of the facility and be on site while the dry cleaning machine is in operation.

(D) 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.

(E) 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 15 days of the departure of the trained operator; and

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

i. 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 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 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. Primary control systems, other than refrigerated condensers, shall be operated to ensure that exhaust gases are recirculated until the Perc 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.

3. 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.

4. 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.

5. 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.

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

7. 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.

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

9. 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.

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

11. Carbon adsorbers in integral secondary control machines 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.

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

(A) *Weekly Leak Checks*. The 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 dry cleaning system shall be inspected at least once per year for liquid and vapor leaks using a portable detector which gives quantitative results with less than ten percent uncertainty at 50 ppmv of Perc.

(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;

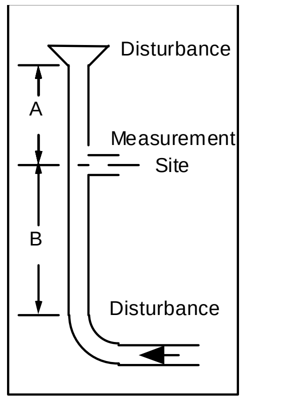
ii. The facility used reasonable preventive measures and acted promptly to initiate the repair;

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

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

(4) *Annual Drum Concentration Checks*. Effective July 1, 2008, each facility shall perform annual drum concentration testing as specified below.

(A) Sampling ports shall be installed in the piping, upstream and downstream of the carbon bed. The sampling ports should be in a straight section of piping, and at least six pipe or duct diameters downstream (shown as distance B in figure below) and two pipe or duct diameters upstream (shown as distance A in figure below) from any flow disturbance such as a bend, expansion, contraction or process in that pipe, if possible.



(B) The sampling ports shall be at least ¼” (one-quarter inch) in diameter. Each port shall be equipped with a Swagelok® male connector, or equivalent, $^{1}/_{8}$” (one-eighth inch) national pipe thread (NPT), $^{1}/_{8}$” (one-eighth inch) tube fitting and $^{1}/_{8}$” (one-eighth inch) tubing plug.

(C) At least once per year measure the Perc concentration at the end of a drying cycle from the sampling ports using a portable Perc detector that gives quantitative results with less than ten percent uncertainty at 50 ppmv of Perc.

(D) The concentration of Perc in the drum, as represented by the reading from the sample port upstream of the carbon bed, shall be:

1. Less than 500 ppmv at the end of the drying cycle for a new integral secondary control machine during the initial start-up period (under the Authority to Construct); and

2. Less than 1000 ppmv at the end of the drying cycle during normal operation after the initial start-up period.

(E) The concentration of Perc at the sampling port downstream of the carbon bed shall be less than 100 ppmv while the secondary control system is operating.

(j) Recordkeeping Requirements.

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

(A) Method of wastewater disposal. If a wastewater treatment unit is being used, then the make and model of the treatment unit shall be recorded;

(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;

(D) Effective July 1, 2008, for add-on or integral secondary control machine: Perc concentrations measured annually at the sampling ports located upstream and downstream of the secondary control system at the end of the drying cycle;

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

(F) 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; and

(G) The type of enhanced ventilation system in the facility (e.g. local ventilation system, partial vapor barrier room, or full vapor barrier room).

(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 facility shall prepare an annual report which covers the period of January 1st through December 31st of each year. The annual report shall include the following information:

(A) The estimated distance of the facility to the nearest sensitive receptor and nearest business;

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

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

(D) The gallons of solvent purchased for all solvent additions in the reporting period;

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

(F) The type of enhanced ventilation system in the facility (e.g. local ventilation system, partial vapor barrier room, or full vapor barrier room); and

(G) The method of wastewater disposal. If a wastewater treatment unit is used, the make and model of the treatment unit shall be reported.

(2) The owner or operator of each facility shall submit this annual report to the district by February 2nd of each year.

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

(4) The districts shall report to ARB the annual Perc purchases of permitted facilities by April 2nd of each year or an alternative date agreed upon by the district and ARB.

(l) Testing and Certification of Secondary Control Systems.

(1) *Test Program and Scope*.

(A) For a given design, a single test program shall be conducted, in accordance with the following procedures, to meet the specifications in subsection (h).

(B) The person conducting the test program shall prepare a test plan that describes, in detail, the dry cleaning machine and control systems being tested, the test protocol, and the test method.

(C) A minimum of three tests shall be conducted for each test program on each control system design.

(D) All tests for a single test program shall be conducted on a single dry cleaning machine.

(E) When testing a particular dry cleaning machine model that is available in various drum capacities and carbon weights in the secondary control system, the testing shall, at a minimum, be conducted on the configuration with the largest ratio of drum capacity to weight of the carbon. The dry cleaning machine drum/carbon ratio shall be calculated as follows:

$$drum/carbon\ ratio = \frac{machine\ drum\ capacity\ (pounds)}{weight\ of\ carbon\ in\ adsorber\ (pounds)}$$

(F) Test results may not be applied to a different make/model or replacement dry cleaning machine that has been reconfigured.

(2) *Test Conditions*. Testing shall be conducted under normal operating conditions, unless otherwise specified.

(A) Each test shall be conducted during the cleaning of one load of materials, after running 80 percent of the manufacturer's recommended number of loads before carbon regeneration.

1. The machine shall be filled to no less than 85 percent of its drum capacity with materials for each test. At least 70 percent of the load to be cleaned must consist of woolen or absorbent padded material.

2. The weight of materials shall be recorded for each test.

(B) An integral secondary control machine shall be tested on a closed-loop machine with the primary control system operating normally.

(3) *Test Methods*.

(A) The temperature of the air in the dry cleaning machine drum shall be measured and recorded continuously during the entire drying cycle, including the operation of the secondary control system.

(B) Sampling shall be conducted as follows:

1. Sampling shall begin at the end of the drying cycle and be completed within 5 minutes.

2. Sampling shall be completed prior to the opening of the dry cleaning machine door and activation of any fugitive control system.

(C) The Perc concentration in the dry cleaning machine drum shall be determined by one of the following methods:

1. 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 ¼” (one-quarter inch), outside diameter, Teflon tubing. Any sampling pump shall have Teflon diaphragms. The gas chromatograph shall measure the concentrations of Perc in accordance with ARB Method 422 (title 17, California Code of Regulations, section 94132) or NIOSH Method 1003 (NIOSH Manual of Analytical Methods, U.S. Department of Health and Human Services, August 15, 1987).

2. 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 ¼” (one-quarter inch) outside diameter Teflon tubing to a Tedlar bag. Any sampling pump shall have Teflon diaphragms. The concentration of Perc in the air sampled shall be measured in accordance with ARB Method 422 (title 17, California Code of Regulations, section 94132) 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.

(D) An alternative test method deemed acceptable by the Executive Officer of the Air Resources Board.

(4) *Certification Procedures.*

(A) The manufacturer shall submit to the Air Resources Board the following information:

1. A detailed description of the dry cleaning system including control devices;

2. A copy of the operations manual, written in plain English;

3. Production photographs of the front and rear of the dry cleaning machine for which certification is being requested;

4. The test plan required by subsection (l)(1)(B), including a detailed summary of the test results; and

5. Any other information deemed necessary by the Air Resources Board to consider the request for certification.

(m) Wastewater Treatment.

(1) Effective July 1, 2008, wastewater shall be hauled away by a registered hazardous waste transporter or treated in a wastewater treatment unit.

(2) The wastewater treatment unit shall meet the following requirements:

(A) A self-contained unit designed to minimize solvent discharge to the environment, including but not limited to the air, water, and sewer system.

(B) The wastewater shall be placed in a wastewater treatment unit that has adequate processing capacity for the facility as determined by the district; and

(C) The wastewater treatment unit shall be equipped with a separator. The separator shall have all of the following:

1. A solvent/water separation settling chamber; and

2. Carbon or another type of adsorbent filtration system that the wastewater cycles through.

(n) Water-repelling Operations.

(1) No person shall perform water-repelling operations unless all materials to be treated with Perc water-repelling solutions are treated in a closed-loop machine.

(o) 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.

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, 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 Regulation

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

(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^{o} F (38^{o} 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

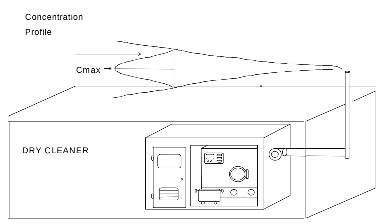
Scenario	Annual (gallons/year)		Hourly (gallons/hour)
	High-End Emissions [1]	Average Emissions	
Converted Machine	113	76	0.45
Primary Control	94	52	0.13
Secondary Control	61	34	0.06

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).

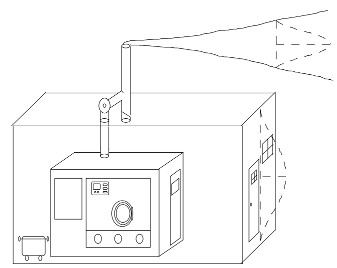
Figure (a) FULL VAPOR BARRIER ROOM (FVR)



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)

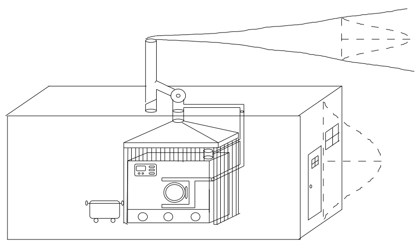


For modeling purposes, assume: 95% capture by PVR, 95% of emissions modeled as point source, 5% of emissions are treated as fugitive and modeled as volume source.

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)

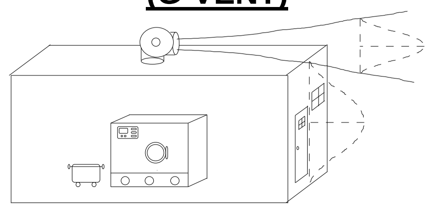


For modeling purposes, assume for typical system: 80% of emissions captured by fan and modeled as a point source, 20% of emissions are fugitive & modeled as volume source.

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)

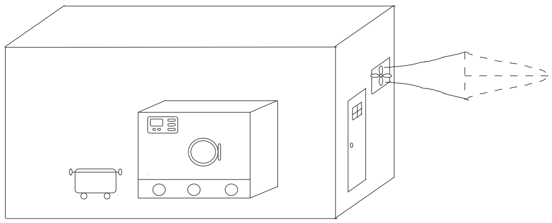


For modeling purposes, assume for typical system (< 1 change per 5 minutes): 60% capture of emissions by fan and modeled as horizontal point source, 40% of emissions are fugitive & modeled as volume source.

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.).
Scenario (B):
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.).
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.).

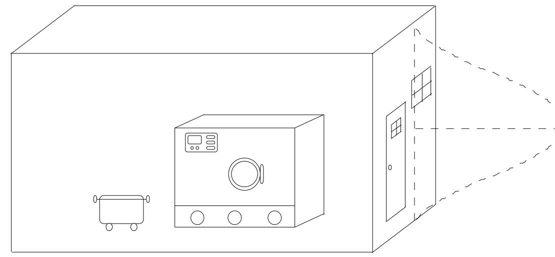
Figure (e) WINDOW FAN (WIN FAN)



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 the 100 meter distance is identified to provide perspective for the potential health impacts at 300 feet, which is distance listed in the regulation for siting criteria.

These tabulated results address each dry cleaner scenario presented in Section B and are broken down by meteorological data set. The risk estimates that are anticipated after implementation of the proposed amendments are footnoted with the number 6 in Tables B-3 to B-6 This footnote identifies the scenarios that use enhanced ventilation. Enhanced ventilation includes local ventilation, partial vapor barrier rooms, and full vapor barrier rooms. 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), 80th 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. Results corresponding to these scenarios are anticipated after implementation of the proposed ATCM.

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 – 80^{th} 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, 80^{th} 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, 80^{th} 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. Results corresponding to these scenarios are anticipated after implementation of the proposed ATCM.

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 – 80^{th} 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, 80^{th} 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, 80^{th} 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. Results corresponding to these scenarios are anticipated after implementation of the proposed ATCM.

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 – 80^{th} 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, 80^{th} 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, 80^{th} 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. Results corresponding to these scenarios are anticipated after implementation of the proposed ATCM.

The chronic hazard indices are less than 0.4 at all receptor locations under the high-end (90th percentile) emissions scenario and less than 0.2 at all receptor locations under the average emissions scenario. The acute hazard indices are less than 0.2 at all receptor locations for dry cleaners with secondary control. Generally, hazard indices less than 1.0 are not considered to be a concern to public health.

REFERENCES FOR APPENDIX B

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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	Owner/operator, manufacturer, or distributor of dry cleaning equipment that uses any solvent that contains Perc or an identified TAC.
Definitions		• 18 new definitions • 6 amended • 7 deleted
Prohibitions	Owner/operator shall not operate a transfer machine, vented machine, or a self-service dry cleaning machine	Expands prohibitions to include primary control machine, converted machine, drying cabinet, conduct dip tank operations, or secondary control system that has not been certified pursuant to subsection (l).
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.
Co-residential Facilities	No provisions	No co-residential facility shall install dry cleaning equipment which uses solvents that contain Perc. Existing co-residential facilities shall remove currently installed Perc dry cleaning machines by July 1, 2010.
New Facilities	Shall install, operate, and maintain a closed-loop machine with primary control and secondary control.	(1) No person shall operate a new facility which uses Perc unless the following is met: - Facility is located at least 300 ft. from a sensitive receptor; - Facility is located outside of and at least 300 feet from the boundary of an area zoned for residential use; - An enhanced ventilation system has been installed; - Facilities using Perc shall install, operate, and maintain an integral secondary control machine; and (2) No person shall operate a new facility that uses a TAC other than Perc unless the following conditions are met: - The facility shall install, operate,

New Facilities (con't)		and maintain best available control technology as required by applicable district rules or regulations; or - In the absence of applicable district rules or regulations, the owner or operator of a new facility shall submit to and have approved by the district a control method or methods that achieve reductions in the risk associated with the TAC that equal or exceed the reductions for Perc under this section. (3) A new facility shall be deemed to meet the above siting requirement if one of the following are met: - If the facility meets the requirement at the time it is issued an authority to construct by the permitting agency, and substantial use of the authority to construct takes place within one year after it is issued; or - If the facility meets the above requirement at the time it is issued an authority to construct by the permitting agency, and substantial use of the authority to construct takes place before any zoning change occurs that affects the operation's ability to meet the standard at the time of initial startup.
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 Perc dry cleaning equipment shall use an integral secondary control machine. Existing facilities that operated Perc dry cleaning equipment prior to July 1, 2007, and do not have an integral secondary control machine, the compliance schedule is as follows: - If the facility is 100 feet or more from a sensitive receptor the facility shall Install, operate and maintain an integral secondary control machine by July 1, 2010 or when the primary, converted, or "add-on" secondary control machine is 15 years of age, whichever comes later; or - If a facility is within 100 feet of a sensitive receptor, the facility

Existing Facilities (con't)		shall install, operate and maintain an integral secondary control machine (or non-Perc alternative) by July 1, 2009, or when the primary, converted, "add-on" secondary control machine is 10 years of age, whichever is later. - All existing facilities that have not already done so under (A) or (B) above, shall install an integral secondary control machine (or non-Perc alternative) by July 1, 2016. - An existing primary control machine that is designed to accept a secondary control system will qualify as an integral secondary control machine if it meets the requirements in subsection (g)(D) of the proposed Dry Cleaning ATCM. All facilities shall install enhanced ventilation by July 1, 2009, if a sensitive receptor is within 100 ft. of facility as of July 1, 2007; or by July 1, 2010, if a sensitive receptor is 100 ft. or more from the facility, as of July 1, 2007.
Specifications for Required Equipment	Outlined specific requirements for primary control systems, converted machines, add-on secondary control, integral secondary control machines, and drying cabinets.	Deleted specifications for primary control systems, converted machines, add-on secondary control systems, and drying cabinets. Requirements for integral secondary control systems remain the same.
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	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)	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.	
	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 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.
	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	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

Good Operating Practices (con't)	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.	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 for liquid and vapor leaks using a PID which gives quantitative results with less than ten percent uncertainty at 50 ppm of Perc.
	Annual Drum Concentration Checks: No requirements	Facilities shall perform annual drum concentration testing by installing a sampling port as specified in section (i)(4)(A)&(B) of the regulation. The sampling shall be done using detector that give quantitative results with less than ten percent uncertainty at 50 ppm of Perc. The concentration of Perc in the drum, as represented by the reading from the sample port upstream of the carbon bed shall be less than 500 ppm at the end of the drying cycle for a new machine during the initial start-up period and less than 1000 ppm at the end of the drying cycle during normal operation after the initial start-up period. The concentration of Perc at the downstream of the carbon bed shall be less than 100 ppm while the secondary control is operating.
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	All records must be retained for at least 5 years. Requirements are the same with the addition of the following: • Wastewater disposal method. If wastewater treatment unit is being used, then make and model of unit. • 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; - Effective July 1, 2008, Perc concentration measured at the

Recordkeeping Requirements (con't)	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	sampling ports located upstream and downstream of the secondary control system at the end of the drying cycle. • 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 1st through December 31st of each year. The annual report shall cover the same requirements, however, in addition the facility must include the estimated distance of the facility to the nearest sensitive receptor and nearest business; the make, model, serial number, and age of the dry cleaning machine; the type of ventilation system in the facility; and the method of wastewater disposal. The owner/operator shall furnish this annual report to the district by February 2nd of each year. The districts shall report to ARB the annual Perc purchases of permitted facilities by April 2nd of each year or an alternate date agreed upon by the district and ARB.
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 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.	Same requirements, however the following additional requirements apply: • When testing a particular dry cleaning machine model that is available in various capacities and carbon weights, testing shall be conducted on the configuration with the largest ratio of drum capacity to weight of the carbon. The ratio calculation is included in the regulation language. • Test results may not be applied to a replacement dry cleaning machine that has been reconfigured. Test conditions for primary control, add-on secondary control and drying cabinets have been deleted.

Testing & Certification of Secondary Control	• 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.	Test conditions for integral secondary control have been modified as follows: Integral secondary control systems shall be tested on closed-loop machines with the primary control system operating normally. The weight of materials shall be recorded for each test. • Each test shall be conducted during the cleaning of one load of materials, after running 80 percent of the manufacturer's recommended number of loads before carbon regeneration. • The machine shall be filled to no less than 85 percent of its capacity for each test. At least 70 percent of the load to be cleaned must consist of woolen or absorbent padded material.
	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 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	Test methods for primary control, add-on secondary and drying cabinets have been deleted. Existing test method requirements for integral secondary control remain the same, however, the following requirement has been modified: • An alternative test method deemed acceptable by the EO of the ARB.

Testing & Certification of Secondary Control (con't)	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.	A detailed description of the dry cleaning system including control devices; A copy of the operations manual, written in plan English; Production photographs of the front and rear of the dry cleaning machine for which certification is being requested; and Any other information deemed necessary by the Air Resources Board to consider the request for certification.
Wastewater Treatment	Wastewater evaporators shall be operated to ensure that no liquid Perc or visible emulsion is allowed to vaporize.	Effective July 1, 2008, wastewater shall be hauled away by a registered hazardous waste transporter or treated in a wastewater treatment unit. The wastewater treatment unit shall meet the following requirements: - A self contained unit designed to minimize solvent discharge to

Wastewater Treatment (con't)		the environment, including but not limited to the air, water, and sewer system; - The wastewater shall be placed in a wastewater treatment unit that has adequate processing capacity for the facility as determined by the district; and - The wastewater treatment unit shall be equipped with a separator with the following requirements: a solvent/water separation settling chamber; and carbon or another type of adsorbent filtration system that the wastewater cycles through.
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-loop machine, a converted machine or a dip tank.	All materials to be treated with Perc water-repelling can only be treated in a closed-loop machine only, <u>not</u> a converted machine or a dip tank.
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.

Appendix D

List of Toxic Air Contaminants in California

HISTORY

1. Amendment filed 1–2–76; effective thirtieth day thereafter (Register 76, No. 1).
2. Amendment filed 3–11–76; effective thirtieth day thereafter (Register 76, No. 11).
3. Amendment of NOTE filed 10–18–82; effective thirtieth day thereafter (Register 82, No. 43).
4. Amendment filed 8–30–84; effective thirtieth day thereafter (Register 84, No. 35).
5. Repealer and former section 92520 and renumbering and amendment of former section 92540 to section 92520 filed 5–1–91; operative 5–31–91 (Register 91, No. 24).

§ 92530. Certified Abrasives.

(a) The ARB shall certify abrasives which comply with the performance standards set forth in subdivision (b) below. Any person who desires certification of an abrasive shall furnish to the ARB an adequate test sample, together with fees to defray the cost of testing. Each certification of an abrasive shall include the ARB's determination of the original cut–point for fineness of the abrasive. The ARB shall maintain an up–to–date list of certified abrasives. Certification shall not be effective for more than two years. Abrasive materials which are certified on the effective date of this section shall remain certified until September 1, 1992.

(b) Performance Standards.

(1) (A) Before blasting the abrasive shall not contain more than one percent by weight material passing a #70 U.S. Standard sieve when tested in accordance with "Method of Test for Abrasive Media Evaluation," Test Method No. California 371–A, dated May 15, 1975.

(B) If the abrasive does not meet the requirements of subdivision (b)(1)(A), the person who desires certification of the abrasive may as an alternative demonstrate within the State of California to the satisfaction of the ARB that the abrasive meets a 20 percent opacity emission limit when tested in accordance with the "Visible Emission Evaluation Test Method for Selected Abrasives listed in Permissible Dry Outdoor Blasting," as adopted by the ARB on April 1, 1991, and incorporated herein by reference. The person who desires certification of the abrasive shall be solely responsible for conducting the demonstration.

(2) After blasting, the abrasive shall not contain morn than 1.8 percent by weight material 5 microns or smaller when tested in accordance with "Method of Test for Abrasive Media Evaluation," Test Method No. California 371–A, dated May 15, 1975.

(c) A used certified abrasive shall not be considered certified for reuse unless the abrasive conforms to its original cut–point for fineness.

(d) A blend of certified abrasives shall be considered certified for purposes of section 92530(a), unless found not to meet the requirements of section 92530(b) pursuant to testing initiated by the ARB.

(e) All manufacturers and suppliers of certified abrasives shall legibly and permanently label the invoice, bill of lading and abrasive packaging or container with each of the following:

(1) The manufacturer's name or identification trade name;

(2) The grade, weight proportion of components in abrasive blends, brand name of the abrasive or brand names and grades of components of abrasive blends; and

(3) The statement "ARB certified for permissible dry outdoor blasting."

(4) This subsection shall become effective six months after April 1, 1991.

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 41900, 41902, 41904 and 41905, Health and Safety Code.

HISTORY

1. New section filed 8–30–84; effective thirtieth day thereafter (Register 84, No. 35).
2. Repealer and new section filed 5–1–91; operative 5–31–91 (Register 91, No. 24).
3. Editorial correction of subsection (d) (Register 2003, No. 16).

§ 92540. Stucco and Concrete.

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 41900, 41902, 41904 and 41905, Health and Safety Code.

HISTORY

1. New section filed 8–30–84; effective thirtieth day thereafter (Register 84, No. 35).
2. Renumbering and amendment of former section 92540 to section 92520 filed 5–1–91; operative 5–31–91 (Register 91, No. 24).

Subchapter 7. Toxic Air Contaminants

§ 93000. Substances Identified As Toxic Air Contaminants.

Each substance identified in this section has been determined by the State Board to be a toxic air contaminant as defined in Health and Safety Code section 39655. If the State Board has found there to be a threshold exposure level below which no significant adverse health effects are anticipated from exposure to the identified substance, that level is specified as the threshold determination. If the Board has found there to be no threshold exposure level below which no significant adverse health effects are anticipated from exposure to the identified substance, a determination of "no threshold" is specified. If the Board has found that there is not sufficient available scientific evidence to support the identification of a threshold exposure level, the "Threshold" column specifies "None identified."

Substance	*Threshold Determination*
Benzene (C_6H_6)	None identified
Ethylene Dibromide ($BrCH_2CH_2Br$; 1,2–dibromoethane)	None identified
Ethylene Dichloride ($ClCH_2CH_2Cl$; 1,2–dichloroethane)	None identified
Hexavalent chromium (Cr (VI))	None identified
Asbestos [asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite), cummingtonite–grunerite (amosite), tremolite, actinolite, and anthophyllite]	None identified
Dibenzo–p–dioxins and Dibenzofurans chlorinated in the 2,3,7 and 8 positions and containing 4,5,6 or 7 chlorine atoms	None identified
Cadmium (metallic cadmium and cadmium compounds)	None identified
Carbon Tetrachloride (CCl_4; tetrachloromethane)	None identified
Ethylene Oxide (1,2–epoxyethane)	None identified
Methylene Chloride (CH_2Cl_2; Dichloromethane)	None identified
Trichloroethylene (CCl_2CHCl; Trichloroethene)	None identified
Chloroform ($CHCl_3$)	None identified
Vinyl chloride (C_2H_3Cl; Chloroethylene)	None identified
Inorganic Arsenic	None identified
Nickel (metallic nickel and inorganic nickel compounds)	None identified
Perchloroethylene (C_2Cl_4; Tetrachloroethylene)	None identified
Formaldehyde (HCHO)	None identified
1,3–Butadiene (C_4H_6)	None identified
Inorganic Lead	None identified
Particulate Emissions from Diesel–Fueled Engines	None identified

NOTE: Authority cited: Sections 39600, 39601 and 39662, Health and Safety Code. Reference: Sections 39650, 39660, 39661 and 39662, Health and Safety Code.

HISTORY

1. New section filed 9-23-85; effective thirtieth day thereafter (Register 85, No. 39). For history of former subchapter 7, see Registers 84, No. 10; 83, No. 2; 81, No. 48; 77, No. 12; and 74, No. 47.
2. Amendment filed 1-14-86; effective thirtieth day thereafter (Register 86, No. 3).
3. Amendment filed 2-10-86; effective thirtieth day thereafter (Register 86, No. 7).
4. Amendment filed 10-9-86; effective thirtieth day thereafter (Register 86, No. 43).
5. Amendment filed 11-25-86; effective thirtieth day thereafter (Register 86, No. 48).
6. Amendment filed 2-23-87; effective thirtieth day thereafter (Register 87, No. 9).
7. Amendment filed 10-8-87; operative 11-7-87 (Register 87, No. 43).
8. Amendment filed 3-15-88; operative 4-14-88 (Register 88, No. 13).
9. Amendment filed 7-22-88; operative 8-21-88 (Register 88, No. 31).
10. Amendment adding Methylene Chloride filed 6-7-90; operative 7-7-90 (Register 90, No. 30).
11. Amendment adding Trichloroethylene filed 2-27-91; operative 3-29-91 (Register 91, No. 13).
12. Amendment adding Vinyl chloride filed 5-10-91; operative 6-9-91 (Register 91, No. 25).
13. Editorial correction, including removal of Inorganic arsenic (Register 91, No. 25).
14. Amendment adding Chloroform filed 5-10-91; operative 6-9-91 (Register 91, No. 25).
15. Amendment adding Inorganic Arsenic filed 6-6-91; operative 7-6-91 (Register 91, No. 26).
16. Change without regulatory effect amending Trichloroethylene and adding Nickel filed 7-14-92 pursuant to section 100, title 1, California Code of Regulations (Register 92, No. 29).
17. Amendment adding Perchloroethylene filed 10-2-92; operative 11-1-92 (Register 92, No. 40).
18. Amendment adding Formaldehyde filed 3-2-93; operative 4-1-93 (Register 93, No. 10).
19. Amendment adding 1,3-Butadiene filed 4-14-93; operative 5-14-93 (Register 93, No. 16).
20. Editorial correction (Register 98, No. 16).
21. Amendment adding inorganic lead filed 4-14-98; operative 5-14-98 (Register 98, No. 16).
22. Amendment adding "Particulate Emissions from Diesel-Fueled Engines" filed 7-21-99; operative 8-20-99 (Register 99, No. 30).

§ 93001. Hazardous Air Pollutants Identified as Toxic Air Contaminants.

Each substance listed in this section has been identified as a hazardous air pollutant pursuant to subsection (b) of Section 112 of the federal Clean Air Act (42 U.S.C. Section 7412(b)) and has been designated by the State Board to be a toxic air contaminant pursuant to Health and Safety Code Section 39657.

Substance

Acetaldehyde
Acetamide
Acetonitrile
Acetophenone
2-Acetylaminofluorene
Acrolein
Acrylamide
Acrylic acid
Acrylonitrile
Allyl chloride
4-Aminobiphenyl
Aniline
o-Anisidine
Asbestos
Benzene (including benzene from gasoline)
Benzidine
Benzotrichloride
Benzyl chloride
Biphenyl
Bis (2-ethylhexyl) phthalate (DEHP)
Bis (chloromethyl) ether
Bromoform
1,3-Butadiene
Calcium cyanamide
Caprolactam
Captan
Carbaryl
Carbon disulfide
Carbon tetrachloride
Carbonyl sulfide
Catechol
Chloramben
Chlordane
Chlorine
Chloroacetic acid
2-Chloroacetophenone
Chlorobenzene
Chlorobenzilate
Chloroform
Chloromethyl methyl ether
Chloroprene
Cresols/Cresylic acid (isomers and mixture)
o-Cresol
m-Cresol
p-Cresol
Cumene
2,4-D, salts and esters
DDE
Diazomethane
Dibenzofurans
1,2-Dibromo-3-chloropropane
Dibutylphthalate
1,4-Dichlorobenzene (p)
3,3-Dichlorobenzidene
Dichloroethyl ether (Bis (2-chloroethyl) ether)
1,3-Dichloropropene
Dichlorvos
Diethanolamine
N,N-Diethyl aniline (N,N-Dimethylaniline)
Diethyl sulfate
3,3-Dimethoxybenzidine
Dimethyl aminoazobenzene
3,3-Dimethyl benzidine
Dimethyl carbamoyl chloride
Dimethyl formamide
1,1-Dimethyl hydrazine
Dimethyl phthalate
Dimethyl sulfate
4,6-Dinitro-o-cresol, and salts
2,4-Dinitrophenol
2,4-Dinitrotoluene
1,4-Dioxane (1,4-Diethyleneoxide)
1,2-Diphenylhydrazine
Epichlorohydrin (1-Chloro-2,3-epoxypropane)
1,2-Epoxybutane
Ethyl acrylate
Ethyl benzene
Ethyl carbamate (Urethane)
Ethyl chloride (Chloroethane)
Ethylene dibromide (Dibromoethane)
Ethylene dichloride (1,2-Dichloroethane)
Ethylene glycol
Ethylene imine (Aziridine)
Ethylene oxide
Ethylene thiourea
Ethylidene dichloride (1,1-Dichloroethane)
Formaldehyde
Heptachlor
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexamethylene-1,6-diisocyanate
Hexamethylphosphoramide
Hexane
Hydrazine
Hydrochloric acid
Hydrogen fluoride (Hydrofluoric acid)
Hydroquinone
Isophorone
Lindane (all isomers)
Maleic anhydride
Methanol
Methoxychlor
Methyl bromide (Bromomethane)
Methyl chloride (Chloromethane)
Methyl chloroform (1,1,1-Trichloroethane)

Methyl ethyl ketone (2–Butanone)
Methyl hydrazine
Methyl iodide (Iodomethane)
Methyl isobutyl ketone (Hexone)
Methyl isocyanate
Methyl methacrylate
Methyl tert butyl ether
4,4–Methylene bis(2–chloroaniline)
Methylene chloride (Dichloromethane)
Methylene diphenyl diisocyanate (MDI)
4,4–Methylenedianiline
Naphthalene
Nitrobenzene
4–Nitrobiphenyl
4–Nitrophenol
2–Nitropropane
N–Nitroso–N–methylurea
N–Nitrosodimethylamine
N–Nitrosomorpholine
Parathion
Pentachloronitrobenzene (Quintobenzene)
Pentachlorophenol
Phenol
p–Phenylenediamine
Phosgene
Phosphine
Phosphorus
Phthalic anhydride
Polychlorinated biphenyls (Aroclors)
1,3–Propane sultone
beta–Propiolactone
Propionaldehyde
Propoxur (Baygon)
Prophylene dichloride (1,2–Dichloropropane)
Propylene oxide
1,2–Propylenimine (2–Methylaziridine)
Quinoline
Quinone
Styrene
Styrene oxide
2,3,7,8–Tetrachlorodibenzo–p–dioxin
1,1,2,2–Tetrachloroethane
Tetrachloroethylene (Perchloroethylene)
Titanium tetrachloride
Toluene
2,4–Toluene diamine
2,4–Toluene diisocyanate
o–Toluidine
Toxaphene (chlorinated camphene)
1,2,4–Trichlorobenzene
1,1,2–Trichloroethane
Trichloroethylene
2,4,5–Trichlorophenol
2,4,6–Trichlorophenol
Triethylamine
Trifluralin
2,2,4–Trimethylpentane
Vinyl acetate
Vinyl bromide
Vinyl chloride
Vinylidene chloride (1,1–Dichloroethylene)
Xylenes (isomers and mixture)
o–Xylenes
m–Xylenes
p–Xylenes
Antimony Compounds
Arsenic Compounds (inorganic including arsine)
Beryllium Compounds
Cadmium Compounds
Chromium Compounds
Cobalt Compounds
Coke Oven Emissions
Cyanide Compounds[1]
Glycol ethers[2]
Lead Compounds
Manganese Compounds
Mercury Compounds
Fine mineral fibers[3]
Nickel Compounds
Polycyclic Organic Matter[4]
Radionuclides (including radon)[5]
Selenium Compounds

NOTE: For all listing above which contain the word "compounds" and for glycol ethers, the following applies: Unless otherwise specified, these listings are defined as including any unique chemical substance that contains the named chemical (i.e., antimony, arsenic, etc) as part of that chemical's infrastructure.

[1] X^1CN where $X=HN^1$ or any other group where a formal dissociation may occur. For example KCN or $Ca(CN)_2$

[2] includes mono– and di–ethers of ethylene glycol, diethylene glycol, and triethylene glycol $(R(OCH_2CH_2)_n–OR^1$ where
$n = 1,2$ or 3
R = alkyl or aryl groups
R^1 = R, H, or groups which, when removed, yield glycol ethers with the structure: $R(OCH_2CH)_n–OH$. Polymers are excluded from the glycol category.

[3] includes mineral fiber emissions from facilities manufacturing or processing glass, rock, or slag fibers (or other mineral derived fibers) of average diameter 1 micrometer or less.

[4] includes organic compounds with more than one benzene ring, and which have a boiling point greater than or equal to 100°C.

[5] a type of atom which spontaneously undergoes radioactive decay.

NOTE: Authority cited: Sections 39657, 39600, 39601 and 39662, Health and Safety Code. Reference: Sections 39650, 39655, 39656, 39657, 39658, 39659, 39660, 39661 and 39662, Health and Safety Code.

HISTORY

1. New section filed 3–9–94; operative 4–8–94. Submitted to OAL for printing only (Register 94, No. 10).

Subchapter 7.5. Airborne Toxic Control Measures

§ 93100. Nonvehicular Airborne Toxic Control Measures.

The nonvehicular airborne toxic control measures contained in this subchapter have been adopted by the state board and shall be implemented by adoption of regulations by local air pollution control and air quality management districts pursuant to Health and Safety Code Section 39666.

NOTE: Authority cited: Sections 39600, 39601, 39650 and 39666, Health and Safety Code. Reference: Sections 39650 and 39666, Health and Safety Code.

HISTORY

1. New section filed 6–16–88; operative 7–16–88 (Register 88, No. 26).

§ 93101. Benzene Airborne Toxic Control Measure—Retail Service Stations.

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

(1) "ARB–certified vapor recovery system" means a vapor recovery system which has been certified by the state board pursuant to Section 41954 of the Health and Safety Code.

(2) "Excavation" means exposure to view by digging.

(3) "Gasoline" means any organic liquid (including petroleum distillates and methanol) having a Reid vapor pressure of four pounds or greater and used as a motor vehicle fuel or any fuel which is commonly or commercially known or sold as gasoline.

(4) "Motor vehicle" has the same meaning as defined in Section 415 of the Vehicle Code.

(5) "Owner or operator" means an owner or operator of a retail service station.

(6) "Phase I vapor recovery system" means a gasoline vapor recovery system which recovers vapors during the transfer of gasoline from delivery tanks into stationary storage tanks.

(7) "Phase II vapor recovery system" means a gasoline vapor recovery system which recovers vapors during the fueling of motor vehicles from stationary storage tanks.

(8) "Retail service station" means any new or existing motor vehicle fueling service station subject to payment of California sales tax on gasoline sales.

(9) "Existing retail service station" means any retail service station operating, constructed, or under construction as of the date of district adoption of regulations implementing this control measure.

(10) "New retail service station" means any retail service station which is not constructed or under construction as of the date of district adoption of regulations implementing this control measure.

Appendix E

Glossary of Definitions, Selected Terms, and Acronyms

Appendix E

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 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.

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.

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.

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).

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.

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.

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).

Drop off Shop: Same as agency shop. A facility with no dry cleaning machine on-site.

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.

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.

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)).

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

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.

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