# SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

# Final Staff Report
# Proposed Amendment Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems

## October 2002

**Deputy Executive Officer**
**Planning, Rule Development, and Area Sources**
Elaine Chang, Dr.PH

**Planning and Rules Manager**
Jill Whynot


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|---|---|
| Authors: | Ali Ghasemi, P.E. – Air Quality Engineer II<br>Pamela Perryman – Air Quality Specialist |
| Technical Assistance: | Barbara Radlein – Air Quality Specialist<br>Helmy Sultan, Ph.D. – Air Quality Specialist |
| Reviewed by: | Laki Tisopulos, Ph.D., P.E.– Assistant Deputy Executive Officer, Planning, Rule Development, and Area Sources<br>Gary Quinn, P.E. - Air Quality Analysis and Compliance Supervisor<br>Barbara Baird – District Counsel<br>Mike Harris – Senior Deputy District Counsel<br>William Wong – Senior Deputy District Counsel |

Staff Contributors

Rudy Eden, Senior Enforcement Manager
Michael Mills, Senior Air Quality Engineering Manager
Mike Nazemi, Planning and Rules Manager
Edwin Pupka, Senior Enforcement Manager
Ben Shaw, Senior Enforcement Manager
Nancy Covey, Procurement Manager
Tom Chico, Program Supervisor
Steve Jones, Air Quality Analysis and Compliance Supervisor
Cher Snyder, Senior Staff Specialist
George Wright, Senior Staff Specialist
Dave De Boer, Air Quality Specialist
Gary Bancroft, Supervising Air Quality Inspector
John Lee, Air Quality Inspector III
Lily Henry, Air Quality Inspector II
Bertha M. Hernandez, Air Quality Inspector II
Don B. Hopps, Air Quality Inspector II
Manny Regala, Air Quality Inspector II
Yasmine Wadia, Air Quality Inspector II
Heather Brown, Air Quality Inspector I
Bertha A. Hernandez, Air Quality Inspector I
James Son, Air Quality Inspector I
Jessica Swift, Air Quality Inspector I
Joan Niertit, Principal Air Quality Chemist
John McLaughlin, Senior Air Quality Chemist
Heather Farr, Air Quality Chemist
Judy Hwa, Air Quality Chemist
Sally Kou, Air Quality Chemist
Phil O'Bell, Air Quality Chemist
Joe Vail, Air Quality Chemist
Efrain Arroyo, Staff Specialist

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# TABLE OF CONTENTS

## TABLE OF CONTENTS (continued)

**ATTACHMENT 1 Proposed Amended Rule 1421**

# EXECUTIVE SUMMARY

## Background

Perchloroethylene (perc), also known as tetrachloroethylene, is a synthetically produced organic compound having industrial use as a solvent in degreasing and cleaning. According to a number of international, federal, and state authoritative bodies, perc is a possible/probable carcinogen and contributes to both chronic and acute health impacts. The health impacts of perc are to the central nervous system, eye and respiratory irritation, kidney, and gastrointestinal system/liver. It is absorbed through the lungs into the blood stream and deposited in lipid-rich tissues. Breast milk can be contaminated. High levels of exposure to perc cause central nervous system intoxication, dizziness and incoordination.

Perc is currently found in soil, groundwater, and wastewater, as well as the ambient air in the SCAQMD Basin. Miniscule amounts of perc can cause an exceedance of the standards at wastewater treatment plants. Site soil and groundwater contamination of perc dry cleaners has also been a problem, as some landlords are unwilling to renew leases to perc dry cleaners due to the high costs of soil remediation when perc contamination occurs.

The MATES II Final Report, March 2000 identified perc as one of six key toxic air contaminants in the Basin. Although perc emissions were shown to have decreased since the early 1990's, perc is still present in the ambient air. The study determined that the major contributors of perc in the ambient air were dry cleaners, with approximately two-thirds of the emissions, and degreasers with approximately one-third of the emissions. Other emissions were attributed to consumer products, industrial solvent use, printing, and other uses. The inventory for MATES II was based on 1998. Since that time the AQMD Governing Board has adopted Rules 1122 – Solvent Degreasers, and 1425 - Film Cleaning and Printing Operations, which will decrease perc emissions by 210 tons per year and 27.5 ton per year perc, respectively. Work during the rule development process has resulted in revised perc estimates from dry cleaners (decreased emissions). The relative contribution of perc emissions from dry cleaners is still the majority of perc emissions from stationary sources, given the implementation of the recently adopted rules listed above.

In order to address the overall toxic risks identified from the MATES II study, the Governing Board approved the final draft "An Air Toxics Control Plan for the Next Ten Years," on March 17, 2000, including a control measure for dry cleaners (Control Measure AT-STA – 02 Further Reductions of Perchloroethylene Emissions from Dry Cleaning Operations). Rule 1402 also identified perc dry cleaning as an industry to be evaluated for a source-specific approach. Both the Rule 1402 Resolution and the toxics plan direct staff to evaluate what perc reductions are possible, considering technical and economic feasibility. The staff proposal seeks to eventually reduce risk to zero through a gradual transition in the dry cleaning industry to non-perc alternatives that are currently commercially available and economically viable. Hundreds of dry cleaners in the Basin, Bay Area, and other regions are already using alternative technologies. The 15-year transition period takes into consideration the small business nature of the industry and is structured to ease economic burdens.

## Industry Characteristics

Most dry cleaners are small businesses, operated by people employing less than five employees and often run by family members. According to Korean Dry Cleaners and Laundry Association (KDLA), approximately 50% of the dry cleaners in the Basin are Korean-owned. The gross revenues vary, but often reflect small profit margins. The field is highly competitive and the market is saturated.

Of the 2,181-perchloroethylene dry cleaning machines operating in the District, 33% of the machines (714) are estimated to be closed-loop dry-to-dry equipped with primary and secondary control systems, and 66% of the machines (1,449) are estimated to be closed-loop dry-to-dry equipped with only primary control system. There are 18 dry-to-dry converted machines. The perc usage for converted machine was 170 gallons per year based on perc ATCM information. The perc usage for a machine with primary control system ranged from 75 to 150 gallons per year based on the actual emissions reported in the draft CAPCOA Industry-wide Risk Assessment guidelines. For a machines with primary and secondary control systems, the perc usage ranged from 26 to 166 gallons per year (average usage $\pm$ one standard deviation) based on the information obtained from facilities during the recent sampling analysis conducted by AQMD staff. The preliminary draft staff report estimated emissions based on a draft CAPCOA document. Extensive sampling and analysis conducted has resulted in revised emission estimates. AQMD sampling analysis indicated that the percent perc emitted for machines with primary and secondary control systems and machines with primary control system were 50% and 54%, respectively. The inventory for perc is approximately 850 tons per year. The risk for older dry-to-dry machines (converted machines) ranges from 45-in-one-million to approximately 190-in-one-million. Machines with primary controls only, the majority of the existing equipment produces risks in the range of 45-in-one-million to 90-in-one-million. The newest machines result in risks in the range of 15-in-one-million to 90-in-one-million.

## Proposal

The proposed amendments to Rule 1421 will gradually transition dry cleaners from the use of perchloroethylene systems to alternative cleaning technologies. This transition will occur when the dry cleaning systems are added or replaced or when a new business is opened. The proposal was developed to reduce the health risk associated with perc exposure because cost-effective, non-toxic alternatives are readily available and have been proven in practice.

Even the newest (latest technology) perc machines would most likely not be able to meet the Rule 1402 – Control of Toxic Air Contaminants from Existing Source, action-level maximum individual cancer risk of 25-in-one-million depending upon their usage and proximity to the closest receptor. These latest machines would also have difficulty meeting Rule 1401 limits. The proposed amendment would require a new facility or existing facilities adding equipment to purchase a non-perc alternative technology starting January 1, 2003. Older machines which have been converted to only primary controls (18 in number) would be required to be replaced with an alternative cleaning technology by July 1, 2004. Those machines currently operating with integrated primary controls and both integral primary and secondary controls would be required to transition to non-perc alternatives at the time of machine replacement, not to exceed 15 years

of equipment use. The 15-year time period was arrived at in discussion with the Working Group and based on testimony from the International Fabricare Institute's (IFI) CEO, before Congress, in the year 2000, that the life of a new perc dry cleaning machine is typically between 8 and 14 years. Thus, based on current Rule 1421 requirements and permitting records, no primary machines should be operating after January 1, 2014 and no perc machines should be operating after July 1, 2019. In an independent effort, staff is proposing a financial incentive program to assist facilities switching to non-perc alternatives in the first year following the rule's adoption before requirements for replacing equipment with non-perc alternatives become effective.

## Alternative Technologies

A number of the alternative non-perc technologies are currently in wide use and others are in developmental stages. There are about 75 hydrocarbon machines, 25 Green Earth™ (a silicone-based solvent), 10 dedicated wet cleaning facilities, and one $CO_2$ machine that are being operated in the Basin. Wet cleaning is widely used in Europe (one manufacturer has sold 800 units in Europe) and the number of dedicated wet cleaning establishments in the Basin has been steadily growing. Currently, there are 10 dedicated wet cleaners and a number of facilities doing a mixture of wet and solvent cleaning. Hydrocarbon cleaning is well established in Europe, and the Bay Area has approximately 15% of all dry cleaning facilities using hydrocarbon technology. There are 881 dry cleaners with 966 dry cleaning machines in Bay Area. Based on recent permitting activity in the Bay Area, 18% were for perc dry cleaning machines and 82% for non-perc machines. In SCAQMD, the number of hydrocarbon machines permitted since August 1988 have been increased from 0.3% to 6% of the total number of permitted dry cleaning machine. The hydrocarbon machines cost approximately $10,000 more than comparable perc machines, but switching to wet cleaning can actually save the operator money as the equipment costs less and energy savings have been documented to be as high as 45% for electricity. Part of these savings may be offset by increased labor costs. $CO_2$ is expensive, but is an emerging technology and costs are expected to go down with time.

Hydrocarbon cleaning process and equipment are very similar to the perc cleaning process and equipment. As discussed under Policy Issues, there is an environmental trade-off because some of the hydrocarbon solvents contain VOCs. The amount of both hydrocarbon and perc emitted from dry cleaning equipment was determined through sampling/testing efforts conducted by AQMD staff. A detailed write-up of the sampling procedure and results is presented in Appendix D of this staff report. In conjunction with the sampling results, staff will be re-evaluating Rule 1401 permitting procedures for perc machines and BACT for hydrocarbon machines.

## Public Input

Staff has participated with stakeholders in an extensive public process. The process consisted of one Public Workshop, five public consultation meetings, eight working group meetings, two focus group meetings, two KDLA meetings, numerous individual meetings and numerous phone calls, and site visits (more than a dozen) to facilities in the District, Bay Area, and Sacramento. Many of these meetings were held in the evening. An additional 35 sites were visited for testing

and six more for quality control analysis. Korean language translators have been available at all public consultation meetings and notices have been printed in Korean as well. Staff appreciates the numerous hours of cooperative effort the Working Group contributed to the rule development effort.

AQMD Public Advisor's Office has recently implemented Focus Groups with facilitators in order to receive information from the regulated community in a more informal setting than through the public workshop process. Another effort to enhance the AQMD's rulemaking process includes the continued refinement of the current AQMD socioeconomic analysis. In 2000, the AQMD hired a consultant to develop new socioeconomic analysis tools for the purpose of conducting facility-based assessments. The information obtained from these two programs has been used during this rule development process.

## Policy Issues

Three policy issues are highlighted below. The first regards possible environmental tradeoffs in switching from a toxic air contaminant to non-perc alternatives. The second concerns recent sampling and analysis data staff collected from dry cleaners and how this will affect permitting under Rule 1401. Finally, OEHHA has recently revised their methodology used in calculating cancer and non-cancer risks. This change in methodology will also impact how the AQMD examines risk from individual facilities under Rule 1401.

The staff's proposal requires dry cleaners to use a non-perc alternative of their own choice as equipment is replaced (up to 15 years use for existing equipment). Each of the alternatives has advantages and disadvantages. Wet cleaning may increase water usage, although not to an environmentally significant level. However, the basic equipment costs less than that used for perc, hydrocarbon solvents or $CO_2$ cleaning, and energy savings may be realized with this process. Some wet cleaners have experienced increased labor costs, although others have not. $CO_2$ cleaning is not harmful to the environment, equipment costs are substantially higher than perc and the process is still being refined. The $CO_2$ used in this process does not contribute to global warming, as it is an industrial by-product from existing operations, primarily anhydrous ammonia (fertilizer) production. This $CO_2$ is also used in other applications such as carbonating soft drinks. The CEQA document provides more detailed information relative to these topics.

Hydrocarbon solvents contain VOC materials, although the VOC content varies by solvent. One silicone-based substance is non-VOC. The CEQA analysis, which analyzes a range of scenarios, including a worst-case scenario of all dry cleaners switching to the highest VOC material, and operating at an average maximum permitted level, showed an increase over time of up to 2.8 tons per day of VOC, with full rule implementation. This VOC increase is 0.6 tons per day in 2006, 1.3 tons per day in 2010, and 2.8 tons per day in 2018. The worst-case scenario was based on all dry cleaners switching to the solvent with the highest VOC content and using maximum average permitted usage. This switch to the highest value VOC solvent is highly unlikely considering the percent market share this solvent currently has and the availability of other alternatives. Some cleaners will choose Green Earth™, which has no VOCs and others will go to wet cleaning or

perhaps $CO_2$. Based on current permitting activity which shows most solvent machines using the lower VOC content solvent and actual usage records versus potential permitted levels, the more likely scenario would result in an average increase in VOC emissions of 0.11 tons per day in 2006, 0.26 tons per day in 2010, and 0.57 tons per day in 2018. Hydrocarbon cleaning equipment varies in cost but is more expensive than comparable perc equipment. Its cleaning process is very similar to perc.

Recent sampling has not validated previous data used to establish screening tables used for permitting perc dry cleaning equipment under Rule 1401 and this recent data would also be used to evaluate these facilities under Rule 1402 in the future, if Rule 1421 is not amended exempting dry cleaners from Rule 1402 inventory requirements. If Rule 1421 were amended, compliant sources would be exempt from the inventory requirements of Rule 1402. In a separate action, the staff bring to the Board, an information item on the revision to permitting tables to reflect the new information on emissions, effective January 1, 2003. New equipment required to go through Rule 1401 analysis is unlikely to be able to meet the usage limits that would be applied. It is also uncertain whether or not existing facilities would be able to comply with Rule 1402 through usage limits.

Although a fairly infrequent occurrence, relocated equipment may be impacted by the change in screening levels. Relocated equipment is also unlikely to be able to meet the 1401 limits and would need to be replaced with non-perc equipment. In addition to relocated equipment, facilities operating without permits or with expired permits that have exceeded the time for reinstatement would be affected.

OEHHA has reassessed the methodology used in calculating cancer and non-cancer risk, and is proposing an inhalation cancer potency factor instead of a unit risk factor (URF). An "Air Toxics Hot Spots Program Risk Assessment Guidelines: Guidance Manual for Preparation of Health Risk Assessments" (OEHHA 2002) has been approved by the Scientific Review Panel at its July 26, 2002 meeting. Release of the finalized guidance manual is expected within the next month. The manual included risk values and algorithms needed to do a Hot Spots risk assessment. The practical application of the new approach is that the calculated risk from dry cleaners (and all facilities) whose emissions follow the inhalation pathway, would be greater by about 30 percent. This would result in even more stringent usage limits under Rule 1401, and further increase the likelihood that operators of perc equipment would not meet these limits.

## Format of This Document

Chapter 1 of this document describes the regulatory history of Rule 1421 and the federal and state standards governing perc dry cleaners. This chapter also discusses the health impacts of exposure to perchloroethylene, a toxic air contaminant. Chapter 1 describes the currently available non-perc alternative technologies. There is also a description of two new tools, focus groups and additional economists' review being employed by the AQMD in this rulemaking process.

Chapter 2 explains the proposed rule requirements. The industry characteristics are described. There is a discussion of the emissions baseline for perc dry cleaners and risks and the estimated reductions to be achieved through implementation of PAR 1421.

Chapter 3 includes an assessment of the impacts relating to the proposed amendments, including environmental and economic. The complete analyses for the environmental and economic reports can be found in the attached Environmental Assessment and Socioeconomic Report.

Appendix A presents response to comments.

Appendix B includes a flow chart of the proposed Rule 1421 requirements.

Appendix C presents the population distribution and emission reduction calculations for perc dry cleaning equipment.

Appendix D presents the sampling and analyses conducted by AQMD staff for perc and hydrocarbon dry cleaning systems.

Appendix E presents a comparative analysis pursuant to Health and Safety Code Section 40727.2

This report is accompanied by an Environmental Assessment for the Proposed Amendments to Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems prepared pursuant to the California Environmental Quality Act (CEQA) and the AQMD's Certified Regulatory Program (Rule 110). Additionally, the Socioeconomic Report for Proposed Amendments to Rule 1421 was available no later than thirty days prior to the Public Hearing.

CHAPTER 1

# BACKGROUND

# REGULATORY HISTORY

Dry cleaners, using perc as the cleaning solvent, were first controlled through AQMD's Rule 1102.1 – Perchloroethylene Dry Cleaning Systems. This rule was repealed December 9, 1994 when Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems, was adopted. Rule 1421 was adopted to reflect the requirements of the state Airborne Toxic Control Measure (ATCM) for Emissions of Perchloroethylene from Dry Cleaning Operations, adopted May 4, 1994, and the federal National Emission Standards for Hazardous Air Pollutants (NESHAP) for Perchloroethylene Dry Cleaning Facilities promulgated September 22, 1993 (58 FR 49354), as 40 CFR Part 63, Subpart M. The NESHAP was amended on December 20, 1993 (58 FR 66287) and September 19, 1996 (61 FR 49263). Rule 1421 was amended June 13, 1997 to incorporate changes to the NESHAP.

The adoption of the NESHAP and its amendments, and subsequent amendments to Rule 1421 resulted in the elimination of transfer machines, which were not as efficient in controlling emissions as dry-to-dry machines. Inspection, recordkeeping and monitoring requirements and these equipment changes were expected to reduce perc emissions by 80%.

Dry cleaning equipment has evolved over time to reduce emissions and consequently the health risk. The terms "dry cleaning equipment" and "dry cleaning system" are defined in Rule 1421 with regards to the use of perc. For the purpose of this report, the term "dry cleaning" may, at times, be assumed to broadly address the industry as a whole, including perc and non-perc alternatives. Initially, dry cleaning facilities were using transfer machines, which emitted high amounts of perc due to the opening of the machine and transferring of clothes from the washer to the dryer. Then, machines were designed with an integrated refrigerated condenser (primary control system) to reduce perc emissions. In these machines, the hot air from the drying drum is recirculated through a refrigerated condenser (where solvent is recovered), with the air reheated and returned to the drum. An inductive door fan (draws air through the loading door and drum, prior to and when the loading door is opened) is used on some machines to protect the operator from residual solvent vapor during unloading (after cool-down). Finally, machines were designed with integrated refrigerated condenser and carbon adsorber (primary and secondary control systems). In these machines, after the refrigerated cool-down cycle, air from the drying drum is recirculated through the secondary control system to reduce the perc concentration in the drum to less than 300 ppm. This type of control further reduces emissions to the atmosphere and residual solvent in the clothing. The carbon module must be regularly regenerated by heated air to maintain effectiveness. The industry often refers to the various machines as third, fourth and fifth generation. There is no consensus on the definitions of these various types of machines, thus, AQMD staff refers to equipment solely on the basis of the controls it is equipped with distinguishing between controls that have been add-on to machines after initial manufacturer and those which are integral to the equipment. However, even with these advances in perc dry cleaning technology, there remains a significant residual risk in the Basin associated with the continued use of perc in dry cleaning operations.

Perc was added to Rule 1401 – New Source Review of Toxic Air Contaminants, in September of 1998 with risk values for cancer and chronic health effects. At the August 13, 1999 Board meeting, an acute risk value was added for perc. Permitting of new, modified and relocated dry cleaners using perc has occurred under Rule 1401 since this time.

Perc was identified as a key toxic air contaminant in the March 2000 "Multiple Air Toxics Exposure Study in the South Coast Air Basin" (MATES – II), which measured over 30 air pollutants. The list of toxic air contaminants are determined by the U.S. Environmental Protection Agency (EPA), and the California EPA, including the Office of Environmental Health Hazard Assessment (OEHHA) and the California Air Resources Board (CARB). MATES II identified perc emissions from stationary sources (primarily dry cleaners, solvent use, degreasing, and film cleaning), with a small subset of emissions coming from "area" sources, i.e. consumer products. Based on 1998 inventory data, dry cleaners are estimated to contribute 60% of all stationary source perchloroethylene emissions. Including diesel particulate, perc contributes 1% of the basin-wide average toxicity; excluding diesel particulate, perc represents 4% of the toxicity. Since that time the AQMD Governing Board has adopted Rules 1122 – Solvent Degreasers, and 1425 - Film Cleaning and Printing Operations, which will decrease perc emissions by 210 tons per year and 27.5 ton per year perc, respectively. Work during the rule development process has resulted in revised perc estimates from dry cleaners (decreased emissions). The relative contribution of perc emissions from dry cleaners is still the majority of perc emissions from stationary sources, given the implementation of the recently adopted rules listed above. The MATES II study was based on 1998 emissions inventory information. If one were to consider the share of dry cleaners emissions to the perc inventory in January 2003, one would find they contribute approximately 90% or more. As of that date, degreasers (31% contribution) will not be using perc unless controlled in an airless airtight system; film cleaners (2% contribution) will have decreased their emissions by 85% and the remaining area source contributors only account for 8% of the total share of perc emissions.

Figure 1 shows the comparative perc contribution of sources as identified in the MATES II study.

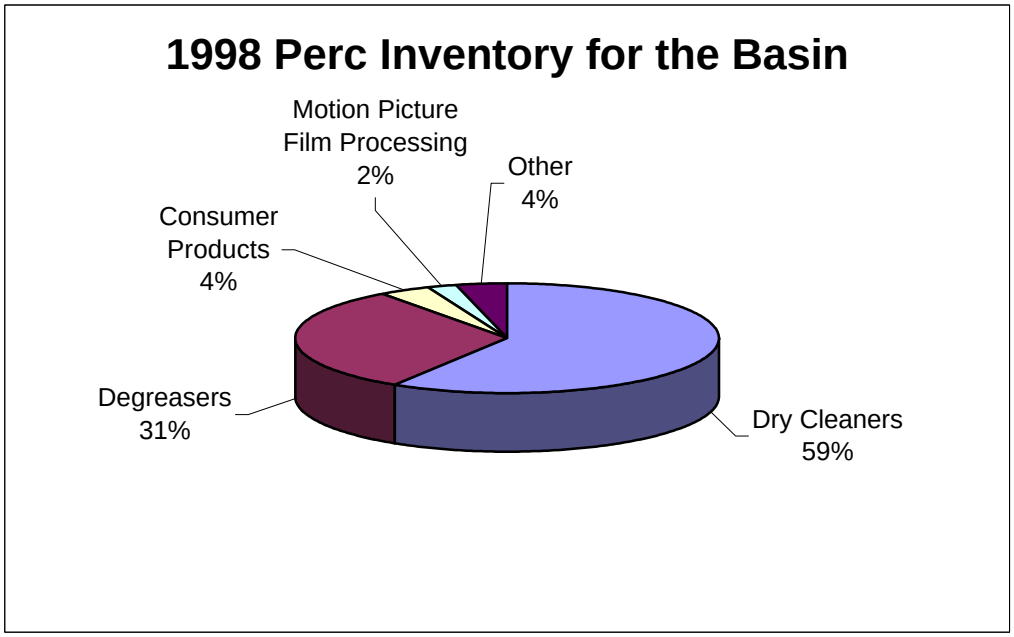



**Figure 1**

On March 17, 2000, the Governing Board approved the final draft "An Air Toxics Control Plan for the Next Ten Years" (the Plan). The Plan's Control Measure AT-STA – 02 Further Reductions of Perchloroethylene Emissions from Dry Cleaning Operations (Amend Rule 1421), calls for a perchloroethylene reduction of 95% by the end of 2010. The Plan states this reduction may be achieved through the "use of alternative solvents (e.g., hydrocarbons, carbon dioxide, wet cleaning) and establishing requirements to use these solvents when equipment is purchased for a new facility or when replacing equipment that has reached the end of its useful life."

The Air Toxics Control Plan calls for reductions in perc emissions to be made by 2010. Perc emissions are already being controlled through the adoption of Rules 1425 – Film Cleaning and Printing Operations, (March 16, 2001) and 1122 – Solvent Degreasers, (September 21, 2001). Both of these sources of perc were identified in the toxics plan, as Control Measures AT-STA-03 and AT-STA-04, respectively.

Rule 1425 requires a minimum 85% overall (capture and removal) efficiency of perc emission reductions from both film cleaning and printing processes. While there are solvent alternatives available for some film cleaning applications, there exists a need to allow the use of perc to clean original-cut negatives and older films for archiving purposes. In addition, there are no available alternatives to perc for film printing due to the chemical's unique refractive index. Given the technical nature of the operations, it was deemed infeasible to require a phase-out of perc for the motion picture film processing industry. Most of these existing facilities, after controls, would be below the Rule 1402 action risk level of 25-in-one-million. New facilities would be subject to both Rules 1425 and 1401.

Solvent degreasers using any NESHAP solvent, of which perc is one, will cease to use these solvent after January 1, 2003 unless they are used in an airless/air-tight cleaning system which achieves a 95% capture and control efficiency.

In addition, AQMD rules have effectively eliminated the use of certain other toxic substances in particular applications, such as, hexavalent chromium ($Cr^{+6}$) in cooling towers (Rule 1404), chlorofluorocarbon (CFC) in hospital and commercial sterilization (Rule 1405), and CFC and methylene chloride in polyurethane operations (Rule 1175).

Although the proposal for this rule amendment is more stringent than the ATCM or the NESHAP, both state and federal law allow the District to enact more stringent toxic regulations. See Cal. Health and Safety Code section 39666(d) and 42 U.S.C. section 7412(r)(11). In addition, the District has the legal authority to regulate toxic air contaminants under broad grants of authority from the state legislature in the Health and Safety Code to regulate stationary sources. See *WOGA vs. Monterey Bay APCD*, 49 Cal. 3d. 347(1989). Examples of other more stringent District rules are Rule 1122 – Solvent Degreasers, and Rule 1405 – Control of Ethylene Oxide and Chlorofluorocarbon Emissions from Sterilization or Fumigation Processes, which are more stringent than the ATCMs and/or NESHAP. The Board also recently amended Rule 1168 - Adhesives and Sealant Applications, to, among other changes, phase out use of the cancer-causing compound methylene chloride in adhesives by Jan. 1, 2004.

The universe of dry cleaners consists of mostly small businesses, employing between two and five persons, that have been regulated in the past through Rule 1421, which has and have contributed to a drop in ambient air emissions of perc. However, a residual toxics problem in the overall Basin still exists as evidenced by the MATES II study, which shows an overall cancer risk in the Basin of 1,400-in-one-million. About 70% of all risk is attributed to diesel particulate, 20% to other toxics associated with mobile sources, and 10% of all risk is attributed to stationary sources. Including diesel particulate, perc contributes 1% of the toxicity; excluding diesel particulate, perc represents 4% of the toxicity. Perc is emitted from stationary sources with a small subset coming from "other" sources, such as consumer products. In 1998, dry cleaners were estimated to have contributed 60% of all stationary source perchloroethylene emissions. CARB's Toxic Air Contaminant Identification List Summaries – ARB/SSD/SES, September 1997 (http://www.oehha.org/air/chronic_rels/ AllChrels.html) for perc (tetrachloroethylene), presents a discussion of atmospheric persistence and concludes, "tetrachloroethylene is sufficiently persistent to be transported through an air basin before it is degraded."

More importantly, there is a localized impact associated with perc emissions. Staff has calculated individual dry cleaning facilities to pose an estimated cancer risk between 20 to 140-in-one-million at residential locations 25 meters or less from a dry cleaner and 15 to 90-in-one-million at commercial locations 25 meters or less from a dry cleaner. Commercial risk is calculated to be less than residential risk due to adjustment of the exposure period to account for a 40-year working exposure spent at the location rather than a 70-year residential exposure.

As to either overall Basin impacts or local impacts, the adoption of PAR 1421 would attain objectives for perc identified in the Air Toxics Control Plan by gradually transitioning out a

primary source of perc emissions where there are feasible, non-perc alternative technologies available.

## HEALTH IMPACTS OF PERCHLOROETHYLENE

The U. S. EPA has listed perc as a hazardous air pollutant and has promulgated National Emission Standards for Hazardous Air Pollutant Standards to control the emissions of perc, including one for dry cleaners and one for solvent degreasing equipment. Target organs for chronic health effects are kidney, gastrointestinal tract, liver, and respiratory system. The acute health effects target the nervous system, eye, and respiratory system.

The U. S. EPA's Integrated Urban Air Toxics Strategy states: "The Act identifies 188 compounds as HAPs. They include pollutants like benzene found in gasoline, perchloroethylene emitted from dry cleaners, methylene chloride used as an industrial solvent, heavy metals like mercury and lead, polychlorinated biphenyls (PCBs), dioxins and some pesticides. These pollutants may cause cancer or other serious effects in humans or in the environment. Health concerns result from both short- and long-term exposures to these pollutants. They may disperse locally, regionally, nationally, or globally and after deposition may persist in the environment and/or bioaccumulate in the food chain, depending on their characteristics (such as vapor pressure, atmospheric transformation rates."

The health impacts of perc are to the central nervous system, eye and respiratory irritation, kidney, and gastrointestinal system/liver. Human exposure to perc occurs in three ways: inhalation, oral and dermal. By far, inhalation exposure is the most significant route of exposure. Perc is readily absorbed into the blood stream from the lung following inhalation exposure. Oral exposure to perc may occur from ingestion of contaminated drinking water or food, or from ingestion of breast milk from perc-exposed mothers. Perc is readily absorbed into the blood stream from the gastrointestinal tract following ingestion. Metabolism of adsorbed perc is expected to be low, roughly 20% (USEPA, 1985). Dermal absorption is possible from activities that require contact with perc, as might occur in occupational settings. Dermal absorption can occur not only from direct contact with the liquid, but also from contact with the vapor in the air.

Perc is absorbed through the lungs into the blood stream and deposited in lipid-rich tissues. Breast milk can be contaminated. High levels of exposure to perc cause central nervous system intoxication, dizziness, and incoordination. A New York study showed deficits in vision when three vision tests were administered to adults at a day care center co-located in the same building where perc measured 2,000 microgram per cubic meter. The vision tests were for acuity, contrast sensitivity and color discrimination. The study is written up in an article in *Environmental Health Perspectives,* Volume 10, Number 7, July 2002, titled "Apartment Residents' and Day Care Workers' Exposures to Tetrachloroethylene and Deficits in Visual Contrast Sensitivity" which states: "Several occupational studies have indicated that chronic, airborne perc exposure adversely affects neurobehavioral functions in workers, particularly visual color discrimination and tasks dependent on rapid visual-information processing. A 1995 study by Altmann and colleagues extended these findings, indicating that environmental perc exposure at a mean level of 4,980 ìug/m$^3$ (median=1,360 ìg/m$^3$) alters neurobehavioral functions in residents living near

dry-cleaning facilities." (This study can be accessed through the Internet at http://ehpnet1.niehs.nih.gov/docs/2002/110p655-664schreiber/abstract.html**.)**

There has been a general decrease in dry cleaning exposures to perc over the past decade, due to the increased use of machines which have both primary and secondary controls. The general public is exposed to perc emissions through the dry cleaning process, solvent cleaning usage and film printing and cleaning operations. Table 1 lists various organizations and the way in which they classify perc.

The International Agency for Research on Cancer (IARC), part of the World Health Organization, has listed perc as a probable human carcinogen. From various international studies (US, Canada, United Kingdom, Denmark, Sweden) on dry cleaner worker exposure, perc is also listed by IARC as possibly carcinogenic to humans. The Environmental Protection Agency (EPA) has listed perc as a hazardous air pollutant on a continuum between possible/probable human carcinogen. The Unit Risk Factor for EPA is currently under review with a proposed range of $4.8 \times 10^{-8}$ to $1.0 \times 10^{-6}$ per ìg/m$^3$. The Scientific Review Panel (SRP) of OEHHA (approval authority), using EPA and IARC information, lists perc as a possible human carcinogen as does the Office of Environmental Health Hazard Assessment (OEHHA). The Unit Risk Factor for perc is listed as $5.9 \times 10^{-6}$ per ìg/m$^3$ by OEHHA. OEHHA establishes risk values for toxic air contaminants and the SRP reviews and finalizes these values. Final action is taken when the Director of OEHHA signs the documents. One dissenting opinion from the American Council on Science and Health (ACSH), a consortium of more than 350 scientists and physicians, funded by industry, declares perc to be not hazardous to humans at typical levels of use.

**Table 1**
**Classifications of Perc by Different Organizations**

| Organization Name | Type of Organization | Perc Classification |
|---|---|---|
| American Council on Science and Health (ACSH) (not a government agency) | Consortium of more than 350 scientists and physicians, funded by industry | Not hazardous to humans at typical levels of use |
| Environmental Protection Agency (EPA) | Federal Government Agency | Hazardous air pollutant; continuum possible/probable human carcinogen |
| International Agency for Research on Cancer (IARC) | Part of the World Health Organization, an International Organization | Possible/probable* |
| Scientific Review Panel (SRP) (approval authority for OEHHA) | Established by law as an advisory group to California Environmental Protection Agency (ARB & DPR) | Possible human carcinogen |
| Office of Environmental Health Hazard Assessment (OEHHA) | State Government Agency | Possible human carcinogen |

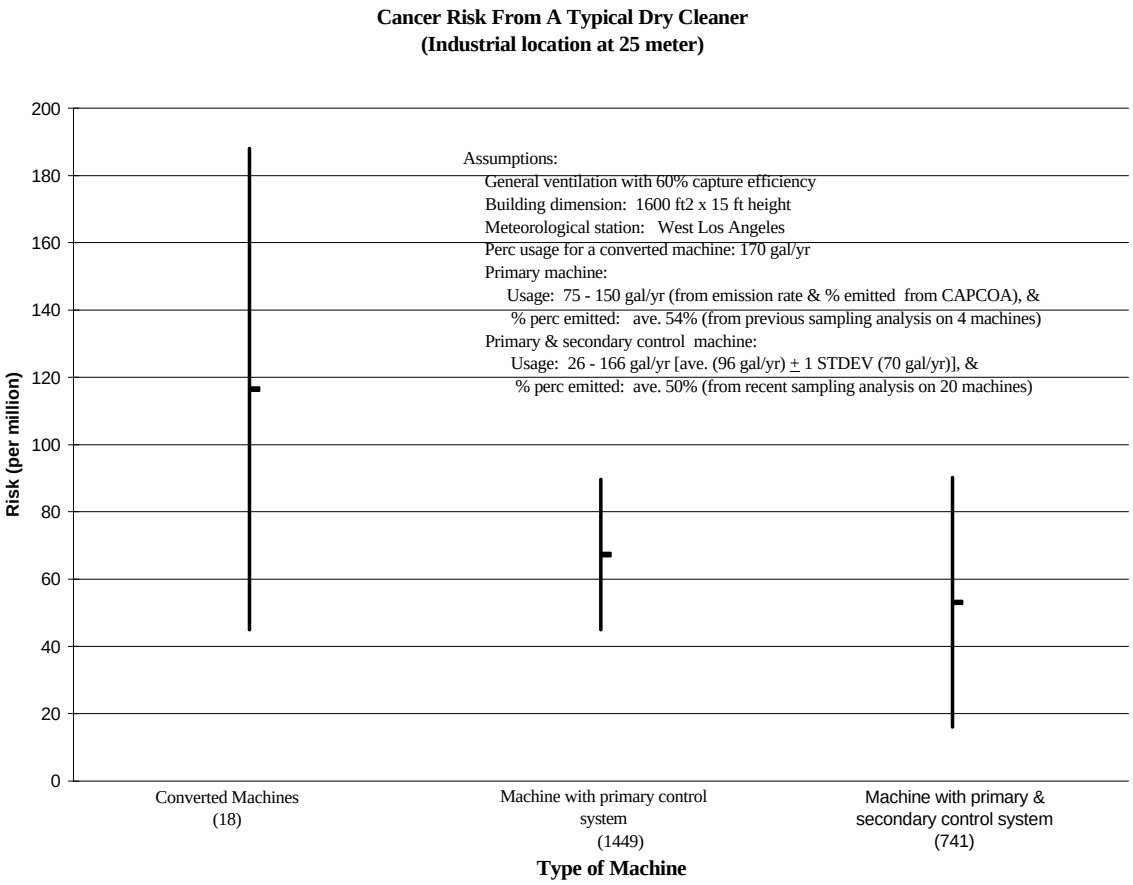
*From various international studies (U.S., Canada, United Kingdom, Denmark, Sweden) on dry cleaner worker exposure, perc is also listed by IARC as possibly carcinogenic to humans.

Numerous perc air-monitoring studies have been conducted. New York and San Francisco Bay Area studies have found elevated levels of perc in co-located residences even with Maximum Achievable Control Technology (MACT) installed. Perc residue from dry-cleaned clothing measures about 5 micrograms per cubic meter; non-detectable to 20 micrograms per cubic meter is background count. According to Dr. Judith S. Schreiber, Senior Public Health Specialist, Office of the Attorney General, Bureaus of Environmental Protection, Albany, New York, co-located apartment measurements were increased in all situations ranging from 100-55,000 microgram per cubic meter. These measurements were made in the 1990's prior to the more stringent perc laws which now require room barriers, ventilation systems, and other controls. One can detect the odor of perc at about 30,000 micrograms per cubic meter. Modeling studies have also been conducted to estimate risks associated with ambient releases of perc. Additionally, the New York State Department of Environmental Conservation found one out of every five of the state's 2,221 dry cleaners had site contamination with perc and identified 235 that threaten drinking water supplies.

MATES-II identified perc as one of six key toxic air contaminant in ambient air monitoring (1,3 butadiene, benzene, hexavalent chromium, carbon tetrachloride, para-dichlorobenzene and perc).

Potential cancer risks provided in the MATES-II report were itemized by six key TACs, including perc. Perc exhibited a seasonal pattern with wintertime maximum and summertime minimum concentrations. According to MATES II, "This pattern is due to local seasonal meteorological conditions." Statistically significant reductions in mean concentrations have occurred over the period 1990 to 1997 for perc. This difference is based on measurements from MATES I (May 1986 to April 1987) and MATES II (April 1998 to March 1999). In the MATES II Final Report, Figure 2-3 – "Trends in Selected Toxic Air Contaminants" depicted perc emissions in 1990 at a concentration level of around 0.5 part per billion and in 1997 at about 0.25 parts per billion. Despite this reduction, there still exists a local risk because many dry cleaners are located in residential areas, near shopping, schools, day-care centers and restaurants, and the cancer risks for dry cleaners at residential locations are still estimated to range from 20 to 140-in-one million. The cancer risk at industrial location is estimated to range from 15 to 90-in-one million. These risk numbers may underestimate risk in some cases because many dry cleaners are located closer than 25 meters to their nearest residence or business. This results in higher risk. Also, these risk numbers are based on estimated actual emissions (96 gallons/year for primary and secondary control machines) that are lower than the facility's potential to emit (100-120 gallon/year based on permit limits) and based on worst-case meteorological data. Figure 2 shows the range of cancer risk for different types of machine at industrial locations 25 meters from a dry cleaning facility.

**Figure 2**

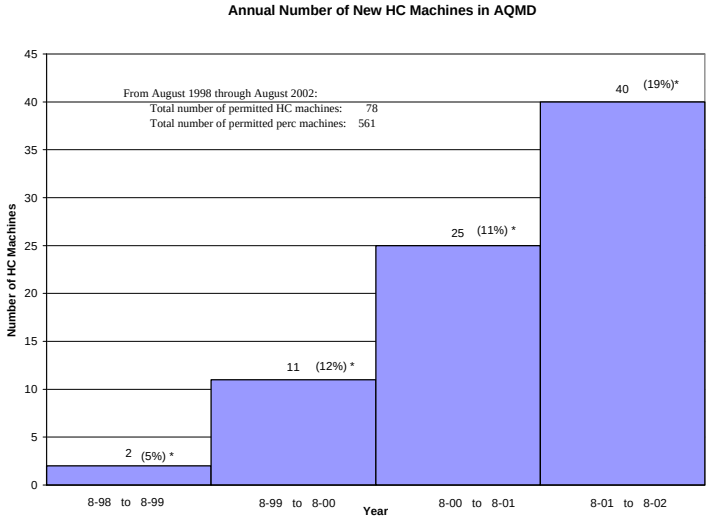


The above risks were determined based on estimated perc usage and emission factors from recent sampling efforts. In addition, some source-specific assumptions such as building size, type of ventilation, and facility location were used. These assumptions were discussed extensively with the Working Group and a consensus was reached for source and building parameters.

Both the IFI and Dow Chemical Company submitted estimates of perc usage and emissions for staff's consideration. Dow Chemical stated 40% of perc used was emitted. The IFI method was based on unsubstantiated assumptions such as the 5$^{th}$ generation machine emits only 5% of perc purchased. However, this information was not used because the data were not based on actual sampling. If we assumed the extreme case of 100% of perc used is recovered through waste, using the numbers submitted, a typical dry cleaning machine with cartridge filters should have a mileage of 255 to 320 lbs. of clothes cleaned per one gallon of perc. This is unreasonable considering the general industry acceptance of approximately 700 – 1,000 lbs. of clothes cleaned per one gallon of perc used. (See Appendix A – Response to Comments, comment numbers 30 and 9 (second set) and Appendix D – Sampling Analysis Procedures and Results)

Using the District's permitting data base, staff analyzed the type of equipment present in the Basin and using perc usage records calculated the risk from the categories of converted equipment, primary control only, and primary and secondary controls. There are 18 converted units permitted in the Basin, 1,449 estimated to be closed–loop dry-to-dry equipped with primary controls only, and 714 estimated to be closed-loop dry-to-dry equipped with primary and secondary control systems. In addition, there are about 75 hydrocarbon and 25 silicon-based machines, 10 dedicated wet cleaning facilities, and one $CO_2$ machine that are being operated in AQMD. Based on the District database, the number of hydrocarbon machines permitted have increased since August 1988 from 0.3% to 6% of the total number of permitted dry cleaning machines. Figure 3 illustrates the annual rate increase of permitted hydrocarbon with respect to total permitted dry cleaning machines. Figure 4A illustrates the distribution of perc dry cleaning facilities in the South Coast Air Basin and Figure 4B illustrates the distribution of non-perc dry cleaning machines in the Basin.

**Figure 3**




* Percent HC machines permitted relative to all dry cleaning machines permitted in the SCAQMD on annual basis

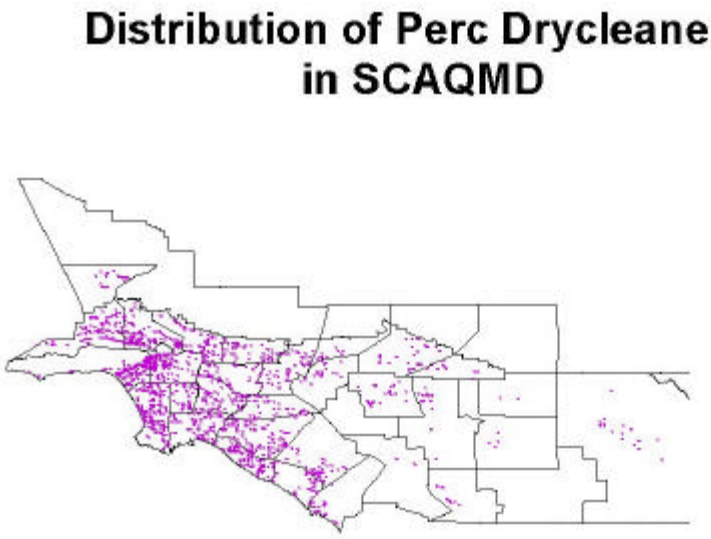



**Figure 4A**

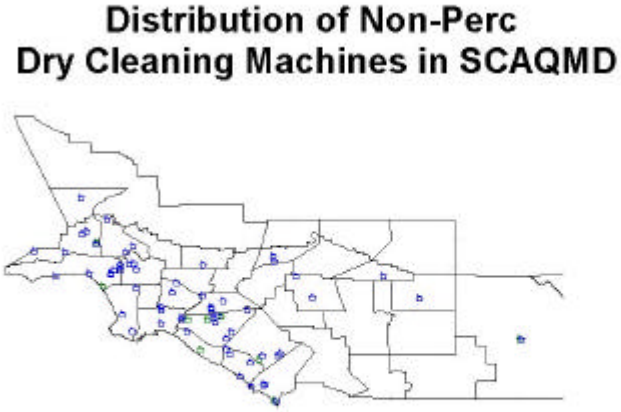



**Figure 4 B**

Additionally, perc is currently found in the Basin's groundwater and wastewater. It has been detected in excess of the current drinking water standard of 5 parts per billion, which must be met at treatment plants that recycle water. The discharge standard at some local wastewater treatment plants is expected to be lowered and may go as low as 0.8 parts per billion. This change is anticipated to become effective in five years. An exceedance of this standard is possible at a smaller wastewater treatment plant with less than two grams of perc present in the water. Site contamination of perc dry cleaners has also been a problem as some landlords are unwilling to renew leases to perc dry cleaners due to the high costs of soil and groundwater remediation when perc contamination occurs.

## ALTERNATIVE TECHNOLOGIES

Non-perc alternative technologies exist in the form of solvent cleaning (regulated under AQMD Rule 1102), wet cleaning, and carbon dioxide ($CO_2$) cleaning. Both solvent and wet cleaning are widely used in Europe. In Germany, which has stringent emission controls on perc usage, 99% of all new machines purchased are solvent cleaning machines. In Germany, most companies also use the wet cleaning technology for about 30-35% of the garments cleaned. $CO_2$ cleaning is used less frequently due to cost and the fact that the technology is not fully mature. Each alternative technology, as well as perc dry cleaning, has advantages and disadvantages, which are described in the following sections, and summarized in Table 2.

As part of the rulemaking process, AQMD staff visited many dry cleaning facilities. Staff visited dedicated wet cleaning facilities and one in which the operator cleaned approximately 30% of the garments by wet cleaning and 70% using the Green Earth™ solvent. Staff also visited several dry cleaners using DF 2000 solvent, Green Earth™ solvent and a number of perc dry cleaning facilities. Additionally, staff visited a facility with a newly installed $CO_2$ machine where the operator was estimating that he would be cleaning 50% of the garments with $CO_2$ and 50% with perc. Staff went to Sacramento to see equipment converted to use Green Earth ™ and also visited four dry cleaners in the Bay Area, where 15% have switched to hydrocarbon cleaning. Two of the dry cleaners visited in Bay Area were using perc, one was using hydrocarbon and one used a combination of hydrocarbon and perc machines. Recent permitting activity in Bay Area has indicated 85% of all new permits issued for dry cleaning equipment have been for non-perc alternatives.

The footprint, or size of the alternative technology equipment, was similar to that of a perc machine. A typical machine is approximately 5 –7 feet in width and length and 7 – 8 feet in height. A yardstick is used in the pictures as a size reference. Figure 5 is a perc machine.


**Figure 5 – Perc Dry Cleaning Machine**

**Yardstick**

## Solvent Cleaning

There are a number of non-perc solvents available for dry cleaning. These include, but are not limited to,: cyclic methylated siloxanes (VMS, Group II exempt compound), Stoddard solvent (petroleum distillate mixture of naptha paraffins and aromatic hydrocarbons), new synthetic hydrocarbons such as PureDry, HC-DCF, and DF 2000, n-propyl bromide, and propylene glycol ether. Stoddard solvent was broadly used in the past but has been phased out due to its flammability, with only five facilities currently using the older solvents such as Stoddard and LPA-142. These older solvents are used in transfer machines which are to be phased out of usage under Rule 1102 – Petroleum Solvent Dry Cleaners, no later than January 1, 2003.

In 1991, German legislation on toxic emissions of perc led to the introduction of hydrocarbons with high flash points. All petroleum-based solvents used in dry cleaning are aliphatic hydrocarbons, meaning they are straight-chained, branched or cyclic as opposed to aromatics, which contain stable carbon-ring structures called benzene rings. Inherent properties of petroleum-based solvents include flammability, solvent power, volatility, odor, and toxicity. Toxicity varies by compound but any petroleum-based solvent has some toxicity by nature. However, none of those listed above have been determined by OEHHA to be toxic air contaminants, and unlike perc, are not listed in AQMD Rule 1401 Table 1 – Toxic Air Contaminants.

Green Earth™, patented in 1998, is a cyclopentasiloxane mixture. Siloxanes are liquid silicones such as those used in cosmetics. They have no smell and contain no volatile organic compounds (VOCs) and are not required to have a Permit to Operate from the AQMD. According to the September 2002 publication *Research Fellowship,* by IFI, they were contracted by Green Earth™ to test and evaluate its cleaning system in comparison to perc and found Green Earth™ to be comparable to perc. Clothes cleaned with siloxanes tend to feel soft, and the non-harsh nature of the solvent allows colors to be mixed, unlike the use of perc or wet cleaning. The distributing company and the manufacturer, General Electric, claim that these solvents pose little environmental risk even if accidentally discharged. Preliminary toxicity testing on Green Earth™, funded by industry, indicates minimal toxicity with most categories reporting no significant toxic responses. The 2-year bioassay test (combined chronic toxicity and oncogenicity) is still in progress with results expected at the end of 2002. Siloxanes separate from and float on water, and largely break down into harmless components in air. Formaldehyde can possibly be formed as a breakdown product, although the formation of formaldehyde is unlikely because the reaction needs high temperatures and oxygen. This reaction is true of all organic material with methyl groups. These solvents, while not themselves chlorinated, are currently manufactured using large amounts of chlorine. Given that these processes also involve heat, oxygen, and often copper-catalysts, dioxin and other organochlorine compounds may be released during production either as emissions or from burning in production waste incinerators. Green Earth™ is manufactured in Waterford, New York.

A fairly new commercially available electro-mechanical system allows dry cleaners to convert existing perc machines to Green Earth™. In order for machines to be converted, the following assemblies must be installed: filtration system; temperature control sensors; pre-water separator

filter; water separator; and electrical control panel. These systems have been installed and are currently operating on several dry cleaning systems in the Sacramento area.

Today's new synthetic hydrocarbons (DF-2000, HC-DCF, and PureDry) differ from perchloroethylene in both weight and solvent aggressiveness. Perc weighs 13.5 pounds per gallon whereas hydrocarbon solvents weigh about half of that amount. The weight of the solvent has a direct relationship to the amount of mechanical action that a solvent has on the fabric. The aggressiveness of a solvent is measured by the Kauri Butanol (KB) value. The higher the KB value, the more aggressive the solvent. The scale places benzene equal to 100 and all other solvents are compared to it. A higher KB value implies better removal of oil and grease stains. Linear paraffins (saturated hydrocarbons or alkanes) have relatively low KB values while aromatics (ringed-compounds) generally have high KB values. The KB value for perc is 90, for PureDry is 37 – 40, and for DF-2000 is 27. Some delicate fabrics may be harmed by too aggressive a solvent and dry cleaners using perc must sometimes use chemical additives to reduce the aggressiveness of perc. The new solvents with lower KB values are still capable of cleaning materials to the satisfaction of the operators and their customers. Each cleaning media has advantages and disadvantages for cleaning different types of soil. For example, water-based stains are more easily removed by wet cleaning while perc and hydrocarbon cleaning works best for stains which are oil-based.

The new solvents no longer contain toxic aromatic compounds such as benzene and they have fairly high flash points that reduce, but do not eliminate, the risk of fire or explosion. The lower vapor pressures of these solvents lowers toxicity due to reduced exposure through inhalation. In addition, most shops using the new hydrocarbon solvents also use efficient new machines that greatly reduce the amount of solvent that escapes compared to older machines. Recent AQMD sampling showed that 34% of solvent used is emitted. The newer solvent equipment incorporates refrigerated chiller systems, thermostat controls, and improved gasket materials. The solvents are mostly odorless and retain the color of fabrics cleaned. DF2000, introduced in 1994 and manufactured by Exxon, PureDry manufactured by Niran Technologies Inc., and HC-DCF manufactured by Chevron Phillips Chemical Company are several of the new synthetic hydrocarbons currently available to dry cleaners as alternatives to perc. DF 2000 is the most widely used of the hydrocarbon-based solvents in the Basin. EPA and Occupational Safety and Health Administration, U.S. Department of Labor (OSHA) may impose new regulations on hydrocarbon solvents, and these compounds can cause site contamination, although waste disposal procedures are in place to prevent such contamination.

The new hydrocarbon dry cleaning equipment is designed to reduce the temperature of the solvent by refrigeration. Temperature monitoring on the machines also reduces the possibility of reaching the solvent's flash point. The flash point for Green Earth™ solvent is $170^0$ F, for DF 2000 is $147^0$ F, and for HC-DCF is $143^0$ F. Hydrocarbon machines operate at temperatures below the flash point (approximately $120^0$ F). The likelihood of requiring other mitigation measures such as sprinkler systems and firewalls are dependent on the local permitting authority. For example, the Los Angeles Fire Department permits dry cleaners on a case-by-case basis. They require that the equipment be listed by a recognized testing laboratory. To obtain a permit in the City of Los Angeles, a dry cleaner must comply with Division 70 of the Los Angeles Fire

Code. The Fire Code classifies solvents on the basis of flammability. A combustible liquid is a liquid having a flash point at or above 100° F. and classified as follows:

Class II liquids with a flash point at or above 100° F. and below 140° F.

Class IIIA liquids with a flash point at or above 140° F. and below 200° F.

Class IIIB liquids with a flash point at or above 200° F. but not above 1500° F.

Class IV includes non-combustible solvents or limited quantities of Class II, IIIA, or IIIB solvent.

Flammable Liquid - Any liquid having a flash point below 100° F. and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100° F. Class I liquids shall be classified as follows:

Class IA liquids having flash points below 73° F. and boiling points below 100° F.

Class IB liquids having flash points below 73° F. and boiling points at or above 100° F.

Class IC liquids having flash points at or above 73° F. and below 100° F.

Perc is a Class IV solvent, and DF 2000, HC-DCF and Green Earth™ are considered to be Class IIIA solvents.

The Los Angeles Fire Code allows Class IIIA dry cleaning plants and associated operations to be separated from other occupancies by two-hour fire-resistive occupancy separations when the total quantities of Class IIIA liquids within the building does not exceed 1,320 gallons and the capacity of individual containers or tanks within the building does not exceed 330 gallons. One of the largest hydrocarbon machines sold, the 77 lb. Satec machine, certified by a testing laboratory, holds approximately 150 gallons. Thus, a dry cleaner could install two of these large machines, in the City of Los Angeles, without installing additional fire suppression systems. The vast majority of dry cleaners have only one machine. A four-hour fire-resistive occupancy separation is required for quantities exceeding those amounts. Dry cleaning rooms containing Class IV (perc) or Class IIIA solvents must be separated from other uses including solvent storage, offices, laundering, scouring, scrubbing, pressing and ironing operations by not less than two-hour fire-resistive occupancy separations.

The Los Angeles Fire Department also approves dry cleaning equipment based on "alternate methods of compliance." For example, Class IIIA hydrocarbon dry cleaning machines with a total aggregate quantity of Class IIIA solvent not exceeding 330 gallons, and with the appropriate safeguards to ensure that the solvent never exceeds it's flash point (such as temperature controls), would typically be approved, based on Article 36 of the 1997 Uniform Fire Code. Such installation would not be required to have firewalls or automatic sprinkler systems installed.

Both the hydrocarbons containing VOCs and propylene glycol ether (the highest VOC content), marketed as Rynex by Arco, would be regulated by Rule 1102 – Petroleum Solvent Dry

Cleaners. This rule was amended November 15, 2000 to reduce emissions of VOCs from solvent dry cleaning operations. There are approximately 100 solvent cleaning operations in the Basin. Information on costs was obtained from equipment distributors. The cost of a closed-loop solvent machine ranges from $40,000 to $100,000 depending on the solvent used and the size of the machine, compared to perc machines, which cost $30,000 - $50,000. One manufacturer, with a small market-share in the Basin, quoted a price for a perc machine approximately $12,000 below the above listed range. Most manufacturers of perc machines also produce hydrocarbon machines and they are distributed by the same companies as the perc machines.

In the Bay Area, there are approximately 135 hydrocarbon machines operating. This represents about 15% of the Bay Area dry cleaners. Staff visited the Bay Area APCD and discussed with staff their approach to controlling perc emissions from dry cleaners. Staff also toured several dry cleaning plants there visiting both hydrocarbon cleaners and perc cleaners operating with vapor barriers (total enclosures). Like New York City, the Bay Area has a problem with dry cleaners being co-located with residences. The acceptable risk level in Bay Area for permitting purposes is set at 1-in-one-million and 10-in-one million with TBACT (machines with primary and secondary control). Also, the meteorology in the Bay Area is very different from the Basin. All other parameters being equal, i.e., amount of perc used, distance to nearest receptor, etc, a source's risk is lower in the Bay Area due to meteorology (mainly wind speed). The operators interviewed in the Bay Area site visits all expressed their satisfaction with the hydrocarbon cleaning process. Additionally, in Germany, which has stringent emission controls on perc usage, 99% of all new machines purchased are solvent cleaning machines.

Another solvent, n-propyl bromide (marketed under the name Comexsol) is in the testing/early-marketing phase of development through New York Machinery Tech, Inc. Although this solvent has not undergone a complete toxicity testing, initial indications are that it may be a reproductive toxin. According to the equipment manufacturer, the solvent is used in a machine similar to a perc machine with similar costs. The solvent itself is more expensive than perc but gets better mileage than perc (50,000 lbs of clothes/55 gal drum of solvent). The cleaning and drying cycles are shorter than perc (about 35-40 minutes) and the KB value is 126 (perc is 90). It is non-combustible and the boiling point is $158^0$F compared to perc's $249^0$F so the operation of the machine can be maintained at a lower temperature thus requiring less energy. The solvent has an extremely low odor threshold and can clean all fabrics including sequined materials, leathers, and furs. The company manufacturing the solvent has filed for VOC exempt status with EPA. Additionally, the company plans on hauling away waste generated from the process to insure proper recycling and disposal.

Hydrocarbon machines are very similar in size to perc machines. The dimensions of a fifty-five to sixty-pound load perc machine are: 81 inches wide, by 67 inches deep; by 90 inches high. A forty-five-pound hydrocarbon machine measures approximately 82 inches wide, with a depth of 69 inches and a height of 81 inches. Figure 6 is a picture of a Green Earth™ machine.


**Figure 6**
**Green Earth™ Dry Cleaning Machine**

## Wet Cleaning

Wet cleaning is an alternative to dry cleaning for fabrics labeled "dry clean only." It is different than commercial laundering in many aspects. In 1991, the technology was introduced by a German company using computer-controlled washers and dryers with detergents specifically formulated for the process. Finishing equipment includes pressing, tensioning and stretcher machines. The wet cleaning machines minimize agitation and are computer-controlled for a variety of fabric types.

All wet cleaning systems consist of a special washer and dryer. The core technology of the washer is the use of a frequency-controlled motor. Controlling rotation of the wash drum (by the motor) produces the ultra-gentle wash action, and extremely smooth acceleration and deceleration can be created. An ordinary washer can damage garments by excessive agitation during the wash and spin cycles. The actual wash program software determines the combination of time, water level, heating, chemical injection, extraction, and drum rotation variables, which can result in successful, wet cleaning. Based on draft results generated by UCLA and the Pollution Prevention Education and Research Center, Occidental College, proper training appears to make a significant difference in the acceptance and application of this technology.

Wet cleaning systems use non-toxic, biodegradable chemicals, which are approved for disposal into the sewer system and do not require a Permit to Operate from the AQMD. Wet cleaning systems are not subject to Rules 1421, 1102, 1401 or 1402. In addition to being pH neutral, detergents must also incorporate agents, which coat the scaly surface and penetrate the hollow core of natural fibers. Without these agents, the fibers will interlock. Many stains are water-based and those are more easily removed by wet cleaning than with perc or hydrocarbon. This is especially true of such stains as salts, sugars, body fluids, starch, milk and many foods and drinks. Solvent cleaning works best for stains which are oil-based such as grease, wax, oils and resins. Wet cleaning can clean oil-based stains with pre-spotting chemicals that are specifically designed for water-based cleaning and are non-hazardous.

In addition, there is less electrical demand by wet cleaning equipment. Based on both electricity and natural gas use in San Clemente Natural Cleaning Center before and after the switch from perc dry cleaning to professional wet cleaning, the cleaner experienced a 45% reduction in electricity use and a 4% reduction in natural gas use. Business levels remained constant, so the change was not a result of fewer clothes cleaned. The monthly energy usage while operating perc dry cleaning operation ranged from 800 to 1500 kWh. This usage was reduced to approximately 600 kWh per month. The machine specifications for the motors for these machines show less energy demand than for dry cleaning machines. The total energy saving was estimated to be about $71 per month or $852 per year, using the average monthly energy usage of 1,126 kWh, costs of $0.14 per kWh, and 45% reductions in energy.

Wet cleaned garments must be carefully dried in preparation for finishing. Wet cleaning generally takes about 45 minutes from wash through drying not including the finishing time. As with aggressive drum agitation, prolonged tumbling in a dryer can cause shrinkage. Over drying clothes also causes shrinkage, which accelerates when the final 6-10% humidity of the garment is evaporated. It is thus essential that drying time be short, and terminate as soon as the desired

humidity level in the garment is achieved. An ordinary dryer will not achieve the desired results as it controls the drying process by time and temperature.

There are approximately six manufacturers providing a variety of sizes and models of wet cleaning machines to the dry cleaning industry. Chemicals typically used by a wet cleaning operation include spotting agents, detergents, fabric conditioners and sizing products. Other products may be used for cleaning leather and suede including water repellants.

There are currently 10 facilities in the Basin dedicated to using the wet cleaning technology. Other facilities use a mix of wet cleaning and hydrocarbon technologies. Those operators using the wet cleaning technology are pleased with the process, as are their customers. Cleaners have reported the ability to wet clean 99% of garments taken in. This is comparable to perc. The AQMD's Technology Advancement Office is working on a pilot program with Occidental College's Pollution Prevention Education and Research Center to convert perc dry cleaners to wet cleaning technology. The cost of a wet cleaning system including tensioning presses is approximately $30,000. A fifty-pound capacity washer measures approximately 43 inches wide by 65 inches high by 50 inches deep. A companion dryer measures approximately 47 inches, by 65 inches, by 38 inches. Various finishing equipment might include a tensioning form finisher which measures 36 inches, by 24 inches by 91 inches; a tensioning shirt finisher is 42 inches, by 87 inches by 65 inches; an up-air finishing board is 23 inches by 64 inches by 70 inches; and a tensioning pants topper is 45 inches, by 20 inches, by 78 inches. Spotting boards are approximately 25 inches, by 50 inches, by 40 inches. This equipment will fit within the current floor space of most typical dry cleaning plants. Figure 7 shows a wet cleaning washer and dryer.


**Figure 7**
**Wet Cleaning Washer and Dryer**

## $CO_2$ Cleaning

Another alternative to perc dry cleaning is the use of liquid carbon dioxide ($CO_2$). This technology uses gaseous $CO_2$ under pressure, making it a liquid and giving it solvent properties. The use of liquid $CO_2$ as an alternative garment cleaning solvent was first explored in 1994 at Los Alamos (under contract to USEPA). Liquid $CO_2$ has been used for some time in nuclear weapons research facilities to clean weapons and optics components and in various commercial applications such as carbonating beverages and decaffeinating coffee beans. An alpha prototype $CO_2$ dry cleaning machine, developed by Raytheon Corp. and Global Technologies appeared at the Las Vegas Clean show in 1997. A Beta commercial unit first appeared in Forest Lake, Minnesota in 1999. $CO_2$ machines have been installed in Illinois, New Jersey, North Carolina, Nebraska, South Carolina, Rhode Island, Massachusetts, Pennsylvania, Georgian, California, Michigan, Florida, Texas and Minnesota. There is one facility using a $CO_2$ machine in the Basin. The liquid carbon dioxide cleaning machines have a configuration, which is similar to a solvent or perc machine. The system is closed loop, with a cleaning chamber, storage unit, filtration, distillation, and lint trap. The difference is in the use of $CO_2$ as a solvent, which precludes the use of conventional machines that are not American Society of Mechanical Engineers approved for this function. Like wet cleaning, operations using liquid $CO_2$ would not be subject to Rules 1421, 1401,1402 or 1102, assuming the detergents and additives used in the operations contained less than 50 grams per liter of VOC. Additionally, these machines would not require an AQMD Permit to Operate. According to the one operator in the Basin, no fire codes are applicable to the $CO_2$ machines.

The $CO_2$ machines pressurize the gas in a drum to between 700 and 800 pounds per square inch (psi). For comparison purposes, a refrigerator is at 350 psi pressure, a fire extinguisher is at 800 psi, and a home oxygen tank is at 2,400 psi. Through either a spinning or agitation motion, the $CO_2$ fluid is forced through the clothes and then pulled out to prevent the dirt from being redeposited on the clothing. At the end of the cycle (35-40 minutes, shorter than perc), the pressure is released and the $CO_2$ returns to a gaseous state, with the dirt and substances removed from the clothing dropping out.

The $CO_2$ used in this process does not contribute to global warming, as it is an industrial by-product from existing operations, primarily anhydrous ammonia (fertilizer) production. This $CO_2$ is also used in other applications such as carbonating soft drinks. The $CO_2$ machines cost between $80,000 and $90,000. However, after adding necessary equipment, and including shipping, distributor commissions and installation cost, the total cost is approximately $110,000. Operational costs, including solvent, chemistry, filters, labor, energy, and environmental compliance, are more in line with conventional solvent systems and may be lower in areas in which conventional systems are under more strict regulatory oversight. There are three U.S. manufacturers of $CO_2$ equipment.

A fifty-five-pound capacity $CO_2$ machine is approximately 84 inches wide, by 92 inches high, by 96 inches deep. Figure 8 shows a $CO_2$ machine from the back.

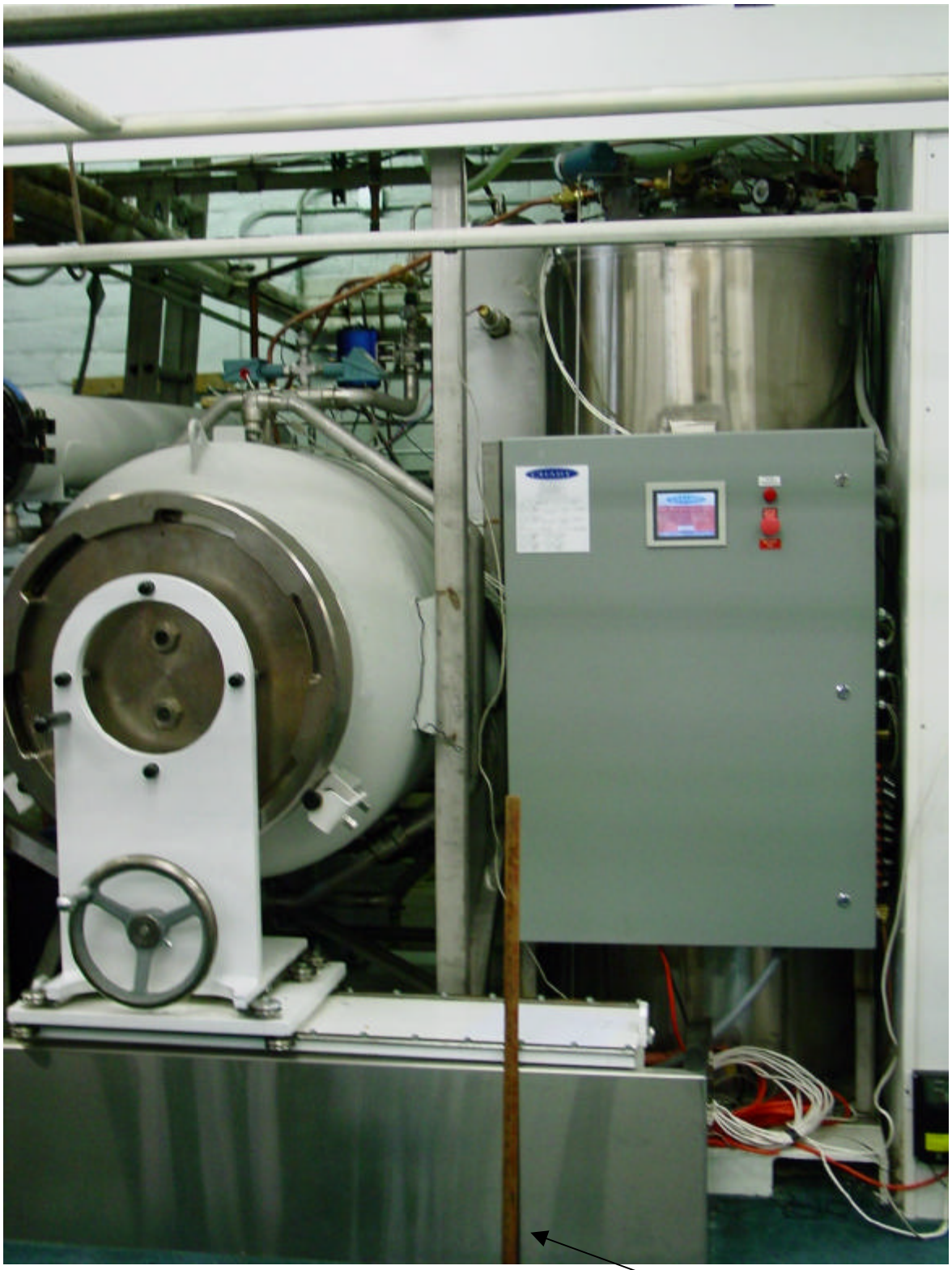



**Figure 8**
**$CO_2$ Cleaning Machine**

In summary, the proposal allows a dry cleaner replacing a perc machine to choose from among many alternatives. An operator would consider such factors in determining which alternative to switch to as: toxicity, equipment cost, cleaning ability, labor and energy costs, maintenance, and solvent cost and disposal issues. The equipment costs for hydrocarbon and $CO_2$ equipment is higher compared to perc. Wet cleaning equipment is less expensive. Based on the information provided by three machine distributors, the cost differential for between a perc and hydrocarbon machine for a 55 to 65 pound capacity were ranged from $8,000 to $12,000. This cost includes the discount price, tax, delivery, and installation cost. Therefore, the capital cost differential for perc and hydrocarbon machines would be approximately $10,000. From the operations standpoint, the cost of solvent for wet cleaning (water) and $CO_2$ is much less than perc or hydrocarbon. Labor costs may be slightly higher for hydrocarbon and wet cleaning due to spotting techniques and finishing costs for wet cleaning but energy savings are seen with wet cleaning. Savings in the area of maintenance costs may also be realized in wet cleaning and $CO_2$. All non-perc technologies save in the cost of environmental compliance. $CO_2$ and wet cleaning do not require AQMD permits and disposal of waste does not require the same methods (hazardous vs. non-hazardous) needed for disposal of perc. Table 2 shows comparative costs and other parameters for some of the alternative cleaning technologies.

**Table 2**

**Comparison of Perc and Alternatives**

| | **Perc** | **HC** | **Wet** | **$CO_2$** |
|---|---|---|---|---|
| Capital, $K (range is for various sizes and models) | $30-50 | $40-100,000 (most are in the range of $45-70,000) | $17-21 (basic) $10-16 (pressing/ tensioning) | $80-90 |
| Installation, $K | $3-5 | $3-5 | $2 | $10-20 |
| Solvent/gal. | $7-8 | $5-6 | $0.002 | $0.25/lb |
| Labor (compared to perc) | Baseline | Operators report no - slightly higher | Operators report no - slightly higher | Operators report same as perc |
| Maintenance annual | $75-250 | $1,000 | Minimal | Minimal |
| Electricity | Baseline | Same | Up to 45% lower has been documented | No data |
| Toxic Air Contaminant | Yes | No* | No | No |
| VOC | No | Yes (Green Earth™ - No) | No | No |
| Applicable AQMD Rules | Rules: 201, 1401, 1421; Reg III, Reg.XIII | Rules: 201, 1102, Regs. III & XIII<br><br>(Excludes Green Earth ™) | None | None |
| AQMD Permit Required | Yes | Yes (Green Earth™ - No) | No | No |

* Not currently being considered by OEHHA or EPA

# PUBLIC OUTREACH

## Focus Group

In addition to all existing rule development processes, this proposed rule was developed with two additional efforts – focus groups and testing a methodology for a more facility-based affordability analysis. The AQMD instituted a Focus Group Program in order to ensure that the AQMD is receiving comments directly from those businesses being affected by its rulemaking

activities. Small businesses frequently do not have time to participate in rule development workshops. Often, comments received during the traditional rule development process, are mainly from trade associations, chambers of commerce, or business advocacy groups whose members may not include the smaller, less-established businesses. For PAR 1421, many individual cleaners came to Working Group meetings or consultation meetings to provide input. Focus Group testing is an established method used by commercial market research firms, and can be used to ensure some direct participation by actual business owners in the rulemaking process.

Staff held an evening focus group on August 30, 2001 for Proposed Amendments to Rule 1421. Approximately 50% of dry cleaners within the AQMD's jurisdiction are Korean. Thus, this Focus Group included owners and operators in the Korean community. This session was conducted with a Korean translator. A second Focus Group was held in Orange County in the City of Orange for non-Korean dry cleaners on October 24, 2001. A facilitator conducted these meetings and the staff observed from another room. Thus, dry cleaners could feel more comfortable to express their opinions of the proposed rule and discuss their specific operations. The comments from individuals participating in the Focus Groups were similar to comments received through other rule development processes. Staff reviewed the information collected from these meetings and incorporated the comments in the rule development process.

PAR 1421 was one of two test cases to evaluate a methodology for facility-based economic assessments. The facility-based analysis is part of the socioeconomic report.

## Public Process

Staff has participated with stakeholders in an extensive public process. The process consisted of one Public Workshop, five public consultation meetings, eight working group meetings, two focus group meetings, two KDLA meetings, numerous individual meetings and numerous phone calls, and site visits (more than a dozen) to facilities in the District, Bay Area, and Sacramento. Many of these meetings were held in the evening. An additional 35 sites were visited for testing and six more for quality control analysis. Korean language translators have been available at all public consultation meetings and notices have been printed in Korean as well. Staff appreciates the numerous hours of cooperative effort the Working Group contributed to the rule development effort.

## Proposals Considered

Figure 9 represents the rate of perc emission reductions over time based on four scenarios. Scenario #1 is the baseline and reflects the proposal that was brought forth by the KDLA. Scenario #2 is one of the industry proposals submitted for consideration by the Halogenated Solvent Industry, California Cleaners Association, and the IFI which called for the replacement of all converted within 1 year and primary only machines to primary and secondary control perc machines within 5 years of rule adoption. The California Cleaners Association and the KDLA withdrew their support for scenarios #1 and #2 in the time-period of summer of 2002 during rule development. KDLA reaffirmed their support for Scenario #2 in the last few months of rule

development. Scenario #3 represents staff's original proposal presented at the September 2001 Public Workshop and supported by the environmental community. Scenario #4 is staff's current proposal, a balance between industry's concerns, the environmental community and protection of public health. For a more in-depth analysis of the various proposals the reader is referred to the Environmental Assessment and Socioeconomic Report.

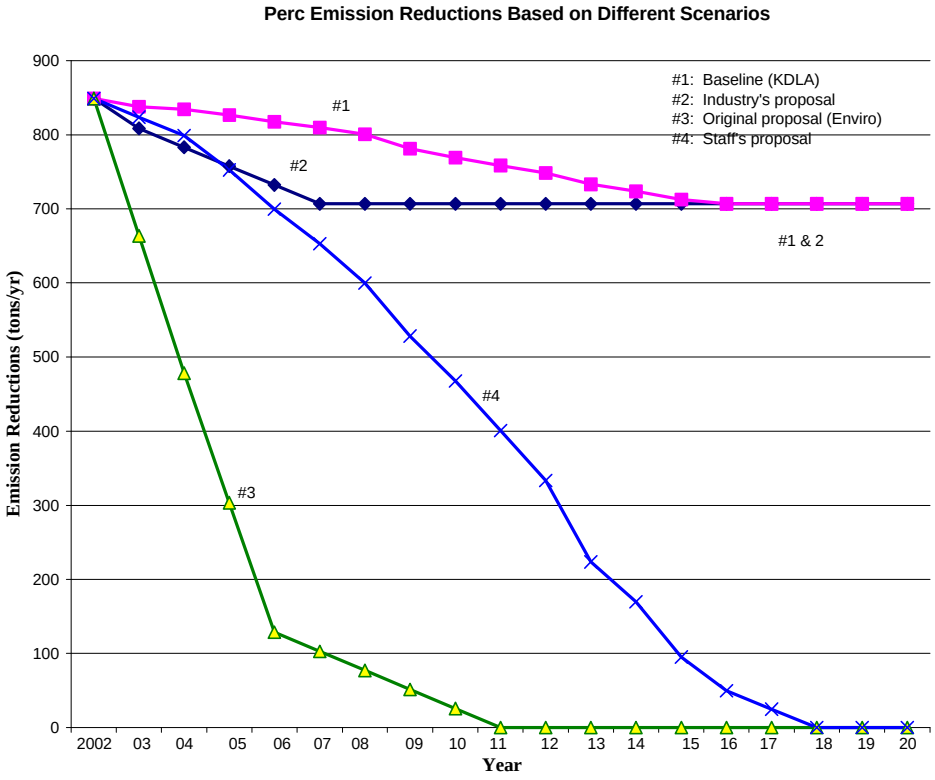



**Figure 9**

Various other rule approaches were considered in addition to the ones listed above. These included a small user exemption, additional maintenance requirements, and machine specifications. An industry representative suggested the rule allow continued use of perc based on usage limits that would vary by distance to their nearest receptor and geographical location. The staff estimates that in order for a source to meet a 25-in-one-million risk, the usage limit would be about 4 gals per month or 48 gallons per year. Industry rejected such a low usage limit as impractical. This suggestion was withdrawn because most cleaners could not operate with that amount of perc.

Additional discussions with industry representatives occurred to evaluate whether very small users, perhaps those with only 2 loads per day, should be considered for a rule exemption. It was collectively determined that such an exemption would be difficult to monitor for compliance and

would limit growth. Industry representatives indicated they did not want to include such a provision.

The same determination of impracticality was reached for the proposal of manufacturer specifications after discussions with manufacturers and working group members. At one of the public consultation meetings, an industry representative described a new stainless steel perc machine with several advanced design features that he stated would greatly reduce perc emissions. The cost of machines would increase substantially and the results of emission reductions would still vary based on operation and maintenance practices. Staff also talked with several equipment manufacturers about what, if any, additional design features could further reduce emissions. It was agreed that it depends on the machine. Some of the more expensive models have better gaskets or materials used in manufacturing, which may reduce emissions, but these parameters can vary with operator and maintenance procedures. After extensive discussions it was agreed to add some simple maintenance requirements of changing gaskets and clean cooling coils to the proposed rule.

The operators of alternative technologies were generally pleased with the results. The wet-cleaning operators expressed pleasure with the process and the results; although one operator felt the process was too labor intensive, others did not. The hydrocarbon operators felt the fabrics came out fresher with no odor and stated they cleaned a wide range of items. Some hydrocarbon machines had cycles running longer than perc machines and some were the same. Most equipment manufacturers now have comparable cycle times. Only one manufacturer recommended buying a larger hydrocarbon machine due to an increased cycle time compared to their perc machines. The operator of the $CO_2$ machine had problems cleaning fabrics with acetate but was confident the manufacturer could eventually address the problem through the development of different detergents.

# CHAPTER 2

## PROPOSED AMENDMENTS

# GENERAL DESCRIPTION AND EXPLANATION OF THE PROPOSED AMENDMENTS TO RULE 1421

## Applicability

The proposed rule applies to dry cleaning facilities using perchloroethylene as a cleaning solvent. A dry cleaning facility is any person or persons who own or operate perchloroethylene dry cleaning equipment and are located on the same parcel or contiguous parcels. Dry cleaning equipment is 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. These terms are all defined in Rule 1421, subdivision (a).

## Definitions

Subdivision (a) of existing Rule 1421 includes definitions for terms found in Rule 1421. The proposed amendments would add a definition for "Alternative Cleaning Technology" which is a dry or wet cleaning technology, including but not limited to: water-based wet cleaning, carbon dioxide ($CO_2$) cleaning, solvent cleaning, or any other non-perc cleaning solvent which complies with Rule 1401 requirements. In other words, permitting procedures that are in place to look at toxicity issues and Rule 1401 compliance will be applied when permitting these alternative technologies. AQMD staff will screen all substances presented to the District as dry cleaning solvents to determine the level of toxicity associated with them and approve them on this basis. Also, definitions for "Dry Cleaning Facility" and "Wet Cleaning" were added for clarification purposes, and "Sensitive Receptor Locations" was added in conjunction with AB-2588 reporting requirements.

## Requirements

Other proposed amendments to Rule 1421 (PAR 1421) would slowly transition the use of perchloroethylene from the dry cleaning equipment to alternative cleaning technologies when a new or replacement dry cleaning system is installed. After the proposed amendments are adopted:

- effective January 1, 2003, a new or existing cleaning facility may only add and operate alternative cleaning technology equipment. In addition, if a facility owner is operating two or more perc dry cleaning machines and decides to replace one of the machines, then the replaced machine must be an alternative cleaning technology. Similarly, if that same owner wants to add a machine, then that additional machine must be an alternative technology.

- operation of converted machines, defined in Rule 1421 as "an existing vented machine that has been modified to be a closed-loop machine by eliminating the

aeration recirculation of the perchloroethylene-laden vapor with no exhaust to the atmosphere.…", would be prohibited on or after July 1, 2004, with their replacement being a non-perc alternative technology or a new perc machine equipped with integrated primary and secondary control systems. If a converted machine is replaced with a new perc machine, this machine may not be operated beyond 15 years.

- effective July 1, 2004, existing perc equipment would, upon replacement; transition to non-perc alternatives. Existing equipment would not be allowed to operate past 15 years. The equipment life would be based on the date of initial purchase of the equipment. If that information is not available, the date the equipment was manufactured will be used. From the rule adoption date up to July 1, 2004, existing perc equipment may be replaced with either a non-perc alternative or a new perc machine with integrated primary and secondary controls. Any new perc machine may not be operated beyond 15 years.

- dip tank operations would be prohibited, effective 2 months from rule date of adoption. Dip tank operations consist of "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" (as defined in Rule 1421). To staff's knowledge, there are no dip tanks currently operating in the Basin.

Based on the requirements of proposed amended Rule 1421, staff anticipates that operation of all perc machines operating solely with primary controls would no longer occur after January 1, 2014, since the last time a primary control machine could have been legally installed was December 9, 1998. Furthermore, operation of all perc machines would after July 1, 2019, not be allowed, because the proposal would require that no new perc machines could be purchased after July 1, 2004 and all perc machines must be replaced after 15 years.

In accordance with the state ATCM, PAR 1421 also specifies the perchloroethylene concentration in units of ppmv as perchloroethylene, as well as in ppmv of methane. For example, 50 ppmv perchloroethylene concentration measured as methane is equivalent to 25 ppmv perchloroethylene concentration measured as perchloroethylene.

Furthermore, to reduce perc emissions, the proposal calls for the removal and cleaning of cooling coils on perc machines every two years while they continue to be used. This cleaning is to be performed by a qualified individual from a repair company licensed by the State of California to handle refrigerant. Persons knowledgeable about the operation of perc machines agree that the coils need to be removed to be properly cleaned and the work performed by a licensed technician to avoid damage to the coils. Also, to help control the loss of perc, the main door, still door, button trap, and lint trap gaskets must be replaced every two years. Equipment manufacturers and distributors suggested these measures to reduce perc emissions. Records of these actions must also be maintained.

Additional proposed amendments are structured to support the District's implementation of the AB 2588 Air Toxics Hot Spots Program. In accordance with AB 2588, the District must analyze

the risk created by dry cleaners either on an industry-wide basis or an individual facility basis. The District is currently waiting for the CARB to finalize guidance for all districts to implement AB 2588 requirements for the dry cleaning industry. The proposed rule language requires sources to submit data specific to their operation, including: amount of perc used, amount of waste recycled, content to recycled material, and nearest residential and commercial receptor sites. Quadrennial updates will then be required. In addition members of the working group suggested to include equipment original purchase date as part of information submitted by the facility. This information is to be submitted initially no later than two months from rule date of adoption.

A flow chart of the proposed Rule 1421 requirements is presented in Appendix B.

Staff sought to work closely with industry, environmental community and other governmental agencies to develop this rule. Staff received proposals from industry which reflected great effort on their part to bring together the variously affected parties. Industry, as a whole, proposed to replace and update the oldest perc equipment with new perc machines with both primary and secondary controls. Converted equipment would be replaced (defined as "…an existing vented machine that has been modified to be a closed-loop machine by eliminating the aeration step, and installing a primary control system, and providing for recirculation of the perchloroethylene-laden vapor with no exhaust to the atmosphere…..") within one year of the rule's adoption and equipment with primary control only, within five years. The KDLA submitted a separate proposal calling for the replacement of the oldest perc equipment with new perc equipment as it reached a 20-year life. KDLA and CCA subsequently withdrew their support for these proposals. The environmental community supported a 10-year phase out of perc.

A related but separate effort will be brought to the Governing Board at the same Board meeting as PAR 1421. This item is independent of the PAR 1421 effort. Staff proposes to establish a grant fund to assist facilities switching to non-perc alternatives prior to rule compliance dates. The funds would be dispensed on the basis of first-come-first-served. An owner or operator would need to present the AQMD with a purchase order for a non-perc alternative dry cleaning technology at least six months prior to Rule 1421's compliance date of July 1, 2004.

Additionally, the Executive Officer will report to the Governing Board no later than 18 months from the date of adoption, on the progress and effectiveness of the financial assistance programs for dry cleaners installing non-perc alternatives. The report will also provide any other available and relevant information relating to non-perc alternatives including but not limited to: the number of installations, equipment type and installation costs, and changes in energy consumption.

## DRY CLEANING UNIVERSE

Based on the AQMD database, there are 2,086 dry cleaning facilities with 2,181 perchloroethylene dry cleaning machines operating in the South Coast Air Basin, which have active AQMD permits. An analysis was conducted on these dry cleaning machines based on the

application submittal date, application type (new construction, alteration, permit to operate without permit to construct, etc), and type of the machines (closed-loop dry-to-dry, converted, etc). The summary of the analysis is described below and included in Tables C-1 through C-5 in Appendix C.

Of the 2,181-perchloroethylene dry cleaning machines operating in the District, 33% of the machines (714) are estimated to be closed-loop dry-to-dry equipped with primary and secondary control systems, and 66% of the machines (1,449) are estimated to be closed-loop dry-to-dry equipped with only primary control system. There are 18 dry-to-dry converted machines. The analysis was based on following assumptions:

- Staff analyzed the permits for perchloroethylene dry cleaning machines with applications filed in 1995 – 1998 and found 504 with primary controls only and 178 with primary and secondary control systems.

- All machines with application submittal dates in 1999 or later were assumed to be equipped with primary and secondary control systems (excluding those with change of ownership applications). Only 20% of the change of ownership filings are assumed to be for machines equipped with primary and secondary controls.

- Dry cleaning machines with permit applications filed before 1995 were assumed to be dry-to-dry with only primary control systems.

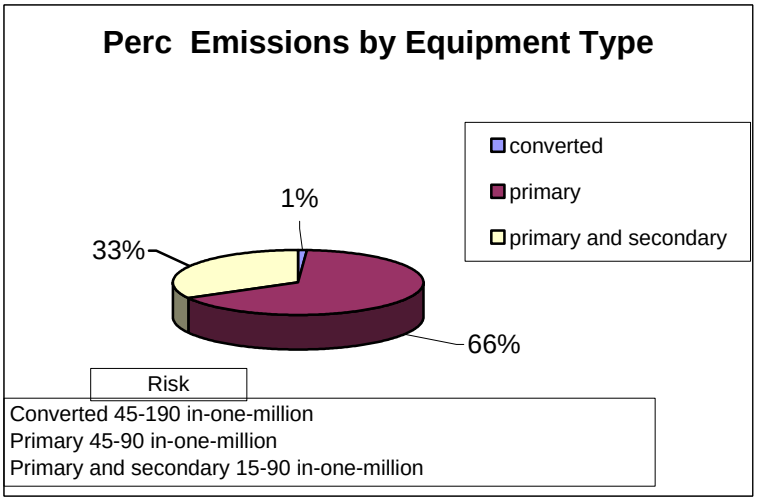
- Dry cleaning machines specified as vented dry cleaning machines were assumed to be converted machines equipped with primary control systems only.

Most dry cleaners are small businesses, operated by people employing less than five employees and run by family members. According to KDLA, 50% of the dry cleaners in the Basin are Korean owned. The gross revenues vary but often reflect small profit margins. The field is highly competitive and the market is saturated. Rent is often a large share of the business' expenses. According to industry representatives, multiple drop-off shops with one plant where all the clothes are cleaned is not practical for the majority of dry cleaners, which are small businesses with few employees. This would not be a viable strategy to centralized emission points to reduce risk. Some landlords do not accept cleaners using perchloroethylene and some dry cleaners have lost their leases due to landlord concerns regarding perc site contamination. Typical leases are for 5 years.

Staff has conducted sampling on the waste sludge of both perc and hydrocarbon machines to establish the percent of solvent emitted. For details please refer to Appendix D. Due to the results from these sampling analyses, AQMD staff will reassess how Rule 1401 permitting will be implemented for perc machines and will prepare a separate report to the Governing Board for its implementation. The current limits given to equipment undergoing Rule 1401 analysis will be reduced based on recent sampling results.

Figure 10 shows the types of equipment and the range of risk associated with each type of equipment. The assumptions include: a perc usage value of 170 gals/yr. for converted machines, 75-150 gals/yr. for a machine with primary control, and 26-166 gals/yr. for a machine with primary and secondary control systems; percent perc emitted of 54% and 50% for primary machines, and primary and secondary machines, respectively; receptor distance of 25 meters; and West Los Angeles meteorological data.

**Figure 10**




## ESTIMATED EMISSION REDUCTIONS

Emission reductions of perchloroethylene from dry cleaning operations were estimated based on an emission factor developed as part of AQMD sampling analysis (refer to Appendix D for more details), emission rates for different types of perc machines and source-specific parameters as specified in the draft CAPCOA Industry-Wide Risk Assessment Guidelines, and methodology specified in the requirement provision, paragraph (d)(1) of the proposed amendments. The annual turnover distributions of these machines to non-perc alternatives are based on the age of the machines. AQMD staff assumed the permit issuance date as the year the machine was built since there was no other data available to estimate the age of the machine. The converted machines (18) were distributed evenly over two years for switching to non-perc alternatives beginning with rule adoption date. About 192 machines that are 1989 or earlier models are 15 years old by the rule adoption date. Staff assumed that 20% of these older machines (38) will switch to non-perc alternatives and the remaining about 154 machines will switch to primary and secondary control machines between the rule adoption date and compliance date of July 1, 2004. If the incentive program is not approved the number of equipment changes in the first year following rule amendment is expected to be lower. These machines equipped with primary and secondary controls will be required to be replaced with non-perc alternatives starting year 2017

based on when equipment is 15 years old. Starting July 1, 2004, the annual distributions of the remaining machines with primary control systems (1,257=1,449-192) and machines with primary and secondary control systems (714) were based on the permit issuance date and assumption of the equipment lasting 15 years. The analysis shows that the perc emissions will be eliminated by July 1, 2019.

Based on the above turnover distributions of the machines, the cumulative emission reductions are estimated to be 849 tons of perc by 2019 compared to the current emissions. Table-3 shows the emission reductions on a yearly basis for the year 2002 through 2020. More detailed results are included in Table C-6 of Appendix C.

**Table 3**
**Annual Average Emission Reductions**
**(Replacement of Perc Machines with Alternative Control Technology)**

| | Perchloroethylene (tons/yr.) | |
|---|---|---|
| **Year** | Yearly | Cumulative |
| 2002 | 0 | 0 |
| 2003 | 25 | 25 |
| 2004 | 25 | 50 |
| 2005 | 46 | 96 |
| 2006 | 53 | 149 |
| 2007 | 47 | 196 |
| 2008 | 53 | 249 |
| 2009 | 71 | 320 |
| 2010 | 61 | 381 |
| 2011 | 67 | 448 |
| 2012 | 67 | 515 |
| 2013 | 110 | 625 |
| 2014 | 54 | 679 |
| 2015 | 75 | 754 |
| 2016 | 45 | 799 |
| 2017 | 25 | 824 |
| 2018 | 25 | 849 |
| 2019 | 0 | 849 |
| 2020 | 0 | 849 |

Without the regulation, assuming machines that are 15 years old are replaced with new perc machines with primary and secondary control systems, the cumulative emission reductions are estimated to be 142 tons by the year 2019.

Originally, staff used draft CAPCOA guideline health risk assessment to estimate the perc emissions from dry cleaning operations in the Basin. The total emissions were estimated to be about 1200 tons per year. This was based on average perc usage of 100 gallons per year and

percent perc disposed as hazardous waste of 20% as indicated in this document. This was similar to the perc emission estimation used in development of the perc ATCM. Based on comments received on the preliminary draft staff report and through the Working Group meetings, an extensive sampling effort was undertaken to better characterize perc emissions. The revised inventory estimate of approximately 850 tons per year reflects the most current information.

# CHAPTER 3

# IMPACT ASSESSMENT

## INTRODUCTION

This chapter discusses the impact assessment for the proposed amendments to Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems.

## ENVIRONMENTAL IMPACT ASSESSMENT

The AQMD has prepared California Environmental Quality Act (CEQA) documentation for the proposed amendments to Rule 1421. A Draft EA was originally circulated for a 45-day public review and comment period from December 19, 2001 to February 1, 2002. Based upon the public comments and concerns expressed by industry during public meetings, staff conducted additional sampling on perc and hydrocarbon machines to better characterize emissions and solvent usage. A Revised Draft EA is being recirculated for a 45-day public review in order to provide the opportunity for review and comment on this new information. The public review and comment period closes on September 26, 2002. All comments received will be addressed and incorporated into the Final EA for the proposed project. The Revised Draft EA is available at the AQMD headquarters, by calling the AQMD's Public Information Center at (909) 396-2039 or accessing the AQMD's CEQA website at http://www.aqmd.gov/ceqa/aqmd.html.

## SOCIOECONOMIC ASSESSMENT

**The final Socioeconomic Assessment of the proposed amendments to Rule 1421 is attached.** As part of continual refinement of the current AQMD socioeconomic analysis, the AQMD hired a consultant to develop new socioeconomic analysis tools for the purpose of conducting facility-based assessments.

## COMPARATIVE ANALYSIS PURSUANT TO HEALTH AND SAFETY CODE SECTION 40727.2

Health and Safety code section 40727.2 requires a comparative analysis. This analysis may be found in Appendix E.

## AQMP AND LEGAL MANDATES

Rule 1421 is an air toxic rule that would implement part of the Air Toxics Control Plan and the source-specific measures the Board directed staff to evaluate as part of the adoption of Rule 1402. This proposed amended rule also includes requirements to ensure compliance with the federal NESHAP applicable to these sources.

## RULE ADOPTION RELATIVE TO COST-EFFECTIVENESS

Proposed Amended Rule 1421 is not a control measure in the 1997 Air Quality Management Plan (AQMP) and thus, was not ranked by cost-effectiveness relative to other AQMP control measures in the AQMP. Cost-effectiveness in terms of dollars per ton of pollutant reduced is not applicable to rules regulating toxic air contaminants. Upon full implementation, PAR 1421 will reduce perc emissions by 849 tons, which results in an average incremental reduction of 53 tons per year. Sources subject to Rule 1425 – Film Cleaning and Printing Operations, federal requirements will reduce perc emissions by approximately 12 tons per year and Rule 1425 will result in an additional 27.5 ton per year perc emission reduction, for a total of 39.5 tons per year. Rule 1122 – Solvent Degreasers, will reduce perc emissions by 245 tons per year.

Although cost-effectiveness is not calculated for toxic air contaminants, staff did analyze the cost to a dry cleaner to switch from a perc machine that is 15 years old, to a non-perc alternative such as hydrocarbon or wet cleaning. A switch to wet cleaning can actually result in cost savings. The basic equipment costs less and monies are saved in permitting requirements, energy, toxic waste fees and solvent usage. Based on the information provided by three machine distributors, the cost differential for between a perc and hydrocarbon machine for a 55 to 65 pound capacity were ranged from $8,000 to $12,000. This cost includes the discount price, tax, delivery, and installation cost. Therefore, the differential cost of switching to a hydrocarbon technology would be approximately $10,000. Energy and maintenance costs have been calculated to be approximately equal when switching from perc to the hydrocarbon technology. The cost per pound of perc reduction for PAR 1421 is $3 compared to Rule 1425, which was $8-30 and Rule 1122 which was $0.25. The specific costs for perc depend on which alternative and the specific machine purchased. Table 4 depicts the annualized cost and cost per pound comparison for the three rules reducing perc.

**Table 4**
**Cost Comparison for Perc Reduction Rules**

| | PAR 1421 | Rule 1425 | Rule 1122 |
|---|---|---|---|
| **Reductions (average tons/yr.)** | 53* | 27.5 | 245 |
| **Annualized Costs (millions)** | $4 | $0.16 – 0.39 | $0.12 |
| **Cost per pound ($/lb.)** | $3 | $8-30 | $0.25 |

*By the year 2019, this amount will accumulate to 849 tons per year.

A related but separate effort will be brought to the Governing Board at the same Board meeting as PAR 1421. This item is independent of the PAR 1421 effort. Staff proposes the

establishment of a financial incentive grant program to help sources transitioning to non-perc alternative technologies early. These funds, $2,000,000, will come from the Air Quality Assistance Fund (AQAF). The program would work on a first-come-first-served basis for those sources switching to non-perc alternatives early in the program, before January 1, 2004. A facility purchasing a non-perc alternative cleaning technology would receive a grant of up to $10,000.

The AQAF was originally established in 1991, in response to legislation. Only about 30 loans were approved under the original program. In May 2001, the Governing Board approved replacing the original AQAF bank loan guarantee program with a more cost-effective, established, statewide program called the California Capital Access Program (CalCAP). This program is administered by the California Financing Authority and provides bank loan insurance to help small businesses with marginal credit obtain loans. Through the District's participation in the CalCAP program, any small business with less than 500 employees can obtain a CalCAP insured loan of up to $500,000 for equipment that creates, controls, monitors, or reduces air pollution, and meets or exceed the requirement of the District. The District pays the borrower's fee (up to three and one-half percent of the loan value).

At the September 2002 Board meeting, the Governing Board approved $295,000 to support the promotion of wet cleaning technology and $30,000 for a wet cleaning demonstration site. Additionally, the District is seeking funds through the federal legislative bill process, rather than budget, to receive $2,500,000 from EPA for promoting environmentally friendly cleaning processes. The decision on this funding will not be known until later this year. Finally, the cost of hydrocarbon machines in the Bay Area has come down as the number of machines installed has risen. The cost difference between a perc and hydrocarbon machine in the Bay Area ranges from $8,000 - $14,000.

According to a notice released by the New York State Environmental Facilities Corporation it "has extended the 1996 Clean Water/Clean Air Bond Act Program called the Financial Assistance to Business (FAB) Dry Cleaner Program." The program provides up to $5,500 in State Assistance Payment for purchase or upgrade of dry cleaning equipment. Those purchasing non-perc machines 55lbs or larger can get up to $5,000 and those with small machines up to $4,000. Dry cleaners in "mixed use" setting (sharing a common wall, floor or ceiling with another business or residence) are eligible for an additional $500.

After rule development for PAR 1421 was initiated, industry suggested that perhaps it would be better if dry cleaners complied with Rule 1402. Staff's analysis of the procedures for an individual dry cleaner complying with Rule 1402 shows the cleaner would pay approximately $9,500 per year. This is based on simple AB 2588 facility with a risk level of 50 to 100-in-one million. Typical inventories and HRAs cost $10,000. If the vast majority of cleaners went through the full process, it could take up to 10 years for the public notification processes and risk reduction processes to be completed.

## INCREMENTAL COST-EFFECTIVENESS

Health and Safety Code Section 40920.6 requires an incremental cost-effectiveness analysis when there is more than one control option which would achieve the emission reduction objective of the proposed amendments, relative to ozone, CO, $SO_x$, $NO_x$ and their precursors. Since the proposed amendments to Rule 1421 apply to a toxic air contaminant, the incremental cost-effectiveness analysis requirement does not apply.

# APPENDIX A

## RESPONSE TO COMMENTS

**Response to Comments**

Comments on the proposed amendments to Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems, were received at the Public Workshop held on September 20, 2001, and Public Consultation Meetings held October 17, and October 25, 2001, and in writing during the comment period ending November 8, 2001. Following are summaries of the comments received and staff responses. Additional sets of comments and responses received during later open comment periods are included following the first section. To date, no comments have been received from ARB or EPA.

1. Comment: According to the Material Safety Data Sheet (MSDS) of petroleum hydrocarbon, published by Exxon Chemical, petroleum hydrocarbon has a flash point of 63.8$^{o}$ C (147$^{o}$ F), an approximate lower explosive limit of 1.3, and an upper explosive limit of 8.8 @ 25$^{o}$ C (77$^{o}$ F). The use of flammable substances poses a significant threat of fire to dry cleaners. Petroleum hydrocarbon is hazardous as defined in 29 CFR 1910.1200. This product is also defined as combustible by Occupational Safety and Health Administration's (OSHA) regulation. Per Exxon's MSDS, this product, at an exposure of over 1000 ppm, may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness, and other central nervous system effects, including death. Also, a small amount of this product aspirated into the respiratory system during ingestion or vomiting may cause mild to severe pulmonary injury possibly progressing to death.

   Response: 29 CFR 1910.1200 – Occupational Safety and Health Standards, Hazard communication, does not specifically list the petroleum hydrocarbon produced by Exxon as a hazardous chemical. This federal law specifies labeling requirements for hazardous chemicals. "Hazardous substance" as a term is defined in the Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.). The OSHA regulation does distinguish between hazardous chemicals, which are physical hazards, and those which are health hazards. The physical hazard, which a petroleum hydrocarbon would be classified as, means a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive chemical.

   Perchloroethylene would be classified as a health hazard meaning there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effect may occur in exposed employees. The Office of Environmental Health Hazard Assessment (OEHHA) has established risk factors for perc for acute and chronic health effects as well as carcinogenic factors. EPA lists

perc as one of 188 Hazardous Air Pollutants (HAPs) and controls the emissions of this chemical through several NESHAPs.

The petroleum hydrocarbon by Exxon may be combustible, but has a fairly high flash point ($147^0$ F) that reduces the risk of fire or explosion. The National Fire Protection Association lists it as moderate flammability class (IIIA). The equipment has thermostats to monitor the temperature and refrigeration systems to cool the solvent. The machines operate at a temperature (approximately $120^0$ F) lower than the hydrocarbon's flash point. Additionally, the solvent machines are efficient and greatly reduce the amount of solvent that escapes into the atmosphere. They are equipped with many safety features and those currently operating in the Basin have been approved by local fire agencies.

The exposure level cited by the commentor of over 1000 ppm is extremely high and not likely to be found in a normal operation. An open container of DF 2000 was measured using a calibrated OVA. Readings did not exceed 250 ppm. Conversely, a very small amount of perc can cause neurological function effects, as seen in a recent New York study, which noted effects, such as changes in visual contrast sensitivity (VCS), at 780 micrograms per cubic meter (about 0.1ppm). The findings of the study published in Environmental. Health Perspectives Volume 110(7): 655-664, on neurological effects on vision is summarized in the discussion on page 661. "Measurements of visual contrast sensitivity (VCS) indicated that chronic, environmental perc exposure may adversely affect neurobehavioral function. VCS was significantly lower (poorer) in the exposed groups than matched-control groups in both the residential study and day care investigation. The VCS deficits were likely of neurologic origin because the exposed and control groups did not differ in visual acuity, indicating that the groups did not differ in optical refraction or in the ability to focus images on the retina". No difference in visual acuity means that the eye function was normal, and that differences in VCS were neurologic in origin.

Finally, the ingestion of petroleum hydrocarbon to the extent necessary to create a problem is unlikely, while the inhalation pathway for perc contamination is a common occurrence. One would have to contaminate food with the petroleum hydrocarbon or mistakenly swallow it.

2. Comment: For a non-toxic alternative to perc and petroleum hydrocarbon, the EPA recommends the use of "Eco-Clean" which is virtually indistinguishable from wet cleaning. However, it is generally

known to dry cleaners that "wet" cleaning processes cannot effectively clean all types of garments.

Response: According to EPA staff, "EPA does not endorse, certify, or recommend any specific brand of cleaner technology process or equipment over another. Rather, EPA encourages garment care professionals to consider incorporating cleaner technologies into their businesses, such as professional wet cleaning or a liquid carbon dioxide process – whichever is most appropriate for their operation." Likewise, the AQMD does not promote a particular alternative technology as a replacement to perc dry cleaning. The statement that wet cleaning cannot effectively clean all types of garments is not an opinion that is shared by persons in the dry cleaning business who have switched to wet cleaning and are satisfied with the results of the cleaning technology. Individuals can choose a non-perc alternative cleaning technology that works best for them.

3. Comment: $CO_2$ cleaning costs could be much higher than that of perc cleaning and the sources of $CO_2$ are limited. The quality of $CO_2$ cleaning is presently not proven.

Response: $CO_2$ cleaning machines cost much more for the initial investment than other machines. Operation costs and cycle times are competitive with perc. According to the manufacturers, the supply of $CO_2$ for cleaning is abundant. It comes mostly as a by-product from the production of anhydrous ammonia (fertilizer). The equipment manufacturers of this system have stated that the $CO_2$ used in the process is recaptured for reuse in the machines. The $CO_2$ is a by-product from ammonia plants, fermentation ethanol plants and hydrogen plants within refineries. Other sources include ethylene oxide, natural gas processing plants and extraction from flue gases. It may also be obtained directly from $CO_2$ wells at high concentrations. Thus, no new $CO_2$ is produced or added to the atmosphere. The quality of cleaning, as experienced by the one dry cleaner in the Basin using $CO_2$, is satisfactory with the exception of acetate. The problem of cleaning acetates is being addressed through development of detergents.

4. Comment: The proposal of non-perc alternatives by 2011, as presented in the September version of the proposed rule amendments, should be extended or shortened until the alternative chemicals are fully and safely developed.

Response: Staff believes the alternative technologies are fully and safely developed, as evidenced by their wide use in Europe and the Bay Area, plus the number of alternative technology-based cleaners

operating in the Basin. The International Committee for Textile Care (CINET) website has a position paper which states: "As a result of new additives and improved process conditions, hydrocarbon solvents (HCSs) as isoparaffins or high-purity crude oil fractions now have a cleaning effect that is almost equaling that of perchloroethylene. Also, as a result of more accurate measuring instruments and increased experience in the field of safety, safe use has taken a great leap forward." CINET further states "Wet cleaning using special machines and matched products is holding a strong position in the international textile care industry. Textile development and care symbols have adjusted to this new cleaning technology which extends the offering and may be used as a substitute for solvents." However, the compliance dates in the proposed rule have been extended to allow sources more time to switch to an alternative technology.

5. Comment: AQMD has been talking about alternative solvents and technology, but not based on concrete data. Different fabrics should be tested by the various methods.

Response: Six dedicated wet cleaners are in the testing mode with the AQMD's Technology Advancement Office, Wet Cleaning Commercialization project in conjunction with Occidental College's Pollution Prevention Education and Research Center (for further updates see chapter 1- wet cleaning). Four additional wet cleaners are operating in the Basin. AQMD staff's visit to one of these facilities showed a wide range of fabrics that had been wet cleaned, including: leather, wool, silk, rayon, linen and sequined garments. The owner of the facility was very pleased with the process. There are approximately 75 hydrocarbon solvent machines permitted in the AQMD. Again, the operators are pleased with the process and have found few items they cannot clean. Conversely, there are limits on fabric types that can be safely cleaned with perc such as sequined garments and suedes. Europe is switching over to wet and hydrocarbon solvent cleaning. There is also emerging technology being demonstrated at a site in Long Beach that cleans with $CO_2$.

6. Comment: The phase-out dates should be extended to allow more time for the development of alternative technologies.

Response: The compliance dates have been extended and a transition period added for those changing equipment that want to remain using perc equipment for up to 15 years. The extension is intended to minimize cost impacts, also for cleaners to experiment and select the best non-perc alternative option.

7. Comment: We have conducted research on the viability of wet cleaning for the past six years and two reports produced by our Center, *Pollution Prevention in the Garment Card Industry: Assessing the Viability of Professional Wet Cleaning* (1997) and *Supporting Pollution Prevention in the Garment Card Industry: An Assessment of Factors Influencing a Switch from Dry Cleaning to Professional Wet Cleaning* (2000), both confirm the viability of wet cleaning as an alternative to PCE dry cleaning and also identify problems with the regulation of PCE dry cleaning.

Based on this information, we recommend prohibiting the purchase of PCE dry cleaning machines at new and existing facilities upon rule adoption, limiting the use of PCE dry clean machines to 10 years. A phase-out structure by date the machine was first placed into service (using 10-year useful life) would create a smooth transition.

The claim of viability can be supported by a series of case studies which showed: the professional wet cleaners were successfully able to clean the full range of garments usually taken to a perc dry cleaner; high level of customer satisfaction; cost of purchasing equipment was lower; overall operating expenses were comparable; and substantial pollution prevention benefit was gained.

Regarding the useful life of dry cleaning machines, note the distinction between the useful life of older perc machines and new equipment with primary and secondary controls. A survey conducted prior to PAR 1421 release gave useful life ranging from 7 – 15 years. The interviews were conducted with manufacturers, repair operators, and garment consultants. The fifteen-year life was only given with the caveat that a significant amount of preventative maintenance must be performed to achieve this. The International Fabricare Institute's CEO William Fisher testified before Congress in the year 2000, (U.S. House, 2000. Committee on Small Business, Subcommittee on Tax, Finance and Exports. *Helping Small Dry Cleaners Adopt Safer Technology: Without Losing Your Shirt*, 106$^{th}$ Congress, 2$^{nd}$ Session, 20 July.) that the life of a new PCE dry cleaning machine was typically between 8 and 14 years. Given this information, we support staff using a useful life of 10 years.

Response: AQMD staff appreciates the comment. The dry cleaners and cleaners associations claim that the useful life of the new machines (5$^{th}$ generation) could be as high as 20 to 30 years. Staff worked with industry association representatives to develop enforceable

under specific circumstances. Examples included low usage and meticulous maintenance. It was mutually agreed that developing and implementing such criteria would be difficult, and that approach was not pursued. Based on work with the stakeholders, staff believes that the useful life for a typical machine is about 8-14 years as the commentor indicated. However, 15 years is recommended by the staff as the maximum allowable equipment life, to minimize potential adverse socioeconomic impacts.

8. Comment: We support the phase-out of perc. Results of audits consistently show the dry cleaners have difficulty complying with the rules designed to minimize PCE emissions. Sacramento showed a compliance rate of 13% (1996); South Coast A.Q.M.D had 10% (1997); San Francisco Bay Area was 21% (1998); New York was 2% (1998); and Massachusetts showed 6% (1998). Furthermore, excess emissions appear to be independent from machine configuration. The AQMD audit noted PCE emissions were not limited to a particular equipment make or year of manufacture. Additionally, PCE dry cleaning regulations are difficult to enforce. The rules impose complicated maintenance and inspection requirements on cleaners and extensive record keeping and reporting. Inspectors often rely on cleaners' records and as one experienced CARB inspector noted, in nine years he has yet to see one facility record a PCE leak as was required. These regulations are impractical from a public health standpoint.

Response: AQMD staff acknowledges the concerns. Staff agrees that pollution prevention is more desirable than pollution control in terms of enforcement and assurance of reductions. Non-perc alternatives especially non-toxic technologies, would provide the optimal public health protection.

9. Comment: The alternatives may be toxic.

Response: Water and $CO_2$ are not considered toxic air contaminants. The hydrocarbon DF2000 has an MSDS listing at minimal toxicity and Green Earth™, another solvent, has been through initial testing and likewise has exhibited minimal toxicity. The liver effects tests on "hepatic cytochrome P450, UDP-glucuronolyltransferase, and expoxide hydrolase in the female Fischer 344 rat and evaluation of liver microsomal enzyme induction potential in rat" gave a result of the Green Earth™ solvent inducing the same liver enzymes as phenobarbital, a drug used to control epilepsy in humans. All other tests reported were "no significant toxic responses." Final toxicity tests are scheduled to be complete for Green Earth™ in late 2002.

10. Comment: There should be no phase-out of perc because there is truly no replacement. We are concerned about the environment and would not willingly pollute. If there were an alternative, we would switch voluntarily.

Response: Dry cleaners currently using the alternative technologies are pleased with their results and have assured staff they clean all types of fabrics. For example, a local dry cleaner using one of the alternatives has said, "Using the GreenEarth solvent with Fabritec detergent produces amazing results on all types of garments. $500 cashmere sweaters come out soft and supple and literally every kind of fabric can be cleaned and we do not worry about the results." Based on the large number of alternative cleaning technologies being used in the Basin, Bay Area, New York and Europe, the alternative technologies are commercially available and proven in practice.

11. Comment: The care labels are for "Dry Clean Only" and a cleaner would be liable if he cleaned a garment by wet cleaning and it was damaged.

Response: Wet cleaning has successfully cleaned "dry clean only" fabrics, according to those persons using the technology. The owner of Cypress Plaza Cleaners reported that 95% of the garments successfully processed at this plant had "dry clean" care labels. Cleaners may be liable for damaging any garment, regardless of labeling or cleaning methods used.

12. Comment: Perc is the only solvent that can clean some fabrics. For example, there are restoration and museum-grade fabrics that only perc can clean.

Response: The revised proposal allows some perc machines with primary and secondary control systems to be operated until the year 2019. This time period should allow the cleaning technology to be enhanced to clean all types of fabrics. The Smithsonian Institution has informed staff that the museum has sent out some articles to be cleaned using hydrocarbon solvents.

13. Comment: $CO_2$ is a global warming gas and water is a resource that should not be used in dry cleaning.

Response: The $CO_2$ used in cleaning is already produced and recaptured for use in the machines. No new $CO_2$ is produced or added to the atmosphere by the process. Water is a resource, which should always be conserved, but can be safely substituted for perc cleaning without damage to the environment. The EA addresses the potential increase in water usage. There would be a potential

increase if all facilities switched to wet cleaning, but this increase would not be significant.

14. Comment: What is the AQMD's opinion on DF-2000, a synthetic hydrocarbon solvent?

    Response: DF-2000 is one of the alternative non-perc technologies available to dry cleaners and would be controlled pursuant to Regulation XIII and Rule 1102 – Petroleum Solvent Dry Cleaners. Please refer to Chapter 1 of the staff report for a description of this and other alternative technologies.

15. Comment: What solvents are pending toxicity testing?

    Response: Green Earth™ is undergoing a 2-year bioassay with results due in 2002. Preliminary results indicate minimal toxicity.

16. Comment: The three dozen hydrocarbon solvent cleaners cited in your public workshop presentation have failed economically and closed their shops.

    Response: Staff has not been able to confirm this statement. According to AQMD records, there are approximately 75 hydrocarbon machines currently permitted in the Basin and an additional 25 Green Earth™ machines.

17. Comment: Which wet cleaning units are used in Europe and what is their success rate?

    Response: Most of the wet cleaning units sold in Europe are Miele or Aqua Clean systems. By success rate, it is assumed the commentor meant percent of garments cleaned by the wet cleaning method or how many facilities are dedicated wet cleaners. The staff has received data from one manufacturer dated January 1996 stating they had sold 212 units in Europe, worldwide 445 units. The other major manufacturer has sold approximately 800 units in Europe. The information provided did not specify if the units were used in dedicated wet cleaning shops. In Germany, approximately 20 dry cleaners are using strictly the wet cleaning process.

18. Comment: Where will the public stand on the cleaning power of the alternatives and the value of service for their money? Europe may use wet cleaning and hydrocarbon cleaning but their work has been mediocre.

    Response: Owner/operators of facilities using non-perc alternative technologies have informed staff that their customers are pleased

the switch. Some of the staff have had their dry cleaning done by facilities using non-perc alternatives and are personally pleased with the results and dollar value of the services received.

19. Comment: In South Carolina, they have determined that the detergents used with Green Earth™ are toxic.

Response: Staff at the South Carolina Department of Health and Environmental Control, Bureau of Air Quality Control, has stated they have not made a determination as to the toxicity of detergents used with Green Earth™. A staff member of South Carolina Department of Health and Environmental Control, Bureau of Land &Waste Management stated at the recent Oregon meeting of the State Coalition for the Remediation of Drycleaners (SCRD) that two facilities in South Carolina using Green Earth™ have chosen, on their own, to dispose of their wastes as hazardous materials. The state of South Carolina implements a program, which allows dry cleaners to pay into a fund (based on the gallons of solvent they use) that may be drawn upon in the case a hazardous waste clean-up, is required. Thus, by recycling their Green Earth™ waste as hazardous materials, these dry cleaners are allowed to pay into the fund and be covered by the program the state institutes should clean-up of any kind needed.

20. Comment: Steamer Cleaners on Ventura Boulevard recently burned due to their hydrocarbon machine.

Response: Staff spoke with personnel at Steamer Cleaners who confirmed the facility did have a fire but it started in the front of the shop (the hydrocarbon machine is located in the back) and was most likely electrical in nature. The Los Angeles City Fire Department, Arson Unit listed the fire (incident #257) as unclassified.

21. Comment: In the past, when dry cleaners primarily used hydrocarbon, there was a gasoline shortage and the people making the solvent no longer produced the dry cleaning solvent. We are an energy depend nation and if you push us into hydrocarbons we may find ourselves without solvent.

Response: The solvent the commentator is speaking of is Stoddard solvent which is no longer widely used. Stoddard is a heavy petroleum solvent. The alternatives are not gasoline-based and a rationing of gasoline would not affect their supply.

22. Comment: What AQMD regulations apply to hydrocarbons?

Response: Rule 1102 – Petroleum Solvent Dry Cleaners, was originally adopted January 6, 1978. It was last amended November 17, 2000. Also, this equipment is subject to Regulation XIII and any increases in VOC emissions of one pound per day or more triggers BACT. This equipment also requires an AQMD Permit to Operate (Rule 201) and is subject to fees (Regulation III).

23. Comment: EPA classifies perc as an animal carcinogen. The evidence of "whether perc is potentially carcinogenic to humans" is not conclusive.

Response: EPA has also listed perc on a continuum between a possible and probable human carcinogen. EPA's Office of Research and Development (ORD) made a B2 probable human carcinogen finding which was published in EPA's Office of Pollution Prevention and Toxic Substances (OPP) 1991 report "Cleaner Technologies Substitutes Assessment for Professional Fabricare Processes" (CTSA), EPA 744-B98-001. From Appendix C, page C-13 the CTSA states: "Overall Evidence: Based on these bioassay data, which show increased incidences of tumors at three different sites and in two animal species, together with its evaluation of several epidemiological studies including Ruder *et al*. (1994), IARC (1995) classified PCE as a group 2A carcinogen; i.e, probably carcinogenic to human…. Since the mechanisms of PCE carcinogenesis are not clearly understood, USEPA has considered the conclusive animal data for PCE, taken as a whole, to be sufficient evidence for classifying PCE as a group B2 substance (probable human carcinogen) (USEPA, 1991)."

The IARC is the International Agency for Research on Cancer. The IARC classifies perc as a probable carcinogen. From various international studies (U.S., Canada, United Kingdom, Denmark, Sweden) on dry cleaner worker exposure, perc is also listed by IARC as possibly carcinogenic to humans. In addition to the carcinogenic effects of perc, it is well established that low levels of perc cause adverse acute and chronic health effects.

Several epidemiological studies showed elevated risks for oesophogeal cancer, non-Hodgkin's lymphoma and cervical cancer. The compound induced leukemia in rats. Nearly every carcinogen (except arsenic) for which the classification as known human carcinogen was based on human evidence initially, was later also shown to be carcinogenic in animals. IARC states "In the absence of adequate data in humans, it is reasonable, for practical purposes, to regard chemicals or exposure for which there is sufficient evidence of carcinogenicity in animals as if they

cystalline silica were reclassified by IARC from Class 2A (probable human carcinogen) to Class 1 (known human carcinogen) when enough epidemiological evidence (cases of diagnosed human cancer) accumulated to declare them known human carcinogens. Ethylene oxide was similarly reclassified when so much genetic evidence accumulated that IARC deemed the change in classification warranted.

24. Comment: Instead of the proposal, staff should just accelerate the approach in Rule 1401 – New Source Review of Toxic Air Contaminants. In addition, the AQMD should perform individual risk assessments much the same way as conducted by the Bay Area AQMD. They found that only 5% of the dry cleaners were at a high risk level.

Response: Rule 1401 only applies to new and relocated equipment or if there is an emissions increase on a replacement. The permits issued under Rule 1401 require throughput limits that would not be practical for even most of the latest technology machines (based on recent sampling and analyses).

The Bay Area AQMD did not conduct individual risk assessments on all dry cleaners. They created generic models based on different meteorological areas, receptor distances, and assumed emissions of 100 gals/yr. The individual dry cleaners could then come into the Bay Area AQMD with their usage data and nearest commercial/residential distance. Based on this information, Bay Area AQMD staff would calculate the usage limit, which results in an acceptable risk level. On average, Bay Area staff estimates that most dry cleaners are between 10 to 100-in-one-million risk and that approximately 15% of the dry cleaners there were over 100-in-one-million, when the study was done, and needed to install ventilation systems and/or other controls to lower their risk.

Bay Area has approximately 800 permitted dry cleaners compared to South Coast AQMD's 2,200. Bay Area's meteorological data is such that dry cleaners with the same operating parameters but located in the South Coast AQMD would have a risk level approximately 3 times higher. The acceptable risk level for permitting in Bay Area is 1-in-one million, 10-in-one-million with TBACT.

When Rule 1402 was amended, the dry cleaning industry was one of several industries identified to evaluate for a source-specific approach. Staff's analysis of the procedures for an individual dry cleaner complying with Rule 1402 shows the cleaner would pay approximately $9,500 per year for Air Toxic (AB-2588) program fees. Individual public notification typically costs approximately

$2,000-3,000, although industry-wide notification procedures are being developed, that are expected to significantly reduce notification costs for individual cleaners. Additionally, it could take up to 10 years for one dry cleaner for the public notification process and risk reduction process to be completed.

25. Comment: The risk data is invalid. For example, as provided by the AQMD staff, the amount of perc emitted is more than the amount sold in the Basin.

Response: Staff respectfully disagrees with both of these statements. The risk estimates established by recent AQMD testing were based on actual numbers. Modeling analyses relying on emissions was used to fill in the data gaps throughout the region. In the year 2000, one supplier reported approximately 3,000,000 pounds of perc were sold to the dry cleaners in California. Southern California represents about 50% of the total state economy. On this basis, if the cleaners in Basin consume half of this amount, this equals to an average of 50 gallons of perc usage per dry cleaner. Using this usage level and emission factor (50% perc emitted) developed from AQMD sampling analysis, the risk would be estimated to be 28-in-one-million which is still within range. Staff conducted sampling/analyses of sludge at 20 cleaners using perc in machines with primary and secondary controls. The average perc used was 96 gallons. Using the 50% perc emitted, the average emissions from these machines are estimated to be 48 gals. per year, which falls within the range specified in the draft CAPCOA Risk Assessment Guidance document (30-75 gals per year).

26. Comment: The preliminary draft staff report assumes that 80 percent of the perc purchased by dry cleaners is emitted to the atmosphere. This is inconsistent with data available from industry associations and dry cleaning equipment manufacturers. It is also in conflict with information used by District permitting staff for permitting new dry cleaners under Rule 1401.

Response: The 80% came from the draft CAPCOA Industry-wide Risk Assessment Guideline document for existing equipment. The current extensive sampling and analyses were conducted during rule development process. Staff re-evaluated the information and no longer is using the 80 percent value to estimate the amount of perc emitted. The recent test data indicated that approximately 50% of perc consumption was emitted to the atmosphere.

Based on the new information resulting from AQMD sampling analysis, staff will re-evaluate the methodology and procedure used in development of risk assessment analysis associated with

dry cleaning operations for Rule 1401. The current limits given to equipment undergoing Rule 1401 analysis will be reduced based on recent sampling results. Thus, it is unlikely any dry cleaner would be able to operate successfully due to the more stringent limit on perc usage.

27. Comment: According to ARB's analysis, the waste from a typical dry cleaning operation, contains about 50% perc. Thus, the amount of perc in the wastes is ¾ or more of the total solvent purchased.

Response: Based on the recent sampling analysis, staff assumes that for machines with primary and secondary controls, 50% of the perc usage is disposed as hazardous waste. In addition, for machines with only primary control system, 46% of the perc usage is assumed to be disposed as hazardous waste. This includes the amount of perc recovered from liquid waste as well as solid waste. The draft CAPCOA Risk Assessment Guideline document indicates that 20 to 30 percent of perc usage is disposed as hazardous waste.

28. Comment: Information presented by staff indicates the highest estimated risks occur at those facilities with the oldest equipment. Based on the information available from District permitting program, the replacement of older equipment would bring these existing facilities into compliance.

Response: AQMD staff acknowledges that replacement of the older equipment with the newer machine reduces the risk. Out of 2,200 permitted perc machines in the South Coast Air Basin, about 300 machines were, at the time of permitting, estimated to have risk below the permitting threshold level of 10-in-one-million based on an assumption that only 15% of perc consumption was emitted. Recent sampling done by staff indicates that the emission factors previously used to permit this equipment were underestimated. As a result, even equipment permitted under Rule 1401 likely poses a higher risk to public health than previously assumed. However, there are technology proven, cost effective non-perc alternative cleaning technologies, which impose no risk to the surrounding communities. These alternatives are more protective of public health than even new perc machines.

29. Comment: We believe the District can achieve the requirements of Rule 1402 without eliminating perc. And

Other industries were asked to reduce perc but not eliminate its use.

Response: The District's goal in amending Rule 1421 is not to purely achieve the requirements of Rule 1402 but to reduce the residual risk from perc by the maximum amount feasible. Based on the sampling analysis, the risk levels of 25-in-one-million (Rule 1402) or 10-in-one-million (Rule 1401) are not achievable in practice without significantly curtailing business (i.e., perc usage). As there are cost-effective, technologically feasible non-perc alternatives available, the risk from dry cleaners can eventually be reduced to zero.

Major reductions are mandated in two other AQMD rules for sources using perc. Rule 1122 for degreasers prohibits the use of all NESHAP halogenated solvents (including perc) by January 1, 2003 unless they are used in airless/air-tight cleaning system which achieve 95% reduction in emissions. Rule 1425 for film printing and cleaning requires an 85% overall reduction by March 2003. While there are solvent alternatives available for film cleaning, there exists a need to allow the use of perc to clean original cut negatives and older films for archiving purposes. There are no available alternatives for film printing. Given the nature of the operations, it was deemed infeasible to require a phase-out of perc for the motion picture film processing industry.

30. Comment: International Fabricare Institute has submitted a method for calculating perc emissions, and, thus risk. The AQMD should use this method.

Response: The IFI method was based on unsubstantiated assumptions such as the 5$^{th}$ generation machine emits only 5% of perc purchased. IFI and others asked AQMD to further investigate perc emissions. This lead AQMD to the testing efforts. The AQMD staff conducted sampling analysis on liquid sludge to estimate the amount of perc being emitted from different type of machines. The results from AQMD sampling (i.e., for machines with primary and secondary control systems, 50% of perc consumption is emitted to atmosphere and 50% is recycled) is being used by staff to estimate the emissions of perc from a dry cleaning machine. This result is substantially different than the 5% stated by IFI, but is based on actual test data.

31. Comment: The tonnage of stationary emissions of perc is approximately 15% of the South Coast Air Basin's toxic air emissions while diesel emissions are three times that amount.

Response: The Air Toxics Control Plan comprehensively addresses all sources of toxic air contaminants. The AQMD is actively pursuing diesel reductions where there is authority for such actions. There

are AQMD fleet vehicle rules and credit generation rules specifically targeting diesel emissions.

On a regional basis, the contribution of perc to the total toxic emissions is small. While, perc concentration was detected in the ambient air throughout the Basin (about 29,700 lb./day annual average daily emissions), in any event exposure to air toxics is more critical at a neighborhood level because of the direct exposure to neighbors and off-site workers.

32. Comment: Is the amount of 55% perc emissions shown in the "MATES II Results" slide presented at the Public Workshop, the 80 gallons per year that industry argued could not be emitted, since the average cleaners only purchases 80 gallons?

Response: No. From MATES II, the amount of perc emissions is 15 tons/day for all sources of perc based on the total perc sold. This data came from the MATES II Final Report which stated: "Perchloroethylene dry cleaning county-wide emissions were apportioned according to the permitted annual emissions and located at their specific address. The perchloroethylene dry cleaning emissions were derived from California import and domestic-production records." See Comment #25 for a discussion of the amount of perc sold to the dry cleaners in the Basin and Appendix D for amount used and emitted.

33. Comment: The life of a perc machine is 20 to 30 years and it is wrong for AQMD to limit the life to 10 years. It is a deprivation of property rights to place such a limit on dry cleaners.

Response: The U.S. Tax Code lists dry cleaning equipment as depreciating over a seven-year period. Manufacturers of the equipment place the life at approximately 15 years. International Fabricare Institute's CEO William Fisher testified before Congress in the year 2000, (U.S. House, 2000. Committee on Small Business, Subcommittee on Tax, Finance and Exports. *Helping Small Dry Cleaners Adopt Safer Technology: Without Losing Your Shirt*, 106th Congress, 2nd Session, 20 July.) that the life of a new PCE dry cleaning machine was typically between 8 and 14 years. Staff has adjusted the proposal to allow 15 years for most categories of equipment being replaced.

Regarding property rights, the commentor is most likely referring to the Fifth Amendment of the U.S. Constitution, which provides in relevant part, "nor shall private property be taken for public use, without just compensation." This provision does not limit the right of an agency to abate nuisances or impose lawful air pollution

regulations limiting emissions of air contaminants. To the contrary, courts have held that there is no property right to emit air contaminants.

34. Comment: AQMD should develop much better scientific, safer and practical machines than the ones used for perc for the benefit of the industry.

Response: AQMD encourages the development and commercialization of such equipment through the open market. AQMD is assisting with the demonstration of alternative technologies through the Technology Advancement Office (TAO) programs.

35. Comment: The EPA and International Fabric Institute have determined that dry cleaning is not a high profit business.

Response: Staff understands the financial concerns expressed by small business owners. In fact, the AQMD Small Business Assistance Office is designed to help address these concerns. Additionally, the proposal has been crafted for a long-term transition period for perc machines allowing sources to make plans for replacement technologies. In an independent effort, staff is also proposing a financial incentive grant program to assist sources making an early transition to a non-perc alternative.

36. Comment: Dry cleaners have already spent $25 million to comply with previous regulations and made reductions in perc emissions by 80%, largely through the purchase of new equipment.

Response: It is true that the dry cleaning industry has made significant reductions in perc emissions. The reduction in perc measured in the ambient air between MATES I (1984) and MATES II (1998) was a decrease of 42%, which includes dry cleaners and other sources. In 1998, dry cleaners contributed approximately 60% of the perc emissions from stationary sources. Virtually all perc emissions come from stationary sources. New machines, which have been permitted under Rule 1401 provisions, may pose a lower risk than older machines. A typical perc machine with primary and secondary control systems poses industrial worker (i.e., risk to workers at neighboring workplaces) risks ranging from 15-in-one million to 90-in-one million and up to 140-in-one million for residential exposure. This information on risk was based on estimated perc emissions using results of recent sampling analysis. Moreover, recent sampling done by staff indicates that the emission factors previously used to permit equipment under Rule 1401 were underestimated. As a result, even equipment permitted

under Rule 1401 is likely to pose a more significant risk to public health than previously assumed.

The 1994 ATCM was estimated (by ARB) to cost statewide industry $4,900,000, annualized. The population percentage of dry cleaners for SCAQMD is 46%. Forty-six percent of $4,900,000 is $2,250,000 (annual cost to SCAQMD dry cleaners). This number multiplied by seven for the years since the ATCM was adopted into Rule 1421 in December 1994 is $16,000,000. Since the 1997 amendments were a relaxation of requirements with an associated total cost savings of $3,300,000, the final cost to the dry cleaning industry in the Basin for complying with Rule 1421 is $12,700,000. Sources of information for this calculation are the Final Socioeconomic Assessment for Proposed Amended Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems, May 1997 and CARB's Technical Support Document to the Staff Report Proposed Airborne Toxic Control Measure and Proposed Environmental Training Program for Perchloroethylene Dry Cleaning Operations, August 27, 1993.

37. Comment: The economy is in a downturn and small business should not be asked to take on this new burden.

Response: Staff is sensitive to small business concerns and thus revised the initial proposal to allow more time for the transition to non-perc alternatives. In addition, staff is finding ways to provide financial assistance for facilities choosing to install non-perc alternatives for early compliance with the rule. The new proposal seeks to balance economic issues with the health risk to the surrounding community.

38. Comment: The rule has changed several times and we have been switched from solvents to perc and now back to solvents. We have always complied with the regulations and are now asked to replace our machines again. We are concerned about future regulations.

Response: The alternatives of $CO_2$ and wet cleaning are not processes requiring a Permit to Operate issued by the AQMD nor are they subject to any District rules. The hydrocarbon equipment is subject to Rule 1102 – Dry Cleaners Using Solvent Other Than Perchloroethylene which was last amended November 17, 2000. Further amendments to Rule 1102 are not currently proposed for the District's Air Quality Management Plan. This equipment is also subject to Regulation XIII – New Source Review and BACT.

39. Comment: The AQMD should just let the dry cleaners turnover machines naturally.

Response: The revised proposal allows most machines to operate for at least 15 years before transitioning to non-perc alternatives. This impacts and allows most equipment to operate closer to its projected life.

40. Comment: Dry cleaners are also under a financial burden to comply with requirements for low $NO_x$ emissions from boilers.

Response: AQMD's goal is to provide clean air in the Basin. AQMD staff understands the commentator's concerns. The compliance schedule for Rule 1146.2 – Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers, is staggered based on the age and size of the unit. Many dry cleaners use boilers in the size range defined in this rule as a "Type 1 Unit" with a Rated Gross Heat Input from 75,000 Btu/hr up to and including 400,000 Btu/hr. The rule for this size of the equipment pertains to the manufacturer of the unit not the owner. The owner, when he or she replaces his or her unit, will be purchasing a unit, which meets the $NO_x$ and CO limits of the rule through the manufacturer of compliant units. They are not required to replace their boiler or water heater of this smaller size on any particular schedule. Those operating with larger boilers, in the range of 1,000,000 Btu/hr and 2,000,000 Btu/hr will be required to replace their boiler if it was manufacturer prior to January 1, 2000 and does not meet the $NO_x$ and CO emission limits of the rule. The AQMD Small Business Assistance Office can help small business owners in complying with AQMD regulations.

41. Comment: Why is a closed loop machine with both primary and secondary controls only given an 8-year life? This would pose an economic hardship for a cleaner opening a new store in 2004.

Response: Under the current draft proposal, an existing closed-loop machine with primary and secondary control has at least fifteen years life. A new dry cleaner opening a facility on or after January 1, 2004 would need to purchase an alternative technology non-perc machine. If the perc equipment was purchased in 2003, it could operate for up to fifteen years.

42. Comment: What are the socioeconomic results?

Response: The socioeconomic analysis is being developed and will be available as an attachment to the final Hearing Package. AQMD staff solicited public input early in the rule development process in order to get information related to the draft rule, as well as socioeconomic and environmental impacts. Two contract efforts, the Focus Groups and the work by done by BBC Research and

Consulting, were initiated to help evaluate small business impacts and overall economic impacts.

43. Comment: In the area from Santa Barbara to San Diego County, there are approximately 2,000 Korean dry cleaners, which is about 2/3 of the total 3,200 dry cleaners in Southern California. The growth trend of the industry has deteriorated due mainly to the negative impact of the rule changes.

Response: The South Coast Air Quality Management District is a bit smaller than the area the commentor survey, and has approximately 2,200 permitted dry cleaners. In meetings held with industry, the reasons given for decline in the industry included: casual dress trends, new fabric designs, the changing nature of the economy, customers' and landlords' environmental concerns, and market saturation.

44. Comment: Korean dry cleaners are socially and economically disadvantaged. Sixty-five percent of these dry cleaners are sole proprietorship and have paid substantial expenses as well as investments to comply with often-changed rules for air quality improvements.

Response: Staff understands the concerns expressed and has structured the proposal to minimize economic impacts. The commentator should provide more details about substantial expenses and investments incurred by dry cleaning facilities due to the rule changes. Rule 1421 was adopted in 1994 as part of State ATCM Plan. To date, there has been only one amendment to the rule. The amendment in 1997 removed the requirement for fugitive emission control systems and wastewater separators, reduced training, reporting, and recordkeeping requirements, and extended the allowable leak repair period. The amendment was projected to result in savings compared to the original rule.

45. Comment: An economic impact study was conducted based on eight factors: (a) negative net present value in capital budgeting; (b) negative cash flows; (c) profits margins squeezed; (d) unfairness for the $4^{th}$ and $5^{th}$ generation machines; (e) inefficiency of the proposed machine cost more; (f) deterioration of capital gains accumulation; (g) sunk cost issues; and (h) economic environment issues.

a) Negative net present value in capital budgeting. Based on the capital budgeting approach, the present value of the expected cash flow is insufficient to accommodate the incremental investment. Thereby, the net present value at the opportunity cost of 12%, which is very reasonable in the quality small business investment, would be negative. Therefore, from the economic analysis point of view, the

additional investment to replace the perc machine is not economical. Based on the business risk of this nature under the recent trend, the opportunity cost of the project analysis should be very high. This is a losing proposition.

b) Negative cash flows. The annual cash flows for the business operations with the new machine installation would generate a negative cash flow for the replacement decision. Dun & Bradstreet reports 85% of dry cleaners' monthly revenues are less than $10,000. Annual statement study by Robert Morris Associates indicates that this size of small business' pretax profits is 6.2% (2000-2001). This would then calculate to $620. The monthly payments for a $70,000 hydrocarbon machine would be $1,000 - $1,500/month for a five-year lease. So, the number would be a negative $630. $CO_2$ machines would mean a higher negative cash flow.

c) Profits margin squeezed. Profit margins have deteriorated. The price of service has not been raised to reflect increased costs for labor, supplies, and repair and maintenance (up 4% per year).

d) Unfairness for the $4^{th}$ and $5^{th}$ generation machines. Those installing these machines since October 1998, due to AQMD rule, find it unfair to limit the life usage of the perc machine. These machines last 20 – 30 years. The $5^{th}$ generation is semi-permanent in terms of efficiency and the reduction of the air quality standard.

e) Inefficiency of the proposed machine higher cost. The proposed machines cost more in maintenance as well as operating expenses. The high-pressure vacuum system for hydro machines costs more. Solvents require $2,500 royalty, which is high compared to perc. The fire department requires more strong anti-fire measures. Washing and ironing takes longer. There is substantial evidence of customer complaints and claims. Workers compensation costs would increase.

f) Deterioration of Capital Gains Accumulation. Business value along with goodwill value has been decreased due to the regulation issues in compliance of the rules and uncertainty about the equipment replacement problems. Every time when new regulations become effective (1992 and 1998), the buy and sell transaction of the business is

affected negatively. The goodwill value will continue to drop and affect the living standards of the dry cleaners.

g) Sunk cost issue. AQMD rules and regulations have already contributed a significant loss of return on investment. More than 50% of the existing equipment have been upgraded or replaced for the cost of $35,000 to $60,000. Most stores also spent $5,000 - $10,000 to install carbon absorbers. Also, education expenses and time have been wasted.

h) Economic Environment Issues. The L.A. riots caused a recession from which many Korean stores have still not recovered. The current recession won't allow dry cleaners to generate finances to replace existing machines.

Response: a) The general assumptions underlying the economic impact study were the immediate replacement of perc machines with an alternative (non-perc) machine. However, the proposed amendments allow drycleaners to use existing perc machines for up to 15 years. As a result, many findings presented by the commentator, including the negative net present and negative cash flow values, are not applicable to the proposed amendments. The commentator estimated a negative cash flow of $630 per month due to purchase of a proposed hydrocarbon machine versus a perc machine. This did not account for replacing machines after 15 years of use. The commentator's negative cash flow calculation was based on an incremental capital investment of $70,000 per hydrocarbon machine relative to a perc machine. However, based on the staff estimates, the incremental capital cost of a hydrocarbon machine is only estimated to be about $10,000. As a result, by using the same methodology and assumption as stated by the commentator, (5-year-lease), the monthly payment would be about $200 (interest rate of 4%). Assuming a pretax profit of 6.2% and monthly income of $10,000 as stated, there would be a positive cash flow of $420 [$10,000 x 0.062)-$200].

b) Please see the response to comment #45 (a).

c) Market saturation, competition, and many other factors could have contributed to the reduction in profits margin for this industry. On the other hand, based on the discussions at the public workshops, the reduction in usage of perc, for those using non-perc alternatives, has resulted

in substantial savings to the owners. There are reductions in the cost of hazardous waste hauling, in some cases permit and water discharge fees, and in the case of wet cleaning a reduction in electricity costs. One operation switching to wet cleaning has seen a 48% reduction in electricity use and a 4% reduction on natural gas use. Additionally, for wet cleaning the solvent cost (water) is less than the cost of perc.

d) The life of dry cleaning equipment has been a point of debate throughout the rule development process. Please see comments and responses #7, 29, 33, 39, 40, and 41. The current proposal allows a use for 15 years.

e) Those operators using the alternative technologies have not expressed concerns about increased maintenance costs. While it is true that the Green Earth™ solvent requires an annual royalty of $2,500, this is not true of other hydrocarbon technologies. The cycle times for $CO_2$ dry cleaning method is similar to that of perc because no drying cycle is required (48-50 minutes). The solvent cleaning machines vary in cycle times but most are similar to perc machines, around 45 minutes. Wet cleaning generally takes about 45 minutes from wash through drying not including the finishing time. According to the operators of alternative technologies, they have not noticed an increased incidence of customer complaints. The Los Angeles City Fire Department did not require additional fire precautions for shops using hydrocarbon technologies. Also, staff is not aware of increased workers compensation costs from facilities operating non-perc alternative dry cleaning technologies. Operators using non-perc technologies have not reported such an increase.

f) Staff understands that dry cleaners have made significant reduction in perc emissions in the past. Because of the need to reduce cancer risk, additional requirements are being proposed. The proposal allows a transition period and 15-year equipment use before replacement, which was intended to minimize disruption to the industry.

g) The proposed amendments to Rule 1421 should temper the negative effects of past and future events on drycleaners' ability to comply. For example, replacement of perc machines will not occur until the equipment is 15 years old. Over time, capital accumulation from delayed replacement

technology would improve and bring down the cost of non-perc machines.

h) The extended compliance schedule is designed to mitigate economic impacts to small businesses. The proposal calls for equipment to be used 15 years prior to replacement with a non-perc alternative. Additionally, technology would improve and bring down the cost of non-perc machines.

46. Comment: New perc machines should not be limited because the lack of their manufacture would lead to a lack of parts supply for repairs and this would affect air quality.

Response: Rule 1421 is local in its impact and would not affect the manufacture of perc dry cleaning machines, as they will continue to be sold throughout the world.

47. Comment: The District should apply a rebate system, to compensate for the replacement such as the water conservation equipment and energy saving equipment as did Edison.

Response: Staff proposing a financial incentive program to assist dry cleaners making an early transition to non-perc alternatives. Staff has also been working with Southern California Edison who has such rebates for energy efficient equipment.

48. Comment: Your own studies show there has been a larger change of ownership and less permits to construct between 1991 and 2001, since the ATCM went into effect. The regulations are really affecting the economic world of dry cleaners.

Response: The ATCM (and Rule 1421) were not in effect until 1994. The ATCM has had no effect on the numbers of change of ownership or Permit to Construct applications the AQMD has received. Comparing four years prior to the ATCM (1991-1994) to four years after (1995-1998) showed an increase in activity for Permits to Construct of more than 100% and an increase in Change of Ownership applications of 17%.

49. Comment: The price quotes for equipment you give are not accurate.

Response: The prices were obtained from several distributors of the equipment. Prices vary by model and size of equipment.

50. Comment: The AQMD has been influenced by manufacturers to make this proposal.

Response: The AQMD is proposing this rule to reduce the public's exposure to a toxic air contaminant. The MATES II study identified perc as a key toxic air contaminant creating a health risk in the Basin. The Air Toxics Control Plan called for a 95% reduction in the usage of perc and AQMD has already adopted Rules 1425 - Film Cleaning and Printing Operations, and 1122 - Solvent Degreasers, to reduce perc from these sources. While manufacturers have been contacted for information and some have participated in Working Group meetings, there has not been any pressure from manufacturers regarding this proposal.

51. Comment: Enforcement actions should be focused on unpermitted operations. Leave the legitimate operators alone from further regulations.

Response: Staff will continue to implement enforcement actions to locate unpermitted dry cleaners and bring them into the system to ensure their emissions are properly controlled. These actions are independent of rulemaking efforts. The proposed rule amendments are designed to further reduce residual risk from facilities currently complying with all regulations and requirements.

52. Comment: The rule has requirements for dip tanks and muck cookers and self-service dry cleaners, none of which are used anymore and should be deleted.

Response: Although these equipment are not known to be operated in the Basin at this time, staff has been told by the various dry cleaning associations about the presence of unpermitted dry cleaning establishments. On this basis, the existence of these antiquated equipment is a possibility. Thus, staff has retained the regulatory language precluding the operation of such equipment. Additionally, this equipment is covered by the state ATCM.

53. Comment: The Preliminary Draft Staff Report, Executive Summary page 1 paragraph 2, states that perc was added to Rule 1401 a second time. Why?

Response: The Scientific Review Panel, the state agency charged with determining risk values for toxic air contaminants, works with the determinations for risk on groupings of cancer, chronic and acute. As these determinations are made and finalized by OEHHA, the AQMD changes Rule 1401. Thus, the listing of perc as having acute health impacts was added at a later time for perc because the determination for an acute value was made at a later time than the cancer and chronic values. The addition of an acute value is not expected to change permitting requirements.

54. Comment: The phase-out of perc, as called for in PAR 1421, was not originally proposed in 1994 when Rule 1421 was originally adopted to implement the ATCM.

Response: The commentor is correct. The ATCM focused on equipment and controls. The current proposal was developed to reduce the public's exposure to a toxic air contaminant. At the time (1994), the non-perc alternatives were not commercially available as they are today. Thus, further reductions are now possible. Also, it is in keeping with the Air Toxics Control Plan, which was approved by the Board in 2000. The Air Toxics Control Plan was developed in response to the MATES II air quality monitoring study conducted from April 1998 through March 1999, which found perc emissions still present in the Basin's ambient air.

55. Comment: Perc machine manufacturers should be allowed to make the machines more efficient so that they can continue to be used.

Response: The newest controls for perc machines (fifth generation) were evaluated for emissions profile as part of the rule development process and found to still present a risk to public health.

56. Comment: Any proposed changes should have been discussed with industry beforehand.

Response: Staff has been working with industry for approximately one year prior to holding the first of five Public Workshops/Consultation Meetings. The Working Group, consisting of approximately 20 industry representatives, first met in June 2000 and prior to the first public workshop, met in August and September 2001 and in January, February March, and June of 2002. Also, a Focus Group meeting, which was set in a more informal atmosphere, was held in August 2001 and again in October. In addition, the manager of the rules team attended an evening meeting for the Korean Dry Cleaners-Laundry Association in early September, again prior to the first Public Workshop. Many of these meetings were held in evening hours.

57. Comment: Any grandfather clause pertaining to the dry cleaning industry should be fully respected for the benefit of the industry.

Response: Staff is not aware of any "grandfather clauses" concerning dry cleaners. The proposed amended rule would provide sufficient time to convert to alternative technologies.

58. Comment: The Korean cleaners cannot come to a Friday morning meeting. The Board meeting should be Thursday evening or afternoon.

Response: Staff conveyed this request to the Governing Board. (Subsequent to this comment being made, KDLA has indicated that a regularly scheduled meeting would be acceptable to them.)

Comments on the proposed amendments to Rule 1421 – Control of Perchloroethylene Emissions from Dry Cleaning Systems, were received at the Public Consultation Meetings held March 27, April 10, and September 4, 2002 and in writing during the comment period ending September 19, 2002. Following are summaries of the comments received and staff responses for comments that are different from previous comments.

1. Comment: I urge you to adopt an accelerated phase-out of perc in dry cleaning and protect public health. The ten-year phase-out is too long considering the technology is already available.

   Response: The staff proposal calls for perc equipment to be replaced as it reaches 15 years old. There are also additional maintenance requirements to reduce perc emissions while the transition is taking place. Staff is also proposing in a separate item for the Governing Board consideration, a financial incentive grant program to accelerate the transition to non-perc alternatives. Staff believes the proposal strikes a workable balance between small business interests and protecting public health.

2. Comment: Is it true that OSHA has recently removed perc from its list of chemicals to amend its rules?

   Response: No. The OSHA concentration limit for perc is 50 ppm for short-term exposure (STEL) and 200 ppm for 8 hours exposure (TWA), based on American Conference of Governmental Industrial Hygienists (1986-1987). Perc is listed the American Governmental Industrial Hygienists book of 2001 as A3, an animal carcinogen and not yet proven as a human carcinogen.

3. Comment: Hazardous waste from dry cleaners includes perc so that should be deducted from emissions.

   Response: The calculation for the percent of perc emitted accounts for the perc that is recycled through waste.

4. Comment: The limitation of perc to 10 gallons per machine is unfair and is controlling a business' growth and potential income and potential income.

   Response: AQMD staff has not formally introduced a perc usage limitation as part of the proposed amended Rule 1421. Rule 1401 does limit perc usage to approximately 7 gals/month for newly permitted equipment in an attempt to limit the risk from such a machine to 10-in-one-million. However, in light of new information obtained through recent District sampling analyses, the District will be reviewing procedures used in permitting dry cleaning equipment pursuant to Rule 1401. This could result in further reduced perc

demonstrates that relying on usage to control risks is not effective and may limit business growth.

5. Comment: Eliminate converted machines.

   Response: The proposal calls for the elimination of converted machines by July 1, 2004.

6. Comment: All machines should have primary and secondary controls.

   Response: The machines with primary and secondary controls create a risk in the range of 15 to 90-in-one-million at a commercial location and 24 to 137-in-one-million at a residential location, 25 meter from the dry cleaners. These risk numbers may underestimate risk in some cases since many dry cleaners are located closer than 25 meters to their nearest residence or business. This would result in higher risk. The proposal calls for perc machines to be replaced with non-perc alternatives as they are replaced, not to exceed 15 years.

7. Comment: Maintenance should be required to minimize emissions.

   Response: The proposal calls for additional maintenance to reduce perc emissions while sources are transitioning to non-perc alternatives.

8. Comment: Relocated perc machines should not be subject to adding secondary controls.

   Response: Rule 1401 applies to new and relocated equipment. It had previously been estimated that perc machines with primary and secondary controls with a gallon usage limit could meet the 10-in-one-million risk level of Rule 1401 assuming only 15% of the perc consumption was emitted. This assumption was based on the study conducted by an AQMD contractor to identify and/or develop additional ways to monitor and reduce perc emissions and to simplify, reduce or eliminated costly monitoring by dry cleaning operators. Fifteen percent (15%) was the average of perc emitted as a result of testing conducted on two perc machines in the Bay Area. However, Rule 1401 permitting procedures will be reviewed in light of sampling analyses recently completed by the staff which showed approximately 50% of perc consumed was emitted. The new results will reduce the allowable perc consumption currently available to dry cleaners. The results of this sampling effort are presented in Appendix D. Currently, relocated perc machines with primary controls are required to install secondary controls when relocated. Perc emissions can have a localized health impact and thus should be controlled to the

9. Comment: International Fabricare Institute provided staff with a number of informational items concerning dry cleaning equipment and its operation such as: a typical dry cleaner processing 50,000 lbs. of clothes would recycle about 100 to 130 gallons of perc via solid and liquid wastes; 28 pounds of distillation residue is generated per 1,000 pounds of garments cleaned; the residue contains 50-60 percent perc; 14-17 pounds of perc per 1,000 pounds of clothes is lost to the still residue; total perc lost in waste (for 50,000 pounds of clothes cleaned) is 100-130 gals for cartridge filtration and 50-65 for spin disk filters.

Response: Staff appreciates the submittal of the information and analyzed it in light of the sampling and testing efforts conducted during the summer months. The calculations presented raise questions. If 28 lbs. of residue is generated per 1,000 pounds of garments cleaned, then 1,400 lbs. of residue are generated for 50,000 lbs. of garments cleaned. If the residue contains 50-60% perc (or 14-17 lbs.), then the amount of perc recovered from the residue would be 52 - 63 gallons. If a standard-sized cartridge contains 14-18 pounds of perc (ave. 16 lbs. or 1.2 gals) per 1,000 lbs. of garment, then 52 to 67 gallons of perc is lost from one filter for cleaning 50,000 lbs. of clothes. A typical dry cleaning machine has 2-3 filters. For a machine with 2 cartridge filters, the annual perc loss would be 104 to 133 gallons. As such, the total perc recycled via liquid and solid wastes would be 156 to 196 gallons annually. Therefore, the calculations do not support what is stated to be fact. If we assumed 100% of perc used is recovered through waste, using your numbers as indicated in the comment letter, a typical dry cleaning machine with cartridge filters should have a mileage of 255 to 320 lbs. of clothes cleaned per one gallon of perc. Furthermore, staff has obtained numerous waste manifest records with the sampling data that has been collect and the number of filters recommended to be recycled is not reflected in these documents. Either the records the operators are maintaining do not include the actual number of filters recycled or their maintenance schedule for filter replacement is not following the recommended practice.

10. Comment: There is an issue with the timing of the rule and how quickly we can change out our equipment.

Response: The proposed rule's effective date for the first required change in equipment for those reaching a 15-year life is July 2004. That would be 21 months from the date of adoption. Some equipment will be allowed to operate until 2019.

11. Comment: The values you list for the cost of new machines should include

Response: Staff has included installation costs as part of their analysis.

12. Comment: EPA will not give funding for the conversion of perc machines to non-perc alternatives.

Response: Staff submitted the proposal for funding spring of 2002 and should know the outcome of this request when the federal budget is finalized in late fall.

13. Comment: The AQMD cannot legally limit perc usage in a permit because that in effect limits production.

Response: The District currently has the legal authority to limit perc usage under existing District regulations, as well as state and federal requirements. For new source review, monthly usage limits are issued in many cases to ensure the cancer risk stays below the requirements of Rule 1401. However, in lieu of limiting perc usage or other reasonable ways to demonstrate compliance, AQMD staff would be required to deny the permit application.

14. Comment: The proposal will limit my ability to expand my business by moving to a larger location.

Response: The proposal does not regulate this move but may require use of non-perc alternatives. In addition, regardless of this proposal, the move is subject current Rule 1401 – New Source Review of Toxic Air Contaminants. Rule 1401 governs emissions from new, relocated and modified equipment. The equipment would have to meet a cancer risk level of 10-in-one-million provided T-BACT is used. Perc limits are often required to make sure the risk thresholds are not exceeded.

15. Comment: I recently purchased a business and knew nothing of these proposed changes. What are my legal rights?

Response: This is not an area that staff can advise a business owner on.

16. Comment: Will I be compensated for down time when I install a new non-perc alternative?

Response: The requirement for installation of non-perc equipment is effective when the perc equipment is replaced, not to exceed 15 years. Staff assumes that the owner would need to replace the equipment at that time regardless of the rule. The installation of non-perc equipment would also require the same approaches to move the equipment into the shop. Additionally, installers have assured staff that the installation of non-perc alternatives does not involve any

17. Comment: When will the socioeconomic report be available?

Response: The socioeconomic report will be available 30 days prior to the public hearing and earlier if possible.

18. Comment: 5th generation machines reduce the amount of perc used by 75% compared to 4th generation machines.

Response: No data has been provided to support the 75% reduction stated. There is an improvement in emissions between 4th and 5th generation machines. The information staff has obtained from equipment distributors indicates that the maximum reduction that can be achieved is 40%. Although the percent control of 4th and 5th generation machines is not great, 5th generation machines generally use less solvent. Testing done has confirmed that even the latest technology perc machines result in cancer risks to the neighboring community above the Rule 1402 levels with typical perc usage.

19. Comment: Why were only 485 businesses analyzed in the socioeconomic presentation table showing length of time in business?

Response: The data analysis was based on permits that had a change of operator. There were 485 businesses with change of operator in the database between 1997 and 2001.

20. Comment: Hydrocarbon machines cost twice as much as perc machines.

Response: Please refer to Comments and Responses for numbers 45 and 49. There is a range of difference in cost of machines. The cost depends on the size of machine, the model and make. Staff obtained data from 6 equipment distributors. The range given in the staff report for perc machines was $30,000 to $50,000. The range for hydrocarbon machines was $40,000 to $100,000 (averaging $45,000 - $70,000). Staff is aware of one manufacturer for which their hydrocarbon machine is twice the cost of their perc machine. However, for the majority of equipment, the typical cost difference is approximately $10,000.

21. Comment: The cost increases when you switch to hydrocarbon not just for the machine but for gas, electricity, and water usage because the cycle time is longer for hydrocarbon machines.

Response: The older hydrocarbon machines had longer cycle times but the newer machines are comparable to perc in cycle time. Only one manufacturer has told staff that they recommend “sizing up” when changing from perc to hydrocarbon. Many other manufacturers say this is no longer necessary.

22. Comment: The staff report makes a statement that miniscule amounts of perc can cause an exceedance of the standards at wastewater treatment plants. However, dry cleaners are prohibited from discharging wastewater-containing perc and water treatment techniques can readily remove small quantities of the solvent. The EPA's National Drinking Water Contaminant Occurrence Database reports that detectable levels of perc have been reported in only eight of 83 public water systems in Los Angeles and Orange counties since 1993. Only three of the eight systems reported perc levels in excess of the drinking water standard, although it is not clear whether they represent measurements prior to/or after treatment.

Response: The proposed rule focuses on air-related impacts, not groundwater. Although dry cleaners are prohibited from discharging perc-laden water into the sewer system, illegal discharges of perc -containing wastewater from dry cleaners may occur. Contamination of 3 of 83 public water systems in excess of the water standard, or 4% of surveyed systems, poses a threat to the integrity of water supplies in Southern California. However, regardless of the incidence of groundwater contamination, wastewater treatments plants in the South Coast Air Basin are legally bound to meet discharge limitations, such as the 5 parts per billion standard set on treatment plants that produce reclaimed water.

23. Comment: According to the MATES II report, perc contributes only 0.8% to the estimated cancer risk in the Basin from all sources, and about 6% from all stationary sources. At the time of the MATES II final report, the AQMD estimated perc emissions from dry cleaners totaled 16,000 pounds (8 tons) per day. That is more than twice the AQMD's current estimate.

Response: The MATES II report specifies the regional impact. PAR 1421, however, also considers localized impact. In MATES II, the total perc emissions from dry cleaners were based on the total amount of perc solvent purchased. The staff report has been changed to clarify that the 6% value relates to stationary sources. As part of rule making effort, the inventory of perc from dry cleaners has undergone major refinement. The value appearing in this report more accurately reflects the true inventory. Moreover, perc emissions from dry cleaners continues to attribute to the regional cancer risk associated with toxic air contaminants, and also represents localized risk which exceeds that established in Rule 1402.

24. Comment: The range of risk presented in the staff report for primary and

estimates and the facilities participating, although chosen to be representative of the Basin's cleaners, cannot be used as a basis for estimating perc usage. The staff report acknowledges the survey may have significant flaws (Appendix D). The 50% emission assumption contrasts with industry estimates of 10-40% (depending on the equipment and filtration type) and with data developed under contract to AQMD.

Response: Staff has acknowledged limitations in the information presented in the report. A characterization of significant "flaws" is not shared by AQMD staff. The 50% value is based on measured and surveyed data. Staff believes this data to be statistically representative of industry-wide emissions. This is in contrast with industry estimates (no supporting data was provided) and the very limited data (two perc machines in the Bay Area) developed under a previous contract to AQMD.

25. Comment: The staff report states that even the newest perc machines would most likely not meet Rule 1402 action level and the Rule 1401 limits. Compliance with Rule 1401 is not relevant for existing sources wishing to replace their equipment with a same size machine. Based on the AQMD's analysis, cleaners using 48 gallons/year can meet the action-level of Rule 1402 (page 1-25 of draft Staff Report). With the reductions in perc consumption demonstrated with the installation of new technology, we believe most dry cleaners would not need to use more than 48 gals/yr.

Response: The comment is correct that replacements are not subject to Rule 1401 unless there is an increase in emissions. Emission estimates have been revised since the draft staff report. The 45 gallons per year usage would result in cancer risk of 25 in-one-million, which would be difficult for most cleaners to meet. This would constrain normal business operation or growth of a cleaner. More importantly, the goal of the rule is not to meet 25 in-one-million, but to reduce toxic emissions based on technically and economically feasible approaches. Since there are viable alternatives, staff is recommending the transition to non-perc equipment rather than low usage levels for some cleaners. Previously, industry proposed and withdrew a proposal to limit perc usage to keep small facilities below 25 in-one-million.

26. Comment: Wet cleaning is used widely in Europe but as a complement to perc. Even in Germany and New York, which have implemented stringent dry cleaning regulations, the number of dedicated wet cleaners is small and has not grown. The staff report states there are 10 dedicated cleaners in the Basin, six of which have received

several wet cleaners opened in the Basin in recent years but have closed or switched to a solvent-based process.

Response: The information staff has from Satec and Böwe, Germany companies, is that wet cleaning is used in Europe with hydrocarbon solvent cleaning. (See Response to Comment #49 [this section]) on hydrocarbon versus perc machines in Germany). According to staff at Urban & Environmental Policy Institute, Occidental College, who have been heading the wet cleaning demonstration project, there have been three wet cleaners in the Basin that opened as new cleaners that have since closed. However, all were new to the industry and had no background in cleaning garments. Additionally, these business were opened in the mid-90's and today there is a support system for those entering the wet cleaning technology market. There is one wet cleaner that has added a solvent machine to the business but still uses wet cleaning. The wet cleaning demonstration sites that have received financial assistance have remained viable in their businesses, as have the four who have not had funding.

27. Comment: The claim that switching to wet cleaning can actually save the operator money does not consider the higher labor costs. The data on energy savings is for one facility and contrasts with EPA's Office of Pollution Prevention and Toxics which conducted a multi-year study of wet cleaning. According to the 1998 study, wet cleaning systems consume considerably more energy than perc-based systems. The study shows the following:

| | Perc with primary only | Perc with primary & secondary | Wet cleaning |
|---|---|---|---|
| Annual Cost | $136 | $186 | $788 |
| $/kWh | $0.0764 | $0.0764 | $0.0764 |
| Annual Use | 1,780 kWh | 2,434 kWh | 10,314 kWh |

Response: The wet cleaners in AQMD's demonstration project have not seen an increase in labor time associated with the change to wet cleaning, although staff is aware that some wet cleaners have noted that some garments take longer to finish. The energy data provided in the Staff Report is based on actual data, before and after the switch monitored by the utilities. The EPA data was not based on overall energy use and was based on manufacturer energy specifications rather than actual data.

28. Comment: The AQMD has not yet provided the public with an opportunity to comment on the results and assumptions of the socioeconomic analysis. A summary of the analysis provided at the September 4, 2002 Public Consultation Meeting indicated the impact of the proposal would total $65 million, $4.3/million/year over 15 years.

Response: The socioeconomic report will be available to the public 30 days prior to the Public Hearing, or earlier if possible.

29. Comment: The Staff Report states wet cleaning may increase water usage, but not significantly. Based on manufacturer information, EPA estimated wet cleaning machine uses an average of 3.5 gallons of water per pound of clothes cleaned. At this rate, EPA calculated a cleaner processing 53,333 pounds of clothes annually would use 186,000 gallons of water, or 750 gal/day, more than a perc cleaner processing the same amount. Assuming 2,200 dry cleaners in the Basin switch to wet cleaning, the increase in water usage would total over 410 million gallons annually or 1.6 million gals/day. This would represent a significant increase in wastewater and place a significant demand on waste-water treatment facilities.

Response: The commentator's estimate of increased water demand resulting from implementing PAR 1421 does not take into account existing water usage at perc dry cleaning facilities. The appropriate analysis is to estimate the incremental increase in water usage at affected facilities from current usage levels. As a result, the commentator's estimate of increased water demand substantially overestimates anticipated increases in water demand if all facilities switched from perc to wet cleaning methods.

The Revised Draft EA contains a comprehensive analysis of the incremental increase in water demand if all dry cleaners in the district switch to wet cleaning. The analysis relies on actual usage data from the University of California, Los Angeles (UCLA)/Occidental College study, "An Assessment of Factors Influencing a Switch from Dry Cleaning to Professional Wet Cleaning" (Pollution Prevention Education and Research Center, February 29, 2000). According to this study, wet cleaning uses approximately 1.77 times more water than perc-based dry cleaning. The study relied on water use data from newer machines with primary and secondary control and not older equipment. The study indicated that in 1997 average water use per perc dry cleaning facility was 125,714 gallons per year. As a result, switching to wet cleaning would be expected to result in an incremental increase in water demand at an average wet cleaning facility of approximately 223,333 gallons per year. Total annual water use from dry

was 264 million gallons. As a "worst-case" scenario, if all existing permitted dry cleaning facilities switched to wet cleaning, the expected annual incremental increase in water demand would be 469 million gallons per year. The resulting incremental increase for a five-day workweek would be 788,462 gallons per day. This is less than the SCAQMD's water demand significance threshold of five million gallons per day. Therefore, increased water demand impacts are not significant. Based on information in the Revised Draft EA, there are sufficient water supplies available to serve the proposed project from existing entitlements and resources in the future, even during periods of critical drought.

30. Comment: The staff report states that a switch to the highest VOC-content solvent is unlikely considering its market share and the availability of other alternatives. None of the non-perc technologies discussed has a significant share of the current dry cleaning market.

Response: Although perc is the predominant solvent used by dry cleaners, hydrocarbon cleaning is second and one particular solvent (DF-2000) which does not possess the highest VOC-content has about 75% of the market share in the Basin for non-perc technologies. Green Earth™ has approximately 25% of the market share with $CO_2$ and wet representing less than 1% of Basin cleaners. The highest VOC-content solvent (propylene glycol ether [7.3 lbs./gal]) is not currently used in the Basin.

31. Comment: The staff report states that a more likely scenario would result in an average increase of VOC emissions of 0.08 tons per day in 2006, 0.19 tons per day in 2010, and 0.41 tons per day in 2018. This information is inconsistent with data presented elsewhere in the Staff Report (Appendix D) or the revised EA. It is presented without the underlying assumptions used in making the estimates.

Response: Staff revised the staff report to reflect the values stated in Appendix D and the draft EA. The above values stated (0.08 in 2006, 0.19 in 2010, and 0.41 in 2018) was based on the actual usage of 5.28 gallons per month, the VOC content of 6.4 lb/gal (for DF-2000), and 365 days per year. Using the actual facility's operating schedule of 264 days per year as opposed to 365 days per year, the average VOC emission increases are 0.11 in 2006, 0.26 in 2010, and 0.57 in 2018. This is consistent with Appendix D in the staff report and draft EA.

32. Comment: The Staff Report fails to discuss the basis for the previous assumption about perc emissions used for reviewing Rule 1401 permits. According to conversations with staff, the previous assumptions were based on sampling analysis conducted by an

why this previous data was discarded in light of the latest survey. As indicated earlier, the installation of new perc equipment means less perc used. Perc consumption is reduced by 45% with the installation of primary and secondary controls with spin-disk filtration. Most cleaners would comply with the Rule 1402 limits, based on the AQMD's analysis.

Response: The commentor is referred to Responses to Comments #8 and #24 (of this section).

33. Comment: The staff report states: "The practical application of the new approach is that the calculated risk from dry cleaners (and all facilities) whose emissions follow the inhalation pathway, would be greater by about 30 percent. This would result in even more stringent usage limits under Rule 1401." The 2002 public review draft of the Air Toxics Program Risk Assessment Guidelines and supporting documentation developed by OEHHA suggest a tiered approach to conducting risk assessments, including estimates of natural variability in exposure based on variability in breathing rates and other parameters. According to the OEHHA draft, "[t]he result of such an analysis is a range of risks that at least partially characterizes variability in exposure….[that] allows the risk manager an estimate of the percentage of the population at various risk levels."

Response: This information is presented to inform readers of changes to the calculation methodology for cancer risk that OEHHA will be finalizing. It is correct that the new method includes several scenarios that can be calculated. Based on using the existing 70 year exposure model, risk would be approximately 25-30% higher for all risk calculations. The AQMD intends to update its Risk Assessment Procedures in the near future relative to OEHHA's new Air Toxics Program Risk Assessment Guidelines.

34. Comment: The conclusion that new perc technology still presents a significant risk to the Basin assumes a higher use of perc than actual values. Assuming a 50% emission rate, although the actual is lower, many cleaners would not present a risk in excess of Rule 1402 levels.

Response: Even with using 1.5 gallon per month of perc, a dry cleaning facility with a brand new machine would create cancer risk of more than 10 in-one-million at a commercial location 25 meters from the facility. This risk would be as much as 15 in one-million at residential location with the same distance. However, the goal of the rule is not to meet 10 or 25 in-one-million, but to reduce toxic emissions based on technically and economically feasible approaches. There are viable alternatives with no cancer risk.

35. Comment: The MATES II inventory significantly overestimates perc emissions. Based on the cancer risk estimates in the Air Toxics Control Plan, perc contributes 4% of the theoretical cancer risk from monitored contaminants other than diesel particulate. The dry cleaning industry likely contributes only about half.

Response: The MATES II study was based on 1998 emissions inventory information. If one were to consider the share of dry cleaners emissions to the perc inventory in January 2003, one would find they contribute approximately 90% or more. As of that date, degreasers (31% contribution) will not be using perc unless controlled in an airless airtight system; film cleaners (2% contribution) will have decreased their emissions by 85% and the remaining area source contributors only account for 8% of the total share of perc emissions.

36. Comment: The Air Toxic Control Plan was developed as a planning document for "possible future action" and is not legally binding and was not subject to review under CEQA.

Response: The staff is aware of that the Air Toxic Control Plan is only a planning document and is not being considered as legally binding. Each rule developed by AQMD staff goes through a CEQA analysis.

37. Comment: The staff report quotes a NY study. Several neurobehavioral studies of perc exposure have found no effects. Although some investigations have purported to document neurobehavioral systems, these studies suffer from methodological and design difficulties that prohibit reasonable confidence in the reported findings. These difficulties include selection, experimenter, and statistical bias.

Response: Recent studies by Altmann et al. 1995, and Schreiber et al., 2002, report similar findings of effects of relatively low level perc exposure among non-occupationally exposed people living near dry cleaning facilities. Altmann et al. used neurophysiological and neurobehavioral techniques to assess the neurological effects of long-term exposure to perc. Subjects were selected using suitable scientific criteria and were given medical examinations to exclude subjects with various medical conditions. Schreiber et al. study used visual assessment techniques to assess neurological function in the visual system to assess the neurological effects of long-term exposure to perc. Subjects were selected using suitable scientific criteria and were screened for visual acuity. Both studies employed methodologies which are not subject to investigator bias (non-subjective tests) and utilized non-occupationally exposed

study subjects who were selected in an unbiased and scientific manner.

38. Comment: The unit risk factor range for EPA that is currently under review ($4.8 \times 10^{-8}$ to $1.0 \times 10^{-6}$ per $\mu g/m^3$) is significantly less than the unit risk factor employed by the AQMD in determining the need to revise Rule 1421.

Response: The AQMD Governing Board has historically supported using risk factors developed by OEHHA. The AQMD utilized the factor of $5.9 \times 10^{-6}$ per $ug/m^3$ developed by OEHHA. It should be noted that this factor is within the range currently under review by EPA.

39. Comment: The discussion of agency rankings of perc as a carcinogen fails to recognize the classification of A3 – Confirmed Animal Carcinogen with Unknown Relevance to Human, given perc by the American Conference of Governmental Industrial Hygienists.

Response: Table 1 – Classification of Perc by Different Organizations, was not an exhaustive list of groups with classifications of perc's toxicity but did list major agencies. This ranking was recognized in Response to Comment # 2 (this section).

40. Comment: The measurements taken by NY State Department of Health (NYSDOH) are not representative of perc levels in apartments and other spaces adjacent to dry cleaning. They represent a small sample, chosen after tenants filed an odor complaint.

Response: The indoor air measurements taken by the NYSDOH were collected in second floor residences in buildings with operating perc dry cleaners in the Albany, Schenectady and Troy, NY (Tri-cities) area. The buildings were located by NYSDOH staff after surveying these areas, and determining whether the residential apartments in the building were occupied. None of the residences was investigated due to complaints. The buildings where the indoor air samples were collected account for all co-located buildings in the Tri-cities area with operating perc dry cleaning facilities with occupied residential apartments at the time the study was conducted.

41. Comment: The Staff Report states that perc is one of six key toxic air contaminants in the MATES II study but failed to identify diesel particulates which are estimated to contribute 72% of the theoretical cancer risk. Even if the reference is to stationary sources, it fails to mention three other contaminants identified in MATES II, particulate matter, ethylene dibromide, and vinyl chloride, whose emissions from stationary sources were estimated

to contribute more to the overall theoretical risk than that estimated for perc.

Response: Perc was detected in the ambient air during the MATES II study. The purpose of MATES II was to look at an overall impact to the region of a number of toxic air contaminants. The Staff Report discusses diesel particulates' contribution to the overall toxic risk on page 1-4. Particulate matter emissions are controlled through the implementation of the 1997 AQMP. Ethylene dibromide and vinyl chloride are from sources included in the AB 2588 program and are controlled through Rule 1402.

42. Comment: The MATES II Final Report states perc emissions in 1990 were at a concentration level around 0.5 ppb and in 1997 around 0.25 ppb. According to the ARB, perc levels in monitoring sites in the Basin have continued to drop since 1997. The average level in 2000 according to the ARB, 2002 California Almanac of Emissions and Air Quality, Table 16 (page 452) was 0.21 ppb.

Response: Staff agrees that the amount of perc in the ambient air has declined. Localized risks around dry cleaners are still of concern.

43. Comment: The Staff Report states that risk numbers may underestimate risk in some cases but are based on more realistic numbers. The unit risk factor developed by OEHHA and used by the AQMD for estimating cancer risk is a theoretical upper bound value. The AQMD analysis overestimates consumption after installation of new equipment and the percent emitted. Thus, risk is greatly overstated.

Response: As stated in Response to Comment #38 (this section), the AQMD staff relies on the expertise of OEHHA to develop unit risk factors. Staff does not agree that the consumption rate is over estimated. The consumption rate is based on actual measurements and survey data. The staff has confidence that the sampling/testing/analysis effort done during rule development is statistically sound.

44. Comment: The Staff Report states that many cleaners are located closer than 25 meters to their nearest residence or business. This data has not been collected by the AQMD.

Response: This has been discussed in Working Group meetings and has not been disagreed with. Inspectors and rule development staff have personally observed the placement of most dry cleaning facilities closer than 25 meters to their nearest receptor. Due to the need to be conveniently located for customers, dry cleaners are often located in strip malls or neighborhood communities

45. Comment: The Staff Report states that risk numbers are based on estimated actual emissions that are lower than the facility's potential to emit. The references to "potential to emit" are inappropriate. To our knowledge, the AQMD has always used an estimate of actual emissions, based on solvent consumption, for permitting new and existing dry cleaning equipment.

Response: For VOCs, the potential to emit (PTE) is used in permitting dry cleaning equipment. For perc, in the past, staff gave the facility operator their requested usage for and the operator would generally ask for an amount higher than their needs, to allow for a comfort zone for future growth. Currently, perc equipment is permitted at the 1401 risk level and sources must operate below that to be in compliance.

46. Comment: The Staff Report notes the Dow Chemical stated 40% of perc was emitted. The information submitted by Janet Hickman of Dow Chemical, indicated the emissions of perc machines with primary and secondary controls were estimated to be 40% of total consumption when using disc, rather than cartridge filtration. Switching to disc filtration eliminates the amount of perc lost to filter waste and significantly reduces overall consumption. This information is based on several German and Italian equipment manufacturers. In providing this information, we noted the new perc machines include disc filters as their sole or primary filtration medium. Staff has failed to recognize this overall drop in consumption with new equipment and thus overestimated perc consumption in the Basin.

Response: The AQMD staff recalls the meeting with Janet Hickman on November 8, 2001 and appreciates the material submitted at that time. At that meeting, Ms. Hickman stated the 40% emission value did not come from testing but from her experience. The commentor has noted that Ms. Hickman stated 40% emissions are associated with disc filter equipment and then has gone on to indicate this filtration system reduces emissions, indicating those with cartridge system would emit greater than 40%. Ms. Hickman's information, however, is lower with respect to the emission rate than has been shown based on staff's recent testing of actual perc equipment within the Basin. Staff has confidence that its sampling data reflects an accurate average emission rate within the Basin. Moreover, even at 40% emitted the risk is still above the Rule 1402 action level for most dry cleaners. The amount of consumption was based on actual records produced by the dry cleaners sampled for the testing and analysis project. See Response to Comment #25 (first section) for a discussion of perc

German and Italian manufacturers but staff will review the information as soon as it is submitted.

47. Comment: As indicated above consumption for machines with cartridge filters is greater and the solvent mileage for these machines is lower. The mileage in the Staff Report of 700-1,000 lbs. of clothes cleaned per one gallon of perc used is based on spin disc filtration.

Response: The mileage was calculated from actual usage and process records supplied by the dry cleaners surveyed in the testing and analysis project. Some of this equipment had spin filter and some had disc filters. Filter disposal was taken into account in the calculations.

48. Comment: The levels of water standard reported to the AQMD reflect measurement prior to treatment and do not violate the federal standards. We are unaware of any need to lower the discharge standards for wastewater treatment plants in southern California. The EPA indicated it did not plan to include perc as part of its current effort to update federal drinking water standards. It is unlikely that the perc standard will be reviewed for several years.

Response: According to Los Angeles County Sanitation staff, installation of advanced treatment equipment to remove trace amounts of solvent at a publicly owned treatment works (POTW) would be extremely costly. It is much more cost-effective and reasonable for POTWs to reduce solvent discharges at their source. It does not make sense to install and operate millions of dollars worth of treatment equipment to mitigate the discharges from those businesses that pollute.

Regarding the EPA action, the commentor is referring to standards imposed on drinking water, not wastewater discharges. In addition to meeting drinking water standards on any reclaimed water that is produced, POTWs must meet discharge standards on wastewater that is discharged from their plants to surface-water bodies such as rivers. On Thursday, May 18, 2000 the USEPA issued water quality standards for toxic pollutants for the State of California. These lower standards generally apply to all surface water bodies within California. They established a standard of 0.8 parts per billion perchloroethylene for water bodies that are current or potential drinking water sources. As the rivers in southern California are generally dry in the summer without POTW discharges, the rivers are considered to be effluent-dominated water bodies and thus in-stream limitations are applied as end-of-pipe limits to POTWs. The Los Angeles Regional Water Quality Control Board, whose job it is to set discharge limitations for POTWs, has taken the position that all inland surface waters in the

Los Angeles area are potential drinking water sources, so the 0.8 parts per billion limit should apply to POTWs that discharge to them. Due to litigation, the Los Angeles Regional Water Quality Control Board is currently not allowed to set limits on Los Angeles area POTWs based on the potential drinking water source designation, but this may change in the future.

49. Comment: The Staff Report states that in Germany, which has stringent control on perc, 99% of all new machines purchased are solvent machines. According to Böwe, perc machines composed 50% of the new machines purchased in Germany in 2001. Information from the International Committee of Textile Care estimated 4,700 perc machines operating in Germany in 2000.

Response: This new information is not consistent with information given to staff. Staff's information was supplied by a representative of Satec who stated the information came from the Hohenstein research group. He also stated that in the early 1990's there were between 8,000 and 10,000 dry cleaners. Now there are only 3,500 and there is no growth in the industry. Böwe has been in Germany since 1946. A Böwe representative told staff (phone conversation 9/20/2002) that very few perc machines are sold in Germany today. The hydrocarbon machines are their top selling machines in the world market. Böwe has seven to ten percent market share in the U.S. and in Germany approximately 70%. Staff requests the commentor provide documentation of the information received.

50. Comment: The Staff Report lists Stoddard solvent as a non-perc solvent available to dry cleaners. This solvent is not an option because of flammability.

Response: Staff agrees with the commentor. The Staff Report goes on to state: "Stoddard solvent was broadly used in the past but has been phased out due to its flammability, with only five facilities currently using the older solvents such as Stoddard and LPA-142. These older solvents are used in transfer machines which are to be phased out of usage under Rule 1102 – Petroleum Solvent Dry Cleaners, no later than January 1, 2003."

51. Comment: IFI's September 2002 publication Research Fellowship found GreenEarth™ solvent to be significantly less effective than perc at removing oils and grease.

Response: The Staff Report is quoting from the front page of the Research Fellowship publication No.F-47, mid-page in italic, bold print that reads: "Based on our overall evaluation, IFI's findings are that

industry, and while different in some respects, is comparable to a perc dry cleaning process."

52. Comment: The Staff Report states that General Electric, the distributing and manufacturer of GreenEarth®, claims these solvents pose little environmental risk. In a 1999 review of GreenEarth® (decamethylcyclopentasiloxane, D5), OEHHA notes that the bioconcentration factor of the substance was 5000, and it had been found in more than half the samples of adipose tissue investigated in a national survey. In a recent meeting of the Binational Toxics Strategy stakeholder group, the National Water Research Institute of Environment Canada listed the low molecular weight cyclic siloxanes (include D5) as emerging chemicals of concern because of their relatively high toxicity to aquatic organisms, significant potential to bioacculumulate, and potential to undergo long range transport.

Response: Staff has been in direct contact with GE representatives on the Green Earth® (D5) testing results. Based on the information provided by GE, it is staff's understanding that the preliminary tests show minimal impacts. The final report has not yet been released. Staff is aware of the OEHHA review. The levels of D5 found in humans are likely the result of exposure to D5 contained in cosmetics and other consumer products. Staff is following the studies on the potential toxicity of the perc alternatives and will evaluate any new information for their implication on AQMD rules. Also, staff has asked the commentor to forward any information on aquatic toxicity that he may have.

53. Comment: Solvents with KB values lower than perc will be less effective at removing oil and grease stains. This will result in more spotting needed.

Response: Working Group participants stated that perc can be too aggressive in cleaning delicate fabrics and although pre-and post-spotting may be required for some cleaning methods, pre-spotting is also required for perc cleaning. According to proponents of non-perc alternative cleaning methods, proper training should result in acceptable effectiveness at removing oil and grease stains.

54. Comment: According to the patent submitted by Niran Technologies, the PureDry solvent contains a hydrocarbon solvent blend with small quantities of perfluorocarbon (PFCs) and hydrofluoroethers (HFEs). The PFCs and HFEs are included in the mixture to suppress the flash point of the hydrocarbon. PFCs have been identified by EPA as having significant global warming potential, 6,500 to 9,200 times that of $CO_2$

Response: The amount of these substances found in dry cleaning is very small, the more significant contributors would be from the production aluminum and semi-conductors. Staff would review any document provided by the commentor and make recommendations as needed.

55. Comment: The operational temperature of hydrocarbon machines is dependent on the particular design. According to the National Fire Protection Association standard for dry cleaning plants, cleaners may avoid the need to install automatic sprinkler systems for the use of Class IIIA and IIIB solvents if storage does not exceed 330 gallons and the machines are equipped with: restriction of oxygen concentrations to less than 8% by volume, limitation of solvent temperature to less than $30^0$ F below the flash point, limitation of solvent vapor concentration to 25% LEL, or incorporation of integral automatic fire extinguishing systems. The NFPA 32 specifies that dry cleaning machines with distillation must include approved electrical components and wiring if the solvent is ordinarily heated to greater than $30^0$ F below the flash point.

Response: The new hydrocarbon dry cleaning equipment is designed to reduce the temperature of the solvent by refrigeration. Temperature monitoring on the machines also reduces the possibility of reaching the solvent's flash point. For example, the flash point for Green Earth™ solvent is $170^0$ F and for DF 2000 is $147^0$ F. Hydrocarbon machines operate at temperatures below the flash point (approximately $120^0$ F). The likelihood of requiring other mitigation measures such as sprinkler systems and firewalls are dependent on the local permitting authority. For example, the Los Angeles Fire Department permits dry cleaners on a case-by-case basis. They require that the equipment be listed by a recognized testing laboratory. To obtain a permit in the City of Los Angeles, a dry cleaner must comply with Division 70 of the Los Angeles Fire Code. The Los Angeles Fire Code allows Class IIIA dry cleaning plants and associated operations to be separated from other occupancies by two-hour fire-resistive occupancy separations when the total quantities of Class IIIA liquids within the building does not exceed 1,320 gallons and the capacity of individual containers or tanks within the building does not exceed 330 gallons. A four-hour fire-resistive occupancy separation shall be required for quantities exceeding those amounts. Dry cleaning rooms containing Class II or Class IIIA solvents shall be separated from other uses including solvent storage, offices, laundering, scouring, scrubbing, pressing and ironing operations by not less than two-hour fire-resistive occupancy separations. The Los Angeles Fire Department also approves dry cleaning equipment

IIIA hydrocarbon dry cleaning machines with a total aggregate quantity of Class IIIA solvent not exceeding 330 gallons, and with the appropriate safeguards to ensure that the solvent never exceeds it's flash point (such as temperature controls), would typically be approved, based on Article 36 of the 1997 Uniform Fire Code. Such installation would not be required to have firewalls or automatic sprinkler systems installed. DF 2000 and Green Earth™ are considered to be Class IIIA solvents. Perc is classified as Class IV. One of the largest hydrocarbon machines sold, the 77 lb. Satec machine, certified by a testing laboratory, holds approximately 150 gallons. Thus, a dry cleaner could install two of these large machines, in the City of Los Angeles, without installing additional fire suppression systems.

56. Comment: The requirement for a two-hour fire-resistive separation is inconsistent with NFPA standards for dry cleaning plants.

Response: See Response to Comment #55 (this section).

57. Comment Two manufacturers of brominated products (Great Lakes Chemical and AtoFina) recommended worker exposure limits for a propyl bromide (nPB) of 5 and 10 ppm as an 8-hour time-weighted average, and have decided not to market nPB into solvent applications like dry cleaning. Two other manufacturers (Albemarie Corporation and Dead Sea Bromine Group) recommended an 8-hour TWA of 25 ppm, the same as the current ACGIH threshold limit value (TLV) for perc.

Response: The statement that n-propyl bromide is potentially a reproductive toxin is in Chapter 1 of the Staff Report. Staff appreciates this information. Approval by AQMD of any new alternative dry cleaning chemicals will be based on compliance with all District rules, including Rule 1401.

58. Comment: One facility's experience should not be used to suggest energy savings, particularly when it contradicts information developed by other sources. According to the 1998 analysis conducted by USEPA, machine wet cleaning systems consume considerably more energy than perc-based cleaning systems. According to the analysis, based on annual volume of 53,333 pounds of clothes cleaned, a wet cleaning operation would consume 10,314 Kwh annually versus, 1,780 Kwh for a facility operating a perc machine with a primary control device. According to USEPA data, a dry cleaner operating a primary and secondary perc machine would consume 2,434 KWh annually.

Response: See Response to Comment #27 (this section). The EPA data was not based on overall energy use and was based on manufacturer energy specifications rather than actual data. San Clemente Natural Cleaning Center is one of the 10 dry cleaning plants under AQMD commercialization project. As part of the program, the electricity used before (when operating perc machine) and after (operating professional wet cleaning) was compared and the results were indicated in the staff report. The monthly energy usage while operating perc dry cleaning operation ranged from 800 to 1500 kWh. This usage was reduced to approximately 600 kWh per month. This is based on approximately 250 pounds of clothes cleaned per day. Business levels remained constant, so the change was not a result of fewer clothes cleaned. Other wet cleaners are being evaluated to determine if they have also had decreases in energy costs. The socioeconomic assessment did not consider energy savings for wet cleaning in the analysis.

59. Comment: According to analysis conducted by the North Carolina Department of Environmental and Natural Resources, the liquid $CO_2$ systems uses a hydrocarbon product as a co-solvent to aid in the removal of oil and grease stain.

Response: Wet cleaning, as well $CO_2$ cleaning, uses detergents and other additives to clean oil and grease stain since water alone would not be able to clean these types of stains. The "co-solvent" mentioned by the commentator are such detergents and additives.

60. Comment: Per a representative of liquid $CO_2$ at a recent meeting of the California Cleaners Association, the solvent costs are likely to be significantly higher for the $CO_2$ system cleaner. It is 18 pounds of $CO_2$ per load at a cost of $0.18 per pound. For a cleaner processing 5 loads of clothes per day (1,250 loads/year), that would represent an annual solvent cost of over $4,000.

Response: Information provided by three suppliers of $CO_2$ who provided the range of $0.20 to $0.27 per pound. Staff used the cost of solvent for $CO_2$ of $0.25 per pound in Table 2 of the staff report. The suppliers gave a range for solvent mileage of 10 to 12 pounds per load. The loss of $CO_2$ varies by machine manufacturer. Machines can be adjusted to reclaim $CO_2$ by regulating the release pressure at the end of the cycle. However, reclamation extends the cycle which will have a bearing on time cost versus solvent cost.

61. Comment: It is generally agreed that labor costs are significantly higher for wet cleaning than for perc dry cleaning.

Response: See Response to Comment #27 (this section).

62. Comment: The liquid $CO_2$ process uses high pressures (750 to 800 pounds per square inch) to operate. Although experience with this equipment is limited, it is reasonable to expect the maintenance costs will be as great, if not greater than for perc.

Response: The $CO_2$ machines pressurize the gas in a drum to between 700 and 800 pounds per square inch (psi). For comparison purposes, a refrigerator is at 350 psi pressure, a fire extinguisher is at 800 psi, and a home oxygen tank is at 2,400 psi. There is no evidence that the maintenance on these equipment is greatly increased due to the pressurized gas.

63. Comment: The AQMD's revised EA concludes that $CO_2$ equipment could require twice as much electricity as currently used with perc. As noted above, the estimate of lower electricity use for wet cleaning is based on report from one facility and is contrary to the conclusion of the EPA.

Response: See Response to Comment #27 (this section ) regarding EPA's wet cleaning study. The staff agrees with the comment as quoted from the CEQA document. However, comparing $CO_2$ to perc is not an exact comparison. Some perc dry cleaners use a water tower as compared to a chiller; some perc cleaners use a chiller but $CO_2$ must use a chiller. Chillers require more energy to operate. There is one $CO_2$ facility currently operating in the Basin. The facility also operates a perc machine. Energy testing has not yet been scheduled for that facility.

64. Comment: We have confirmed with representatives of CCA and KDLA that the associations continue to support the alternative to require all cleaners to install perc equipment with primary and secondary controls over a 5-year period.

Response: CCA and KDLA withdrew their support for this proposal in the summer of 2002. KDLA submitted a letter September 19, 2002 stating their renewed support for this proposal and the Staff Report now reflects this. As of September 25, 2002, no comment letter was received from CCA stating their renewed support for this proposal.

65. Comment: Figure 8 in the Staff Report understates the reductions to be achieved through implementation of Scenario #2. We estimate perc emissions would be reduced to under 500 tons/year (a 43% reduction) over 5 years.

Response: Staff disagrees that perc emissions would be reduced to below 500 tons per day using scenario #2. Based on staff's evaluation, the

perc emissions in this scenario will be reduced from 850 tons per year to 700 tons per year, which is about 18% reduction. Appendix C of the Staff Report provides details on the calculation methods and results. The commentor needs to submit similar details in order for staff to understand the calculation.

66. Comment: A number of considerations must be made regarding cycle time and the cost of hydrocarbon machines that have not been identified in the Staff Report. Reductions in cycle time are made by increasing rotational speed of the drum during solvent extraction, or increasing air flow through the clothes during the drying cycle. Increased rotation is achieved using higher speed motors in traditional "rigid" mount design or "soft" mount design using springs of other methods to absorb vibrations. The cost of these "soft" mount designs is estimated to double cost differential between perc and hydrocarbon machines. "Rigid" mounts cannot increase rotation speed as much and thus not shorten cycle time as much. The high-speed motors contribute to the cost differential and will increase maintenance costs. Air flow eliminates the cost and maintenance but it is not clear how much this will reduce cycle times. Also, with increased air flow more solvent is vaporized and may increase vapor loss. The impact on cycle time is also dependent on the solvent. Differences in volatility and surface tension make these techniques most effective for perc and least effective for cyclic methylated siloxanes.

Response: Staff disagrees that the cost differential between the perc and hydrocarbon machine would be doubled due to these new design features of hydrocarbon machines. Based on the information provided by three machine distributors, the cost differential for between a perc and hydrocarbon machine for a 55 to 65 pound capacity were ranged from $8,000 to $12,000. This cost includes the discount price, tax, delivery, and installation cost. One manufacturer recommended going up in one machine size in a switch to hydrocarbon from perc to maintain processing volume. One manufacturer had a cost of twice as much for a hydrocarbon machine as a perc machine but this was the exception. Most were the same size replacement and cost ranges as described above.

67. Comment: District staff has indicated the availability of data on perc use and disposal and the location of nearest receptors presented significant obstacles to the implementation of the industry's alternative proposal. The proposed changes to the rule eliminate this obstacle and make the industry's proposal viable.

Response: PAR1421 does ask for receptor distance to facilitate public notice

record keeping requirements for perc purchases and disposals. Even with simplified recordkeeping forms in multi languages, it is difficult for many shop owners to keep adequate records and for staff to verify compliance. The goal of this rule amendment is to decrease risk based on technology and economic feasibility. Continued use of perc would result in a continued public health risk.

68. Comment: Maintenance costs for hydrocarbon machines are higher than perc equipment. This comes from the North Carolina Department of Environment and Natural Resources and the District's socioeconomic staff. The socioeconomic presentation at the September public consultation meeting estimates an annual cost of impact of $4.3 million /year over 14 years or a total impact of $65 million. The Staff Report estimates emissions to be 850 tons (1/7 million pounds) annually. The cost per pound of perc reduction is over $38.

Response: The Staff Report also notes an increased cost for hydrocarbon maintenance (See Table 2 – Comparison of Perc and Alternatives). The emission reduction cumulatively is 849 tons over the entire rule implementation period, not per year. The annual reduction is about 53 tons per year. The cost per pound of perc reduced is less than $3 (See Staff Report).

69. Comment: The Staff Report does not show how it calculated the cost of compliance with Rule 1402. Additionally, the installation of primary and secondary equipment would allow cleaners to comply with Rule 1402 without the need for risk reduction.

Response: The cost of compliance with Rule 1402 was based on AB-2588 requirements for facilities that are required to prepare individual health risk assessment. Based on AB-2588 fee schedule, a simple facility (one permit) with risk of 50 to 100 in–one-million would pay a fee of $9,500 per year. The commentor is referred to Response to Comment #25 (this section) for a discussion of primary and secondary control equipment complying with Rule 1402 requirements

70. Comment: The Staff Report inappropriately compares well recognized, acute central nervous system effects (e.g., headaches, dizziness, anesthesia, and unconsciousness) resulting from solvent overexposure to subtle neurobehavioral effects that have been alleged in limited studies of exposures to low levels of perc.

Response: Please see response to comment #1 (first section). The Schreiber et al. study identified deficits in neurological function in the visual

system of chronically exposed residents. However, the results indicated pre-clinical visual deficits, and blurry vision was not reported to our knowledge. The response to comment #1 has been revised to reflect this.

71. Comment: The Staff Report states that "several epidemiology studies showed elevated risks for esophageal cancer, non-Hodgkin's lymphoma, and cervical cancer." Important lifestyle and socioeconomic risk factors exist for both cervical and esophageal cancer that have not been fully taken into account in the epidemiological studies that have been conducted to date. The number of cases of non-Hodgkin's lymphoma is too small to be able to suggest an association with solvent exposure.

Response: The epidemiological study showed excess cancer mortality in several sites. Although lifestyle and other risk factors cannot be fully accounted for, these studies add to the weight of evidence regarding solvents used in the dry cleaning industry.

72. Comment: The Staff Report states the final cost of compliance with PAR 1421 is $12,700,000. However, according to the Air Toxics Control Plan, the cost to implement the requirements of the Control Measure were $18.3 million and the cost of the wastewater treatment requirements of Rule 1421 was an additional $7.5 million.

Response: The reader is referred to Response to Comment #36 (first section). The figure of $12,700,000 was for compliance with Rule 1421 from the time of the ATCM through the 1997 amendments (which were a savings) and were not inclusive of the current proposed amendments. The Air Toxics Control Plan gave the estimated economic impact of additional rule changes based on preliminary estimates (in 1999 dollars) as $8.7 million annually. The cost to implement the ATCM/NESHAP was $18.3 million plus cost to add wastewater control of $7.5 million less the cost of hauling waste perc by $17.1 million, based on a 15-year period. The report went on to say there was an overall savings to industry in 1997 amendments of $4 million. During rule development, inventory, reductions, costs and impacts are assessed. Often, the analysis shows different results than may have been projected in the Air Toxic Plan or AQMP. For example, during this rule development effort, cost data and emissions inventory data were revised compared to the information available when the Air Toxics Control Plan was developed.

73. Comment: The Staff Report states that discussions at public meetings indicate the reduction of perc usage for those using non-perc alternatives

has resulted in substantial savings to the owners. This contradicts the results of the socioeconomic analysis presented at the September public consultation meeting.

Response: The socioeconomic analysis presented at the September 2002 Public Consultation Meeting, indicated that there would be additional operating and maintenance costs associated with using solvent cleaning machines relative to perc machines. Operating and maintenance costs include chemical, detergent, and maintenance costs. Facilities that would select wet cleaning technology would have a substantial savings in their operating costs by replacing perc with water.

74. Comment: Rules 1425 and 1122 require control of perc emissions at a level comparable to that achieved with dry cleaning equipment with primary and secondary controls. Neither rule prohibits the use of perc or mandates the phase-out of its use.

Response: See Response to Comment #29 (first section).

75. Comment: The Staff Report (Appendix D) states that "Of the above possible data limitations, #4 could affect the results most significantly and could tend to over estimate the amount of solvent being recycled and consequently under estimate the amount of solvent emitted to the atmosphere." The claim is not supported by the available information. Because of the significantly higher cost of disposal of hazardous waste, it is unlikely that cleaners will purposely add water, spotting agents, or soap to their waste. Any quantities of spotting agents or soaps have already been accounted for in the AQMD's analysis of the still bottoms.

Response: Several comments were raised during the June 13, 2002 Working Group meeting. One of the comments (#4, as stated in Appendix D) was that waste might also contain lint, spotting agents, water, soaps, etc. Staff responded that this could tend to over estimate the amount of solvent being recycled and consequently under estimate the amount of solvent emitted to the atmosphere. This is because the amount of perc being credited to the facility (not emitted to the atmosphere) is based on percent perc estimated in the liquid waste and the total quantity of liquid waste.

76. Comment: The Staff Report states: "Regarding facilities not filling the tanks to capacity of the same fill mark, this could either over or underestimate the solvent usage. In a statistically significant sample, these effects would be expected to cancel out because there would not be a bias expected towards one direction. Staff use of solvent added to the machine as usage, and excluded the

amount of solvents used to fill the machine when information was provided. In other cases, staff assumed the amount of solvent purchase and usage was the same." This is entirely inconsistent with the results of the very limited follow-up conducted by staff. As noted, four survey participants were contacted in a conference call with industry representatives. Three of the four indicated the AQMD's analysis overstated their perc usage. (Facilities P2, Q2, W and X). Despite these discrepancies, staff failed to contact other participants to verify their solvent use.

Response: Staff estimated the perc usage based on the assumptions indicated in the staff report. Staff verified information submitted by HC facilities for 10 out of 11 facilities through the suppliers and waste haulers. Staff also verified information submitted by perc facilities regarding the amount perc purchased or amount recycled for 12 out of 20 facilities through either the solvent suppliers or waste haulers. Based on information associated with these 12 facilities, the percent perc emitted was estimated to be 48%. There should not be any original fill issues associated with these 12 facilities since the newest machine included in this group was built in the year 2000. Six out of 20 facilities tested reported their annual perc usage. The report indicates the amount of perc added to the machine during the year by specific dates. Based on information obtained from these six facilities, the % perc emitted was estimated to be equal to 52%.

77. Comment: The Staff Report states: "For Facility W, the initial information indicated that they recycled more perc than they purchased. Based on the phone conversation, the amount of perc purchased was reduced from 85 to 65 gallons per year, the amount of perc used changed from 85 to 55 gallons per year, and the number of filters disposed changed from 8 to 4. These revisions did not affect the previous results."

Response: The statement made in the staff report justified the reason why Facility W was not included in the analysis. Even after making the revisions, the information indicated that the facility recycled more perc than they purchased.

78. Comment: The staff's generic profile of a typical dry cleaner assuming a building area of 1,600 $ft^2$, and a building height of 15 ft, general ventilation system with 60% capture efficiency, and operating hours of 8hrs/5day/52wk/yr., is not accurate. Dry cleaners typically open 10-12 hours and conduct much of their business in the early morning hours. The AQMD's analysis further overstates exposures to off-site workers.

Response: Staff does not share the same conclusions made by the commentor. The building dimensions and hours of operation were based on the information submitted by the facilities tested. Based on the information submitted by these dry cleaners, the average building area and building height were estimated to be equal to 1622 $ft^2$ and 13 ft, respectively. The average daily work by these facilities was estimated to be 8 hours. The number of days per week could have been either 5 or 6 days since half of those facilities surveyed responded 5 and half responded 6. However, based on the information obtained in the AQMD consultation meeting, it was concluded that the even if the facility operates 6 days per week, they only do dry cleaning 5 days per week. Therefore, staff used 5 days per week operation as opposed to 6.

79 Comment: The AQMD's analysis described in Appendix D focused on machines with primary and secondary controls. Implementation of this new technology significantly reduces solvent consumption.

Response: See Response to Comment #18 (this section).

80. Comment: Perc poses a serious human health risk and we support a 10-year phase-out of perc machines as the longest phase-out the AQMD should consider. The economic value is recovered in 10 years. Replacements should be required starting immediately on rule adoption, not July 2004.

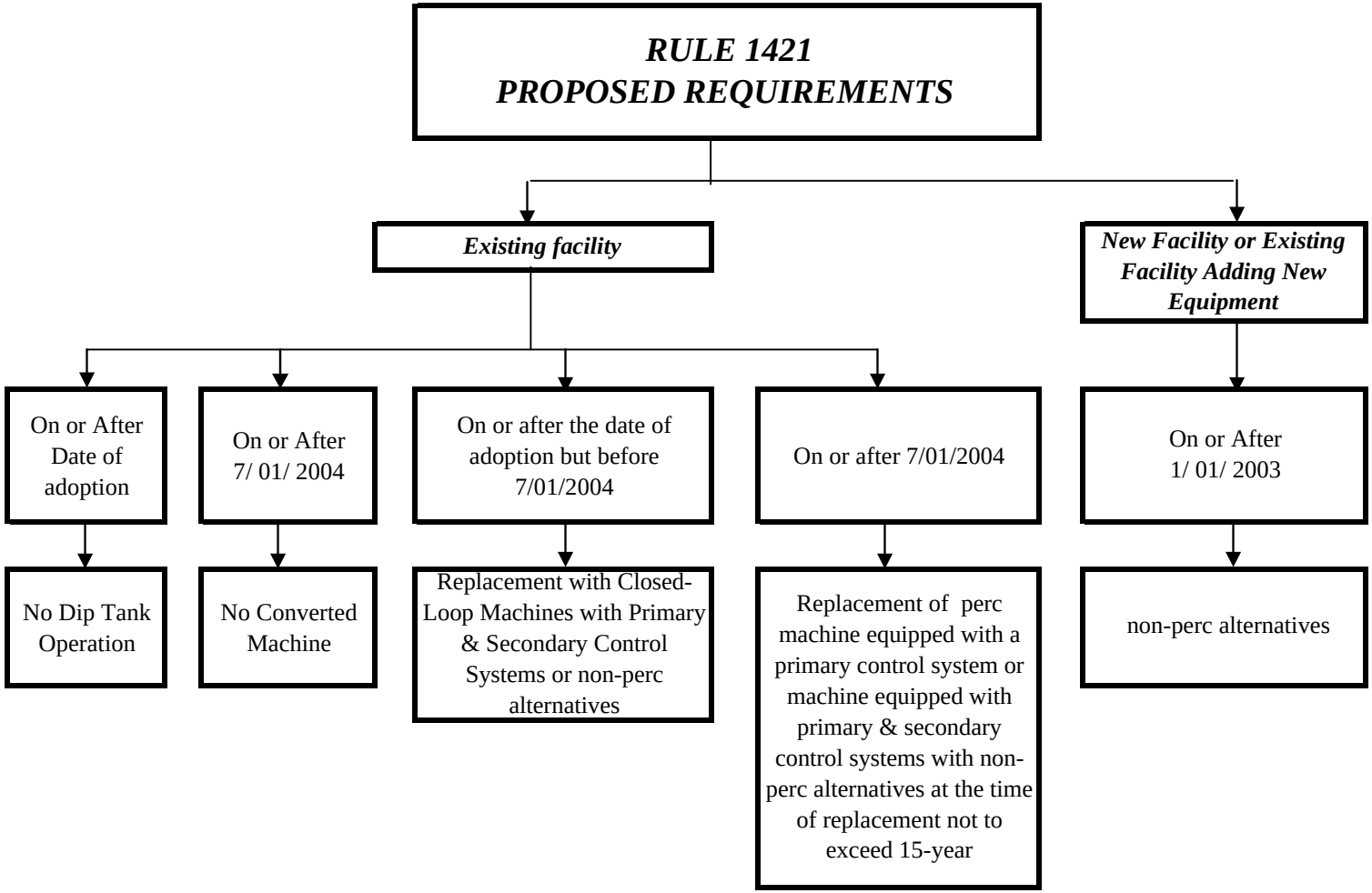
Response: The proposal developed by staff gives a start date of July 1, 2004 for mandatory transitions and up to 15 years use of equipment in recognition of the nature of the industry. Dry cleaners are generally small businesses with low profits. The Governing Board will consider the commentor's suggestion (and other options) that are included in the range of analysis in EA.

81. Comment: We support the AQMD's efforts to provide incentives to early adopters of non-toxic alternatives. Such funding should only be given to wet cleaning and $CO_2$ technologies, which are non-toxic and non-polluting alternatives. Toxicity studies are not final on Green Earth™, and hydrocarbon-based solvents contribute to VOCs, a precursor to ozone.

Response: The Board also will consider AQAF funding as separate item. It should be noted that at the September 2002 meeting, the Governing Board approved $30,000 for wet cleaning sites and $500,000 for the transition of perc to wet cleaning.

# APPENDIX B

## FLOW CHART - RULE 1421 PROPOSED REQUIREMENTS


RULE 1421
PROPOSED REQUIREMENTS
Existing facility
New Facility or Existing Facility Adding New Equipment
On or After Date of adoption
On or After 7/ 01/ 2004
On or after the date of adoption but before 7/01/2004
On or after 7/01/2004
On or After 1/ 01/ 2003
No Dip Tank Operation
No Converted Machine
Replacement with Closed-Loop Machines with Primary & Secondary Control Systems or non-perc alternatives
Replacement of perc machine equipped with a primary control system or machine equipped with primary & secondary control systems with non-perc alternatives at the time of replacement not to exceed 15-year
non-perc alternatives

# APPENDIX C

## POPULATION DISTRIBUTION AND EMISSION REDUCTIONS CALCULATION

## Perchloroethylene Dry Cleaning Equipment Distributions

Tables C-1 through C-5 include the number of perc machines based on equipment types, permit application submittal date, and application types. These tables are used to determine the number of converted machines (18), machines with only primary control system (1449), and machines with primary and secondary control systems (741) based on the following assumptions.

Assumptions:

1. All machines with application submittal date before 1995 are assumed to be equipped with primary control systems.
2. For the years 1995 through 1998, there are 504 machines with primary control systems and 178 machines with primary and secondary control systems. This was based on actual permit description verified by the staff.
3. All machines with application submittal date in 1999 or later are assumed to be equipped with primary and secondary control systems (excluding machines with change of ownership applications. Only 20% of these machines are assumed to be equipped with primary and secondary control systems since out of 10 change of ownership permits ,which were randomly checked, 2 permits were for primary & secondary machines.

**Table C-1, Perc dry cleaning equipment distributions based on permit application submittal date and type**

| *Machine Type* | Year | *Permit to Construct (P/C)* | *Rule 219 (Exempt Equip.)* | *Permit to Operate (P/O)* | *P/O no P/C* | *Change of Ownership (C/O)* | *Alteration* | *Change of condition* | *Registra-tion* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|
| **DRY CLEANING EQUIPMENT (Type not Specified)** | 1981 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 1982 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 |
| | 1983 | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 6 |
| | 1984 | 3 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 7 |
| | 1985 | 3 | 0 | 0 | 2 | 2 | 3 | 0 | 0 | 10 |
| | 1986 | 8 | 0 | 2 | 8 | 1 | 2 | 0 | 0 | 21 |
| | 1987 | 15 | 0 | 5 | 3 | 5 | 5 | 0 | 0 | 33 |
| | 1988 | 5 | 0 | 3 | 25 | 6 | 5 | 0 | 0 | 44 |
| | 1989 | 0 | 1 | 10 | 19 | 10 | 1 | 0 | 0 | 41 |
| | 1990 | 5 | 0 | 38 | 16 | 25 | 3 | 0 | 0 | 87 |
| | 1991 | 15 | 0 | 30 | 34 | 21 | 2 | 0 | 0 | 102 |
| | 1992 | 49 | 0 | 5 | 13 | 15 | 6 | 0 | 0 | 88 |
| | 1993 | 52 | 0 | 4 | 15 | 27 | 2 | 2 | 0 | 102 |
| | 1994 | 7 | 0 | 4 | 6 | 32 | 2 | 2 | 0 | 53 |
| | 1995 | 2 | 0 | 0 | 2 | 20 | 0 | 0 | 0 | 24 |
| | 1996 | 3 | 0 | 0 | 1 | 15 | 0 | 0 | 0 | 19 |
| | 1997 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 7 |
| | 1998 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 |
| | 1999 | 1 | 0 | 2 | 5 | 23 | 0 | 0 | 0 | 31 |
| | 2000 | 3 | 0 | 2 | 5 | 66 | 0 | 0 | 0 | 76 |
| | 2001 | 1 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 35 |
| Sub-Total | | 179 | 1 | 106 | 155 | 314 | 35 | 4 | 0 | 794 |

**Perchloroethylene Dry Cleaning Equipment Distributions**

**Table C-2, dry-to-dry, non-vent perc dry cleaning equipment distributions based on permit application submittal date and type**

| *Machine Type* | Year | *Permit to Construct (P/C)* | *Rule 219 (Exempt Equip.)* | *Permit to Operate (P/O)* | *P/O no P/C* | *Change of Ownership* | *Alteration* | *Change of condition* | *Registra-tion* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|
| **DRY-TO-DRY NON-VENT** | 1987 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1991 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 1992 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1993 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| | 1994 | 47 | 0 | 4 | 39 | 2 | 3 | 0 | 0 | 95 |
| | 1995 | 87 | 0 | 2 | 6 | 1 | 3 | 0 | 0 | 99 |
| | 1996 | 83 | 0 | 2 | 17 | 6 | 14 | 0 | 0 | 122 |
| | 1997 | 76 | 0 | 2 | 25 | 27 | 1 | 0 | 0 | 131 |
| | 1998 | 117 | 0 | 2 | 14 | 32 | 4 | 4 | 0 | 173 |
| | 1999 | 8 | 0 | 1 | 14 | 62 | 2 | 1 | 1 | 89 |
| | 2000 | 3 | 0 | 0 | 34 | 68 | 2 | 3 | 0 | 110 |
| | 2001 | 3 | 0 | 0 | 14 | 30 | 3 | 1 | 0 | 51 |
| Sub-Total | | 426 | 0 | 13 | 164 | 228 | 32 | 10 | 1 | 874 |

**Table C-3, dry-to-dry, vented perc dry cleaning equipment distributions based on permit application submittal date and type**

| *Machine Type* | Year | *Permit to Construct (P/C)* | *Rule 219 (Exempt Equip.)* | *Permit to Operate (P/O)* | *P/O no P/C* | *Change of Ownership* | *Alteration* | *Change of condition* | *Registra-tion* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|
| **DRY-TO-DRY VENTED** | 1994 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 4 |
| | 1995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1996 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1997 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | 1998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1999 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | 2000 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | 2001 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-Total | | 1 | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 7 |

**Perchloroethylene Dry Cleaning Equipment Distributions**

**Table C-4, dry-to-dry, nv, w/SIC perc dry cleaning equipment distributions based on permit application submittal date and type**

| *Machine Type* | Year | *Permit to Construct (P/C)* | *Rule 219 (Exempt Equip.)* | *Permit to Operate (P/O)* | *P/O no P/C* | *Change of Ownership* | *Alteration* | *Change of condition* | *Registra-tion* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|
| **DRY-TO-DRY NON-VENT WITH SECONDARY INTEGRATED CONTROL(SIC)** | 1996 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| | 1997 | 8 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 10 |
| | 1998 | 62 | 0 | 0 | 8 | 0 | 2 | 0 | 13 | 85 |
| | 1999 | 83 | 0 | 1 | 17 | 3 | 7 | 1 | 2 | 114 |
| | 2000 | 117 | 0 | 3 | 9 | 15 | 17 | 2 | 0 | 163 |
| | 2001 | 89 | 0 | 1 | 4 | 19 | 7 | 0 | 0 | 120 |
| Sub-Total | | 359 | 0 | 5 | 43 | 37 | 33 | 3 | 15 | 495 |

**Table C-5, converted perc dry cleaning equipment distributions based on permit application submittal date and type**

| *Machine Type* | Year | *Permit to Construct (P/C)* | *Rule 219 (Exempt Equip.)* | *Permit to Operate (P/O)* | *P/O no P/C* | *Change of Ownership* | *Alteration* | *Change of condition* | *Registra-tion* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|
| **DRY-TO-DRY CONVERTED** | 1994 | 1 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 4 |
| | 1995 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| | 1996 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | 1997 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1998 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 1999 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| | 2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2001 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-Total | | 5 | 0 | 0 | 1 | 1 | 4 | 0 | 0 | 11 |

Total Number of machines = 2181 = 794 (Table C-1) + 874 (Table C-2) + 7 (Table C-3) + 495 (Table C-4) + 11 (Table C-5)
Total Number of converted machines = 18 = 7 (Table C-3) + 11 (Table C-5)
Total Number of machines with primary control system = 1449 (705 (all machines with permit before 1995) + 504 (based on hand counts of actual permits issued from 1995 through 1998) + 258 (based on assumption that 80% of all permits issued under change of ownership from 1999 through 2001(323) are machines with primary control system - 18 (Tables C-3 & C-5, vented & converted)
Total Number of machines with primary and secondary control systems = 714

## *Assumptions and Information Used in Table C-6*

| | | |
|---|---|---|
| Total Number of closed-loop machines (P, P+S & Conv) | ***2181*** | |
| Total Number of closed-loop machines with primary & secondary controls (P+S): | 714 | |
| Total Number of closed-loop machines with primary control (P): | 1449 | |
| Total number of converted machines (C): | 18 | |
| Converted Machines (C) remaining lifetime from year May 3, 2002 (years): | 2 | |
| Perc machine lifetime (years): | 15 | |
| Number of machines (P) with fifteen-year equipment life by July 1, 2004 | 192 | (# of machines permitted in 1989 or earlier + 10% of machines permitted via C/O after 1998) |
| Number of machines (P) with fifteen-year equipment life by July 1, 2005 | 112 | (# of machines permitted in 1990 + 10% of machines permitted via C/O after 1998) |
| Number of machines (P) with fifteen-year equipment life by July 1, 2006 | 128 | (# of machines permitted in 1991 + 10% of machines permitted via C/O after 1998) |
| Number of machines (P) with fifteen-year equipment life by July 1, 2007 | 113 | (# of machines permitted in 1992 + 10% of machines permitted via C/O after 1998) |
| Number of machines (P) with fifteen-year equipment life by July 1, 2008 | 129 | (# of machines permitted in 1993 + 10% of machines permitted via C/O after 1998) |
| Number of machines (P) with fifteen-year equipment life by July1, 2009 | 173 | (# of machines permitted in 1994 excluding converted machines + 10% of machines permitted via C/O after 1998) |
| Number of machines (P & P+S) with fifteen-year equipment life by July 1, 2010 | 148 | (# of machines permitted in 1995 excluding converted machines (117 primary & 6 primary and seconday machines) + 10% of machines permitted via C/O after 1998) |
| Number of machines (P & P+S) with fifteen-year equipment life by July 1, 2011 | 169 | (# of machines permitted in 1996 excluding converted machines (112 primary & 32 primary and seconday machines) + 10% of machines permitted via C/O after 1998) |
| Number of machines (P & P+S) with fifteen-year equipment life by July 1, 2012 | 173 | (# of machines permitted in 1997 excluding converted machines (103 primary & 45 primary and seconday machines) + 10% of machines permitted via C/O after 1998) |
| Number of machines (P & P+S) with fifteen-year equipment life by July 1, 2013 | 287 | (# of machines permitted in 1998 excluding converted machines (167 primary & 95 primary and seconday machines) + 10% of machines permitted via C/O after 1998) |
| Number of machines (P & P+S) with fifteen-year equipment life by July 1, 2014 | 166 | # of primary and secondary machines |
| Number of machines (P & P+S) with fifteen-year equipment life by July 1, 2015 | 230 | # of primary and secondary machines |
| Number of machines (P & P+S) with fifteen-year equipment life by July 1, 2016 | 140 | # of primary and secondary machines |
| Number of machines permitted via change of ownership (C/O) after 1998 | 253 | |
| Time period allowed for a closed loop machines to be replaced with 5th generation (years) | 2 | |
| Percentage of early transition of older machines to non-perc alternative (prior to July 1, 2004) | 10% | |
| Perc usage for machines with primary control system (gal/yr): | 113 | |
| Perc usage for machines with primary & secondary control systems (gal/yr) (See Appendix D): | 96 | |
| Perc usage for converted machines (gal/yr) (from perc ATCM): | 170 | |
| * Percent perc emitted (from the AQMD sampling analysis on 20 facilities (P+S), See Appendix D): | 50% | |
| * Percent perc emitted (from the AQMD sampling analysis on 4 facilities for (P), See Appendix D): | 54% | |

**Perc emission per machine = perc usage (gal) x density (lb/gal) x % perc emitted**

**Turnover distribution:**

The converted machines (18) were distributed evenly over two years for switching to non-perc alternatives beginning with rule adoption date. About 192 machines that are 1989 or earlier models are 15 years old by the rule adoption date. Staff assumed that 20% of these older machines (38) will switch to non-perc alternatives and the remaining about 154 machines will switch to primary and secondary control machines between the rule adoption date and compliance date of July 1, 2004. These machines equipped with primary and secondary controls will be required to be replaced with non-perc alternatives starting year 2017 based on when equipment is 15 years old. Starting July 1, 2004, the annual distributions of the remaining machines with primary control systems (1,257=1,449-192) and machines with primary and secondary control systems (714) were based on the permit issuance date and assumption of the equipment lasting 15 years.

# Perc Emission Reductions

**Table C-6, Perc emission reductions based on yearly turnover of different perc machines**

| *Calendar year* | *Yearly Turnover To 5th generation Machine (11/02 to 7/04) Part #1* | | | *Yearly Turnover To non-perc alter (11/02 to 7/04) (for conv. & Incen. prog.) Part #2* | | | *Yearly Turnover To non-perc alternative (7/04 to 7/19) Part #3* | | | *Perc usage per machine (gal/yr) PAR1421* | | | *Perc Density* | *Perc Ems per machine (tons/yr) PAR1421* | | | *Total Perc Ems (tons/yr) Before PAR1421* | *Ems Red. (tons/yr) after PAR1421 Part #1* | *Ems Red. (tons/yr) after PAR1421 Part #2* | *Ems Red. (tons/yr) after PAR1421 Part #3* | *Total Ems Red. (tons/yr)* | *Cumulative Ems. Red. Based on proposal* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *P* | *P+S* | *C* | *P* | *P+S* | *C* | *P* | *P+S* | *C* | *P* | *P+S* | *C* | *(lb/gal)* | *P* | *P+S* | *C* | *P , P+S & C* | | | | *P, P+S &C* | *(Tons/yr)* |
| May-02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | 1.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 |
| May-03 | 77 | 0 | 0 | 19 | 0 | 9 | 0 | 0 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | 1.15 | 49.93 | 6.76 | 18.25 | 0.00 | 25.01 | 25 |
| May-04 | 77 | 0 | 0 | 19 | 0 | 9 | 0 | 0 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | 1.15 | 49.93 | 6.76 | 18.25 | 0.00 | 25.01 | 50 |
| May-05 | | | | | | | 112 | 0 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | 1.15 | 46.25 | 0.00 | 0.00 | 46.25 | 46.25 | 96 |
| May-06 | | | | | | | 128 | 0 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 52.84 | | | 52.84 | 52.84 | 149 |
| May-07 | | | | | | | 113 | 0 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 46.67 | | | 46.67 | 46.67 | 196 |
| May-08 | | | | | | | 129 | 0 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 53.26 | | | 53.26 | 53.26 | 249 |
| May-09 | | | | | | | 173 | 0 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 71.38 | | | 71.38 | 71.38 | 320 |
| May-10 | | | | | | | 142 | 6 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 60.56 | | | 60.56 | 60.56 | 381 |
| May-11 | | | | | | | 137 | 32 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 66.92 | | | 66.92 | 66.92 | 448 |
| May-12 | | | | | | | 128 | 45 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 67.42 | | | 67.42 | 67.42 | 515 |
| May-13 | | | | | | | 192 | 95 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 109.99 | | | 109.99 | 109.99 | 625 |
| May-14 | | | | | | | 0 | 166 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 53.78 | | | 53.78 | 53.78 | 679 |
| May-15 | | | | | | | 0 | 230 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 74.52 | | | 74.52 | 74.52 | 754 |
| May-16 | | | | | | | 0 | 140 | 0 | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 45.36 | | | 45.36 | 45.36 | 799 |
| May-17 | | | | | | | | 77 | | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 24.95 | | | 24.95 | 24.95 | 824 |
| May-18 | | | | | | | | 77 | | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 24.92 | | | 24.92 | 24.92 | 849 |
| May-19 | | | | | | | | 0 | | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 0.00 | | | | 0 | 849 |
| May-20 | | | | | | | | | | 113 | 96 | 170 | 13.5 | 0.41 | 0.32 | | 0.00 | | | | | |

# APPENDIX D

## SAMPLING ANALYSIS PROCEDURES AND RESULTS

# SAMPLING ANALYSIS AND PROCEDURES

This appendix describes the sampling effort conducted in April and May of 2002 on perchloroethylene (perc) and hydrocarbon (HC) dry cleaning machines to obtain data on emissions from these types of machines.

## Background

Very little field testing has been done on perc machines to estimate emissions. Prior to December 2001, emissions from perc machines were based primarily on estimates from the draft CAPCOA Risk Assessment document. The CAPCOA study was based on survey information provided by the dry cleaning industry, which indicated 70 – 80% of total perc consumption was emitted from a typical dry cleaning machine. Dow Chemical estimates the percent perc emitted from a machine with primary and secondary control systems to be 40% of perc consumption, based on the experience of one of their executives.

Since last December, AQMD staff has completed two sets of sampling analysis on liquid sludge from perc and HC machines. The purpose was to estimate the percent solvent in the sludge and consequently the percent solvent emitted to the atmosphere using a mass balance equation. The first set of sampling were from machines with primary control and machines with primary and secondary control systems. The second set of sampling focussed on machines with primary and secondary control systems to better analyze potential impacts of the proposed rule and alternative proposals.

The first set of sampling analysis was conducted on six machines, four with primary control systems and two with primary and secondary control systems, to estimate the amount of perc being emitted from these types of perc machines. The analysis from the first set of sampling indicated that the percent perc emitted from machines with a primary control system and machines with primary and secondary control systems was very similar and on average 60% of perc consumption is emitted to the atmosphere.

Emission testing on perc machines has been very limited and tests on emissions from HC machines either has never been done on commercially operating machines or sampling data were not released. For these reasons, staff conducted another set of testing for perc and a first time testing on HC machines. Statistical analysis was performed to estimate the number of machines to be tested to give less than or equal to 10% error rate at a 95% confidence level. All sampling and laboratory analyses were based on standard procedures as described in the following sections.

## Sample Size

A standard formula listed in “Statistics and Research Methods for Managerial Decisions” by Anderson, Sweeney, Williams, Davis, Utts, and Simon, published by South Western

in 2001, page 304, was used to estimate the number of machines needed to be tested. This is a standard formula used for random sampling with known population size.

$n = N*\sigma^2 / (((N-1)*B^2/Z^2)+\sigma^2)$
where,
n = size of sample
N = total population
$\sigma$ = population standard deviation
$\sigma^2$ = population variance
B = 10% (allowable error)
Z = 1.96 (95% confidence)

a) Estimation of the sample size for perc

$n = N*\sigma^2 / (((N-1)*B^2/Z^2)+\sigma^2)$

*Total Population (N):*

Total population was based on the number of perc machines with primary and secondary control systems.

N = 714

*Population Standard Deviation (s):*

To estimate the population standard deviation, staff used the percent (%) perc concentration in waste sludge (35.2%, 50.3%, 89.2%, 60.2%, 89.9%, and 80.8%) that resulted from the first set of samples. This data set included machines with primary control only and machines with primary and secondary controls. The data did not indicate a difference in percent perc emitted between machines with different controls.

$\sigma = 0.224$

*Allowable error (B):*

Staff used an allowable error of 10%.

B = 10%

*Z-Score (Z):*

Z was based on 95% confidence level.

Z = 1.96

$n = 714*(0.224)^2 / ((713*(10\%)^2 / (1.96)^2) + (0.224)^2)$
n = 19

b) Estimation of the sample size for HC

$n = N*\sigma^2 / (((N-1)*B^2/Z^2)+\sigma^2)$

*Total Population (N):*

Total population was assumed to be 70, which was based on the total number of facilities with the HC machines.

$N = 70$

*Population Variance (s):*

To estimate the population standard deviation, staff used the percent HC emitted (10%, 38%, 35%, and 50%) that has been listed by a manufacturer, estimated by industry, or used by the permitting staff to estimate HC emissions.

$\sigma = 0.168$

*Allowable error (B):*

Staff used an allowable error of 10%.

$B = 10\%$

*Z-Score (Z):*

Z was based on 95% confidence level.

$Z = 1.96$

$n = 70*(0.168)^2 / ((69*(10\%)^2 / (1.96)^2) + (0.168)^2)$
$n = 9$

For consistency purposes to HC machines, staff estimated that the sample size for perc machines would be 10, if the population standard deviation were calculated based on % perc emitted (67%, 69%, 25%, 55%, 45%, and 59%) as opposed to % perc in the sludge. However, 20 samples were taken.

## Facility Selection Process

In the analysis, AQMD staff selected facilities with a single machine, primary and secondary control systems, and a sludge cooking schedule that would accommodate the field efforts. The selection procedures are outlined as follows:

- AQMD staff independently used the AQMD database to search for facilities with primary and secondary control systems located in each inspector's sector using the basic equipment category (BCAT) and control equipment category (CCAT). In the entire selection process, staff purposely did not account for the facility's emission data or any compliance history. The only criteria used in this selection process were to choose facilities with primary and secondary control systems;

- Facilities with multiple machines were excluded because it would not be straightforward to analyze the sludge per machine and there was a possibility of mixed solvents in the sludge when different solvents are used; and
- Facilities with sludge cooking time schedules that fell outside of the testing period were not tested. Dry cleaning facilities remove sludge at different times based on the amount of clothes cleaned. In addition, sludge cooking occurred at the beginning and end of day or weekends. Staff contacted all those selected dry cleaning facilities with a single machine equipped with primary and secondary control systems. This step was taken to find out their next cooking and sludge removal schedule so that they could set up a time for sampling. Staff accommodated facilities that would cook or remove their sludge very early in the morning, late in the afternoon, or weekend. Facilities with sludge cooking and removing schedules outside of the testing period were not tested.

By following these procedures, AQMD staff had a high degree of confidence that the selected equipment constituted a diverse sample population, while enabling the sampling analysis to be completed in a timely manner.

## Sampling Procedures

Seven AQMD inspectors were assigned to collect samples. All inspectors were given standard procedures to follow and were trained in sample collection techniques. The procedures entailed taking proper glass containers provided by the AQMD laboratory and collecting samples of sludge from hydrocarbon and perc dry cleaning facilities. Also, pure hydrocarbon (DF-2000) samples were collected in metal pint containers. Prior to sampling, AQMD inspectors contacted the dry cleaning owner/operator to schedule a time for sampling.

For consistency, all samples were taken between 4 to 6 hours after completion of the cooling cycle. AQMD inspectors visited the facility and asked the operators to stir the sludge prior to sampling and collect the sample of sludge from the still. The operator then handed the glass container directly to the AQMD inspector. The inspectors labeled the sample bottle, put the sample into a cooler, and brought it back to the AQMD laboratory for analysis. In addition, AQMD inspectors collected purchase invoices and waste manifest documents for estimating the amount of solvent purchased and recycled.

## Laboratory Analysis Methods and Procedures

Dry-cleaning still bottoms (sludge samples) were received in pre-cleaned, 250-ml glass jars with Teflon-lined screw caps, although a few samples were received in metal one-pint cans. Sample bulk density was measured according to SCAQMD Method 304-91 *Determination of Volatile Organic Compounds (VOC) in Various Materials*. The density measurement consists of placing a portion of mixed sample in a pre-weighed container of known volume (Gardner cup) and re-weighing the container.

Sludge samples were distilled according to SCAQMD Method 302-*91 Distillation of Solvents from Paints, Coatings, and Inks*. The procedure consists of heating a weighed portion of the sample under vacuum and recovering the distillate in a liquid nitrogen-

cooled trap. The distillation is applicable to perchloroethylene, but it was also validated for hydrocarbon-based dry cleaning fluids by distilling pure DF2000 to verify a recovery of better than 95%.

The distillates were examined for uniformity. Distillates that had more than approximately 0.2 ml of water prompted an analysis of the bulk sample for water. The water analysis was conducted using Karl Fischer titration by SCAQMD Method 304-91, which involves adding a weighed amount of sample to a Karl Fischer titrator and adding measured amounts of a standardized titrant until the water in the sample is consumed. The percent water results were used to correct distillate volume.

Distillates were analyzed for volume percent dry-cleaning fluid using SCAQMD Method 303-91 *Determination of Exempt Compounds.* This method consists of diluting distillates and analyzing them for individual compounds using a gas chromatograph equipped with a thermal conductivity detector. The method is applicable to perchloroethylene, but requires modification for hydrocarbon-based dry-cleaning fluids. Hydrocarbon-based dry-cleaning fluids elute as a merged series of related hydrocarbons, rather than as a single sharp peak. In addition, the detector response for these compounds is low. However, due to the high concentrations detected, this is not an issue. Appropriate elution times and response factors were established using pure DF2000 and HC-DCF. The amount of dry-cleaning fluid in the distillate and the amount of distillate in the sample were used to determine the weight percent of dry-cleaning fluid in the sample.

The weight percent dry-cleaning fluid was totaled with weight percent water and residue. If the result was more than 100, the weight percent dry-cleaning fluid was corrected downward. Corrections, when they occurred, were less than 5%.

Although the laboratory staff has not as of the date of publishing this document completed multiple test aliquots on sludge samples taken in July 2002, the laboratory staff has, in the past, run multiple test aliquots on solvent and coating samples containing perc. It is estimated that the measurement error for the hydrocarbon and perc samples would not exceed ±15%.

## Summary of Sampling Procedures and Results

1. *Initial Perc Sampling*: Twenty facilities operating perc machines were initially selected for possible testing. The facilities were selected using criteria such as facility location (at least one in each county) and machine specifications (i.e., different types, models, and ages). Due to scheduling difficulties only six facilities were selected. Among the six machines sampled, there were four machines with only primary control systems and two with primary and secondary control systems. The samples were taken from the bottom of the stills and analyzed for perc concentrations and sludge density in the AQMD laboratory. In addition, staff obtained annual operation information as well as copies of waste manifests and perc purchase records. The annual operation information included: amount of clothes cleaned, operating hours, amount of perc purchased, and amount of liquid and solid sludge for each facility. The perc concentration in the liquid sludge ranged from 35 to 89% by weight for machines with primary control systems and 80 to 90% by weight for machines with primary and secondary control systems. Using these results and the facility's

operating information, the amounts of perc being emitted and recycled were estimated for each facility. The following information summarizes the results:

- For machines with primary control systems, the percentage of perc emitted ranged from 25 – 69% by weight;

- For machines with primary and secondary control systems, percent of perc emitted ranged from 45-59% by weight;

- Regardless of the type of machine, 5 out of 6 samples indicated that the percent perc emitted ranged from 45-69% by weight. Using this range, the average percent perc emitted and recycled was estimated to be 60% and 40% by weight, respectively. The percent perc emitted from one sample, which was thought to be an outlier, was 25%. If the result from this sample is included, the average percent perc emitted from all six samples is 53% by weight.

2. *Recent Sampling for Perc and HC*: Based on the population of perc and hydrocarbon machines in the district, statistical procedures indicate that to have statistically significant results, 19 perc machines and 9 HC machines need to be tested (the sample size for perc machine is 10, if percent perc emitted is used to determine the population variance). AQMD selected perc facilities from a group that have equipment with primary and secondary control systems. Samples were taken following standard procedures, and delivered to the AQMD laboratory for analysis in accordance with AQMD standard chain of custody. In addition, staff obtained annual operation information as well as copies of waste manifests and perc purchase records. Where possible, staff verified the information submitted by the dry cleaners through the suppliers and waste haulers and revised the information as needed to maintain consistency between the two sources of information. Sources may have information on solvent usage from annual records required to be kept, purchase receipts or through the supplier. Approximately 85 percent of the facilities sampled had purchase records, 50% of those with purchase records were verified through the suppliers, seven facilities had annual reports of which three had no purchase records. For facilities that kept monthly records of the amount of solvent added, staff used the recorded amount as the actual usage. For facilities that did not keep monthly records of the amount of solvent added, staff assumed the usage was the same as the amount purchased on an annual basis. For facilities with a newer machine, the perc usage was estimated to be equal to the amount purchased excluding the amount used for original fill of the machine.

   Staff verified information submitted by HC facilities for 10 out of 11 facilities through the suppliers and waste haulers. Staff also verified information submitted by perc facilities regarding the amount perc purchased or amount recycled for 12 out of 20 facilities through either the solvent supplier or waste hauler.

   The sample results indicated that the perc concentration in the liquid sludge of a perc machine ranged from 17 to 96% by weight and VOC concentration in the liquid sludge of a HC machine ranged from 13 to 85% by weight. The liquid sludge

densities ranged from 9 to 13 pounds per gallon (lb/gal) for perc and 7 to 9 lb/gal for HC machines. Using these results and the facility's operating information, the percentage of perc and VOC being emitted and recycled were estimated for each facility. The following information summarizes the results:

Perc

- The annual perc consumption for a machine with a primary and secondary control system ranged from 20 to 245 gallons. The average perc consumption was 96 gallons per year.
- The percentage of perc emitted ranged from 15 – 91% by weight. The average percentage of perc emitted from a machine with primary and secondary control systems was 50% by weight.
- The mean and standard deviation of perc sampling results are estimated to be 50% and 18% respectively.
- The 95% confidence limit on the average percent perc emitted is 41 – 58% by weight.
- At the 5% level of significance there was no difference with respect to equipment size and age, between the perc sample data and the perc population data.

HC

- The annual solvent consumption (DF-2000) for a HC machine ranged from 30 to 140 gallons. The average solvent consumption was 63 gallons per year.
- The percentage of VOC emitted ranged from 12 – 75% by weight. The average percentage of VOC emitted from a HC machine was 34% by weight.
- The mean and standard deviation of HC sampling results are estimated to be 34% and 21% respectively.
- The 95% confidence limits on the average percent VOC emitted is 21 – 47% by weight.
- At the 5% level of significance there was no difference with respect to equipment size and age, between our HC sample data and the HC population data.

Staff had a statistician from one of the major universities to assist and review the above statistical analysis.

The HC and perc analysis results are summarized below:

| | HC Machine | Perc Machine |
|---|---|---|
| Number of facilities tested | 11 | 20 |
| Average mileage (lb / gal) | 838 | 885 |
| Average solvent purchased (gal/yr) | 87 | 112 |
| Average solvent used (gal/yr) | 63 | 96 |
| Average % solvent in waste sludge (w%) | 46% | 64% |
| Average waste sludge density (lb/gal) | 8 | 11 |
| Average % solvent emitted | 34% | 50% |

For more details, please refer to the attached spreadsheets (Table 1-Summary of HC Sampling Analysis and Tables 2 and 3 – Summary of Perc Sampling Analysis).

## Data Limitations

On June 13, 2002, a Working Group meeting was held with dry cleaners, dry cleaners association representatives, solvent industry representatives, environmental groups, and others to review preliminary sampling results. Several comments and questions were raised:

1. need information on types of filters – cartridges or spin disc;
2. need to check if wastes disposed include one filter or multiple filters,
3. facilities do not always fill tanks to capacity or to same fill mark;
4. waste may also contain lint, spotting agents, water, soaps, etc; and
5. some data points looked like outliers.

Of the above possible data limitations, #4 could affect the results most significantly and could tend to over estimate the amount of solvent being recycled and consequently under estimate the amount of solvent emitted to the atmosphere.

Regarding the exact number of disposed filters, staff used the number of filters listed in the manifests or provided by the dry cleaners. In the June 13$^{th}$ meeting, only Safety Kleen (waste hauler) was identified as not listing the exact number of filters in such waste manifest. In the analysis, staff assumed 1 gallon of solvent is recovered per filter and the solvent recovered from the liquid sludge is assumed to be 50%. As the number of disposed filters increases, the amount of solvent recovered will increase which reduces the percent solvent emitted. However, solvent recovered from the disposing of filters is a small fraction compared to the total solvent recovered from the liquid waste sludge.

Regarding the facilities not filling the tanks to the capacity or to same fill mark, this could either over or underestimate the solvent usage. In a statistically significant sample,

these effects would be expected to cancel out because there would not be a bias expected towards one direction. Staff used amount of solvent added to the machine as usage, and excluded the amount of solvents used to fill the machine when information was provided. In other cases, staff assumed the amount of solvent purchase and usage were the same.

Regarding outliers, staff presented all the data collected from the facilities in the attached spreadsheets. Although mileage of a machine (amount of clothes cleaned per one gallon of solvent used) may appear to be low or high compared to the average, it was information submitted by the dry cleaners. However, neither the machine mileage nor amount of clothes cleaned is a factor used to calculate solvent usage. These numbers were listed for information purposes. No information was obtained that would invalidate any of these data points. Using the average percent perc emitted from only data points within one standard deviation of the mean would change the average percent perc emitted from 50% to 47%.

Staff has performed follow-up phone calls to facilities to ask if any of the above data limitations pertain to their facility and to what extent. Many of these calls were conference calls with representatives from the California Cleaner's Association, Korean Dry Cleaning and Laundering Association, the Halogenated Solvent Industry Alliance. Calls were made to four dry cleaners whose businesses participated in the AQMD perc sampling of sludge. Initially, staff selected eight facilities with input or calculated results that were questioned by industry. One facility representative refused to participate, another had a phone number that was disconnected, and two representatives could not be contacted after repeated attempts. The results of the phone surveys were compared to the data staff had received from the shop owners or operators through facility records. Based on revised information, few changes were made to the input data and sampling calculation. For Facility W (see Table 2), the initial information indicated that they recycled more perc than they purchased. Based on the phone conversation, the amount of perc purchased was reduced from 85 to 65 gallons per year, the amount of perc used changed from 85 to 55 gallons per year, and the number of filters disposed changed from 8 to 4. These revisions did not effect the previous results. For Facility P2, the amount of perc purchased and used was changed from 50 to 40 gallons per year and from 50 to 20 gallons per year, respectively. The amount of perc recycled was reduced from 30 to 24 based on the information provided by the owner that one-half gallon of wastewater per month was included in the sludge. Further verification and refinements were incorporated in the data.

## Emission and Risk Calculations

### Estimation of Percent (%) Solvent Emitted

From the sludge samples collected from the dry cleaners, staff measured the percent solvent in the sludge and sludge density. In addition, from the information provided by the dry cleaners such as purchase records and waste manifest, staff estimated the amount and percent solvent being emitted using a mass balance equation. The mass balance equation and a sample calculation are shown below.

*Mass Balance Equation:*

Amount of solvent emitted (gal/yr) = amount of solvent used (gal/yr) – amount of solvent recovered

Amount of solvent recovered (gal/yr) = (amount of liquid sludge recycled (gal/yr) x sludge density (lb/gal) x weight percent of solvent in the sludge / solvent density (lb/gal)) + (number of filters recycled x 1 gallon of solvent per filter)

Percent solvent emitted = amount of solvent emitted (gal/yr) / solvent used (gal/yr)

Where,

Amount of solvent used: given by cleaner (from purchase records)

Amount of liquid sludge recycled: provided by the cleaner (from manifest)

Number of filters recycled: provided by cleaner (from manifest)

Weight percent of solvent in the sludge: measured via sampling analysis

Sludge density: measured via sampling analysis

*Example:*

Using the information provided for Facility F listed in the attached spreadsheet titled "Summary of Sampling Analysis on HC Machines":

Solvent usage = 55 gal/yr (from purchase record)
Liquid sludge recycled = 55 gal/yr (from manifest)
Sludge density = 7 lb/gal (measured from sampling analysis)
Solvent density (DF-2000) = 6.4 lb/gal (from MSDS)
W% of solvent in the sludge = 63.4% (measured from sampling analysis)
Number of filters recycled = 4 (from manifest)
Amount of solvent in a filter = 1 gallon (assumed)

Amount of solvent recycled (gal/yr) = ((55 gal/yr x 7 lb/gal x 63.4%) / (6.4 lb/gal)) + (4 filters x 1 gal/filter)) = 42.1 gal/yr

Amount of solvent emitted (gal/yr) = 12.9 = 55 gal/yr – 42.1 gal/yr

Percent solvent emitted (%) = 12.9 / 55 = 23.4%

*Estimation of Total Perc Emissions in Basin Using Results of Sampling Analysis*

Based on the new sampling analysis results, the perc emission reductions from machines with primary and secondary control systems and machines with primary control system were re-estimated. As such, the total perc emission reductions from 2,181 machines were revised to approximately 850 tons/yr. from the previously estimated 875 tons/yr. This is based on the average perc usage and percent emitted of 96 gallons per year and 50% by weight, respectively for machines with primary and secondary control systems. The average perc usage and percent emitted used for

machines with only primary control system were 113 gallons per year and 54% by weight, respectively.

For any population there is a range, that is, the distance between the smallest and largest of a frequency distribution. Within the range of data, there is a center or middle area of the frequency distribution. There are three ways of denoting the central tendency or average and each has a distinct meaning. The mean is the arithmetic average of the summation of all values divided by the number of values or points in the data. The median is the value at the middle or the range below which half the values in the data population fall. The mode is the value, which appears most frequently.

Of these three statistical measurements, the mean is the most commonly used and best understood measure of central tendency. On this basis, the mean of such measurements as percent perc emitted is presented in this appendix.

Based on the recent sampling analysis for 20 machines with primary and secondary control systems, the average perc usage and percent emitted were estimated to be 96 gallons per year and 50% by weight, respectively. For the data that was verified through phone calls, the percent perc emitted was 47%. Previously, the perc usage and percent perc emitted from these types of machine were estimated to be 66 gallons per year and 60% by weight, respectively.

For machines with primary control systems only, the average percent perc emitted is estimated to be 54% by weight based on sampling analysis on 4 machines. The amount of perc usage for these machines was assumed to be 113 gallons per year. This was based on the estimated range of usage for this type of machines (75 to 150 gallons per year) using emission rates and percent perc emitted as indicated in CAPCOA document. Previously, the percent perc emitted from the primary and primary and secondary machines were estimated to be equal to 60% by weight. This previous estimate for these two machine types was based on the average percent perc emitted from 3 machines with primary control systems and 2 machines with primary and secondary control systems.

*Estimation of Total Perc Emissions in Basin Using CAPCOA*

Originally, staff used draft CAPCOA guideline health risk assessment to estimate the perc emissions from dry cleaning operations in the Basin. The total emissions were estimated to be about 1200 tons per year. This was based on average perc usage of 100 gallons per year for any closed-loop machines and percent perc disposed as hazardous waste of 20% – 30% as indicated in this document. The emission from a converted machine (only 18 machines) was assumed to be 170 gallons per year. These assumptions were similar to the assumptions used to estimate perc emission in development of perc ATCM.

*Estimation of Cancer Risk*

Staff developed a generic profile for a typical dry cleaner by assuming a building area of 1,600 $ft^2$, a building height of 15 ft, a general ventilation system with 60% capture

efficiency, and operating hours of 8 hours per day, 5 days per week, and 52 weeks per year. The Working Group indicated that these values were acceptable. A standard Gaussian model, ISCST3 (Industrial Source Complex-Short Term, Version 3) was used to estimate the annual average perc concentration at different receptors. This is a Tier IV level analysis. The cancer risk was estimated by multiplying the average annual perc concentration by perc unit risk factor ($5.9x10^{-6}$ $(\mu g/m^3)^{-1}$). Then, the cancer risk was adjusted for operating hours and the commercial receptors as described below:

- The cancer risk was adjusted by a factor of 0.71 (6240 hours / 8760 hours) so that the perc concentration would be distributed evenly throughout the year. This was because the actual operating hours for a typical dry cleaner was assumed to be 8 hours/day, 5 days/week and 52 weeks/year and the ISCST3 model was run for the actual operating hours. That means the emissions were considered to be zero for the hours that emissions did not occur (machine was not in operation).
- The cancer risk was also adjusted by a factor of 0.66 (46 years / 70 years) for commercial receptors based on the CAPCOA risk assessment guidelines.

Using the above methodology and sampling analysis results, the cancer risk from a typical perc machine at a residential location 25 meters from the facility ranged from 20 to 140 in-one-million which is slightly lower than previously estimated range of 40 to 150 in-one-million. The cancer risk ranged from 15 to 90 in-one-million at a commercial location 25 meters from the facility. This cancer risk was previously ranged from 27 to 100 in-one-million. These cancer risk levels were based on the perc usage of 26 to 166 gallons per year (average usage $\pm$ one standard deviation) and average percent perc emitted of 50%. The average cancer risk for residential and commercial locations 25 meters from the facility were estimated to be about 80 and 55 in-one-million, respectively.

These risk numbers are not necessary conservative. Many dry cleaners are located closer than 25 meters to their nearest residence or business. This results in higher risk. Also, these risk numbers are based on estimated average emissions that are lower than emissions reported by the dry cleaners included in the CAPCOA Industry-wide Risk Assessment Guidelines for primary machines.

*VOC Trade-Off*

PAR1421 requirements provide various compliance options such as wet cleaning, solvent cleaning, hydrocarbon cleaning, and $CO_2$ cleaning. Hydrocarbon cleaning equipment is currently tends to be the preferred choice of alternative technology. The choice of hydrocarbon will result in an increase in VOC emissions in the Basin. The amount of increase in VOC emissions is dependent upon the number of facilities that choose this alternative, the type of solvent chosen, such as synthetic aliphatic hydrocarbon or substituted aliphatic glycol ether, the amount of solvent used and the emission rate from the replacement machines. Based on the AQMD sampling analysis, the average solvent usage and percent VOC emitted from hydrocarbon

equipment were estimated to be 5.3 gallons per month and 34% by weight, respectively. Following scenarios were considered in estimating the VOC emission increases:

*Worst Case Scenario*

This scenario was analyzed for the purpose of CEQA, which assumed all perc dry cleaners would switch to the highest VOC content hydrocarbon cleaner (aliphatic glycol either) and operate at their maximum permitted levels (22.5 gallons per month). In this scenario, by the year 2019, an increase of 2.8 tons/day in VOCs would occur, if all 2181 perc machines were converted to hydrocarbon machines. It is unlikely, that all perc dry cleaning facilities would switch to hydrocarbon technologies, or would use the solvent with highest VOC content (7.3 pounds per gallon), or would use the maximum potential solvent usage permitted.

*Actual Case Scenario*

It is most likely that dry cleaners would use the synthetic aliphatic hydrocarbon (DF-2000) which is currently the most commonly used solvent with the VOC content of 6.4 pounds per gallon. Staff is not aware of any facility in the Basin using the aliphatic glycol ether, which has the VOC content of 7.3 pounds per gallon. In addition, based on the information obtained from the facilities during the sampling analysis, the estimated actual average solvent usage was 5.3 gallons per month. Using this information on usage and type of solvent, the actual increase in VOCs would be approximately 0.57 tons per day, if all 2,181 perc machines were switched to hydrocarbon machines. Again, this is an overestimate because there currently are approximately 30 Green Earth™ cleaners and 10 dedicated wet cleaners in the Basin. Both of these alternatives are expected to grow in number.

The above results are summarized in table below:

| Scenarios | All Affected Equipment | Solvent Usage (gal/month) | No. of days per month | VOC Content synthetic aliphatic hydrocarbon (lbs./gal) | VOC Content substituted aliphatic glycol ether (lbs./gal) | % VOC Emitted | Potential VOC Emissions (lbs./day) |
|---|---|---|---|---|---|---|---|
| Worst Case | 2,181 | 22.5 (maximum potential) | 22 | 6.4 | 7.3 | 34% | **4,854 – 5,536*** (2.4 – 2.8 tons/day) |
| Actual Case | 2,181 | 5.3 (actual) | 22 | 6.4 | 7.3 | 34% | **1,143 – 1,304**** (0.57 – 0.65 ton/day) |

NOTE: lbs. = pounds; gal = gallon

[#]This calculation assumes an operating schedule of 5 days per week, 52 weeks/year. (5 days/week x 52 weeks/year)/12 months/year = 22 days/month;

*6.4 lbs./gal x 22.5 gallon/month / (22 days/month) x 2,181 machines x 34% emitted = 4,854 lbs. per day;
7.3 lbs./gal x 22.5 gallon/month / (22 days/month) x 2,181 machines x 34% emitted = 5,536 lbs. per day

** 6.4 lbs./gal x 5.3 gallon/month / (22 days/month) x 2,181 machines x 34% emitted = 1,143 lbs. per day;
7.3 lbs./gal x 5.3 gallon/month / (22 days/month) x 2,181 machines x 34% emitted = 1,304 lbs. per day

# APPENDIX E

## COMPARATIVE ANALYSIS PURSUANT TO HEALTH AND SAFETY CODE SECTION 40727.2

# APPENDIX E
# Comparisons of PAR 1421 with NESHAP and ATCM

| **Requirements** | **NESHAP** | **ATCM** | **PAR1421** | **Comparison of PAR1421 with NESHAP and/or ATCM** |
|---|---|---|---|---|
| Averaging | None | None | None | None |
| Operating Requirements | - keep door closed<br>- operate and maintain equipment by mfg specifications.<br>- drain cartridges<br>- proper containment of perc & waste<br>- weekly inspection<br>- immediate repair | - trained operator<br>- operate, inspect, and maintain equipment according to mfg's recommendations<br>- drain cartridges<br>- clean traps<br>- keep doors closed<br>- separator used without perc<br>- weekly checklist inspection<br>- immediate repair | - same as ATCM with additional requirements such as:<br>- cleaning the cooling coil every two years<br>- replacing the main door, still door, button trap, and lint trap gaskets every two years | more stringent than ATCM and NESHAP |
| Monitoring Requirements | - calculate monthly perc purchases to track annual usage<br>- refrigerated condenser at 45$^{o}$ F | - maintaining purchases and delivery receipts and annual reports<br>- refrigerated condenser at 45$^{o}$ F | - same as ATCM | Equivalent to ATCM and NESHAP |
| Reporting Requirements | - initial notification<br>- annual report | - initial notification<br>- annual report | - same as ATCM with additional reporting requirements for AB-2588 notification process. | More stringent than ATCM and NESHAP |
| Recordkeeping Requirements | - perc purchase receipts<br>- perc purchased over previous 12 months<br>- leak detection and repair<br>- operating manual<br>- 5 years | - perc purchase receipts<br>- perc purchased over previous 12 months<br>- leak detection and repair<br>- operating manual<br>- 5 years | - same as ATCM | Equivalent to ATCM and NESHAP |
| Applicability | - Perc dry cleaners | - Perc dry cleaners | - same as ATCM | Equivalent to ATCM and NESHAP |
| Sources Affected | - major (>10 tpy)<br>- large area: (not all are defined)<br>- small area (some are exempt) | -all | - same as ATCM | Equivalent to ATCM and more stringent than NESHAP |

# APPENDIX E
# Comparisons of PAR 1421 with NESHAP and ATCM

| **Requirements** | **NESHAP** | **ATCM** | **PAR1421** | **Comparison of PAR1421 with NESHAP and/or ATCM** |
|---|---|---|---|---|
| Exemption from Control Requirements | - dry-to-dry <140 gpy perc purchased<br>- transfer <200 gpy perc purchased | - no exemption<br>- no exemption | - same as ATCM | Equivalent to ATCM and more stringent than NESHAP |
| Restrictions | - no new transfer system after 9/96 | - no new transfer system after 12/94 | - same as ATCM | Equivalent to ATCM and more stringent than NESHAP |
| Machine Requirements | - None | - conversion by 6-96<br>- closed-loop by 12-98 | - same as ATCM | Equivalent to ATCM and more stringent than NESHAP |
| Control Requirements | - refrigerated condenser by 9/93 on existing major & large area sources before 12/91<br>- refrigerated condenser & carbon adsorbers on new major sources after 12/91<br>- refrigerated condenser on new area sources after 12/91<br>- refrigerated condenser on new area sources | - primary control on existing machines<br>- primary control on new machines before 6/96<br>- primary & secondary controls on new machines after 6/96 | - no dip tank operation after 1/03<br>- non-perc alternatives for new facility & existing facility adding a new machine after 1/03<br>- no converted machine after 7/04<br>- no perc machine with 15 years old after 7/04<br>- primary & secondary controls or non-perc alternatives on new machine before 7/04 | More stringent than ATCM and NESHAP after 7/04 |